International Conference on Research in Education & Science

ICRES2017

May 18-21, 2017 Ephesus-Kusadası/TURKEY

PROCEEDING BOOK

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Wenxia WU
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TURKISH STUDENTS' EXPERIENCES IN USING A COMPUTER SUPPORTED COLLABORATIVE LEARNING (CSCL) TOOL (VIRTUAL MATH TEAMS - VMT)

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Abstract: This study aims to identify usability problems related to Virtual Math Teams (VMT) system, which is supporting online collaborative activities of learning groups. For the usability assessment, two major evaluations have been conducted. In the first evaluation, students filled the scale of framework for CSCL system Usability Evaluation including dimensions - Effectiveness, Efficiency, Collaborativity, Error Tolerance, Universal Accessibility, Satisfaction. The second evaluation considers students answers to open ended question related to system's usability problems. These two approaches together released the usability problems related to VMT system. The problems identified are related to four major usability aspects: system design, file upload, process tracking/automated notification, and error prevention. This study also suggests which immediate actions should be taken to improve usability of the system.

***Keywords*:** Computer supported collaborative learning, virtual math teams, usability.

Introductıon

Collaborative learning is defined as "a situation in which two or more people learn or attempt to learn something together" (Dillenbourg, 1999). In recent years, professional work settings involve increasingly more knowledge-based, interdisciplinary and complicated tasks; hence it becomes hard for individuals to perform tasks without the contribution of others (Wang, 2009). Although face-to-face collaboration is possible, computers and Internet facilitate collaboration of individuals, especially of students.

Researchers have recently started to explore the use of Internet and Communication technologies (ICT) to satisfy collaborative learning of student teams, which results in the emergence of Computer Supported Collaborative Learning (CSCL) field. CSCL is one form of online learning that also emerged as a reaction to most traditional educational settings where students learning as being isolated individuals. CSCL aims to offer new software and applications that connect learners, and support creative activities of intellectual exploration and social interaction (Stahl, Koschmann, & Suthers, 2006). While collaborating in a CSCL environment, learners employ computer-mediated-communication (CMC) in order to communicate with their group members. CMC capabilities provided in CSCL environments can be categorized as either synchronous (e.g., via a chat facility or video conferencing), asynchronous (e.g., via a wiki, forum or e-mail), or a combination of both (Janssen, Erkensa, Kanselaara, & Jaspersa, 2007).

Learners may benefit from CSCL in several ways. Petropoulou et al. (2010, p. 232) have provided the list of advantages of CSCL as follows:

- "opportunities for participants to share their knowledge and expertise;
- opportunities for participants to discuss, plan, reflect on and explore learning issues;
- increased inspiration, innovation and motivation amongst participants;
- increased social contact between individuals having different backgrounds;
- a reduction in feelings of isolation (both geographically and emotionally);
- increased access to shared resources."

- Selection and peer-review under responsibility of the Organizing Committee of the conference

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CSCL environments have been generally investigated according to instructional, motivational and social aspects. For example, the study of Francescato et al. (2006) compared effectiveness of collaborative learning between online and face-to-face groups. The results demonstrated that there is no significant difference in professional knowledge levels of learners. Eales, Hall, and Bannon (2002) compared use of CSCL in various settings – workplace, schools, and universities- and found that CSCL is worthwhile in enhancing learners' motivation for learning and exploration in all these settings. In addition, increase in social interaction and knowledge sharing are potential consequences of CSCL since learning groups are formed in these environments.

In this study, we aimed to investigate usability of Virtual Math Teams (VMT), which was developed as a CSCL environment with several interaction spaces as chat, whiteboard and wiki components. The chat tool of VMT provides a communication channel for the participants to discuss online on those subjects related to their interests. In the context of a course, instructors can assign homework via VMT which enables students in groups to share their ideas and understandings to solve the questions. While chatting online, learners benefit from Whiteboard or GeoGebra to explain their ideas through drawing functionalities. The group work can continue with learners' sharing of their solutions over the Internet. VMT supports this kind of online publication process by offering a Wiki component. Learners can insert appropriate text and images in order to reflect their solutions as Wiki output. In this way, instructors can view the product of the online collaboration and conduct corresponding evaluations.

This study serves the purpose of identifying problems preventing appropriate use of VMT in a course supporting online collaborative activities. In particular, the research objectives of the study are:

- To analyze factors affecting usability of VMT as one CSCL environment,
- To identify main usability problems based on evaluation,
- To suggest what actions should be taken to improve usability of VMT.

In order to accomplish objectives of the study, two different usability studies have been performed. Initially, user based evaluation of the VMT has been conducted. That is, Turkish students are required to fill questions of the framework for CSCL system Usability Evaluation (Huang, 2010). Then, same students were asked about their problems in using VMT. Findings based on these assessments have been reflected in this paper.

The CSCL environment - Virtual Math Teams (VMT)

In this study, we employed the Virtual Math Teams (VMT) system to support learners' collaborative learning activities in the frame of a semester long course on research methods and statistics. VMT offers a set of tools (i.e. chat, whiteboard and wiki tools) that allow learning groups study collaboratively on concepts of the course. Instructors and students can register to VMT system without any payment requirement.

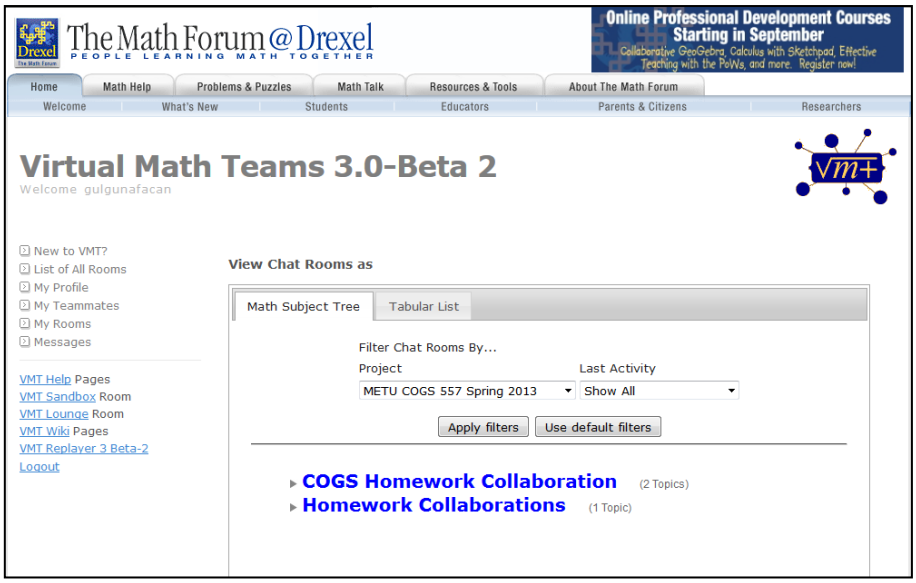

Figure 1. VMT lobby

When users entered to the VMT system, they encounter with the lobby. The major function of the lobby is that it provides a list of current chat rooms created by registered users. By choosing the room learners can enter, and

then communicate with the other members logged into this chat room. By using the "My Profile" page, users can review and change their profiles or their passwords. With the help of the "My Teammates" page, users can review the profiles of their teammates. Additionally, by employing the "Messages" page, users can send messages to each other for coordinating chat sessions, offer an idea, etc.

The chat tool primarily satisfies synchronous communication of members of a learning group. In the chat environment, team members are listed if they signed in the system and entered the chat room. Every member can post messages, and read posts of other members. At the same time, chat environment provides shared whiteboards for the purposes of drawing and organizing ideas. For example, the screenshot of VMT chat in the Figure 2 shows a learning group's work in the whiteboard area. In this work, learners used the tool for sharing their statistical findings related to the question of an assignment. The chat room additionally provides Web browser facility for learners' collaborative web browsing when it is necessary to conduct a research with respect to topic of their group work.

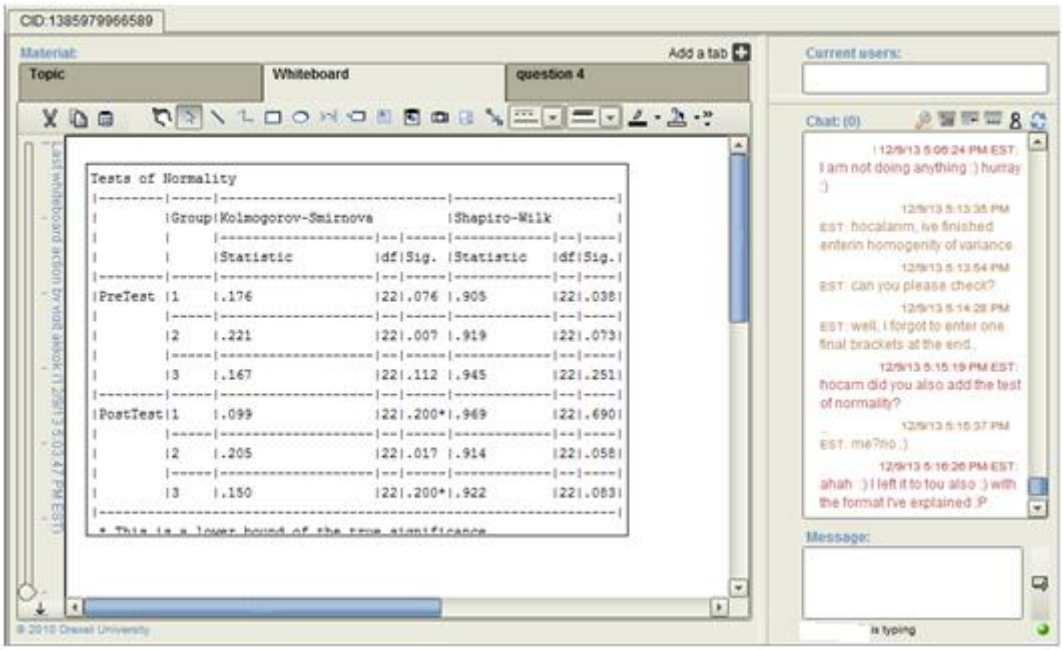

Figure 2. VMT chat

Each chat room provides a corresponding wiki page, by which learners can publish their findings on the Internet. For instance, the screenshot of VMT wiki in the Figure 3 demonstrates a part of the text submitted by one learning group as the solution of an assignment. All Internet users can review Wiki contents but have no permission to perform any changes related to this kind of contents. That is, the Wiki content can be edited by the owner user or owner group. Additionally, by using the help of 'View history' link, learners can review the Wiki edits performed by each member.

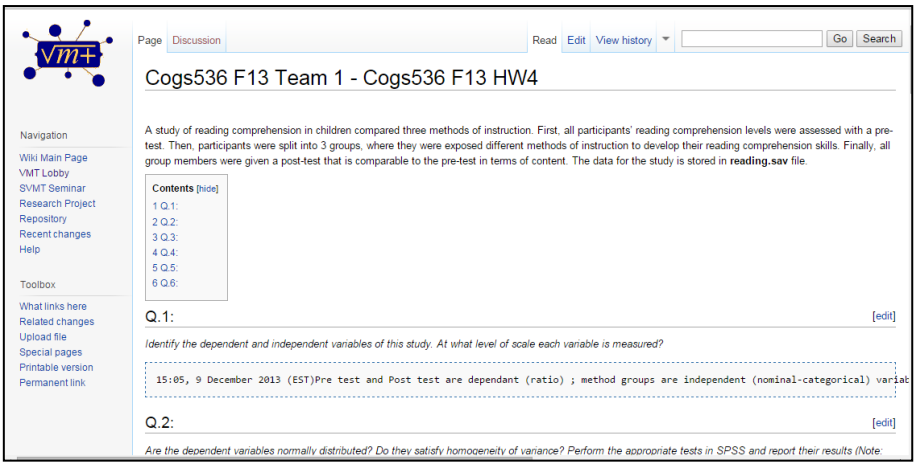

Figure 3. VMT wiki

The Research Methods & Statistics Course

We conducted the study within the context of a graduate level Research Methods & Statistics course, which aims to explain major concepts of empirical research and experimental design. The students were taught the methods and methodology of psychological research (experiment, observation, independent/dependent variable(s), ex-post-facto design, cross-sectional studies, longitudinal studies), Descriptive Statistics (building statistical models, the relation between population-sample, distributions, various central tendency values, variance, standard deviation, standard error, confidence intervals, test statistics), as well as to univariate and multivariate forms of Inferential Statistics (General Linear Model (GLM), ANOVA, ANCOVA, MANOVA, repeated measures ANOVA, mixed design ANOVA, correlation, regression, non-parametric tests, factor analysis). Statistical analyses were performed by using Statistical Package for the Social Sciences (SPSS).

Students were divided into learning groups. All groups were required to perform course assignments by collaboratively working online in the VMT environment. In the first weeks of the semester, students were introduced about the VMT environment with the help of an online orientation session organized by the course instructor. The other weeks were dedicated for execution of weekly assignments. In every assignment, learning groups were firstly required to conduct online chat meetings, then share their findings as co-authored wiki outputs.

Methodology

Research Design

The purpose of this study is to explore experiences of Turkish graduate students in using a CSCL tool (i.e. VMT) in a graduate course having collaborative activities. Mixed methods approach involving quantitative and qualitative methods has been employed in order to provide a deep understanding of the research problem.
The research question of the study can be stated as follows:
1. What are the experiences of Turkish graduate students towards use of VMT tool in a course requiring collaborative activities?

Participants

Table 1. Demographic characteristics of students

Age Group

		Frequency	Percent	Valid Percent	Cumulative Percent
	N.A.	4	19.0	19.0	19.0
	22-29	12	57.1	57.1	76.2
	Over 29	5	23.8	23.8	100.0
	Total	21	100.0	100.0	

Gender

		Frequency	Percent	Valid Percent	Cumulative Percent
	N.A.	4	19.0	19.0	19.0
	Female	6	28.6	28.6	47.6
	Male	11	52.4	52.4	100.0
	Total	21	100.0	100.0	

Grade

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Masters	12	57.1	57.1	57.1
	PhD	9	42.9	42.9	100.0
	Total	21	100.0	100.0	

The study has been conducted in the context of a graduate level course in a major state university of Turkey. Each registered student to this course has been considered as one participant of the study. Totally, there were 21

participants at the beginning of the study. Although we have attempted to collect demographic data from all of the participants, there are some minor missing data, which are indicated with not applicable (N.A.) tag. Age, gender and grade distributions of participants are demonstrated in the following table. Majority of the participants (i.e. 57.1%) are between 22 and 29 years old and male (52.4). They are graduate students with different educational backgrounds and will get MSc or PhD degree after the graduation. 57.1 of participants are master students whereas 42.9 of them are PhD students.

Data Collection Instruments

All students of the course are considered for filling the scale. For the quantitative part, the framework for CSCL system Usability Evaluation (Huang, 2010) was selected (Appendix A). The framework for CSCL system Usability Evaluation includes items within 6 dimensions, namely Effectiveness, Efficiency, Collaborativity, Error Tolerance, Universal Accessibility, Satisfaction.
For the qualitative part, the purpose is identifying the problems that participants encountered in using the system. After filling the scale, the participants were required to reply the open ended question - 'What are your problems with using the VMT Tool?'.

Data Analysis

The descriptive statistics (frequency and percentage) was employed to analyze the scale. The participants' answers to open ended question was analyzed by the content analysis approach.

Findings

Findings of the Scale

This study investigates the experiences of Turkish graduate students towards use of a CSCL tool (i.e. VMT) in a graduate course having collaborative activities. The descriptive statistics of the scale can be seen in the Table 2.

Table 2. Descriptive statistics of the scale

Item no	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
		%/#	%/#	%/#	%/#
Item1.1.1	0/0	0/0	11.8/2	64.7/11	23.5/4
Item1.2.1	0/0	11.8/2	29.4/5	35.3/6	23.5/4
Item1.3.1	0/0	23.5/4	23.5/4	41.2/7	11.8/2
Item1.3.2	0/0	5.9/1	17.6/3	52.9/9	23.5/4
Item1.4.1	0/0	5.9/1	23.5/4	41.2/7	29.4/5
Item1.4.2	0/0	0/0	47.1/8	29.4/5	23.5/4
Item2.1.1	0/0	5.9/1	17.6/3	47.1/8	29.4/5
Item2.1.2	11.8/2	5.9/1	11.8/2	41.2/7	29.4/5
Item2.2.1	0/0	11.8/2	11.8/2	52.9/9	23.5/4
Item2.2.2	0/0	5.9/1	23.5/4	41.2/7	29.4/5
Item2.3.1	0/0	0/0	17.6/3	52.9/9	29.4/5
Item2.3.2	0/0	11.8/2	11.8/2	47.1/8	29.4/5
Item2.3.3	5.9/1	0/0	5.9/1	47.1/8	41.2/7
Item3.1.1	0/0	5.9/1	5.9/1	41.2/7	47.1/8
Item3.2.1	0/0	17.6/3	11.8/2	41.2/7	29.4/5
Item3.3.1	11.8/2	29.4/5	17.6/3	35.3/6	5.9/1
Item3.3.2	5.9/1	29.4/5	17.6/3	29.4/5	17.6/3
Item3.4.1	5.9/1	17.6/3	35.3/6	29.4/5	11.8/2
Item3.4.2	5.9/1	17.6/3	23.5/4	35.3/6	17.6/3
Item3.5.1	5.9/1	0/0	29.4/5	41.2/7	23.5/4
Item3.6.1	0/0	5.9/1	41.2/7	35.3/6	17.6/3
Item3.6.2	0/0	0/0	23.5/4	58.8/10	17.6/3
Item4.1.1	0/0	35.3/6	35.3/6	23.5/4	5.9/1

Item4.2.1	5.9/1	11.8/2	64.7/11	11.8/2	5.9/1
Item4.3.1	0/0	23.5/4	35.3/6	35.3/6	5.9/1
Item5.1.1	0/0	5.9/1	35.3/6	29.4/5	29.4/5
Item6.1.1	0/0	41.2/7	11.8/2	35.3/6	11.8/2
Item6.1.2	0/0	17.6/3	23.5/4	47.1/8	11.8/2
Item6.1.3	0/0	0/0	41.2/7	47.1/8	11.8/2
Item6.2.1	0/0	5.9/1	5.9/1	64.7/11	23.5/4
Item6.2.2	0/0	5.9/1	23.5/4	47.1/8	23.5/4
Item6.3.1	0/0	11.8/2	17.6/3	47.1/8	23.5/4
Item6.4.1	0/0	11.8/2	17.6/3	47.1/8	23.5/4
Item6.4.2	0/0	0/0	35.3/6	47.1/8	17.6/3
Item6.4.3	0/0	0/0	52.9/9	35.3/6	11.8/2
Item6.5.1	5.9/1	23.5/4	5.9/1	52.9/9	11.8/2
Item6.6.1	5.9/1	11.8/2	17.6/3	47.1/8	17.6/3
Item6.6.2	0/0	23.5/4	35.3/6	17.6/3	23.5/4

Effectiveness Dimension

It can be understood from the findings that 88.2% of the students could complete the task on the system with a proper time frame. The finding about the visibility of the system provides average level of satisfaction. That is, 58.8% of them indicated that the system has a good menu or obvious links to support and help to complete a task. Similarly, the system interface and design wasn't found friendly and familiar by 47% of the students. On the other hand, 76.4% of them thought that steps to complete a task follow a logical sequence. Furthermore, 70.6% of them indicated that it is easy to find their location and the necessary information when they were working on a task. Lastly, 52.9% of students agree with the statement that the information in the system clearly points the next step/task in a workflow.

Efficiency Dimension

Related to the Speed criteria, 76.5% of students thought that they were able to access resources, and work on tasks efficiently. What is more, 70.6% of them indicated that the system speed is fast enough. For the Familiarity/Consistency/Standards criteria, 76.4% of them agreed with the idea that icons, menus, and information are familiar and understandable on a task screen. Furthermore, 70.6% of them thought that the layout and interface design are consistent through the whole online system. Regarding the Effort criteria, 82.3% of students agreed that they are not required to continue remembering information throughout several actions, 76.5% of them agreed that they are not required to learn a lot of things before they can get going with this system, and 88.3 % of them agreed that they are not required the get the support of a technical person to be able to use this system.

Collaborativity Dimension

It was revealed in the findings that 88.3% of students approve that they were able to communicate with the teammates and other users on the system as necessary. Furthermore, 70.6% of team acknowledge that they were able to manage their files/notes and the shared files/notes. However, students were not satisfied enough regarding File/Content Sharing & Management criteria. That is, only 41.2% of students indicated that files can be easily uploaded to the system and 47% of them indicated that files can be retrieved easily in the share workspace on the system. The findings related to Process Tracking/Automated Notification criteria don't provide expected level of satisfaction. 41.2% of students thought that they were able to send a notification to the team after completing the task, and 52.9% of them thought that they were able to find out the status of a task/teamwork, e.g. a task in progress, or completion. Regarding the File/Content Protection criteria 64.7% of students stated that the system gives a warning when they try modifying files or notes on the share workspace while their teammates are working on them. Furthermore, 52.9% of them approved that the system seems secure for storing teams' work/files. Lastly, 76.4% of them agree with the statement that "users need to logon to modify their artifacts or contact their teammates on the system."

Error Tolerance Dimension

The finding about the error prevention criteria provides low level of satisfaction. That is, 29.4% of students approved that the system provides warning if they about to make a potential error, 17.7% of them approved that the system gives error alerts that clearly tell how to correct errors, 41.2% of students approved that whenever they make a mistake, they were able to recover it easily and quickly.

Universal Accessibility Dimension

Related to the criteria – support users with different levels of IT expertise, 58.8% of students agreed with the statement "the system supports both novice and expert users, advance features are available to expert users."

Satisfaction Dimension

It was revealed in the findings that nearly half of the students (i.e. 47.1%) agreed that the system has all the functions and capabilities they expect it to have. Moreover, 58.9% of them stated that the system is useful for teamwork, and 58.9% of them stated that the various functions in this system are well integrated. About the criteria Learnability/Predictability/Recognition/Memorability, 88.2% of students indicated that it is easy to learn how to use this system and 70.6% of them indicated that tasks can be performed in a straight-forward manner. Besides, 70.6% of students found the use of the system as simple. Related to the Help/Documentation criteria, 70.6% of students indicated that information (such as online help, on-screen messages, and other documentation) provided on this system is clear, understandable, and helpful, 64.7% of them indicated that it is easy to access help documents. However, only 47.1% of students stated that they can easily switch between help and their work. 64.7% of students found the system interface as pleasant and attractive, and 64.7% of students found the system reliable. However, only 41.1% of students are satisfied with the system.

Findings of the Open-ended Question

For the qualitative part, the purpose is identifying the problems that participants encountered in using the system. The participants were asked the open ended question - 'What are your problems with using the VMT Tool?'.
It can be deduced from the findings that more than half of the participants (i.e. 58.8%) experienced some problems while using the VMT tool.

Table 3. Number of participants that experienced problem

	Frequency	Percent
No	7	41.2
Yes	10	58.8
Total	17	100.0

Students' problems can be investigated in following categories.

- **Login problem:** First of all, the participants experienced login problems. This might occurred because of the distant location of the server, lack of electricity or high traffic in the internet.
- **Problems Related to the Chat Environment:** Some participants indicated usability problems related to the chat environment. They expected that the chat screen has better functionality. That is, one of the participants indicated that the chat part can be opened as a separate and a larger page. In this way, the discussion can be better as it will allow them see and read the comments and arguments better in a large screen. One problem is the lack of sound notification when a message is posted. For instance, some learners entered to the chat environment before his team members. While waiting the members, he could view other web sites or work on other things. The early coming members expected to receive a sound notification to understand coming of remaining members while conducting their other responsibilities.
- **Problems Related to the Whiteboard Area:** Two of the participants indicated the problem of inserting tables to the whiteboard. The participants couldn't achieve the process or couldn't insert the table in a proper way. Additionally, one participant indicated the decrease of the system speed while attempting to insert a table to the whiteboard area.
- **Problems Related to Wiki Environment:** The other common problem is related to posting results and uploading files to wiki page. In editing process, learners have to write a short part and save it, otherwise all the stuff they write may disappear in a short while. If group members attempt to edit the same text simultaneously, then the system may produce errors and delete the text. Learners were required to submit their solutions with the appropriate statistical results as the image format. Some of the participants found

the uploading files to wiki page as a time consuming process, hence offered new ways. For instance one participant stated that "I was too lazy to upload every single file but later I found a way to overcome it. I would join all the pictures in one file for each question and upload one *.jpg file".

Discussion nad Conclusion

With this study, usability of VMT tool has been investigated according to users' responses to the framework for CSCL system Usability Evaluation, and open ended question. These two approaches have complemented each other in a way to explore existing usability problems related to the VMT tool.

The major usability problem is related to design of the system investigated. In general, the system wasn't found to provide a good menu or obvious links to support and help to complete a task. Similarly, the system interface and design wasn't found friendly and familiar by some students. We can offer that the system should consider aesthetic issues to satisfy a more pleasing interface. Screens should cover visuals besides textual elements; thus memorability aspect of the system can also be enhanced.

Additionally, some students indicated the problems of uploading or retrieving files related to whiteboard and wiki environments. This problem should be eliminated to enhance the system's efficiency. Some links should be improved to satisfy the system' ease of use and effectiveness.

One essential usability problem is related to Process Tracking/Automated Notification criteria. The system doesn't support users' sending of notification to the team after completing the task or when members enter the system. The system should provide an appropriate function to notify users about these issues. Such a behavior of the system would enable a pleasing interaction among members of learning groups.

Furthermore, students indicated the usability problem of the system regarding error prevention criteria.
That is, the system does not address how to fix errors occurring during system use. In case of any error, the system should give error messages clearly informing users about the way of fixing problems. In this way, users would feel comfortable in using the system. This is because users would know that they are able to recover easily and quickly even if they make any mistake.

As overall summary, the system doesn't satisfy the users and usability problems prevent adoption of the system. The system improvement can be carried out to fix usability problems of this technology. In this way, students will be able to experience advanced level collaborative activities.

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Appendıx-A

The framework for CSCL system usability evaluation

Dimension	Item	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
Effectiveness	1.1 Completeness 1.1.1 I am able to complete a task on this system within a proper time frame.					
	1.2 Visibility 1.2.1. The system has a good menu or obvious links to support and help me complete a task					
	1.3. Organisation/Design 1.3.1. The system interface and design are user friendly and familiar.					
	1.3.2. Steps to complete a task follow a logical sequence.					
	1.4. Navigability 1.4.1. It is easy to find where I am and the information I needed when working on a task.					
	1.4.2. The information in the system clearly points me to the next step/task in a workflow.					
Efficiency	2.1. Speed 2.1.1. I am able to access resources, and work on tasks efficiently.					
	2.1.2. The System speed is fast enough.					
	2.2. Familiarity/Consistency/Standards 2.2.1. On a task screen, icons, menus, and information are familiar and understandable to me.					
	2.2.2. The layout and interface design are consistent through the whole online system.					
	2.3. Effort 2.3.1. I don‘t have to continue remembering information throughout several actions.					
	2.3.2. I don‘t need to learn a lot of things before I can get going with this system.					
	2.3.3. I don‘t need the support of a technical person to be able to use this system.					
Collaborativity	3.1. Communication 3.1.1. I am able to communicate with the teammates or other users on the system as necessary.					
	3.2. User Control/Moderator & Teacher control 3.2.1. As a user, I am able to manage my files/notes and the shared files/notes.					
	3.3. File/Content Sharing & Management 3.3.1. Files can be easily uploaded to the system.					
	3.3.2. Files can be retrieved easily in the share workspace on the system.					
	3.4. Process Tracking/Automated Notification 3.4.1. After I complete a task, I am able to send a notification to the team.					
	3.4.2. I am able to find out the status of a task/teamwork, e.g. a task in progress, or completion.					
	3.5. File/Content Protection 3.5.1. The system would give me a warning when I try modifying files or notes on the share workspace while my teammates are working on them.					
	3.6. Security 3.6.1. The system seems secure for storing teams’ work/files.					

	3.6.2. Users need to logon to modify their artifacts or contact their teammates on the system					
Error Tolerance	4.1. Error Prevention 4.1.1. The system warns me if I am about to make a potential error.					
	4.1.2. The system gives me error alerts that clearly tell me how to correct errors.					
	4.1.3. Whenever I make a mistake, I am able to recover it easily and quickly e.g. by using an "undo" or “cancel” or “reverse” button.					
Universal Accessibility (Ubiquity)	5.1. Support different users with different levels of IT expertise 5.1.1. The system supports both novice and expert users, advance features are available to expert users.					
Satisfaction	6.1. Usefulness/Functionality 6.1.1. This system has all the functions and capabilities I expect it to have.					
	6.1.2. The system is useful to my teamwork.					
	6.1.3. The various functions in this system are well integrated.					
	6.2. Learnability/Predictability/Recognition/Memorability 6.2.1. It is easy to learn how to use this system.					
	6.2.2. Tasks can be performed in a straight-forward manner.					
	6.3. Simplicity 6.3.1. It is simple to use this system.					
	6.4. Help/Documentation 6.4.1. The information (such as online help, on-screen messages, and other documentation) provided on this system is clear, understandable, and helpful.					
	6.4.2. It is easy to access help documents.					
	6.4.3. I can easily switch between help and my work.					
	6.5. Aesthetic Design 6.5.1. The interface of this system is pleasant and attractive.					
	6.6. Overall 6.6.1. The system always is reliable.					
	6.6.2. I am satisfied with this system.					

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THE EFFECTIVENESS OF CLINICAL SUPERVISION ON TECHNOLOGY TEACHER'S PROFESSIONAL DEVELOPMENT IN JERUSALEM A CASE STUDY

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Abstract: This study aims to investigate the effectiveness of Clinical Supervision on Technology teacher's professional development in Jerusalem by attempting to answer the following key research question: What is the effectiveness of clinical supervision on technology teacher's professional development in Jerusalem? The study utilized a Qualitative Research Methodology with an analytical descriptive design. The case study consists of a participant teacher who was chosen via a diagnostic survey distributed to three teachers who taught technology from 5th to 12th grade due to the difficulties that the Technology teachers faced, since the subject is variety in content and need to apply different ways to educate. The researchers implemented this type of supervision that consists of a cycle of three stages: a planning session, classroom observation and a feedback session (Gall & Acheson, 2011). The aim of the study was to change the teacher's viewpoint and perspective towards supervision with the aid of the following instruments: an interview with her, at the beginning and the end of the study; to determine her needs, and to meet these needs by using interviews and diagnostic and observation tools as well as following upon her portfolio and Teacher's Journal. The researchers focused on communication methods that supports teacher's reflections within a relationship of fellowship, trust and partnership. The study used four consecutive applications of the clinical supervisory cycle following a constructivist approach to meet the teacher's needs. Following the feedback session, an implementation period for the developmental practices that have been reached during the meeting was provided along with the indicators developed qualitatively to identify the level of progress and change. The results of the study revealed that the technical clinical supervision model contributed effectively to the professional development of the participant teacher. This development included communication skills, and teaching practices as well as reflection and self-assessment skills. In light of the study findings, relevant recommendations foe policy making bodies were offered to improve the educational supervision in the Palestinian education system especially in Technology subject.

***Keywords*:** Clinical supervision, teacher, professional development, technology.

Introduction

The Education System in Modern Communities contributes in achieving their goals and future aspirations through making available several factors, on top: attention to teachers considering them one of the cornerstones of the learning educational process; accordingly selecting the convenient teacher, the quality of preparing and selecting his/her training methods, following-up with him/her, fulfilling his/her needs, and providing the subjective support compatible with his/her needs, are all deemed as indicators of the attention level in his/her professional development Based on this, special concern was given to the educational supervision for being the most appropriate element in achieving all aforementioned.

Educators have given special attention to supervision through evolving the concept of inspection and its methods into the concept of educational supervision aimed at enhancing the learning and education processes.

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Humanitarian relations are deemed as the general framework of professional work with teachers, so as to move forward towards their development and capacities building during duty (Hussein & Awadallah, 2006).

Hence, educational supervision is considered an essential pillar in the education system due to the liability relying upon the educational supervisor in following up with enforcing the educational – learning policy including all its merits; so as to realize the prospective educational goals. Given the importance of the supervisor's work, it should be stressed that he seeks to keep pace with the contemporary global trends which depend on a scientific theory as well as organized, sequential techniques, within a systematic framework characterized with flexibility and durability, in order to achieve the said goals at a high level of efficiency.

Theoretical Framework

The perspective towards the concept of supervision has remained mysterious in connection to the supervisor's status, which is neither administrative nor educational, but rather a status in-between. This has raised the dissatisfaction of some educators until the seventies, which has led to the emergence of clinical supervision (Ebaidat & Abu Al-Smeid, 2007). Both, Ryan & Gottfried (Ryan, & Gottfried, 2012), have defined the term "supervisor" as: a person who assists, guides, directs and supervises a group of individuals he leads, he is not only liable for supervising the acts of these individuals, but also for understanding the beliefs and attitudes of his subordinates. The technical clinical supervision of Gall and Acheson (Gall & Acheson, 2011) and Pajak (Pajak, 2002) is adopted as the theoretical framework of the study considering it as one of the modern supervision forms distinct with its sequential, organized, and supervisory cycle including three stages as shown in figure.1 below, namely: planning conference, observation, and feedback conference.

Figure.1: Stages of the clinical supervision cycle

However, Sullivan and Glanz (Sullivan & Glanz, 2005) have added to the previous stages, a fourth stage after the feedback conference, namely "the professional development" stage to implement the agreed upon recommendations within the joint developmental plan. The stage is called the "professional development" as shown in figure.2 below:

Figure.2: The professional development stage

This approach of educational supervision has been developed by Goldhamr and Kogan in 1960. The clinical supervision is considered a direct contact with teachers who have the desire to develop the educational process,

and upgrade the professional level. Therefore; it is a sequential, organized, supervisory and continuous process, carried out through partnership and cooperation between the teacher and the supervisor to develop the educational practices of the teacher inside the classroom. It provides multiple tools and techniques to provide support based on the teacher needs, in addition to teachers' capacities development towards employing self-supervision (Tesfaw & Hofman, 2014).

The clinical supervision is characterized by main features as clarified by Sullivan and Glanz (Sullivan & Glanz, 2005) that it includes techniques aimed at education development; it deliberately intervenes in the educational process; it is purposeful since it considers the school needs based on the developmental needs of relevant parties; it develops a professional relation between the teacher and supervisor; it requires a high level of trust to reflect on awareness, support and commitment with professional development; it is organized; in addition to flexibility and continuity in changing methodology; it creates a fruitful tension to reduce the gap between the actual situation and the perfect situation; and it contributes in developing the supervisor's expertise in analyzing the education and learning process, as well as the effective communication techniques.

The effectiveness of clinical supervision depends on several factors, including: the preparation context, the expertise level of education supervisor, the time availability, the opportunities for planning another cycle of clinical supervision stages to implement further classroom observations (Zepeda, 2002). Therefore; guarantees have to be added so clinical supervision realizes its goal and provides its services to the fullest with the development of portfolio. These guarantees are techniques and processes made by connecting the efforts of the supervisor with other applications leading to professional development, such as: procedural research and connecting the activities of every stage in supervision with the other stages by capacities building tools, meditation for example (Zepeda, 2002).

Based on the aforementioned, the technical clinical supervision approach of Gall and Acheson (Gall & Acheson, 2011) has been adopted. According to the researchers' experiments in educational supervision, they have concluded that great numbers of technology teachers are concerned with, and accept dealing with the raised evidences, details, facts, and information. Not only knowing the approaches and their trends enables the supervisor to know his tendencies in terms of gathering and judging data, but also enables him to know the tendencies of teachers, and so, using the appropriate supervisory methods, providing that the supervisor shall use the method through which the teacher can better learn achieving himself. The approach under study also provides multiple tools, techniques and methods from which the most appropriate to the educational stand could be selected.

Problem of the Study

The educational supervision in Palestine has passed through several stages towards development and renovation, as in the case of all educational supervisory systems at the global and Arab world levels. The stages start with inspection, guidance, and then educational supervision as an intuitive outcome in conjunction with the educational and social development, and in compatibility with the growing interest in enhancing humanitarian relations and considering the same as a key element for the success of communication between individuals, in the context of the open-mindedness and technological revolution, in general. Furthermore, various supervisory patterns were developed as well, such as comprehensive follow-up, permanent supporting supervision, specialized supervision, general supervision. The Development continued in providing quality coordinator and a development unit in the school.

As for the essence of supervision in this study; it takes the approved pattern of supervision in palestine, the permanent supervision (General Management of Educational Qualification and Supervision, 2013). This pattern provides support and aid for specialized and new-coming teachers, in the same context implemented by other studies supervisors in accordance with the instructions placed by the Ministry of Education & Higher Education in Palestine. It should be noted that the educational supervisor in the study is specialized in carrying out all of the supervision functions in connection to teachers, including class visits, writing descriptive reports, making annual evaluation, holding workshops and courses, meetings of studies committees, quality coordinator, technological contests, programs and projects coordinator in cooperation with the relevant sections, in addition to participating in the curriculum in terms of preparation, implementation, enrichment and development.

Upon inception, the Palestinian Ministry of Education & Higher Education has set out the idea of curriculum development as one of its strategic goals. Indeed, it has started by unifying curricula between the West Bank and Gaza Strip, from one hand, causing a qualitative transition in curricula in terms of content so as to take into account the technological scientific progress, from another hand. The Ministry has decided to insert to schools the subject of technology and applied science as an obligatory material, starting from the fifth basic grade until the twelfth grade, by fact of two lessons per week according to the expertise of scholars. This will enable our

students to keep pace with their era, apprehend its technological outcome, and provide them with support so they can be effective members in the desired development system.

The Ministry has a vision focused on the necessity of developing a curriculum that takes into account the Palestinian privacy to achieve the Palestinian people aspirations until it defines its status among others. Developing a Palestinian curriculum is considered an essential foundation to build the national sovereignty of the Palestinian people and to strengthen values and democracy. It is a humanitarian right and a tool to develop sustainable human resources strengthened by the Five-Year Plan of the Ministry. According to the Ministry, the importance of curriculum lies in the fact that it is considered the main tool of education, through which the communities' objectives are realized. Therefore, the Ministry pays careful attention to the school book as an element of the curriculum, since it is the intermediate source of learning, and the first tool at the hand of both, teacher and student, in addition to other means, including the internet, computer, local culture, and family learning, as well as other assistance means (General Management of Scientific Subjects, 2015).

The teacher is considered the cornerstone in teaching the subject of technology. Freihat and Aboushi (2009) have clarified that the teacher depends on achieving goals and applying the curriculum. In order to achieve this, the teacher has to be active through having the desire and willingness to work as a technology teacher, and to possess general life skills such as critical thinking and innovation, as well as handling problems by skills and scientific methodology. Furthermore, to lead students towards high stages of thinking so they can be innovative in the future, and so they respect others' rights, trust their achievements and build on them.

Due to the subject privacy in terms of content and diversity of fields, connecting theoretical concepts with practical applications, in addition to employing tools and multiple technological means, the educational supervisor holds several roles as Al-Aker (2008) stated, including providing the technological means and devices, training the teacher on producing educational means, and making available the specialized and technical competencies in the field of means, holding training courses, reducing the burdens placed on the teacher, devoting interest to quality not quantity when presenting the school subject, in addition to development and continuous follow-up to the professional growth level of teachers. Accordingly, Al-Aker concludes that the educational supervisor has to achieve cooperation and continuous harmony with the concerned subject teachers, and work on developing and educating them in compatibility with the technological knowledge revolution, in addition to following up with the updates and solving the teachers' problems effectively and practically.

Based on this, the teacher and educational supervisor have great responsibility in applying the curriculum, and continuous professional growth in compatibility with the subject evolution through scientific mastery of the technological knowledge, and the ability to achieve its goals. Therefore, and to achieve integration, it is important to introduce the methods and mechanisms of achieving this professional development to teachers. Accordingly, the study has focused on researching for a modern, internationally-agreed upon method that develops and supports the educational supervision process in the subject of technology, and enhances the prospective human relations between the supervisor and teacher to achieve together the educational system goals.

In light of this, the problem of the study is summarized in verifying the effectiveness of clinical supervision on professional development of the participant technology teacher from Jerusalem. From here, the study sought to answer the following main question: What is the effectiveness of clinical supervision on the professional development of the participant technology teacher from Jerusalem?

Study Questions and Objectives

The study is aimed at verifying the effectiveness of clinical supervision on the professional development of the technology teacher participating in the study by following up the impact of employing various techniques and tools to identify needs in order to make available an effective and subjective support with the participation of the teacher during the entire supervisory course, which in turn, will lead to holding another supervisory course within a constructive, permanent and supervisory context during the school year.

Following the background and objectives of the study, the study problem is identified with the following question: What is the effectiveness of clinical supervision on professional development of the participant technology teacher in Jerusalem Governorate?

Study Procedures

The study has answered the main question by holding a codified interview, at the beginning of the study, with the participant teacher to identify her view towards educational supervision. The interview was held again at the end of the study, in addition to following up with the impact of her participation in the supervisory course stages by learning about the previous appointment of each stage, and the joint discussion and contemplation in-between, in addition to observing contemplations and notes in the teacher's journal, as well as the researchers' contemplations during the study progress.

The diagnosis tools applied in the first planning session were used to identify the professional challenges the participant teacher is facing during her educational practices, such as: planning for lessons, class control, time partition, or the ability to employ proper strategies, or selecting the appropriate education method, in addition to other challenges. Additionally, arranging the same in terms of the importance degree and concern level, as well as the semi-organized interviews conducted with the teacher participating in the planning sessions of the four supervisory courses.

This was followed by analyzing the observation tools agreed upon during the planning session. These tools were specified based on the goals of class observation according to the needs revealed in the outcomes of the interview and the diagnosis tools. Then observing the analysis outputs represented in recommendations, and development plans of future practices. Followed by holding a subsequent supervisory course, and monitoring any developments at the level of class practices, for the purpose of comparison with the previous analysis, to hold another supervisory course until the completion of four supervisory courses within a framework of joint contemplation during the feedback session of the course; to discuss the implementation period following each supervisory course and specifying the planning session for a subsequent supervisory course and the following constructive permanence.

This was supported by having a sight at the portfolio of the participant teacher to make comparisons with the previous years in terms of organization, and the method of monitoring achievements. Through following up with the contemplations model of the teacher in its cumulative image for each supervisory course, and the contemplations model of researchers, the key question of the study shall be deemed answered.

The Study Tools

Several tools were employed to achieve the study objective as follows:
Interviews: two types of interviews were applied; the first interview is codified and conducted at the beginning of the study with the participant teacher. This interview was conducted again at the end of the study to analyze the teacher's answers and compare the outcomes so as to verify the extent of change in her view towards educational supervision after participating in the study. Some interviews related to verifying the effectiveness of a supervisory method were taken into account for the purpose of enlightenment in order to develop the concerned supervisory method in a manner goes in line with the study objectives. The interview conducted at the beginning of the study included another axis related to identifying the teacher's background on the clinical supervision, providing that an introductory meeting on the same subject was held for a period of half an hour.

The interview included six questions addressing inquiry about the number of years in which the teacher was subject to educational supervision, the extent of supervisory visits impact on the teacher's professional development, her self-evaluation of planning aspects, scientific mastery, teaching methods, educational tools and methods employment, evaluation methods, and the mechanism of communicating students. The fourth question has addressed the most important knowledge expertise the teacher has acquired through the supervisory system guidelines and how it can be developed from her perspective. The sixth question has concluded with inquiry about the matters she will give special attention to if she was an educational supervisor. As for the second section, it included six questions addressing inquiry about her knowledge on the existing educational supervision model, its stages, the nature of observation tools she would employ according to the system, and whether she has a previous background on the clinical supervision model. The fifth question has focused on inquiring about the method of organizing her portfolio and whether she had a journal to write down her notes and contemplations regarding her educational practices.

As for the second type of interviews, they are semi-organized interviews conducted in every planning session during every supervisory course to identify the teacher strengths in the educational practices and challenges she is facing (Gall & Acheson, 2011), and to follow up with the recommendations of the previous course to place supportive recommendations.

The first planning session interview included six questions focused on inquiring about the teacher's self-evaluation of the educational process in general. The second question focused on identifying the strengths of her educational practices, considerations and evidences in her method of teaching which require deep contemplation. The fourth question is focused on inquiring about her most favorable teaching methods which reach the level of generalization. The fifth question has inquired whether the teacher has any concerns regarding the students' integration in class as a result of her efforts in planning for the class. The sixth question has concluded with asking the teacher about her motives of selecting the profession of teaching.

As for the second planning session interview, it included nine questions. The first question is focused on inquiring about the teacher's self-evaluation of the educational practices implementation period in light of the first feedback session discussions. The second and third questions are focused on inquiring about the indicators pointing to change in the practices and whether they are directed towards motivating students on learning. The sixth question is focused on inquiring about the future development steps for motivating students on learning. As for the seventh question, it discusses whether specifying the motivation axis is the most important axis to the teacher after the experience of the implementation period, in addition to the aspects which the experience has brought the teacher's attention to, and the extent to which visual transcription contributes in achieving this. The interview concluded with its ninth question focused on clarifying the future class observation aspects.

The third planning session interview included six questions. It started with asking the teacher to summarize the previous feedback session recommendations, inquiring about the teacher's self-evaluation of the implementation period based on the above mentioned recommendations, and inquiring about the outputs which the teacher has reached in the implementation period. The third question focused on inquiring about the relation between these development practices and raising the level of students' motivation towards learning, in addition to inquiring about the mechanism of developing these practices in a better manner towards motivating students. The interview concluded with the sixth question focused on identifying the future class observation aspects.

As for the fourth planning session interview, it included eight questions. The first question addressed the teacher's self-evaluation of her new method in planning for lessons. The question inquired about the existence of a positive relation between the method of planning and motivating students towards learning. The third and fourth questions inquired about the level of expertise acquired by the teacher through planning for, and giving the class, as well as identifying the quality of implemented activities, and the impact of this on students themselves. In light of focusing on the most important challenges the teacher has faced during giving the class, it was inquired about the teacher's self-evaluation of time partition in the sixth question. The seventh question focused on the nature of development steps in this regard with the support of examples and educational situations. The interview concluded with the eighth question through inquiring about the future class observation aspects.

The Diagnosis Tools: Tools in the form of observation lists and estimation scales aimed at assisting the participant teacher in prioritizing the professional challenges each teacher faces. Furthermore, these tools focus on the most professional aspects the teacher is concerned about so as to learn the limits of his/her problem as a preliminary step towards identifying the sources of support, whether at the knowledge or educational level (Gall & Acheson, 2011). The diagnosis tools fall under the theoretical framework of the technical clinical supervision.

The Observation Tools: These tools are divided to several methods, namely, the selective verbatim transcription, wide-lens techniques, seating chart observation records, achievement tests, checklists, rating scales, and timeline coding. The appropriate tool was selected based on the outputs of the planning session on professional challenges in compatibility with the class observation objective to provide supervisory support to the teacher within joint contemplations according to the specified tool data analysis.

The following observation tools were used during the class observation stage: Transcribing Teacher Feedback Statements, Transcribing Teacher Structuring Statements, Creating Anecdotal Records, and Transcribing Classroom Management Statements.

The Transcribing Teacher Feedback Statements tool was used in the first supervisory course. The aim of the class was to motivate students on learning, providing that the pen and paper form were used with this tool to transcript the statements to be observed, including: statements of confirming what students say, statements of employing students thoughts, statements of comparing between students thoughts, statements of summarizing students conservations, statements of praising students' answers, statements of criticizing students' answers, and statements of rejecting answers (either by correction or transforming the question).

As for the Transcribing Teacher Structuring Statements, it was used in the first and second supervisory courses; since the class observation objective in both was to motivate students on learning as well as using the pen and paper form with the tool. The teacher statements were transcribed in the following fields: the education content,

the teaching strategies, the evaluation strategies, the educational activities, the guidelines, directions, and values. The Creating Anecdotal Records tool was used in the third supervisory course since the class observation objective was focused on searching for supportive factors to motivate students on learning. Observations were transcribed manually as a descriptive listing in logical sequence of the class occurrences, with special focus on the extent of employing resources, activities, and evaluations methods. As for the Transcribing Classroom Management Statements tool, it was used in the fourth supervisory course, since the class observation objective was focused on searching for the teacher's challenges concerning time management, given that they constitute an obstacle before the efforts exerted in motivating students on learning. Therefore, it was focused on the field of time management in particular, and other fields in general: administrative environment management, education and learning management, class interaction, as well as emotional and physiological climate. The time period of each element of the class, in terms of introduction, content presentation, and conclusion, was transcribed manually.

The teacher was directed towards transcribing her observations in her journal using her own language and in the form of storytelling, which is used in tracking the level of progress during the employment of clinical supervision stages in its sequential courses. The teacher was also encouraged to transcribe whatever she thinks in each planning sessions, as well as her contemplations in each class, and her observations in each feedback session. Then her observations about each complete supervisory course, and then her observations at the end of teaching procedure, which is to complete all course during the school year. The contemplations model is one of the observation tools falling under the wide-lens methods. The teacher's portfolio was also employed. Through this portfolio, all achievements made at the educational and professional level are gathered, and all special individual initiatives are monitored, not to mention that it is one of the observations tools falling under the wide-lens method, known as "the Portfolio and Work Samples" or "Portfolio". The teacher has prepared her portfolio electronically in organized folders.

Data Analysis

The fundamental analysis carried out to this study is qualitative for being a case study. Researchers have used the encoding method to indicate the three cases of three participant teachers, and to express their different answers through reconnaissance and demonstrating the justifications of selecting the participant teacher among them, then employing the same in expressing her answers and contemplations during the clinical supervision stages in the four supervisory courses, including the outcomes analysis of diagnosis and observations tools in the narrative storytelling method. Then summarize all data in an organized and classified table, to be then arranged and summarized under joint titles.

After that, analyze the data as follows:
First: qualitative analysis for the diagnosis tools outcomes in the first stage of the first supervisory course, and analyzing the observation tools outcomes in the second stage of each supervisory course as well as the interview results employed in each planning session in all courses.

Second: analyzing the participant teacher's answers in the interviews conducted at the beginning of the study, during and after the completion of the study.

Third: qualitative analysis of the contemplations model for the participant teacher following each course, and with all courses by using the Continuous Comparison Mechanism and organizing the same in a classified table.

Fourth: analyzing the portfolio of the participant teacher, in comparison with the records from previous years to set out descriptive indicators on the difference progress in the record content, method of organization, and its structure, which reflects the participant teacher's interests, in addition to the content of portfolio including the reflections and indicators of professional growth.

Study Outcomes

It is concluded from this study that employing the technical clinical model has contributed in causing a change in the educational practices of the participant teacher, and intellectual change in some of her professional convictions through strengthening the communication skill, the contemplation skill, and motivation towards continuous self-learning, which has reflected on her professional level in terms of preparation, planning, implementation, and learning new educational concepts, through tracking her respond in the four supervisory courses, and her practices during the implementation period, in addition to the observations and contemplations she has transcribed in her journal, and then compare her answers in the pre- and post experience interviews. This is compatible with Prosper study (Prosper, 2006) which indicates that cooperative clinical supervision is based

on the in-presence communication between the supervisor and the teacher, focusing on the class, and considering it a constructive tool for the teacher's learning. The Supervisor shall be an actual partner with the teacher in all decisions, and he shall establish for a liable and participatory relation. This change is shown in the teaching practices and intellectual change of the participant teacher within several elements: communication, teaching skills represented in planning, nature of content, teaching methods, educational means, handling student, evaluation methods, self –evaluation and contemplation skill.

Communication

The participant teacher's window was concealed according to Johari Window. That is, talking a bit about what happens in the classes due to fear that practices are not as expected (Zepeda, 2007). Therefore, work has been done to motivate the teacher on involving in a public discussion about educational practices and educational objectives of a specific lesson, though asking more specific questions, particularly in the first stages, in addition to employing communication techniques (Gall & Acheson, 2011) to enhance self-confidence, so that the teacher would become more comfortable with her window, which is considered her educational stand from another hand. The teacher has transcribed her notes in her journal after holding the first planning session:

> *"Concerning the first meeting, which is planning, initially, it is similar to the previous pattern in terms of principle, which is identifying the class and agreeing to attend it, however, the difference is shown in giving me the space to identify my desires, feelings, opinions, and needs including all of the educational process aspects, so I felt it was like "pouring out my heart" to the facts, and most importantly, an objective for the visit has been set, which means that now we have a goal to achieve from the visit, and not just a visit to be documented in records. To me, I will go through the experience and hope that I will improve or benefit myself - for myself only -".*

Through tracking the development achieved in the four supervisory courses, in terms of the teacher's respond to the feedback sessions recommendations, and the practices she has conducted through the implementation period, it was shown that the teacher had some sort of reservation when expressing her professional needs; however, she was able to identify the intersections of what she has stated with her responds to the diagnosis tools so as to identify the matter of motivating students on learning, in addition to enhancing her strengths in terms of the class introduction. She wrote in her journal:

> *"The discussion has focused on a specific point, which is the method of raising the motivation of the technology subject students. The difference between this discussion and the previous one, is that the previous included all educational directions, but the current discussion focused on a specific aspect from another side. The aim from the discussion is not limited to informing me with the advantages and disadvantages, but also to clarify the defect in adopting appropriate measurement tools and providing me with the optimum solution so that I follow it as well as providing me with a trial period to follow this method. The result: agreement to employ positive criticism and enhance conduct, rather than persons."*

The teacher has also showed her reservation when she was asked to give her permission in using the visual recording of classes, providing that she indicated that she does not wish to do so in the current period. She also showed reservation in using the audio recording during the planning and feedback sessions. However, during the first implementation period that is after completing a full supervisory course the teacher has employed the visual recording of her class so she can see herself in the eyes of her students. This was new for her considering her experience, and it indicates that she accepted the recording, particularly knowing that researchers have told her that the recording is only for her. She wrote in her journal:

> *"I tried to work on two points: body language and the proper evaluation of the answer, or method or solution, and not the student. For me, I worked hard to pay special attention to these points, as for the evaluation, I pay special attention to this, but I think I have to try harder, the problem is not in time currently, but the strike has slightly influenced the photography process which I will certainly carry out soon."*

The study of Kaneko Marques (Kaneko-Marques, 2015) and Knoll (Knoll, 2014) has reported the importance of visual recording as an effective tool in identifying the challenges teachers face, through providing the opportunity to go through the contemplation experience and deep analysis of educational practices, resulting in developing a set of standards, preparing a development plan for these practices, and consequently, directing teachers towards self-evaluation for their performance, as well as developing their teaching experience. This experience had a great impact on the teacher in terms of her self-evaluation level of body language, her common statement concerning feedback, the level of her interaction with students, in addition to paying attention to the lesson distraction, such as the entrance of the school guard, or some teachers to the laboratory to ask for

technological aids, which has motivated her to contemplate in the method of handling these aspects and controlling the progress of the class as she expects.

The teacher has initiated to watch several classes on the internet in the first stage and in the implementation period of the second supervisory course. She noticed a class for her colleague teacher in the school, and this has encouraged her to directly ask for more models even if from outside her school. This is what the researcher Zepeda has reached (Zepeda, 2002), that teachers have the ability to urge themselves to self-learning. During the feedback session in the second supervisory course, the teacher initiated her approval to use the audio recording to document the session, in addition to her approval to communicate through emails in the joint preparation for the class during the third class observation, and complete preparation during the fourth class observation.

The teacher clarified her need for supportive factors deeper than the body language, or effective praise, through the planning session of the third supervisory course. She then directly asked for highlighting more focus on time management in the class, and to be supported in handling this aspect and completing the fifth supervisory course by the beginning of the academic year, as shown in her answers in the post-experience interview. This indicates to a tangible development in connection to communication skills, and growing from reservation to openness, and from caution to trust. This is compatible with the clinical supervision objectives which affirm the fellowship relation between the teacher and the supervisor (Gall & Acheson, 2011). This relation cannot be created between the supervisor and teacher unless there is openness, accepting the other, trust, and good self-evaluation. Further, partnership, actual and effective cooperation between the teacher and supervisor can be achieved to develop the education practices of the teacher inside the classroom and to develop the capacities towards employing self-supervision (Tesfaw & Hofman, 2014).

Teaching Skills

The teacher explained that she does not face real problems concerning the teaching skills of planning, privacy of content, teaching methods, means and methods, handling students and methods of evaluation in the pre-experience interview where she indicated that she computerizes the preparation, and exchanges the experiences to resolve the problem of continuous planning. She indicated that she prepares the lesson just to prepare, but during the feedback session at the second supervisory course, and when discussing her preparation according to what was presented in the lesson, she found that the theory is not compatible with the practice. Therefore, it is recommended to develop the lesson planning and show its elements. In the third supervisory course, the teacher expressed that she faces problems regarding the preparation, when the practices were discussed during the implementation period in the planning session. She transcribed in her journal:

> *"A review of the previous notion which is raising the students' motivation through body language, positive reinforcement and the need to continue on the same method is done during this session in order for me to master these two strategies. It was agreed to work using the notion of teaching methods, in conjunction with the new direction of the same goal (raising motivation), since diversity creates the desire and motivation among students. I don't feel that my method has changed in regard to preparation. In my opinion, preparation is the sequence of concepts and accompanied activities during the class. As for the method, it is acquired skills integrated with personality, which plays a major role in the used method or in adopting one method as a permanent one."*

The preparation has revealed to her determining the procedural goals, selecting the appropriate activities to employ pivotal learning. Following this, the joint work in the third supervisory course was to design a certain lesson according to the effective learning model. The following implementation period was to complete the preparation of the teacher with the support of the researches. It was found that this experience has led the teacher to acquire new experience regarding the preparation. She trained in a practical method to define the objectives, activities and methods of evaluation and that has led her to focus more on the time of each activity that was done during the class, but she faced the problem of time management and that appeared in her note:

> *"The problem is that I was able to do only half of the planned goals during the lesson and not all of what was required. The problem has reasons and one of its reasons is the delay of the students and I think that their explanations during the activities were long; therefore I had to reduce the comments and select the most important and appropriate ones, and stop the discussion at some point."*

The experience continued developing and the teacher employed learning in the projects. The new preparation method drew the teacher's attention to the importance of collaboration work among students and she assigned them cumulative structural activities which results in an integrated project. Therefore, she directed the group to complete the project, and give it a mark to be compared with the previous context. The teacher said that she still uses written tests and her comment was "*as for students' evaluation methods, they are presented in the*

observation during the practical implementation and the answers to oral questions". She also has experience in the implementation of oral tests, but she did not proceed with this method because she is not convinced with it. After the experience, she went towards the practical projects in addition to evaluating the oral answers at the groups' level and she documented the group's answer on colored cards. That progress appeared in her note:

> *"The groups were able to complete the agreed upon scenario and the planned activities regarding the audio records and they added them to the PowerPoint during the mentioned class, and they were assigned with collaborative work within the groups in order to complete the project which will be given a mark on the grades book."*

The teacher explained that she faces constant renewal problems regarding the content which are related to the technology class through looking to the resources on the internet.

> *"The technology curriculum includes multiple and overlapping notions with different areas, and the content of the curriculum develops to serve this overlap. As a teacher of this class, I have to keep pace with this development and enrich my knowledge and to develop my skills to be able to deliver the educational content to my students to the fullest"* as she expressed in her journal."

She has undergone courses related to the new curriculum and in parallel with the experience, in addition to the provision of the appropriate resources through a group of class teachers through the social network sites. Two researchers contributed the teacher in designing a presentation for a specific lesson where she explained the appropriate method in presenting the content in work with the overall objectives of the curriculum. This experience was a beneficial addition to the teacher and it drew her consideration to important details in the preparation, in addition to the amazing presentation which helped attracting the students during the lesson. The teacher expressed satisfaction about this aspect, because most of the teachers consider that the supervisor does not have the teaching skills and that all that he does is giving comments. Therefore, she wanted to influence her colleagues regarding this side. In addition to restoring the confidence that the supervisor can be a real source of support, and a reference for the teacher, especially in light of the absence of supervisor role in the initial interview as appeared in the teacher's answers. The preparation also drew the teacher's attention towards the diverse teaching methods. Before the experience, she indicated the generality of teaching methods as appeared in her note:"It goes without saying that the teacher will like a certain method. And the method that I find appropriate for me in the technology class is solving problems". She explained that she had seen a lot of these methods through the Internet, and she was subjected to a course on the subject however the session method was dictation, and thus she directly declared the need to determine a lesson and put forward several alternatives (appropriate teaching methods) such as the joint work in the third supervisory session as stated in her note:

> *"During this meeting, we agreed upon a class for the eighth grade class entitled "Writing a tune" The preparation and presentation were together."*

Then they discussed what was employed in the class by linking between her theoretical and practical knowledge during the experiment, by that she reached to several ways such as: cooperative learning, brainstorming, role-playing, peers' supervision, pivotal learning, and learning through projects. The teacher's approach to solve the problems of dealing with students, especially that they are in a marginalized environment in Jerusalem, was in her wish for the parents to care about their children, as it was written sown in her journal:

> *"The effect is simple and I hope that the parents began to care more about their children, since a certain situation can affect the teacher's frame of mind and therefore is reflected on his mood throughout the day, although these events bother me personally but they do not affect my performance."*

Due to her need, she selected the students' motivation challenge towards learning, and searched for the procedures that support this challenge during the experiment, as she stated in her journal:

> *"I noticed that the students understood the tasks, especially that the first presentation was about cartoons that is easy to link and memorize them, but when the systems were presented the information was more and thus the students tended to memorize it, but I noticed that the information was difficulty for some students."*

Whereas she explained during the third and fourth supervisory session that the students' interaction during the lesson become more positive, and their participation increased during that period, as it was stated in her notes:

> *"During the class at the beginning, I did the presentation and the show as it is known in the computer lab and I noticed that students enjoyed during the activities despite that it's just cards and pens. As for the*

method despite that I took a different method for me, it was suitable to present the planned thing and achieved the goals."

Moreover, the teacher raised an example of a student who did not participate at all during the lesson, in addition to increase their attention to her physical movements when she wanted to express the idea of the lesson, as appeared in her note about that:

"Actually, I began to use my movements to confirm or make the answer clearer than what it was previously, for example, when I explained the take-off of the sailing I moved from the first of the class to the end of the class with rising a bit so that the students can understand the idea. Most of the students have followed my movements in the class, despite presenting the idea through a video."

According to this, the teacher concluded that it is possible to develop this side, despite obvious absence of the parents' role. In addition, she gave examples of the students' interaction in presenting the projects, and asking about additional information about the lesson, especially with the eighth grade, as appeared in the teacher's answer in the followed interview.

Contemplation Skill and Self-Evaluation

The studies indicated that the notion of meditation and feedback is the greatest effect affecting the development in addition to the fellowship relationship which reduced the gap between the theory and practice. The partnership between the supervisor and the teacher enabled to provide self-evaluation, meditation and cooperative planning opportunities (Bulunuz, Gursoy, Kesner, Goktalay & Salihoglu, 2014). From that was the attention to this notion in the learning process. It was found through the experience that the skill of meditation is one of the most difficult skills in changing, because it is a skill that needs continuous training, and awareness for its importance and effectiveness. Before the experience the teacher did not reveal that she has this skill. There were some challenges during the course of the first and second supervisory session in directing the teacher to meditation, particularly that the traditional educational supervisory system is practiced till this moment. At the same time, the seek is to achieve clinical supervision competency of the researchers about this experiment, and what revealed that context is the sound recording, where the researchers noted that the teacher is the less one talking during the first and second planning and feedback session. This motivated the researchers to be more aware about the contact and communication techniques to enhance the meditation skill of the teacher as explained by Jul Watsheson (Pajak, 2002), and in the same time for them to have the clinical supervision skills and techniques, and therefore it cannot be said that the teacher had this skill at the high level of professionalism after the study, but to a certain level which suit the implementation period. The teacher is aware about the importance of thinking about her teaching practices; therefore she was supported and guided to write down her notes on a journal, as a practical method of the meditation skill.

Whereas, self-evaluation was a new and comfortable experience for the teacher at the same time, the discussion of specific recommendations and applying them during the implementation period and the use of a specific method as an indicator of the progress in these practices, such as visual recording and note taking was a beneficial experience for her. She revealed that through her answers in the four planning sessions, in addition to her notes in the journal. This is an indicator of the teacher's commitment to the implementation period and the ability to continue the changes in the practices during the four sessions. This progress also coincided with the completion of the teacher on the level of the preparation of the portfolio file, where she added worksheets, activities, the lessons preparation and projects evaluation criteria to their previous computerized volumes within a special folder called "clinical supervision" and this is an indication of the teacher's attention to what she acquired from new experience including notes and observations for each stage of the experiment, as well as audio and video recordings. These results coincided with the study of (Demonte, 2013) And (Caena, 2011).

At the same time, the model contributed in developing the researchers skills in using the communication techniques during the planning and feedback sessions, paying attention to the mutual dialogue and avoiding as far as possible dictating, giving commands and instructions, as shown in the audio recording of the second supervisory session. The trend was to attend the lesson with a clear background about the information about the lesson, and that was a motivation to pre-prepare for each supervisory session in comparison to what was not employed at this level of the current educational supervision which only tend to see the schedule of classes to ensure having classes for the visiting teacher at that day. While the goal of classroom observation was clear and specified in the experiment, and the appropriate observation tools were employed in classrooms, in addition to the analysis skill to provide objective and not random recommendations. In addition of writing a developmental plan characterized by its constancy and structuralism and applying the real partnership experience with the teacher at all the stages of the supervisory courses, and using indicators to check the level of progress through the implementation period, in order for the study to be within an organized experience. In light of developmental

cooperative steps where the Fellowship relationship, and confidence were enhanced as appeared by following the teachers answers during the four session and by comparing between her answers in the previous interview, followed interviews , and the notes in her journal. In addition to get the chance to know the details of the professional and educational level of the teacher the thing that was not revealed during the previous supervisory years. Therefore, the previous recommendations lose their importance in an unclear context previously.

Following the number of supervisory visits conducted during the study in comparison to the number of current supervisory visits we conclude that clinical supervision needs time and much effort to achieve its objectives effectively. This corresponds to the educational literature findings that employing the model requires time and resources to achieve its objectives in raising the teachers efficiency, and thus recommended the future studies to take this into account **(**Bulunuz, Gursoy, Genser, Goktalay, and Salihoglu, 2014) because that acquires new experience and at a good level, but requires more training and practice to be able to acquire all clinical supervision skills as states in the (Wills, 2010) study. The teacher stated that although supervisors are clinical experts, many are not thus they need guidance, training, continuous evaluation, and having these skills to develop their relationships with teachers, and to avoid redundant relationships. It should be noted that the number of courses was not determine in advance, but it depended on the teachers need in the field. however, the school has announced the partial strike during that period as a united step with the rest of schools in the country (in Palestine), which made some confusion in organizing the schools work therefore the implementation period of the fourth supervisory session was with the end of the current academic year.

Recommendations

Recommendations Associated with the Outcomes of the Study

The outcomes of the study indicated that that the clinical supervision model contributed to change the participant teacher's perception about supervision positively, and it enhanced the cooperative relationship between her and the researchers. It also contributed in determining the needs of the teacher through planning session tools and techniques within the supervisory courses, and in meeting the needs of the participating teacher by using observation tools and feedback session techniques in the supervisory course. In conclusion the effect was in developing the participant professionally, and developing the supervisory work itself through supporting the performance of the supervisor for him to provide objective recommendations based on data analyzed within the framework of collaborative continuous and constructive work, and take into account the characteristics of the visiting teacher. Therefore, we recommend educators supervisors to employ communication techniques, and diagnosing and observation tools during their supervisory work in order for the supervisor to choose the educational model that fit the needs of the teacher.

Recommendations for Future Studies

The study indicates that there is a lack of qualitative research on the Arab literature specifically regarding the notion of the existing educational supervisory system. Therefore, we recommend researchers to work on further qualitative researches and studies in this context to serve the educational process. Following that with the supervisory process through employing a new supervisory process to learn more about the stages of teaching process and evaluating the educational supervisory work, and how it achieves the desired goals related to quality of education, teachers' professional development, and presenting successful supervisory models to form a model that can be developed in the educational supervision system.

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AN EDUCATIONAL MOBILE CITY LEARNING APPLICATION FOR KIDS

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Abstract: Along with the development of technology, mobile devices have started to take place in every aspect of life. One of these is entertainment sector thanks to the visual and interactive interface of these devices. However, by their accessibility and ease of use, mobile devices have extremely simplified touching to entertainment which has led to waste of time for people, especially children. It is crucial for children to divert their wasting time to education in terms of their development. That can be viable with turning the education into fun. In this work, we aim to develop a mobile application which enables children to learn about the cities in their country with pleasure. Integrating game and education, this application will ensure the children recognize the historical, geographical and cultural features of the cities. In the game, children start an exploration from a city. They proceed by travelling over cities using a map while they both enjoy and learn.

***Keywords*:** Game based learning, mobile programming, learning for kids

Introduction

There is much easiness that rapidly developing technology brings to our lives. Today, mobile platforms have become one of the most important tools for this easiness. People use mobile devices not only at home, but also at school or work and on the road. For this reason, people are a large part of the time during the day with these devices we can say. However, while mobile devices can be used in a useful way, they can be also harmful. It is really difficult for children to control it. When children spend their time with mobile devices, educational outcomes become important for their development. We thought that we could do this by attracting interest of children. This can be achieved if we can bring together education and entertainment. This idea can be provided with what we have designed. Children will play games as well as explore the cities in the country and learn new information.

In the literature, there are applications for educational purposes in mobile platforms. Puja and Parsons (2011) present a location-based mobile game of business consulting simulation for students. Users take the role of consultants at a virtual company and physically move to different locations to conduct interviews to discover the weaknesses of the company and they can make change recommendations. Wang and Tseng (2014) examine learning performance of students in environmental education using mobile game-based learning. They prepare a model which combine skills, challenge, incentives, cognitive load, playfulness and learning performance. In the result of this study they indicate that individuals with high skills and challenge can be good character students. In study of Kırcı and Kahraman (2015) plan an education application for primary school kids in a mobile platform. A kids can learn a course with presented examples and they can have some exams whenever they desire from smartphones. Their main purpose is attracting attention of kids together with presenting a useful application. Bartel and Hagel (2014) present a mobile game-based learning. The application focuses a joyful stabilization of knowledge and the engagement of students. Steps are described for the realization of the concept in a university. Cheah and friends (2013) present an interactive mobile game to teach about sustainability issues. They created this game named as “LifeTree”, and it introduces a new design strategy. Initial user testing has indicated that the game is found to be interesting and relevant to learn environmental issues. Urturi, Zorilla and Zapirain (2011)

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present a system composed of Serious Games oriented to first aid education based on mobile platforms. It includes what you will do in certain conditions and it shows basic knowledge about healthcare. The application permits an objective evaluation of therapy process. Alobaydi E, Alkhayat R, Mustaffa N. , Arshad M. and friends (2016) propose a solution that is faced by these children in learning Arabic vocabulary by developing a learning system. They evaluate on 20 students in elementary school and obtain from the statistical analysis. It indicates that the applications of the ubiquitous technology are preferred and helpful in performance of students in learning Arabic vocabulary.

The rest of the study is organized as follows. Non-Functional and Functional Requirements includes under the Requirements title for application. In the following section we introduce Proposed Method which has Database Design and Implementation Details. In the last part conclusion and future direction of this study are presented in Conclusion title.

Requirements

Non-Functional Requirement Analysis

Performance

Our program is mostly consisting of graphical part. However nowadays, most of mobile devices have two or more core. Also, our program does not keep high detail graphics and enormous database. Result, performance is not trouble.

Portability

Program is portable for android mobile devices but also we can make an IOS edition of the program later.

Security

This program does not include important information about user so that it is safe enough. Just user name and city are hold. In addition, user cannot change the database manually and program does not have any internet connection for first edition. For further editions, we may add internet connection our game. Result of this connection, we can use authentication and authorization.

Maintainability

We use the Object Oriented Programming Principles. So, if the program requires maintaining, we will recover it quickly. In addition, we keep track of the user recommendation and upgrade the version.

Integrity

We do not allow the users to insert, update, and delete operations to the database so they do not change the important database information. Integrity is achieved with this way.

Availability

It is available for all time when user wants to use it. When users like and show their interests in our program, we will continue developing this application by upgrading and extend its support time longer.

Functional Requirement Analysis

This game includes a Turkey map. User chooses a city at initial, because, by starting the initial city, user aims to tour all cities of Turkey and collect high points. The game includes some question related to the current city. Related to user's grade, city which is completed has different colors at Turkey map. (No reached cities: white, 75% success or above: green; 75% - 50% success: yellow, 50% - 25% success: orange, 25% - 0% success: red)

Users are allowed to play the game again for yellow, orange or red cities to improve his/her grade, but are not allowed for green cities. User can zoom into the map.

Proposed Method

Database Design

In this application we use SQlite (Web Page, accessed 4/2017). We created some tables. *Users* table which has *UserId* and *UserName* attributes for user information. Each user can have different game screen. *Cities* table includes *CityId, CityName* and *AdjacentName* that user can learn just neighbors of current city attributes. *GameInformation* table is necessary to hold user how much learn cities. It has *UserId, CityId, CorrectCount* and *WrongCount* attributes. *Categories* table is important to present different type questions to user. It has *CategoryId* and *CategoryName* attributes. *QuestionInfo* table which has *CityId, QuestionId* and *AnswerId* is used to obtain answer of each question. For variety of options of each question we use *CorrectAnswer* and *WrongAnswer* tables. They have *CityId, QuestionId, Question* and *Answer* attributes. Attributes of *Questions* table *QuestionId, Question, CategoryId* and similarly *Answers* table includes *AnswerId, Answer* and *CategoryId* attributes. Lastly because of reaching for some changing and updating program *Admins* table is essential for this game. *AdminId, AdminName* and *Password* are attributes of it.

Figure 1 is showed to database design of this game:

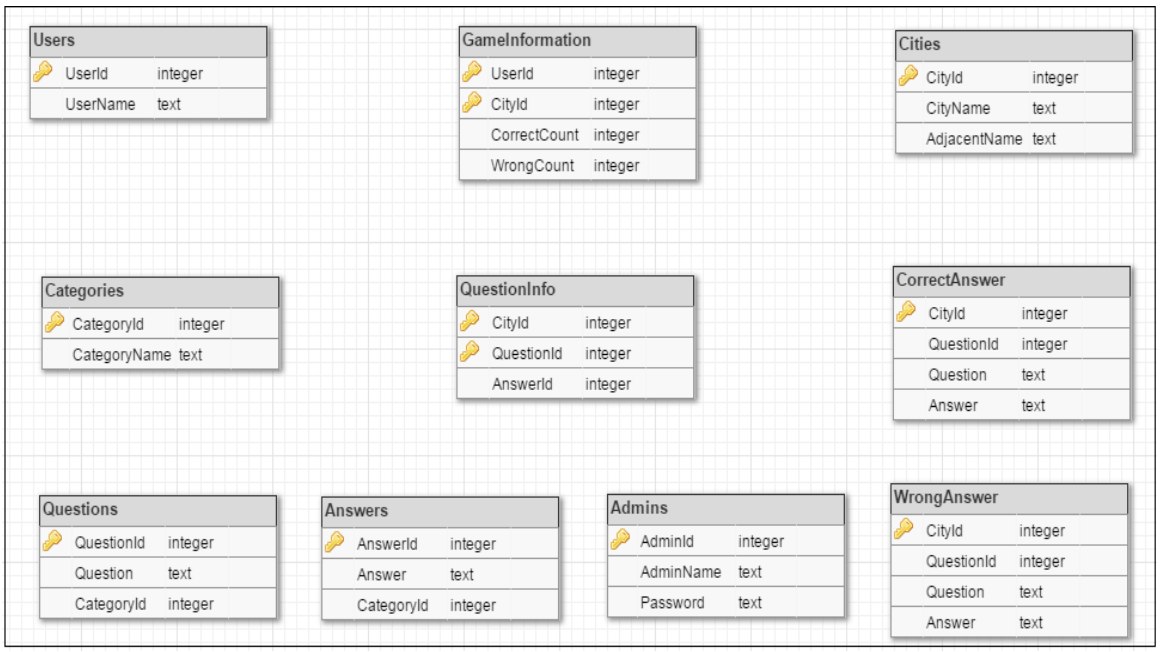

Figure 1: Database design

Implementation Details

This application includes some design steps from start to completed stage and we use a diagram to explain these. We can show this diagram in figure 2.

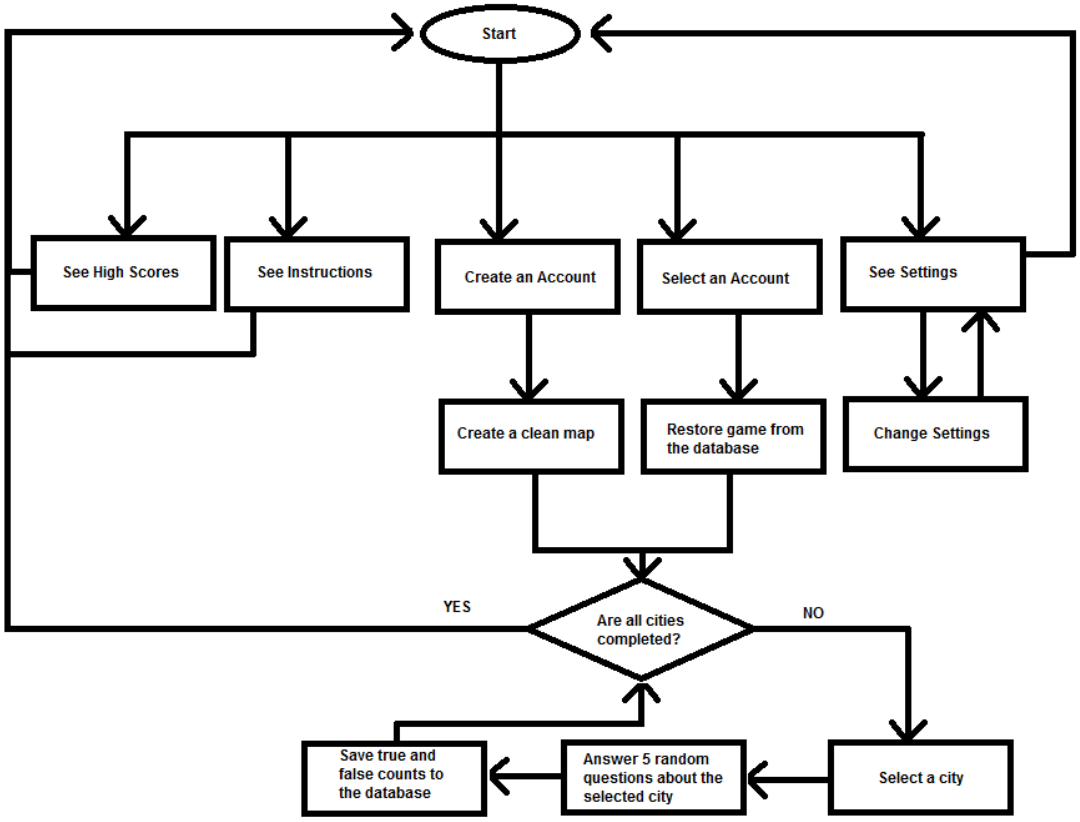

Figure 2: Game steps

In the main screen, there are five buttons and each of those buttons leads to a different screen. During their and implementation of their listeners, used methods and classes are generic methods and classes which are always used. Their safety is guaranteed by the android itself. In the profile creation screen (new game screen), there is a text view to enter the name of the new account and a button to proceed. Entered name is checked by querying it from the database to check its existence. Every account should have a unique name and our code guarantees it. In the profile selection screen (resume game screen), there is a list view that lists the accounts saved in the database and a button to proceed. Saved accounts are queried from the database. Possible exceptions are handled in the code. Querying process is guaranteed to be safe by the SQLite itself. In the map screen, there is only an image view. It shows the current status of the map. It is scalable and it has sliding ability which allows the user to see different parts of the zoomed map.

Scalability is implemented by using android scale gesture listener and some custom methods. Recognizing the scaling event and calculating the scale ratio are done and guaranteed by the listener. Our custom methods take a part of the map that should be shown according to the scaling value and scales it into the screen size. Our custom methods limits the scaling ratio between one and five, and they guarantee all of the written functionalities work without exceptions.

Sliding can be done in the zoomed map and it is implemented by using android scroll gesture listener and some custom methods. Recognizing the sliding event and calculating the amount of slide are done and guaranteed by the listener. Displaying the resulting map of the slide is done by our custom methods. Map boundaries are checked to prevent possible exceptions. Our custom methods guarantee that sliding process works fine. Other than its useful sliding and scaling abilities, map also offers ability to select a city which is one of the cores of our project. Although we researched much, we haven't found a useful listener for the selection event, so we wrote a listener. The listener can capture most of the click events without a problem. It's not in the perfect form that can be written, but it is good enough to play the entire game without much problem. After the image view is clicked, there is an algorithm (can also be called as a useful trick) that finds the clicked city. Clicked location is send to a fake map that is held in the background. In the fake map, blue values of the every pixel of the every city are held its license number. We use the number in the clicked location to identify our city. The algorithm and the fake map guarantee the city selected is identified correctly. After a valid city selection, quiz screen becomes visible.

In the quiz screen, random five questions and, for each question, one true and three random wrong answers are queried from the database. Questions and answers are queried from two different views called True Answer and

Wrong Answer. Safety of these queries is guaranteed by the views and the SQLite. Questions are shown in a label one by one, and their true answer is placed randomly on a button. Each button has the same amount of chance to get the true answer. Randomness is guaranteed by the android's Random class. After each question is answered, an alert dialog is seen which shows the question is answered right or wrong, tells the points won or lost, and the city's small map as icon. These functionalities are guaranteed to work flawless by our custom methods even if there are not enough questions in the database. After five questions for the selected city is answered, true and false counts are recorded into the database. Recording is made by insert queries, so SQLite guarantees its safety.

In the high scores screen, for each user, user's game information is queried from the database, user's total point is calculated, calculated scores are sorted by using bubble sort algorithm, and they are placed into a list view in the descending order. All of these works are done by using custom methods. These methods guarantee that they can work safely.

In the instructions screen, there is only a text view that shows instructions. Its text is hardcoded and we don't believe it can cause any abnormality in the application.
In the settings screen, user can adjust the volume of the game music and the sounds. Currently there is no in-game music, but we can place a one someday, so we wrote some code. These doesn't cause much trouble but for safety reasons their work is guaranteed by the written code.
In figure 3 we can see green cities are completed by user. We can say users obtain some info of green cities. Red cities can be started to cover because these are neighbors of green cities and other cities cannot be reached. These are not neighbor any green cities.

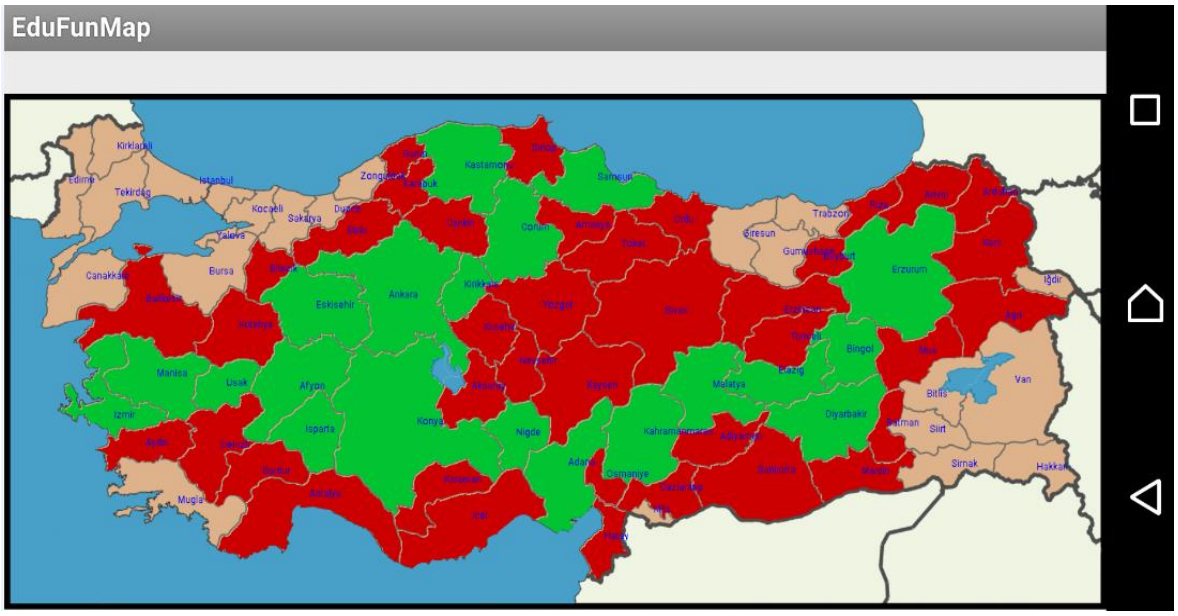

Figure 3: Map screen

Conclusion

We develop an application which provide children to learn about the cities in their country specifically Turkey for mobile devices used in every aspect of life. This game was accomplished in terms of performance, portability, security, maintainability, integrity and availability. This game ensures the children learn cities in different categories which are historical, geographical and cultural properties of their countries with pleasure due to game and education integrated. With increasing similar educational games, wasting time of children diverts to educational purposes.

In future, we plan to record more questions and answer to database of the application. In this way it can be provided to sustainability and wide range of information. With success of these steps a road can be opened to adaption of various countries.

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ESTIMATION OF ITEM RESPONSE THEORY MODELS WHEN ABILITY IS UNIFORMLY DISTRIBUTED

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Abstract: Item Response Theory (IRT) models traditionally assume a normal distribution for ability. Although normality is often a reasonable assumption for ability, it is rarely met for observed scores in educational and psychological measurement. Assumptions regarding ability distribution were previously shown to have an effect on IRT parameter estimation. In this study, the normal and uniform distribution assumptions for ability were compared for IRT parameter estimation, when the actual distribution was either normal or uniform. Uniform distribution assumption in 2PL model yielded more accurate estimates of ability independent of the actual ability distribution. Similarly, a uniform distribution assumption for ability yielded more accurate estimates of ability in 3PL model when the actual ability distribution was uniform. For Rasch model, there was not an explicit pattern for comparing accuracy of ability estimates from uniform and normal distribution assumptions.

***Keywords*:** Item response theory, IRT, uniform distribution, normal distribution, ability.

Introduction

Item Response Theory (IRT), also known as latent trait theory, is a modern mental test paradigm which is extensively used in psychological measurement (Embretson, 1996), and in educational measurement (Lord & Novick, 1968). It also has a wide usage in other fields such as public health, ecology and sociology. Student ability as a latent trait is unobservable and can not be measured directly. IRT defines a continuous and monotonic mathematical function (Reckase, 2009) for explaining the relationship between latent ability and student responses to test items (Embretson & Reise, 2000).

IRT models traditionally assume a normal distribution for ability while estimating ability of students. Normality is often a reasonable assumption for ability (Embretson & Reise, 2000). However, the normality assumption is rarely met for observed scores in educational and psychological measurement (e.g., Cook, 1959; Lord, 1955; Micerri, 1989). Micerri (1989), in example, examined 440 raw-score distributions from large-scale achievement and psychometric measures. Of these measures, 125 were moderately asymmetric (i.e., 28.4%), and 135 were extremely asymmetric (i.e., 30.7%).

Estimation of parameters in IRT models can be done by employing either marginal maximum likelihood estimation (Bock & Aitkin, 1981) or Bayesian estimation methods. Both methods make prior assumptions regarding the ability distribution (Baker & Kim, 2004, de Ayala, 2009). In this study, Markov chain Monte Carlo estimation was used for estimation of the models, which is a Bayesian estimation technique. Bayesian estimation method requires specification of a prior distribution for each parameter in the model that reflects prior assumptions regarding that parameter. Parameter estimates may be biased if priors are poorly specified in Bayesian estimation (e.g., Mislevy, 1986). Therefore, a sufficiently informative prior should be used for obtaining accurate estimates of model parameters (Baker & Kim, 2004; Mislevy, 1986).

Assumptions with respect to ability distribution have been shown to have an effect on IRT parameter estimation, depending on the deviation from the actual ability distribution (Reise & Yu, 1990; Roberts, Donoghue, & Laughlin, 2002; Sass, Schmitt, & Walker, 2008; Sen, Cohen, & Kim, 2016; Seong, 1990; Stone, 1992). The bias in item parameter estimates due to misspecification of actual ability distribution often can be reduced by

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increasing sample size and test length (e.g., de Ayala & Sava-Bolesta, 1999; Kirisci, Hsu, & Yu, 2001, Reise & Yu, 1990; Roberts et al., 2002; Seong, 1990; Stone, 1992).

In this study, the normality assumption for ability was investigated for its sufficiency to yield reasonable estimates of item and ability parameters, especially when the actual ability distribution was uniform. A simulation study was done to analyze student responses with a normal and a uniform underlying ability using a unidimensional IRT model for dichotomous items. These IRT models included Rasch (Rasch, 1960), two-parameter logistic (2PL; Birnbaum, 1968), and three-parameter logistic (3PL; Birnbaum, 1968) IRT models. Uniform and normal ability distributions were assumed for estimation of each IRT model. Finally, item and ability parameter estimates from these models were compared to the generating item and ability parameters. Thus, normal and uniform priors were compared for accuracy of item and ability parameter estimation in unidimensional IRT models for dichotomous items, when the actual ability distribution was normal or uniform.

Methods

Unidimensional Item Response Theory Models

The most commonly used unidimensional IRT models are the ones for dichotomous items (e.g., multiple choice). These models include Rasch, 2PL and 3PL models. The name of 2PL and 3PL models are based on the number of item parameters included in the models. Namely, the 2PL model has two item parameters, and the 3PL model has three item parameters. The 3PL model defines the probability that an examinee j with ability θ answers item i correctly $(P_i(\theta_j))$ by the following equation:

$$P_i(\theta_j) = c_i + (1 - c_i)\frac{1}{1 + e^{-a_i(\theta_j - b_i)}}, \quad (1)$$

where b_i is the item difficulty parameter for item i, a_i is the item discrimination parameter for item i, and c_i is the pseudo-guessing parameter for item i. Fixing c_i parameter in 3PL model to zero reduces the 3PL model to a 2PL model. Thus, the probability that an examinee j with ability θ answers item i correctly in a 2PL model is defined as:

$$P_i(\theta_j) = \frac{1}{1 + e^{-a_i(\theta_j - b_i)}}. \quad (2)$$

Similary, fixing the c_i parameter to zero and the a_i parameter to one in a 3PL model yields a Rasch model. The Rasch model defines the probability that an examinee j with ability θ answers item i correctly as:

$$P_i(\theta_j) = \frac{1}{1 + e^{-(\theta_j - b_i)}}. \quad (3)$$

Simulation Design

Student responses to dichotomous test items were generated using R (2016) software for Rasch, 2PL and 3PL models. Underlying ability distributions were generated to follow either a standard normal distribution or a uniform distribution on the interval [-3, 3]. Two test lengths (15-item and 30-item) and two sample sizes (600 and 2,000) were generated. Twenty-five data sets were simulated for each simulation condition. Item parameters used to generate student responses are given in Table 1.

Table 1: Item parameter estimates used for generating student responses

	Rasch	2PL		3PL		
	b	***b***	***a***	***b***	***a***	***c***
1	2.75	2.75	1.0	2.75	1.0	0.25
2	2.50	2.50	1.0	2.50	1.0	0.25
3	2.25	2.25	1.0	2.25	1.0	0.25
4	2.00	2.00	1.0	2.00	1.0	0.25
5	1.75	1.75	1.0	1.75	1.0	0.25
6	1.50	1.50	1.5	1.50	1.5	0.15
7	1.25	1.25	1.5	1.25	1.5	0.15
8	1.00	1.00	1.5	1.00	1.5	0.15
9	0.75	0.75	1.5	0.75	1.5	0.15
10	0.50	0.50	1.5	0.50	1.5	0.15
11	0.25	0.25	2.0	0.25	2.0	0.10
12	0.00	0.00	2.0	0.00	2.0	0.10
13	-0.25	-0.25	2.0	-0.25	2.0	0.10
14	-0.50	-0.50	2.0	-0.50	2.0	0.10
15	-0.75	-0.75	2.0	-0.75	2.0	0.10

Estimation of Item Parameters

Estimation of parameters was done by using the Markov Chain Monte Carlo (MCMC) method as implemented in the computer software OpenBUGS (Lunn, Spiegelhalter, Thomas, & Best, 2009). A burn-in period of 3,000 iterations was used with a total number of 30,000 iterations for each model. Following priors were used for MCMC estimation of model parameters:

$$b_i \sim \text{Normal}(0,1), \quad i = 1, \dots, n,$$
$$a_i \sim \text{Normal}(0,1) \text{ and } a_i > 0, \ i = 1, \dots, n, \tag{4}$$
$$c_i \sim \text{Beta}(5,17) \text{ and } 0 < c_i < 0.3, \quad i = 1, \dots, n.$$

Following priors were used for estimation of ability parameter, depending on the prior assumptions regarding ability:

$$\theta_j \sim \text{Normal}(0,1), \quad j = 1, \dots, N,$$

or (5)

$$\theta_j \sim \text{Uniform}(-4,4), \quad j = 1, \dots, N.$$

The scale of ability is arbitrary in IRT estimation which is denoted as metric identification problem (de Ayala, 2009, p.41; Baker & Kim, 2004). The metric of ability was identified using item centering method (de Ayala, 2009). That is, the mean of item difficulty parameter estimates were fixed to zero for estimation of each model. The scale of parameters from estimated models were placed on scale of the generating parameters by using mean and sigma equating method (Marco, 1977).

Item Recovery Analyses

Item recovery analyses were conducted to compare parameter estimation from the MCMC analyses with a normal prior and the MCMC analyses with a uniform prior. For this purpose, accuracy indices and Pearson correlations were calculated to compare item parameter estimates from the MCMC analyses with a normal prior to the generating parameters. Similarly, accuracy indices and Pearson correlations were calculates to compare item parameter estimates from MCMC analyses with a uniform prior to the generating parameters. Accuracy indices included mean bias, mean absolute error (MAE), mean-square error (MSE), and root-mean-square error (RMSE). The mean bias, MAE, MSE, RMSE and Pearson correlation values were calculated across twenty-five replications for 15-item and 600 sample size condition, and for 30-item and 2,000 sample size condition, individually, for each IRT model. As an example, the equations for calculating the accuracy indices and Pearson correlation for item difficulty (*b*) are given below:

$$\text{Bias}(\hat{b}) = \frac{\sum_{r=1}^{R}\sum_{i=1}^{n}(\ddot{b}_i - \ddot{b}_{ir})}{Rxn}, \tag{6}$$

$$\mathrm{MAE}(\hat{b}) = \frac{\sum_{r=1}^{R}\sum_{i=1}^{n}|\hat{b}_i - \hat{b}_{ir}|}{Rxn}, \quad (7)$$

$$\mathrm{MSE}(\hat{b}) = \frac{\sum_{r=1}^{R}\sum_{i=1}^{n}(\hat{b}_i - \hat{b}_{ir})^2}{Rxn}, \quad (8)$$

$$\mathrm{RMSE}(\hat{b}) = \sqrt{\frac{\sum_{r=1}^{R}\sum_{i=1}^{n}(\hat{b}_i - \hat{b}_{ir})^2}{Rxn}}, \quad (9)$$

$$\mathrm{Cor}(\hat{b}, b) = \frac{1}{R}\sum_{r=1}^{K}\mathrm{Cor}(\hat{b}_i, \hat{b}_{ir}), \quad (10)$$

Where ($\hat{b}_i$) is the generating item difficulty parameter for item i, ($\hat{b}_{ir}$) is the item difficulty parameter estimate for item i from MCMC analyses with a uniform/normal prior from *r*th replication, *R* is total number of replications which is 25, and *n* is the total number of items which is either 15 or 30.

Results and Findings

Accuracy indices and correlations for parameter recovery are calculated for item difficulty, item discrimination, item pseudo-guessing, and ability parameters (see Appendix A, Tables A1-A4). The MSE values did not indicate a substantial difference between uniform and normal prior for item difficulty for different IRT models. However, there were differences in MSE values for remaining item parameters and ability.

Post-hoc comparisons were conducted for transformed MSE values using Tukey's HSD procedure (see Table 2). Square-root or natural logarithm transformation was adopted for transformation of MSE values in order to achieve normally distributed residuals. Cohen's *d* values for the post-hoc comparisons are reported in Table 2. Cohen's *d* values of 0.2, 0.5, and 0.8 indicate small, medium, and large effects, respectively (Cohen, 1988). Cohen's *d* values of 0.8 and larger were considered to reveal a substantial difference in mean MSE values between uniform and normal priors for a given parameter from a particular model for a given number of items and sample size condition.

Results did not indicate a difference in mean MSE values between normal and uniform prior for item difficulty from Rasch model, for both 15-item and 600 sample size and for 30-item and 2,000 sample size. There was not a constant pattern for differences in mean MSE values between uniform and normal prior for ability from Rasch model.

For the 15-item and 600 sample size, there was not a substantial difference in mean MSE values between uniform and normal prior for estimation of item difficulty and item discrimination using a 2PL model, when the actual distribution was uniform. When the actual distribution was normal, uniform prior yielded larger mean MSE value compared to the normal prior. For the 30-item and 2,000 sample size, for both item difficulty and item discrimination, the normal prior yielded larger mean MSE value when the actual distribution was uniform. Similarly, the uniform prior yielded larger mean MSE value when the actual distribution was normal, for both item difficulty and item discrimination. For estimation of ability using a 2PL model, the normal prior yielded larger mean MSE values compared to uniform prior for all conditions.

For analyses of 15-items using a 3PL model for 600 sample size, there was not a substantial difference in mean MSE values between uniform and normal prior for both item difficulty and item discrimination, when the actual distribution was uniform. For item pseudo-guessing, uniform prior yielded larger errors compared to normal prior, when the actual distribution was uniform, for 15-item and 600 sample size condition. Again for 15-item and 600 sample size condition, uniform prior yielded larger errors compared to normal prior, when the actual distribution was normal, for estimation of item difficulty, item discrimination and item pseudo-guessing.

For 30-item and 2,000 sample size, normal prior yielded larger mean MSE values compared to uniform prior, for estimation of item difficulty and item pseudo-guessing parameter, when the actual distribution was uniform. For item discrimination, on the other hand, there was not a substantial difference in mean MSE values between normal and uniform priors. Again for 30-item and 2,000 sample size, uniform prior yielded larger mean MSE values for item difficulty, item discrimination, and for item pseudo-guessing parameter, when the actual

distribution was normal. For estimation of ability in 3PL model, normal prior yielded larger mean MAE values compared to uniform prior, when the actual distribution was uniform. The effect sizes for the difference between normal and uniform priors were medium to large (i.e., between 0.5 and 0.8) when the actual distribution was normal.

Table 2: Estimates of cohen's *d* values from post-hoc comparisons using tukey'd HSD procedure for transformed MSE values

			Rasch		**2PL**			**3PL**			
Condition	**Actual Dist.**	**Prior Dist.**	***b***	***θ***	***b***	***a***	***θ***	***b***	***a***	***c***	***θ***
15-item and 600 sample size	Uniform	Normal – Uniform	0.138 U>N	**1.240 U>N**	0.579 N>U	0.236 U>N	**3.467 N>U**	0.611 N>U	0.780 U>N	**0.915 U>N**	**7.627 N>U**
	Normal	Normal – Uniform	0.026 U>N	0.455 U>N	**1.243 U>N**	**2.819 U>N**	**7.526 N>U**	**2.299 U>N**	**5.090 U>N**	**2.319 U>N**	0.756 N>U
30-item and 2,000 sample size	Uniform	Normal – Uniform	0.245 U>N	**3.809 U>N**	**0.999 N>U**	**1.314 N>U**	**3.197 N>U**	**2.240 N>U**	0.281 U>N	**1.466 N>U**	**6.022 N>U**
	Normal	Normal – Uniform	0.013 U>N	**2.092 N>U**	**1.231 U>N**	**3.914 U>N**	**3.903 N>U**	**2.998 U>N**	**7.894 U>N**	**1.056 U>N**	0.727 U>N

Note: 1) Dist.: Distribution, N: Mean parameter estimate for the model with normal prior, U: Mean parameter estimate for the model with uniform prior, *b*: Item difficulty, *a*: Item discrimination, *c*: Item pseudo-guessing, *θ*: Ability 2) Large effect sizes (i.e., larger than .80) are shown in bold.

Conclusion

The primary purpose of using IRT models is to locate students on a continuous scale by estimating their ability (Baker, 2001). This study compared uniform and normal distribution assumptions for estimation of item and ability parameters in IRT models. Assuming a uniform distribution for ability led to more accurate estimates of ability in the 2PL model no matter if the actual ability distribution was uniform or normal. Similarly, assuming a uniform distribution for ability in the 3PL model yielded more accurate estimates of ability when the actual ability distribution was uniform. However, the difference between assuming a normal or uniform distribution for ability was only moderate for estimation of ability, when the actual distribution was normal. For the Rasch model, there was not an explicit pattern for comparing accuracy of ability estimates from uniform and normal distribution assumptions. These results suggest using a uniform distribution assumption in a 2PL model in order to achieve more accurate estimates of ability. Similarly, a uniform distribution assumption for ability may be used for achieving more accurate estimates of ability in a 3PL model if the actual ability distribution is not known.

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Appendix A

Accuracy Indices and Correlations

Table A1: accuracy indices and correlations for 15-item and 600 sample size when actual distribution is uniform

	MRM				2PL					
	Item difficulty		Ability		Item difficulty		Item discrimination		Ability	
Prior	**Uniform**	**Normal**	**Uniform**	**Normal**	**Uniform**	**Normal**	**Uniform**	**Normal**	**Uniform**	**Normal**
Bias	0.000	0.000	1.037	0.977	0.000	0.000	0.036	0.030	0.900	0.932
MAE	0.083	0.086	1.078	1.011	0.073	0.080	0.124	0.114	0.916	0.949
MSE	0.011	0.012	1.506	1.405	0.009	0.011	0.025	0.022	1.064	1.145
RMSE	0.107	0.109	1.227	1.185	0.092	0.107	0.159	0.149	1.031	1.070
Cor.	0.995	0.995	0.931	0.930	0.996	0.995	0.945	0.961	0.957	0.953

Table A1 Continues

	3PL							
	Item difficulty		Item discrimination		Item pseudo-guessing		Ability	
Prior	**Uniform**	**Normal**	**Uniform**	**Normal**	**Uniform**	**Normal**	**Uniform**	**Normal**
Bias	0.000	0.000	-0.123	-0.151	0.001	-0.018	0.922	1.039
MAE	0.124	0.136	0.234	0.205	0.035	0.030	0.978	1.059
MSE	0.026	0.033	0.078	0.061	0.002	0.001	1.295	1.477
RMSE	0.162	0.183	0.280	0.246	0.043	0.038	1.138	1.215
Cor.	0.989	0.986	0.869	0.953	0.735	0.868	0.933	0.930

Table A2: Accuracy indices and correlations for 15-item and 600 sample size when actual distribution is normal

	MRM				2PL					
	Item difficulty		Ability		Item difficulty		Item discrimination		Ability	
Prior	**Uniform**	**Normal**	**Uniform**	**Normal**	**Uniform**	**Normal**	**Uniform**	**Normal**	**Uniform**	**Normal**
Bias	0.000	0.000	0.848	0.901	0.000	0.000	-0.172	-0.047	0.862	0.978
MAE	0.078	0.078	0.918	0.921	0.147	0.104	0.257	0.154	0.876	0.983
MSE	0.010	0.010	1.144	1.110	0.033	0.021	0.099	0.038	0.969	1.145
RMSE	0.099	0.099	1.069	1.054	0.182	0.145	0.314	0.195	0.985	1.070
Cor.	0.996	0.996	0.833	0.835	0.986	0.991	0.790	0.900	0.900	0.908

Table A2 Continues

	3PL							
	Item difficulty		Item discrimination		Item pseudo-guessing		Ability	
Prior	**Uniform**	**Normal**	**Uniform**	**Normal**	**Uniform**	**Normal**	**Uniform**	**Normal**
Bias	0.000	0.000	-0.114	-0.150	0.020	0.001	0.967	1.062
MAE	0.230	0.136	0.447	0.210	0.049	0.040	1.007	1.070
MSE	0.075	0.035	0.288	0.061	0.004	0.002	1.389	1.407
RMSE	0.274	0.187	0.537	0.247	0.061	0.048	1.179	1.186
Cor.	0.968	0.985	0.226	0.913	0.432	0.656	0.868	0.875

Table A3: Accuracy indices and correlations for 30-item and 2,000 sample size when actual distribution is uniform

	MRM				2PL					
	Item difficulty		Ability		Item difficulty		Item discrimination		Ability	
Prior	Uniform	Normal	Uniform	Normal	Uniform	Normal	Uniform	Normal	Uniform	Normal
Bias	0.000	0.000	1.136	1.000	0.000	0.000	-0.002	0.037	1.003	1.029
MAE	0.048	0.050	1.145	1.005	0.046	0.057	0.063	0.079	1.006	1.034
MSE	0.004	0.004	1.548	1.249	0.004	0.006	0.007	0.011	1.156	1.235
RMSE	0.059	0.062	1.244	1.117	0.060	0.075	0.081	0.104	1.075	1.112
Cor.	0.998	0.998	0.958	0.960	0.998	0.998	0.982	0.985	0.975	0.971

Table A3 Continues

	3PL							
	Item difficulty		Item discrimination		Item pseudo-guessing		Ability	
Prior	Uniform	Normal	Uniform	Normal	Uniform	Normal	Uniform	Normal
Bias	0.000	0.000	-0.172	-0.036	-0.002	-0.019	0.987	1.043
MAE	0.076	0.113	0.207	0.188	0.019	0.025	0.999	1.049
MSE	0.010	0.023	0.059	0.052	0.001	0.001	1.222	1.357
RMSE	0.099	0.153	0.242	0.229	0.025	0.033	1.106	1.165
Cor.	0.996	0.990	0.928	0.973	0.919	0.910	0.958	0.953

Table A4: Accuracy indices and correlations for 30-item and 2,000 sample size when actual distribution is normal

	MRM				2PL					
	Item difficulty		Ability		Item difficulty		Item discrimination		Ability	
Prior	Uniform	Normal	Uniform	Normal	Uniform	Normal	Uniform	Normal	Uniform	Normal
Bias	0	0	0.838	0.945	0	0	-0.117	-0.014	0.945	1.003
MAE	0.047	0.047	0.863	0.948	0.090	0.061	0.158	0.076	0.946	1.003
MSE	0.003	0.003	0.935	1.071	0.013	0.009	0.037	0.009	1.023	1.115
RMSE	0.059	0.059	0.967	1.035	0.115	0.093	0.191	0.095	1.011	1.056
Cor.	0.999	0.999	0.904	0.906	0.994	0.996	0.956	0.976	0.935	0.944

Table A4 Continues

	3PL							
	Item difficulty		Item discrimination		Item pseudo-guessing		Ability	
Prior	Uniform	Normal	Uniform	Normal	Uniform	Normal	Uniform	Normal
Bias	0.000	0.000	0.032	-0.032	0.025	0.005	0.932	0.968
MAE	0.182	0.088	0.470	0.145	0.036	0.029	0.941	0.969
MSE	0.047	0.016	0.364	0.034	0.002	0.001	1.101	1.087
RMSE	0.216	0.126	0.604	0.185	0.043	0.038	1.049	1.043
Cor.	0.980	0.993	-0.058	0.922	0.829	0.806	0.910	0.921

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THE INVESTIGATION OF THE RELATIONSHIP BETWEEN SELF-REGULATION AND LANGUAGE LEARNING STRATEGIES

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Abstract: A body of research has shown that self-regulation and language learning strategies are important variables influencing learning. The aim of the study is to analyze the relationship between students' self-regulations and their language learning strategies. For research purposes, the changes in self-regulations and language learning strategies according to achievement and grade levels, together with the more or less frequently used language learning strategies are investigated. The participants comprise 860 higher education students attending various departments in a state university in Turkey. The Scale on Self-Regulation in Learning (SSRL) and Strategy Inventory for Language Learning (SILL) were used to gather data. Descriptive statistics, one-way MANOVA and ANOVA, and correlation statistics were used during data analyses. The findings show medium positive correlations between the two main constructs, changes in both student self-regulations and their language learning strategies when students' achievements and grade levels are considered and reveal some facts about the frequently used or neglected strategies in language learning. Conclusions are drawn and suggestions for further practice and research are made in the end accordingly.

***Keywords*:** Self-regulation, language learning strategies, achievement, grade level, higher education

Introduction

Since the mid-1970s, there has been substantial growth in the literature on language learning strategies and self-regulated learning. Oxford (1990) defines learning strategies as "specific actions taken by the learner to make learning easier, faster, more enjoyable, more self-directed, more effective, and more transferrable to new situations" (p. 8). Self-regulation is one of the key concepts in Bandura's *Social Learning Theory* and is described by Zimmerman (2000: 14) as "self-generated thoughts, feelings, and actions that are planned and cyclically adapted to the attainment of personal goals".

So far, comparatively few studies have examined self-regulation in language learning settings. For example, Kim et al. (2015) investigated English language learners' self-efficacy profiles and their relationship with self-regulated learning strategies. In another research, Ekhlasa and Shangarffam (2013) examined the relationship determinant factors of self-regulation strategies have with main four language skills and overall proficiency. Despite the growing interest in language learning strategies and self-regulated learning, there has been no detailed investigation of the interplay between these two constructs.

In this respect, the main purpose of the present study is to investigate the relationship between the self-regulation levels students have and the language learning strategies they use during learning. The research questions addressed in this paper include:

1. Are the self-regulation levels students have and the language learning strategies they use related?
2. Do students' self-regulations and their language learning strategies change through grades?
3. Are there differences between high and low achievers in terms of their self-regulations and language learning strategies?
4. What language learning strategies are employed more or less frequently by students having high or low self-regulation and achievement levels?

- Selection and peer-review under responsibility of the Organizing Committee of the conference

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Studies on Self-regulation and Language Learning Strategies

Recently, a considerable literature has grown up around the theme of language learning strategies. There is a growing number of publications focusing on the likely relationship between language learning strategies and several factors or outcomes such as achievement, proficiency level, nationality; motivation, beliefs about language learning, learning style, vocabulary size, goal orientations and cultural background etc. (Bremner, 1999; Chang & Liu, 2013; Chen, 2009; Diseth, 2011; Goh & Foong, 1997; Grainger, 2012; Griffiths, 2003; Kim et al., 2015; Magogwe & Oliver, 2007; Nacera, 2010; Phan, 2009; Shmais, 2003; Wong & Nunan, 2011; Yalçın, 2003; Zare-ee, 2010).

Taking the proficiency levels of students, some research found positive correlations between level of proficiency and language learning strategy use (Karahan, 1991; Lai, 2009; Liu, 2004), while some others reported no relationships (Çavuşoğlu, 1992; Tüz, 1995). Studies focusing on relationships between language learning strategies and achievement also had inconsistent results. Again, while some authors reported significant relationships between students' achievement levels and their language learning strategy use (Alamdari, 2010; Aydemir, 2007; Cesur, 201; Sucu, 2009), the others observed insignificant or no relationship at all (Yalçın, 2003).

The recent study of Al-Natour (2012) reported that fourth year (senior) students used language learning strategies significantly higher than the students in other levels. Similarly, Wu (2008) found that higher proficiency EFL students used learning strategies more often than lower proficiency EFL students, especially those cognitive, metacognitive and social strategies. On the other hand, in a Turkish context with 140 undergraduate students from a state university (Yılmaz, 2010) the students were found high strategy users and the language learning strategies were widely used among more proficient learners than less proficient learners. In another study (Al-Buainain, 2010), the results suggested that there was a positive relationship between language learning strategy use and learning level (years of studying English). Similarly, in a recent study that investigated language learning strategy used by Saudi EFL students (N=134) at Aljouf University, Alhaysony (2017) found no significant difference in relation to duration of studying English, although students with long duration reported using language learning strategies most frequently.

Studies on self-regulation have generally investigated the relationship self-regulation might have with different factors and/or examined the influence of self-regulation on some other dependent variables such as academic achievement. However, the results were mixed, inconsistent and inconclusive. For example, in some studies the effects of self-regulation on academic achievement were positive (Cekolin, 2001; Douglas, 2006; Erdogan, 2011; Staudt, 1995), whereas in some other research self-regulation didn't have any significant influence (Heo, 1998; Lewis, 2006). Moreover, some evidence suggested that development of self-regulation took some time. In their longitudinal study with higher education students, Van der Hurk et al (1999) found that students' self-regulation or self-regulatory learning skills developed significantly only in the third and fourth grades. Erdogan (2011) added further evidence on the gradual development of self-regulated learning and identified that senior students' self-regulated learning levels were significantly higher than those attending their initial years in tertiary education.

Methods

Participants and Sampling

In this descriptive study, the participants were higher education students studying at various departments in a state university in Turkey. By using cluster and convenience sampling together, research instruments were given to a total of 860 students (1st grade=237, 2nd=194, 3rd grade=213, 4th grade=216) who were taking English as a foreign language courses through all grades (from freshmen to seniors).

Instruments

The study was conducted in the form of a survey, with data being gathered via "Scale on Self-Regulation in Learning-SSRL" and "Strategy Inventory for Language Learning-SILL". The 67-item SSRL (Erdogan & Senemoglu, 2016) has two subscales as self-regulated learning skills/strategies (45 items) and motivational factors (22 items). The SILL (Oxford, 1990) consists of 50 items under two main constructs of direct (29 items) and indirect (21 items) learning strategies, with three categories under each subscale. In the present study, the alpha coefficients were computed as .91 for both SSRL and SILL. The sub-categories and factors of each scale and their equivalent Alpha coefficients found for the present sample are shown in Table 1.

Table 1. The sub-categories and factors of SSRL and SILL

Scale on Self-Regulation in Learning (SSRL) (α=.91)		**Strategy Inventory for Language Learning (SILL)** (α=.91)	
Self-regulated Learning Skills	**Motivational Factors**	**Direct Strategies**	**Indirect Strategies**
Arrangement of study time Planning Environmental structuring Organization and transforming Seeking appropriate information Seeking easily accessible information Rehearsing and memorizing Self-monitoring Seeking peer, teacher or adult assistance Self-evaluation Self-consequences after success Self-consequences after failure (α=.89)	Self-efficacy Goal-orientations Task value Attributions for failure Anxiety (α=.81)	Memory strategies Cognitive strategies Compensation strategies (α=.85)	Metacognitive strategies Affective Strategies Social strategies (α=.85)

Procedures and Data Analysis

Both instruments were given separately to the same students with one week interval between the two administrations. Grant of application was received from the Board of Ethics. Help was given by the faculty during scale applications, administrations of which took 20-25 minutes each. The data were analyzed with SPSS Version 20. Descriptive statistics, one-way MANOVA and ANOVA, and correlation statistics were used for analysis purposes.

Results And Findings

Findings and related comments for each research question are given separately below.

Research Question 1: Are the self-regulation levels students have and the language learning strategies they use related?

Based on data obtained from SSRL and SILL scores, there is a positive medium correlation (.53) between the two inventories as a whole. Similar positive significant correlations are also true for the subscales. The correlations between the entire inventory and subscales of both SSRL and SILL range from .54 to .11, where the strongest correlation seems to exist between SSRL Skills and SILL Entire and the lowest correlation is between SSRL Motivational Factors and SILL Affective Strategies. These results might indicate that language learning strategies and self-regulation, measured with self-report inventories, are intertwined. Nevertheless, these correlations tell us nothing about the direction of causality. Hence, we cannot suggest that frequency of language learning strategies is attributable to specific aspects of self-regulation. These are simple correlations.

Research Question 2: Do students' self-regulations and their language learning strategies change through grades?

Considering the self-regulation levels and language learning strategies of students, there was statistically significant difference between grade levels on the combined dependent variables ($p< 0.05$). Hence, it can be asserted that both SSRL and SILL mean scores increased through grade levels. However, it is important to consider that while there was a steady increase in SSRL Entire and subscale mean scores through grades, no significant changes were observed from freshmen to seniors in SILL Direct Strategies of Memory, Cognitive and Compensation.

Research Question 3: Are there differences between high and low achievers in terms of their self-regulations and language learning strategies?

In order to find the answer to this question, students were ranked according to their achievement grades in English as a Foreign Language course. Later the top and the bottom quartiles (n=215) were selected and labeled as high and low achievers.

Considering the self-regulation levels of students, there was a significant difference between high and low achievers. When the results for the entire inventory and subscales of SILL were considered separately, there were significant differences (p<0.01) in entire inventory and subscale mean scores of SILL; except for SILL Affective Strategies and SILL Social Strategies (p>0.05).

Research Question 4: What language learning strategies are employed more or less frequently by students having high or low self-regulation and achievement levels?

In order to investigate students' use of SILL strategies based on their levels of self-regulation and achievement levels, mean scores of the individual SILL categories were calculated. For this purpose, the top and the bottom quartiles (n=215) were selected and labeled as high and low both in self-regulation and achievement.

According to Oxford (1990, p. 300), mean scores between 1.0 and 2.4 are defined as "low" strategy use, 2.5 and 3.4 as "medium" strategy use, and 3.5 and 5.0 as "high" strategy use. The analysis of mean scores of each SILL strategy revealed that students in the high level self-regulation group used the entire strategies more frequently than the students in the low level self-regulation group. The high level self-regulation group students were "high" users of memory, cognitive, compensation and metacognitive strategies and "medium" users of affective and social strategies; whereas the low level self-regulation group students were "medium" users of all SILL strategies. When the achievement levels of students were considered, the high achievers seemed to use the entire SILL categories more frequently than the low achievers except for the affective strategies. Again the high achievers were "high" users of compensation and metacognitive strategies and "medium" users of the remaining SILL strategies; whereas the low achievers were "medium" users of the entire SILL categories.

Conclusion

The results of the present study confirmed the existence of an intimate relationship between students' levels of self-regulation and their language learning strategy use. According to grade levels; while students' SRL increased significantly, the only significant increase found in language learning strategies were in indirect strategies (metacognitive, affective and social). Between high and low achievers; there was a significant difference in self-regulated learning, while the same difference was also observed in language learning strategies, except for affective and social strategies. The present study also confirmed that students with high self-regulated learning were high level strategy users and they significantly differed from students with low self-regulated learning. Additionally, high achievers were medium level strategy users and they differed significantly from low achievers, except for affective and social strategies.

Recommendations

It is important to note that the participating students didn't have any overt language strategy use instruction. The existing literature on strategy instruction (Cohen & Weaver, 1998; Dreyer & Nel, 2003) confirms the positive and significant effects of such training not only on frequency of learning strategy use, but also on other learning outcomes such as achievement. So, it is believed that repetition of this study with groups having explicit language strategy use instruction would reveal different results.

The follow-up of this study would be to individualize classroom instruction based on students' levels of language learning strategy use and self-regulation and see the results of the intervention. Another subsequent study would be to analyze the relationship between students' self-regulated learning levels and the learning strategies they employ in other disciplines such as math, science, literature, history and do comparative analyses between the findings.

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AN INVESTIGATION OF LEARNING APPROACHES AND LANGUAGE LEARNING STRATEGIES: ARE THEY RELATED?

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Abstract: In related research, learning approaches and learning strategies have been reported as important variables influencing the quality of student learning. The aim of the present study is to investigate the relationship between the learning approaches and the language learning strategies of higher education students. The research was conducted with the participation of 493 freshmen (M=257, F=236) attending various departments at Balikesir University in Turkey. For research purposes, the Turkish versions of Strategy Inventory of Language Learning (SILL) and the Approaches and Study Skills Inventory for Students (ASSIST) were used. After the reliability of both instruments was computed, descriptive and inferential statistics were used to analyze data. The findings are to be discussed and commented considering students' levels of language learning strategy use and their learning approaches and changes in those levels according to participants' gender and field of study.

***Keywords*:** Learning approaches, language learning strategies, gender, grade level, field of study

Introduction

Learning approaches (LAs) and language learning strategies (LLSs) are considered as important variables influencing the quality of student learning. Oxford (1990) defines LLSs as "specific actions taken by the learner to make learning easier, faster, more enjoyable, more self-directed, more effective, and more transferrable to new situations" (p. 8). LAs on the other hand are the different orientations (deep, surface and strategic) students in higher education may adopt depending upon the their perceptions of the content, the context and the demands of academic situations (Marton, 1976; Ramsden, 1979).

Enwistle and Peterson (2004) argue that like other broad constructs such as conceptions of knowledge and conceptions of learning, Las (orientations) also develop and change during the learning process and within different environments. In their review Baeten et al. (2010) present a list of encouraging and discouraging factors that may influence students' orientations to learning (p. 247), where they group them as contextual factors , perceived contextual factors and student factors. Among many other factors, they discuss the influence of discipline or area of study, gender, academic skills and coping strategies, learning habits, and emotions on students' adoption of LAs. In conclusion, since the findings are inconclusive and inconsistent, their review points out to the necessity of additional research on these issues. Additionally, as Oxford and Burry-Stock (1995) suggest, teachers must also keep in mind differences in motivation, learning style, gender, and other factors that affect LLS use. So, examining the factors that influence LLS use would give both researchers and teachers insight on how to enhance student learning.

In this respect, this study endeavors to determine and compare the LAs and LLSs of students in higher education. The research questions addressed in this study are:

1. What is the level of relationship between students' LAs (deep, surface and strategic) and their LLSs?
2. Is there a significant difference between LAs and LLSs based on students' major and gender?

- Selection and peer-review under responsibility of the Organizing Committee of the conference

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Prior to this study, no attempt has been made to investigate the relationship between LAs and LLSs. The authors' aim is not to replicate the studies found in literature, but to bring an insight into the interplay between them and to discuss the differences based on factors such as discipline and gender.

Review of Research on Learning Approaches and Language Learning Strategies

Studies conducted on gender differences and Las adopted have not produced conclusive results. While some research reported no consistent evidence of significant difference between males and females (Ballantine, Duff & McCourt Larres, 2008; Mogre & Amalba, 2015; Vermunt, 2005), some other found significant differences (Karaduman et al., 2015; Xie & Zhang; 2015). Similarly, studies investigating differences in learning orientations based on field of study revealed interesting findings. Baeten et al. (2010) showed that students in various disciplines differ in their LA, with students in human sciences in general adopting the deepest approach. Ballantine, Duff and McCourt Larres (2008) found significant increase in accounting and business students' surface approach to learning. Booth, Luckett & Mladenovic (1999) found that Australian university accounting students had significantly higher surface approach scores and lower deep approach scores than arts, education and science university students. Lake, Boyd and Boyd (2015) demonstrated that deep approach didn't appear to vary greatly across seven discipline areas; however the results considering the surface approach revealed that Arts & Social Science had a significantly lower score than Environment, Science & Engineering, Health & Human Science, Business, and Tourism & Hospitality. Kember, Leung and McNaught (2008) observed that the social science students were most likely to adopt a deep approach and least likely to adopt a surface approach compared to their counterparts in science disciplines.

Relatively few studies have examined the relationship between field of study and LLS use. Chang (1991) found that compensation strategies were used the highest and the affective strategies the lowest. Moreover, humanities and social science majors utilized more learning strategies than science majors. Peacock and Ho (2003) reported that English major students made use of strategies the most, while computer science majors used the strategies the least. Chang (2012) reported that European Language majors used the strategies the most, while Sports Business Management majors utilized them the least. Regarding gender differences in LLS use there are some inconsistencies. In many LLS studies involving gender, differences between males and females were reported, usually favoring females as more frequent users of strategies (Alhaysony, 2017; Al-Natour, 2012; Goh & Foong, 1997). However, a few studies gave accounts of males surpassing females in strategy use (Peng, 2001; Tercanlıoğlu, 2004; Wharton, 2000), whilst in some other studies, no empirical evidence was found to support gender factor in LLS preference and use (Chang, 2012; Griffiths, 2003; Poole, 2000).

Methods

Participants and Sampling

This descriptive study involved students attending various departments at Balikesir University in Turkey. Data were gathered from 493 freshmen (female=236, male=257), who took English as a foreign language as an obligatory course. Students were selected on voluntary basis with convenience sampling. The administration of each inventory took 20-25 minutes.

Instruments

For research purposes, the Turkish versions of Strategy Inventory of Language Learning (SILL) and the Approaches and Study Skills Inventory for Students (ASSIST) were used.

SILL (Oxford, 1990) consists of 50 items under two main constructs of direct (29 items) and indirect (21 items) learning strategies. Direct strategies are subdivided into memory (9 items), cognitive (14 items), and compensation (6 items) strategies, whereas indirect strategies are subdivided into meta-cognitive (9 items), affective (6 items), and social (6 items) strategies. The Turkish version of SILL was adapted by Cesur and Fer (2007) and the correlations of the six sub-dimensions of the adapted version with the original ones range from .65 to .78.

ASSIST (Tait, Entwistle & McCune, 1998) measures students' approaches to learning on mainly three dimensions as deep, strategic, and surface-apathetic. The inventory is comprised of 67 statements and respondents indicate their agreement with each statement using a five point Likert scale. The Turkish version was adapted by Senemoglu (2011) and has a correlation coefficient of .82 with the original one. In the present study, the 52-item second section of the inventory was used to find out students' preferences to LAs.

Data Analysis

To facilitate efficient data analysis, data were coded into SPSS version 21. Both descriptive and inferential statistics were used during analyses. Pearson correlation was run to investigate the relationship between Las and LLSs. One way between groups multivariate analysis of variance (MANOVA) was performed to determine significance of variation in Las and LLSs in relation to gender and fields of study.

Results And Findings

Research Question 1: What is the level of relationship between students' Las (deep, surface and strategic) and their LLSs?

Based on data obtained from ASSIST and SILL scores (Table 1), the correlations of SILL with deep approach and strategic approach are at medium level (.35). These results might indicate that language learning strategies and learning approaches of deep and strategic, as measured with self-report inventories, are intertwined.

Table 1. Correlations between subscales of ASSIST and SILL

Subscales ASSIST	Entire SILL	SILL Direct	SILL Indirect	Memory	Cognitive	Compensation	Metacognitive	Affective	Social
Deep	,348**	,368**	,280**	,455**	,278**	,231**	,255**	,259**	,216**
Surface	,072	,080	,052	,121**	,018	,116**	,042	,082	,014
Strategic	,346**	,332**	,322**	,435**	,244**	,186**	,280**	,341**	,226**

**. Correlation is significant at the 0.01 level (2-tailed).

Research Question 2: Is there a significant difference between LAs and LLSs based on students' major and gender?

To investigate the differences a one way between groups multivariate analysis of variance (MANOVA) was performed. Findings indicated that both males and females were equally motivated for achievement, organizing their studies, monitoring their understandings and managing their time (strategic approach) more than the other approaches. And compared to males, females were significantly in favor of surface approach. Even though the differences were not significant, the males were slightly more inclined to deep approach, whereas the females preferred strategic approach slightly more. When the results for the entire inventory and subscales of SILL were considered, there were statistically significant differences ($p< 0.05$) in entire inventory and subscales of SILL mean scores, except for memory strategies: $F(1, 491)=2.02$, *partial eta squared*=0.004 and affective strategies: $F(1, 491)=2.70$, *partial eta squared*=0.020. These findings reveal that male students were inclined to use LLSs more than females.

Taking the majors or disciplines of students into account, a significant difference was observed for all Las ($p<0.05$). Overall, the findings indicate that students at different disciplines were more inclined towards strategic approach. A further outcome that emerged was that students at health sciences tended to use surface approach more than the other disciplines, while students studying at education faculty were the ones favoring the surface approach the least. Perhaps the most interesting finding to emerge from the analysis was that engineering students had the highest total mean scores in deep and strategic approach.

Based on the results for the entire inventory and subscales of SILL, there were statistically significant differences among students from different majors. Pair wise post hoc analyses indicated that students studying at engineering departments made use of language learning strategies the most, while the students enrolling at health sciences departments resorted to them the least. Interestingly, students majoring at education had the lowest total mean scores in memory and compensation strategies.

Conclusion

This study used quantitative data from two scale applications to investigate the relationship between students' LAs and LLS use. Further, this research set out to examine the differences in LAs and LLSs based on gender and

field of study. The results of the research showed that students' LAs were associated with their language learning strategy use. There was positive correlation between all components of LLSs and deep and strategic approaches, while the only significant correlations between surface approach and LLSs were memory and compensation strategies. The results further showed that ASSIST and SILL identified differences between gender groups and fields of study.

Recommendations

Given that the previous and present research suggest mixed findings on factors like gender and field of study, there is a need for more research to explore the relationship between learners' LAs and their LLSs. Later, those results obtained might be utilized to design the courses for individual students with varying types and levels of LAs and strategy use, thus provide students instructional support in a constructive way.

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EXAMINATION 8TH GRADE STUDENTS' COGNITIVE STRUCTURES ABOUT PHYSICAL AND CHEMICAL CHANGES THROUGH WORD ASSOCIATION TEST

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Abstract: In this study it is aimed to investigate middle school students' cognitive structures of physical and chemical changes through word association test (WAT). The data were collected from 126 eight grade students. The WAT was used as data a data collection instrument developed by the researcher in her previous study. At the beginning of the study, the physical and chemical change topic placed in the middle school science curriculum was examined and also the opinions of the two science teachers were asked to establish the content validity of the stimulus words of WAT. The same WAT comprised of eight total stimulus words was decided to use without modification. The response frequency mapping method was used to examine students' cognitive structure which was developed by the researcher. At the end of the study, it was found that all stimulus words appeared and were added to the map at the frequency range $16 \leq f \leq 20$ as five separate islands. Besides, it was concluded that the eight grade students, like ninth and tenth grade students, could not associate with the concept of energy with other concepts of the subject.

***Keywords*:** Eight school students, cognitive structures, physical and chemical changes, WAT

Introduction

There is an interaction between the students' new knowledge thought in class and their existing knowledge. For this reason what the students have learned in their previous class and how this knowledge in their cognitive structure have constructed are very important to subsequent learning. The cognitive structure comprises learners' existing experiences and knowledge that will lead to their reconstruction and information processing of the incoming stimuli (Nakiboğlu, 2008). The researchers use different terms to describe cognitive structure, such as, structural knowledge (Jonassen et al., 1993 cited in Tsai and Huang, 2002) or knowledge structure (Champagne, Klopfer, Desena and Squires, 1981). The knowledge students acquire in science classrooms is stored in long-term memory in a hierarchically organized form, and can be represented as a cognitive structure in their memory (Tsai, 2001; Kalyuga, 2006). Proping students' cognitive structure is important to discover what students learn and how their knowledge may change during the learning process (Tsai and Huang, 2002). Therefore, knowing students' prior knowledge can guide teachers to design appropriate teaching strategies in their classless.

In this study, it was focused on students' cognitive structures of the physical and chemical changes. The subject of the physical and chemical changes is one of the basic and essential issues of both middle school science curriculum and the high school chemistry curriculum. This subject is also related to daily life. On the other hand, it was found that students had learning difficulties and misconceptions concerning the identification of the physical and chemical changes. So many studies of specific learning problems and students' misconceptions concerning the physical and chemical changes have been reported in the literature. Since there was not known about students' cognitive structure of the physical and chemical changes, the high school students' cognitive structures of the physical and chemical changes through word association test (WAT) were investigated in the previous study by Nakiboğlu (2016). Nakiboğlu (2016) compared the results of ninth and tenth grades students' cognitive structures concerning the physical and chemical changes. The comparison of the students' cognitive structures showed that all stimulus words appeared and were added to the map at the frequency range $16 \leq f \leq 20$ as three separate islands in the ninth grade students' cognitive structures, not all stimulus words appeared at the

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same frequency range of the tenth grades'. In the case of 9th grade that before teaching the physical and chemical changes topic there were more disconnected ideas in the students' minds. She concluded that there were differences between these two grades and the instruction has an influence on students' cognitive structure about the physical and chemical changes (Nakiboğlu, 2016). From this departure point, it was aimed to find out eight grade students' cognitive structures of the physical and chemical changes firstly, and to compare the results with results of high school students'.

Methods

Data were collected 126 eight grade students from two middle schools. All students were taught the unit "The particulate nature of matter/Matter and change (in 6th, 7th and 8th grades) before data were collected. The WAT was used as a data collection instrument developed by the researcher in her previous study. At the beginning of the study, the physical and chemical change topic placed in the middle school science curriculum was examined and also the opinions of the two science teachers were asked to establish the content validity of the stimulus words of WAT (Gay and Airasion, 2000, p. 163). The same WAT comprised of eight total stimulus words was decided to use without modification. The students were provided with a booklet, each page containing each page of which contained one of the eight stimulus words.

Analysis of Data

There are several ways of scoring the data provided by a WAT. The response frequencies method developed by Nakiboğlu (2008) was used to mapping of students' cognitive structures in this study. This mapping method is an integrated method which is based on Gussarsky and Gorodetsky' (1988) relatedness coefficient method and Bahar et al. (1999) response frequencies' mapping method. The number of responses to each stimulus word was tabulated for 8th grade firstly and then maps were drawn taking into account these tables. While drawing the tables, when a stimulus word was obtained from students as a response word, it was enclosed in a frame to the map. When a response word was obtained as a new word, it was added to the map without frames.

Results and Findings

The map of students' cognitive structures was drawn from the frequency tables. In Figure 1, a part of map concerning cognitive structure of students at frequency 20 was presented.

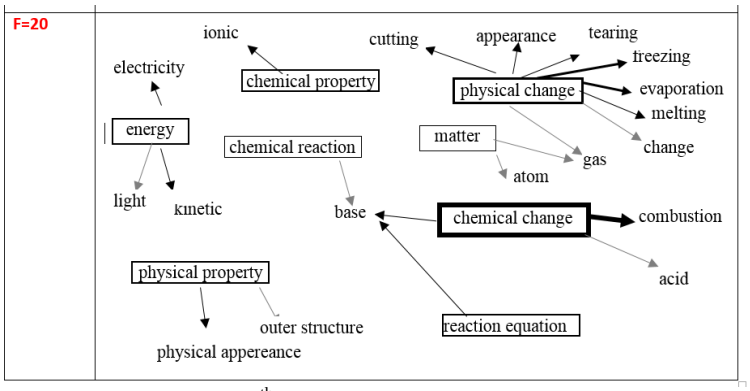

Figure1. The 8th grade students' cognitive structure

It was seen that from Figure 1, the first and strongest relationship is between chemical change and combustion. This result is very similar to the results obtained from the 9th and 10th grade students. It is also seen that there are no connections between concepts and that the concepts are clustered into separate islands. On the other hand, the relations placed in the cognitive structures of 9th and 10th grade students were better than the map placed in Figure 1.

Conclusion

In this study, the word association test (WAT) was applied successfully for identifying conceptual organization of the cognitive structure of middle school. It was concluded that the chemical change, chemical properties and reaction equation concepts are correlated with one another in the eight grade students' cognitive structures. It is

interesting finding is that the relationships between concepts are constructed based on the "base" concept. On the other hand, in the secondary students'cognitive structures the concepts were mostly constructed based on the concept of "atom". This may be related to the fact that the concept of the atom is too abstract for 8th grade students. Another interesting result is that the concept of energy has emerged as a separate island like in the high school students' cognitive structures.

Recommendations

The first general recommendation of this study is that the teachers should gain information about their students' prior knowledge before the instruction that so they can find to chance to reconsider their teaching strategies. To gain students' cognitive structures can use so many techniques such as concept map and flow map. The WAT technique can also be suggested using before the instruction to gain the students' prior concepts in students' conceptual structure and after the instruction to see how changes the students' cognitive structures. Finally it can be recommended that the abstract concepts like the atom concept should be explained more carefully for the middle school students.

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SHOULD THE STUDENTS BE ENGAGED IN THE HIGHER EDUCATION QUALITY ASSURANCE? (PERSPECTIVES OF STUDENTS AND QUALITY ASSURANCE DEPARTMENT)

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Abstract: Almost all higher educational institutions create their own education quality management systems throughout the world. Higher educational institutions need to respond to the international standards and criteria of quality development. The education quality management is the internal and external assessment procedure; which implementation contribute to the quality increase of an institute. In our case, the quality assessment provides the education quality improvement at a higher educational institution. In the regulation of the European universities, the student's role is clearly defined and highlighted in the above-mentioned process. With the student's engagement, we mean the interaction of students and other resources of a university for the increase of educational result and the development of educational activities in order to improve the reputation of higher educational institution. Since the European country joins the Bologna Process, the country has obligation to share the European countries' experience and satisfy all the demands stated towards the country. Thus, it is important to study and implement the world's best practices of student's engagement in the education quality management process. During the research, we have learned the students' attitudes towards the education quality management department and its activities, how students are engaged in the quality management process, whether the mentioned department gives feedback to students, what students think about their role in the described process. The research was conducted in two Georgian and one Spanish universities. The interviews were done with students and representatives of education quality management department. The research showed that the most of respondents have the wish to increase the students' engagement level. However, there were defined the different obstructions and challenges; the students name the less feedback from university, and the representatives of the Education Quality Assurance Department highlight the problem of students' less knowledge and awareness.

***Keywords*:** Education quality management, student's engagement, higher educational institution, Georgian education.

Introduction

In the modern world, the issue of education field and educational institutions has been becoming more and more actual. The 21st century is unimaginable without education and modern educational system; the latter needs the permanent changes, reforms and quick development in the competitive market conditions. Georgia is a developing country, which follows the global achievement and tries to implement them in the Georgian practice as the reforms. The Georgian higher educational system is one of the most important and permanently developing fields for the country. In the recent years, many interesting changes and reforms have been implemented in the higher educational system. In 2004, the higher educational system and legislative regulations

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were greatly changed; and in 2005, Georgia joined the Bologna Process at the Bergen Summit, where the country took some responsibilities and duties (Communiqué of the Conference of European Ministers Responsible for Higher Education, 2005). The Bologna Process is the harmonization process of European countries' education systems that aims at working out the methods and instruments for creating the united European space of higher education. Nowadays, 49 countries and some international organizations are the members of Bologna Process. (Bologna Declaration, 1999)

In the United States of America and the leading European countries, the role of the students in the educational process and higher education quality assurance is very important. Since Georgia joined the Bologna Process, the country is responsible for considering and sharing the best practice of European countries in order to comply the Georgian education system with the standards of the European education system and to satisfy the demands stated towards the country. Thus, it is important to study and implement the successful experiences of students' engagement in the higher education quality assurance process of the world's best universities.

According to the document "Standards and Guidelines for Quality Assurance in the European Higher Education Area (ESG)", which is prepared in Belgium in 2015, a high educational institution is obliged to engage students in the education quality management process and consider their ideas. The mentioned is substantiated with the following quote: "Students' opinions and their ideas are often very relevant and effective". Georgian education system is also obliged to implement the document in practice in order to make the Georgian education system, and the country in general, harmonized with the European Union's standards. (Standards and Guidelines for Quality Assurance in the European Higher Education Area (ESG), 2015)

The quality assurance includes the evaluation and assessment of the higher education standards and quality in compliance with the educational expectations. In the regulations of the European universities, the role of students is clearly highlighted in the above-mentioned process. The higher educational institutions are obliged to collaborate with the students in the quality assurance in order to proceed the educational process in an effective way. Besides the mentioned responsibilities of European countries towards the European Union, according to the Georgian Law "the collaboration between the quality assurance department of a Legal Person of Public Law – higher educational institution and the quality assurance of the main educational unit is regulated with the regulation of a higher educational institutions", which means that based on the Georgian Law, a Georgian educational institutions has the complete authority in own educational activities. The same legislation describes the obligation of an educational institution to contribute to the Students' Self-Government organizations to fulfil their duty and engage each student in the evaluation process of academic staff. In addition, according to the Georgian Law on Higher Education, a student has the right to participate in the educational management process, furthermore, a higher educational institution and its Students' Self-Government have the responsibility to consider all the students' opinions and engage them in the decision-making process. (Georgian Law on Higher Education, 2014)

What is the Students' Engagement?

Students' engagement in the quality management process has the key role in the effective education quality assurance. The term "students' engagement" was established in the scientific educational literature in 1990s, which means the interaction of students and other departments of an educational institution to increase the academic results and to develop the educational activities, which aim at increasing the students' experience and higher educational institution's reputation (Trowler V., 2010). The engagement in the education quality management process is more than a simple participation; for the engagement, the personal motivation is very important in order to receive the targeted and analyzed participation in the processes. The engagement is the process, where an educational institution gives the possibility to the students to take participation in the educational activities. There are three types of students' engagement:

- Behavioral engagement – students, who are behaviorally engaged in the management process, mainly satisfy the institutional behavior norms related to the management, such as attendance and participation in the management process;
- Emotional engagement – students, who are emotionally engaged, have their own identity with the process, and therefore, they have the internal interest towards the work, identity and positive attitude to the activity;
- Cognitive engagement - students, who are cognitively engaged, try to acquire with more information about the process and deeply analyze it. They pay attention to the educational process, additional requirements and take any challenges with great pleasure. (Bloom, 1956)

Each type of above-mentioned engagement has the positive and negative sides. With the terms "positive" and "negative", the students' evaluation, attitude and expectation level is meant, which is expressed in their

productive performance. The engagement is the process, where an educational institution gives students the possibilities to create and participate in the educational activities.

Why is the Students' Engagement Important?

Students' engagement in the process of higher education management is one of the most important parts of the Bologna Process. The main topic of the Oslo Conference 2010 was the students' participation in the higher education quality management. In addition, according to the communique of the conference in Prague, the Ministers of the participant countries affirmed that "Students should participate in and influence the organization and content of education at universities and other higher education institutions", and "Students are the full members of education system". This idea was supported by the Ministers of Education of the European countries, among them is the Ministry of Education and Science of Georgia, as a participant country of the Bologna Process. (Prague Communique, 2001)

The document "Standards and Guidelines for Quality Assurance in the European Higher Education Area (ESG)", which is prepared in Brussel, Belgium in 2015, is oriented on the education quality management that is related to the learning and teaching factors in the higher education, such as educational environment, research and innovations. One of the main demands of the mentioned document is the students' engagement in the quality management process, their active participation and consideration of students' ideas. (Standards and Guidelines for Quality Assurance in the European Higher Education Area (ESG), 2015)

The document "Standards and Guidelines for Quality Assurance in the European Higher Education Area (ESG)" is based on the following four principles for the education quality assurance of higher educational institution:

1. Higher education institutions have primary responsibility for the quality of their provision and its assurance;
2. Quality assurance responds to the diversity of higher education systems, institutions, programs and students;
3. Quality assurance supports the development of a quality culture;
4. Quality assurance takes into account the needs and expectations of students, all other stakeholders and society. (Standards and Guidelines for Quality Assurance in the European Higher Education Area (ESG), 2015)

Students engagement in the higher education quality assurance process has many benefits; many books and articles underline its benefits. For example, the Practice Guide for Higher Education Providers and Students' Unions explain the positive impact of students' engagement: "It was clear that decisions at every level of an institution impact on the students' learning experience, be it module/unit level, program, department, faculty/school or institution wide policy and strategy. Institutions reported that involving students at all levels provided a different perspective and ensured students were engaged more closely to inform how learning experiences could be better aligned to student learning needs". (Velden G. M. 2013)

Moreover, the 'student voice' provides valuable insight to auditors and reviewers about the student experience. "Audit teams recognize the value and importance of student's involvement in the audit process". (Annual QAA Report to the Higher Education Funding Council for England, 2006)

According to the experience and best-practice of developed countries, we can say that the students' engagement in the higher education quality assurance process is very important. For this reason, "many countries have made some progress in involving students in quality assurance. However, a small number of countries have not yet begun to involve students at any level in quality assurance". (Bologna Stocktaking Report Bologna Follow-Up Group, 2005)

Research Methods

The research goal was to study the students' engagement in the education quality management and organizational development process of higher educational institutions, and the openness level towards the mentioned process from an institution.

The research objectives were the following:

- To define the students' engagement level in the higher education quality management and quality organizational development process at the state and private higher educational institutions;

- To study the students' awareness on the education quality assurance department;
- To work out the recommendations aiming at the students' engagement and active involvement in the organizational development of education quality.

The research was conducted with the qualitative method, in particular the semi-structured interview. For this reason, the special question matrix was worked out. For the research, three European universities were selected: two Georgian universities – Ivane Javakhishvili Tbilisi State University (state) and Tbilisi Open Teaching University (private), and one Spanish university – University of Coruna (state). The interviews were conducted with the central and faculty representatives of education quality assurance department; as well as the Bachelor's Degree students of different faculties and courses. In total, interviews were done with 7 university quality department representatives and 30 students.

Among the Georgian respondent students, there were the students' self-government representatives; but the system of students' self-government does not exist at the University of Coruna. In case of desire, the students can become a member of Erasmus Student Network (ESN) if they used as the Erasmus Exchange Program before. The Erasmus Student Network members are obliged to plan the different kinds of extracurricular and entertaining activities for students, which is not related to the education quality management at all.

Results and Findings

Interviews – Quality Assurance Department

It is worth to mention that almost all units of an educational institution are involved in the education quality assurance, such as deans, quality assurance and strategic development department, representative and academic senate that makes the final decisions and rector that issues a statement. All the units have own function, which are defined with the regulation. The state universities (Ivane Javakhishvili Tbilisi State University and University of Coruna) have the central and faculty representatives of quality assurance department; the latter is accountable to the central one. The private university (Tbilisi Open Teaching University) has one quality assurance department that fulfills own duty in collaboration with the dean.

As a result, there is found that the representatives of quality assurance department see their responsibilities broadly, simultaneously they consider that the quality assurance department should work on the development of university by strategic planning, researching, educational program creating/improving, etc.

> *"Our main function is to work out the recommendations to improve the education quality. Quality is not the one that I have today and that is all. We should be oriented on the permanent development and progress". (Central Quality Assurance Department, Ivane Javakhishvili Tbilisi State University, State)*

> *"Our obligation is to participate in the strategic plan creation of a faculty and its monitoring, to work out the quality assurance mechanisms and researches, to plan/develop the educational program/syllabuses, to recognize credits, to study the labor market and its demands, to monitor the students' academic performance, to prepare the staff schedule, to participate in the methodology of defining the scientific and invited staff capacity". (Faculty Quality Assurance Department, Ivane Javakhishvili Tbilisi State University, State)*

> *"We are using the evidence-based researches, data, quality measurement with the specific indicators in order to provide better service. We are doing all these by using the special guide for higher education quality assurance of our university". (Central Quality Assurance Department, University of Coruna, State)*

The Georgian universities, as the most of European universities, have two directions, where the students' engagement is very important. They are: internal quality assurance and extracurricular activities. In the internal quality assurance process, all the students have the right to get engaged; but this engagement should be in an organized way. Moreover, the universities have the Board (in case of state universities, faculty has own Board), which makes decision aiming at the development of faculty/university. Some of the Board members are students/students' self-government members, who are involved in the different educational program planning, modifying and other education quality assurance issues. In the process of the creation of faculty, the faculty board is created that makes decision with the purpose of the faculty development.

According to the quality assurance department representatives, the students' engagement is assessed in the following way:

"One quarter of the board members is students, who are engaged in the educational program planning and modification issues. For example, in the process of educational program creation, the working group includes the academic staff, students, graduates and employers. The program prepared with the students' engagement passes the expertise in compliance with the legislation, then the program goes to the quality management and strategic development department, and finally, the dean presents it at the academic and representative senate, where the head of students' self-government and graduated are involved. Then, the board makes the final decision on the program implementation". (Quality Assurance Department, Tbilisi Open Teaching University, State)

"Article 6, Item 45 of the Georgian Law on Higher Education is about the students' self-government; the members of the students' self-government are authorized to participate in the university development process, to work out any suggestions, etc. The faculty board members include the representatives from the students' self-government, which quantity is defined with the board regulation. However, the law indicates that their number must not be less than a quarter. But, the other students' engagement is a little limited." (Central Quality Assurance Department, Ivane Javakhishvili Tbilisi State University, State)

"*The representatives of the students' self-government, who present other students, actively participate in the meetings organized by the faculty board. For example, the representatives of faculty self-government were against to increase the number of literature in English language, and their demand was satisfied." (Faculty Quality Assurance Department, Ivane Javakhishvili Tbilisi State University, State)*

We should mention that during the illustration of the specific examples of students' engagement, the respondents talk about the official, legally binding and regulated procedures of students' engagement; there are less cases or almost none of specific cases of students' initiatives, suggestions or other kind of their engagement in the quality development process. Thus, as the result of interviews, there is found out that the system of students' self-government engagement is mainly organized, but the other students are less involved in the education quality management. According to the quality assurance department, this fact is conditioned with the less interest from students, as nowadays students can find any kind of information, even about their rights and engagement possibilities in case of their interest.

It is worth to say that the evaluation questionnaire of lecturers and educational process, which are prepared by the education quality assurance department, are quiet actively used by the same department. However, almost all respondents (representatives of Quality Assurance Department) say that most of the students do not fill in the questionnaire, or they fill in it because they have to do, as they cannot go their profile page in the university online base if they do not complete the questionnaire; as a result, we receive the irrelevant results from the evaluation process. Thus, the only instrument of feedback, such as the evaluation questionnaire, is considered as "non-formal" or unreliable by the Quality Assurance Department.

Simultaneously, due the respondents, there is some kinds of incredibility and disappointment among the students towards questionnaire:

"During filling in the questionnaire by a student, the main problems are arisen. I want to say sincerely that when I was a student and had to complete the evaluation paper, even I was not very frank, because I had a very little hope of any changes at university." (Central Quality Assurance Department, Ivane Javakhishvili Tbilisi State University, State)

The author of the above-mentioned quotation is an ex-student, who currently works at the education Quality Assurance Department. The attitude towards the evaluation questionnaires is clearly visible that even the respondents do not have any expectation of changes during filling in the questionnaires. The same reply is received from the representative of the central Quality Assurance Department at University of Coruna, who is also ex-student of the same university. From the mentioned interviews, we can see clearly that the respondents do not have any real expectation of the students' sincerity (because of their own experience). However, besides that fact that they know the real reason of little level of students' activeness and sincerity, none of them mentions any kind of strategy or approach to the mentioned problem-solving prepared by the university, in particular by the Quality Assurance Department.

Moreover, in the opinion of the representatives of Quality Assurance Department, the less engagement of students is provoked by the low level of motivation. Two reasons of low level of motivation were mentioned: the first – the low knowledge of not only education quality, but in general students' responsibilities and activities or other university issues, and the second – the big number of students. According to the Georgian respondents, recently, most of the Georgian schoolchildren become students with as low grades (in case of passing the minimum limit), as high grades. Due to the representatives of Quality Assurance Department, low grade students have the low motivation to study or to get involved in any activity.

As the reason of students' inertness, there are also named the national character and mentality by the representatives of all three universities. It is interesting that the replies of Georgian and Spanish universities around the mentioned reason of students' inertness are coincided with each other.

It is worth to say that during the interviews all the representatives of Quality Assurance Department of three universities express their will to increase the students' engagement, as in their opinion, in case of more engaged students, the performance quality of Quality Assurance Department will be increased.

> *"If students are more engaged, and demand more from me, I will work and do more. The society receives whatever they demand." (Central Quality Assurance Department, Ivane Javakhishvili Tbilisi State University, State)*

The interview results show that the representatives of the Quality Assurance Department consider the students' engagement as very important. They think that not only the members of students' self-government should be engaged, which somehow creates the border and "close" space. They think that it is important to make the systematic changes in this direction at the government level, to plan the communication between high school pupils, students and university in a better way. It is important to strengthen the engagement at the faculty by using the information boards and organizing the meetings.

> *"In England, universities have a very good practice, they organize the open meetings not only during one day, but it continues for a long time. The meetings are held with future students. It is important to have the strong communication with schools; the Ministry should provide high school pupils with the information meeting, they can attend the lecturers as free listeners. Children become students, and then they realize that they do not wish it. In England, schoolchildren get acquired with the theoretical knowledge about university at schools, they visit universities and learn the university system in practice, and they know where to pass and what they desire." (Central Quality Assurance Department, Ivane Javakhishvili Tbilisi State University, State)*

> *"When I was a student, I did not know the university system and university life. The term "credit" was associated with the bank credit. That is why it is important to give the information about university life to students or high school children." (Central Quality Assurance Department, Ivane Javakhishvili Tbilisi State University, State)*

> *"Our department meets the first year students on the first days of academic year, we explain the importance of their engagement and involvement. However, students are not interested in the university issues very much at the second and third year, and at the fourth year it is too late." (Faculty Quality Assurance Department, University of Coruna, Private)*

As the result of interviews, there are defined the advantages and disadvantages of students' (future) engagement due to the opinions of representatives of Quality Assurance Department. As the positive side of students' engagement, there are considered the following: defining problem and showing the necessity of development, which will contribute the Department to improve their performance and results.

> *"Students often give the fair demands, for example, systematically missing a lecture or being late by a lecturer. Those problems are solvable." (Central Quality Assurance Department, Ivane Javakhishvili Tbilisi State University, State)*

> *"Students' engagement is very important not only because we are obliged to involve them, but it is necessary to hear their ideas, complaints and to have the relevant feedback to the problems." (Faculty Quality Assurance Department, University of Coruna, Private)*

However, we should mention that a respondent receives the above-mentioned information from own students during lecturing, and not as a representative of the Quality Assurance Department.

As the only negative result of students' engagement, there is defined the students' young spirit.

> *"The negative result is probably the fact that they are young and "their boiling blood", so they may demand what they desire at wrong time in a wrong way. I cannot see any other negative factor of students' engagement, vice versa it is very beneficial when students involve in any activity." (Central Quality Assurance Department, Ivane Javakhishvili Tbilisi State University, State)*

Thus, the representatives of Quality Assurance Department think that the students' engagement has the function of monitoring on the education quality; however, it is necessary to implement the clear regulations/instructions in order to make students' activities objective and to use their involvement for the improvement of a university.

During the research, the motivation of students' engagement is studied in the opinion of the representatives of Quality Assurance Department. They think that the students' main motivation is self-development, collaboration and education process and teaching quality improvement. However, they also mention that they have not received any kind of complaints or suggestions of collaboration from students. They have made their conclusion due to their personal talks. In the Georgian universities, the "influence from outside" is also named as the motivation of students' engagement.

> *"Unfortunately, sometimes students' motivation is not always pure. Sometimes, some people use students for their own purposes." (Central Quality Assurance Department, Ivane Javakhishvili Tbilisi State University, State)*

In case of extracurricular activities, the students and members of students' self-government are more active. Their activities are independent from the university administration. In addition, the students' extracurricular and entertaining activities are implemented with the budget defined by the university.

> *"The students' self-government organizes the entertaining activities, excursions and sport events with the support of university; in this case, students have their own system, and we, the administration, do not interfere in their choices and regulations. We only support their activities." (Quality Assurance Department, Tbilisi Open Teaching University, State)*

It is worth to say that the representatives of Education Quality Assurance Department of all three universities think that the students' engagement have the positive impact on students' academic performance and the satisfaction level with university.

In conclusion, we can say that:

1. In the education quality management process, there are mainly involved the members of students' self-government, and less the other students;
2. The engagement of students' self-government in education quality management process is regulated with the university regulation, therefore, their involvement is well-organized; but the other students' engagement scheme is very formal, and in fact, such kind of engagement does not exist at all.
3. The level of students' activities in the education quality management process is very low. They do not present their opinions, advices or recommendations for the education quality development. The mentioned can be explained, on one side, with the less trust or expectation of any changes, and on the other hand, their information level is very low, the big number of students, inert character, lack of interests and motivation.
4. The representatives of Education Quality Assurance Department consider the students' engagement very crucial. However, there is no relevant strategy or plans to provide their involvement in the process.

In the research process, during the interviews, the representatives of Education Quality Assurance Department of all three universities highlight the very important problem. In their opinion, students are not ready for the students' life at the beginning stage, for example, sometimes the lack of knowledge of credit system and educational program. According to the representatives of Education Quality Assurance Department, the mentioned problem hinters the students' engagement in the education quality management process. Due to the mentioned problem, the following recommendation is worked out – to implement a small course or training for the high school children, which will make students prepared and contribute to their future choice and development, moreover, it would be better if Education Quality Assurance Department are involved in such kind of training preparation process.

Interviews – Students

Within the quantitative research, during the interviews, we have tried to define whether students have any connection with the Education Quality Assurance Department at university, whether they are engaged in the education quality management process, and if they are satisfied with students' involvement and participation in the management activities in general. In addition, during the interview, we have defined what kind of information students have about the Education Quality Assurance Department at university and its responsibilities. As we mentioned above, the interviews have been conducted at three universities – Ivane

Javakhishvili Tbilisi State University (Georgia), Tbilisi Open Teaching University (Georgia) and University of Coruna (Spain), Bachelor's Degree students are from different faculties and different courses.

The students say that in case of any problem, they go to the Dean's office to a lecturer. However, it is worth to say that the students have very little expectation that their problem will be considered, that is why they are less involved in the university issues. This factor is stronger at the big state universities. Due to their experience, the students often do not even try to express a problem or work to solve it. For example, one Georgian active student, who is a member of students' union "European Law Students Association (ELSA)", said that her passiveness is conditioned with the low expectation of sharing a student's problem by the university.

> *"I think that, in many cases, syllabuses have problems sometimes they are old and need to be renewed. However, I was not active in this direction, because I know a lecturer will refuse my suggestion." (Student, Ivane Javakhishvili Tbilisi State University, State)*

> *"They (university administration) do not receive students' problems and complaints seriously." (Student, Ivane Javakhishvili Tbilisi State University, State)*

Thus, the most of students explain their less involvement with the universities' attitudes towards them. They mention that the university administration does not pay attention to the problems stated by students. Therefore, students do not express their opinions and problems.

The students mention that they only participated in the questionnaire survey in the point of education quality management, as the participation of the questionnaire survey is required by the Education Quality Assurance Department during the academic year. The questionnaire survey aims at evaluating the subject, educational process and professors. However, as students say, filling in the survey is not compulsory, therefore, some part of students are not interested in the survey and do not complete the questionnaire.

We think it is very interesting and important for our research to define the students' awareness level about the activities and duties of Education Quality Assurance Department of a university. Within the research, students have been asked to list the obligations and responsibilities that they think Education Quality Assurance Department has. As a result of research, there is found out that only half of the list is relevant to the real activities of Education Quality Assurance Department. Students give the following activities as the part of Education Quality Assurance Department's responsibilities:

- Solving students' problems
- Controlling the quality of syllabuses
- Searching for the books for syllabuses
- Monitoring of teaching quality, educational process and lecturers
- Monitoring exam center
- Working out the evaluation system
- Preparing questionnaires and feedback
- Displaying new on the web-page of a university
- Controlling the students' academic performance
- Organizing conferences
- Searching for the exchange programs for students
- Collecting the statistical data of students'' employment.

We also consider important to study the students' attitudes towards the education quality management process, and the area of students' possibilities in their opinion; to define what students think about their rights and duties in the quality assurance. The respondents have list the different kinds of activities that students can perform for the education quality development at university. Below there is given the list of the activities that in the students' opinion they can perform:

- To reach students' problems and opinions to the administration through the article, students' magazine or social network;
- To prepare the researches, reviews and present them with the problem-solving methods;
- To indicate the interesting issues for students, which can be solved with the joint work of students and Education Quality Assurance Department.

In the research process, we also wanted to study the students' opinion whether they are satisfied with the students' engagement and participation in the decision making process of education quality management. The research showed that the most of respondents are not satisfied with the students' engagement, and they want to

have more information about the involvement possibilities in the quality management process in order to have the chance to participate in the quality creation process. However, they say that there is very little interest from university, and this have the negative influence on students' motivation. Some of the respondents say that they do not have any information about the students' engagement.

The students are also asked about their motivation, when they get involved in the different kinds of activities and in the decision-making process of some issues at universities. The students, who have the experience of involvement in any activity name their motivation, and who do not have any experience describe the possible motivation. The following motivators were defined:

- Self-demonstration
- Receiving education/improving knowledge
- Acquiring experience to get a good job in the future
- Developing a university
- Improving the education quality
- Protecting students' rights/being a students' representative
- Making changes, for example, in the subject selecting system
- Offering goof projects to students.

We also investigate the students' opinions on whether the students should be involved in the education quality management process or not, in addition to the students' self-government members. Most of the respondents say that all the students should have the possibility to participate in the decision-making and working process. Because as one student says, there are 140 students at the faculty, and only 30 of them are involved in the student processes, and it is not enough. The same respondent says that a student may not have the wish to become a member of students' self-government, but have own opinion about the specific issue that can be contributive to the university and education quality. It is worth to say that almost nobody agrees to the idea that the self-government is enough. In addition, the interviews show that most of students do not have any communication with students' self-government, therefore, students' problems and opinions do not reach to the self-government, and then to the relevant university department. Thus, if a university wants to learn the opinions of each student and their engagement, which obligation they have due to the international regulations, they should provide the involvement of all students.

The students have been asked about what kind of changes they would make in the communication and working process between the students and Education Quality Department of university; they think that, at first, the mentioned department should have the wish to collaborate with students and to make the joint decisions with students. This can be implemented through the meetings, mutual discussion of problems, even with the minimum involvement of students, as in this case *"students would have the obligation and responsibility to think about the new and innovative ideas" (Student, Ivane Javakhishvili Tbilisi State University, State).* In the respondents' opinion, it is also very important to provide students with information about the Education Quality Department and its rights and duties in order to increase the students' awareness around the department. However, students receive the online questionnaire at the beginning or end of a semester, but they do not fill in it, because there are many questions and it is boring for them; also, students say that nobody really wants to know their opinion, they do not see any feedback from university, therefore, they have very low motivation to spend time on the evaluation questions, and in fact, very little number of students complete it.

There is learnt the influence of the students' more engagement in the education quality management process on the students' satisfaction with university, and what students think how they can be more involved in the mention process. It is worth to say that students see the direct connection between their involvement in the decision-making process and their satisfaction with university; however, very few students say that there is no correlation between their participation and satisfaction with university.

Most of students see the engagement of even one student as a very important activity in the education quality management process, as this can be grown into the group engagement. They say that any negative issue has the influence on students, for example, such as a defect in syllabus. Therefore, they should have the possibility to express their ideas, that can be discussed and in case of approval to participate in practice. There is one more very important factor that the students may have the different ideas and opinions that should be analyzed and then to choose the best one.

This idea is formed by one of the students in the following way:

"We do not know all the students' education range, consciousness; they may have the necessary resources and their contribution may become very important to implement any innovation at university". (Student, Ivane Javakhishvili Tbilisi State University, State)

The students have been asked to list the professional and personal life aspects that may be influenced by the increase of education quality. The respondents think that the improvement of the education quality at university will have the positive impact on the following:

- Future career *(Today, people think that if you do not have the foreign experience, you are not relevant for a job; I think in case of increase of quality, this problem will be solved". (Student, Ivane Javakhishvili Tbilisi State University, State)*
- Increase of learning quality
- More opportunities of personal self-development
- Increase of experience and qualification
- Increase of self-evaluation and self-estimation.

"For me, the success of university is very important, because the success of university is my success, and vice versa, my success is the university's success". (Student, Tbilisi Open Teaching University, Private)

"Probably, if a university is improved and becomes more known, me, as a future graduate of my university, will become more desired for employers". (Student, University of Coruna, State)

The students have been assessed whether they know the university goal and objectives, what is university for them. how often they receive information about the education quality management process of university, and news. These questions aimed at studying the students' attitudes towards the university. The research showed that the students' interest towards the university processes and news is quite high. They get acquired with the information via social network. This can be considered as the expression of students' identity towards university.

It is worth to mention some of the Georgian students are active in the extracurricular activities and events, and the Georgian universities support them in the organization process. However, this does not have any connection with the education quality management. The university administration (here, the Education Quality Assurance Department is not meant, as we already mentioned above, the most of students do not have any idea about the Education Quality Assurance Department) often supports the students' ideas and extracurricular activities, such as intellectual game: "What? Where? When?", inviting the actors and famous people, arranging excursions, etc. The same can be said about the students' experience of University of Coruna. For example, one student says:

"I am a member of students' association, and participate in some activities. However, this is not related to the education quality. I only try to help other students and provide them with the information about the university". (Students, University of Coruna, State)

As the conclusion, we can say that students are less or almost not at all in the communication with the Education Quality Assurance Department. Therefore, they have never been involved in any specific issue, problem or any other decision making process related to the education quality management. Moreover, during the research, the following tendency is defined – students do not have any information about this kind of department at university, and their thoughts about the department is not relevant to the reality.

The students think that their engagement is very important in the academic life of university; they consider that by this way their identity and satisfaction will be increased. The students explained their passive performance with the low expectations and low feedback from university. It is worth to say that in this point of view, the opinions of students and representatives of Education Quality Assurance Department are coincided with each other; and this approves the reliability of the research findings once more.

It was very interesting that, on the contrary of the opinions of the representatives of the Education Quality Assurance Department, students think that in case of will of this department, it is possible to provide the students' engagement. The research revealed as the academic (related to learning), as achievement (related to the social success) basis of students' engagement motivation, and the specific forms of their engagement, which will be acceptable for the students.

Conclusion

The research shows that the most of respondents as the representatives of the Education Quality Assurance Department, as students have the wish to increase the students' engagement level. However, there were defined the different obstructions and challenges; the students name the less feedback from university about any issue, and the representatives of the Education Quality Assurance Department highlight the problem of students' less knowledge and awareness. In fact, students do not really have not only complete information, but they have no idea about the Education Quality Assurance Department and their opportunities and rights of their engagement in the education quality management.

Due to the above-mentioned, it is important to provide students with full information, and give them feedback. There is recommended to give the information about university, its department, academic performance, student's life and their rights and obligation to last year schoolchildren or first year students. It will contribute to the communication development between students and universities. University should have the quick, timely and exhaustive feedback to the students' ideas, recommendations or problems. Simultaneously, it is important to have more communication between students and the Education Quality Assurance Department, and to discuss the collaboration types suggested by students.

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AN ENTERTAINING MOBILE VOCABULARY LEARNING APPLICATION

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Abstract: Learning a foreign language has become a necessity in today's globalized world. While grammar structure of foreign language is learned easily, it is generally a difficult and boring job for people to develop the vocabulary knowledge. At this point it is essential to make learning easy, practical and fun. Beginning to play a substantial role in learning, mobile platforms are utilized for their practicality, portability and dynamism in this context. Moreover, it is viable with a game to turn the learning process into fun. In this work, it is purposed to develop a mobile game assisting people in memorizing the words of a foreign language. It is a kind of word prediction game giving clues according to the user's guesses. In this game, both options are available, either to play with the whole words already in the application or to specify the words used in the gameplay.

***Keywords*:** Game based learning, mobile programming, foreign vocabulary learning.

Introduction

It is a plus to learn a second language which can be used in every aspect of life such as vacation and socialization. Most of the countries take note of foreign languages within their education systems. Providing a whip hand for the students, it is begun to teach English as a foreign language at primary school in Turkiye continuing with high school and university likewise.

Learning environment of a language consists of four main sections including listening, speaking, reading and writing. As a requirement in all of these sections, vocabulary is the core stuff in any learning process. Poor vocabulary knowledge leads to have poor communication skills. Having a good vocabulary knowledge is not a redress by itself. Oxford (1990) indicated that language learners have trouble with remembering large vocabularies frequently. Hence learners also must do some memorial exercises on vocabulary. Oxford (1990) categorized the memory exercises into four categories as creating mental linkages, utilizing images and sounds, employing actions and reviewing. In our study an importance is attached to the reviewing process.

Gaining a vocabulary knowledge in a reasonable level is a difficult job and a long process while learning a second language. It is considered boring to learn vocabulary by the students especially who grew up in the digital age (Yip & Kwan, 2006). The negative perception affects the success of the second language learners adversely. It is a vital to turn this process into an enjoyable stuff which has a potential to be achieved by the help of digital games.

By means of the advances in technology, various and fascinating digital games have been developed. Surpassing age constraints, digital games have started to appear in most of the areas interacting with people. Education is one of these areas which games enable a huge numbers of engagements in. Accessing to a digital game is very simple due to mobile devices which are another edge in order to utilize them in education. Accordingly, educational gaming gains importance day by day.

- Selection and peer-review under responsibility of the Organizing Committee of the conference

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Related Work

There have been many studies which work up to develop language learning skills of the students through digital applications. Most of the studies and researches are done on English which is the most prevalent language in the world. Liu and Chu (2010) investigated effects of ubiquitous games on learning outcomes and motivation of English listening and speaking. They demonstrated that the use of ubiquitous games in learning can produce better learning outcomes than the non-gaming method. Chen and Chung (2008) developed a personalized mobile English vocabulary learning system based on item response theory and learning memory cycle. The system consists of a remote management server, client mobile learning system and data synchronized agent. In the system, personalized English vocabulary is recommended for each user according to the user's vocabulary ability. The experimental results reveal that the review strategy in the proposed system is very helpful for the interested learners. Yip and Kwan (2006) compared the learning outcomes of two groups that consist of undergraduate students learning English vocabulary. While students in the first group try to learn English vocabulary by activity based lessons, students of the second group studied with two dedicated websites having games. Their research results show that learning with online games is more effective than activity based learning with respect to learning outcomes. Wu and Huang (2017) constructed an English vocabulary practice system that utilizes game based learning concept. According to the results they obtain, the game based system not only increased students' interest and attention but also effectively strengthen their memory and learning ability. Yen, Chen and Huang (2016) analogized two mobile English vocabulary learning applications to find out the effects of game related functions on the learning performance. In their study, it is revealed that gamified functions of the mobile application are positively correlated with the learning performance. Sandberg, Maris and de Geus (2011) built a mobile English learning application in a serious game form and they observed the effects of the application on fifth grade children with respect to vocabulary learning outcomes. The application composes five different types of games: a multiple choice quiz, a spelling quiz, a memory game, a Yes or No game and a jigsaw puzzle respectively. It is demonstrated in the study that the application, which allure students, provides adequate learning recipes for them. Smith et. al. (2013) designed an experiment which compares two groups of Chinese college students studying with eBooks that includes inference based computer games and studying with traditional methods like reading hardcopies, multiple choice questions etc. Their study purported that inference based computer games incline students to study and make them learn significantly more vocabulary than the traditional methods.

Application Details

Scope

In this study, it is aimed to leverage the vocabulary skills of the learners with a mobile game developed for this purpose. It is intended to make students carry out the review process of the vocabulary by using the mobile application. People will not only learn but also will have pleasure in this way.

Design and Functionalities

Our application is composed of two basic functionalities:

Word Supplement: User is able to designate particular words that he/she wants to learn in the application. While user can attach the words one by one, he can also select a category of words such as plants, animals, etc. to study with. This feature will provide a fully personalized practice system for the user.

Gameplay: There is an entertaining word prediction game in the application in order for learners to do practice. User tries to find the word picked by the system by way of some feedbacks given after each try of the user. In the beginning of the game, the system picks a word through the supplemented words in the application randomly. User starts to play the game by entering a word. The system checks the entered word against the secret word and gives some – and + points to the user. For each letter matched with its position, the system counts +1 point. For each letter matched without its position the system counts -1 point. If a letter does not occur in the secret word, no point is counted for that letter. After the points are calculated by the system, + and – points are summed up respectively and delivered to the user. In the consideration of these points, user makes prediction with a new word and again gets a feedback for his word. It goes on like that until the user reaches the desired word. The point here is that the user has to find out the word within minimal number of steps. An example is given below inasmuch as comprehension of logic of the game:

Secret word: house

Prediction 1: place
Points: +1

Prediction 2: touch
Points: +2, -1

Prediction 3: amuse
Points: +3

Prediction 4: mouse
Points: +4

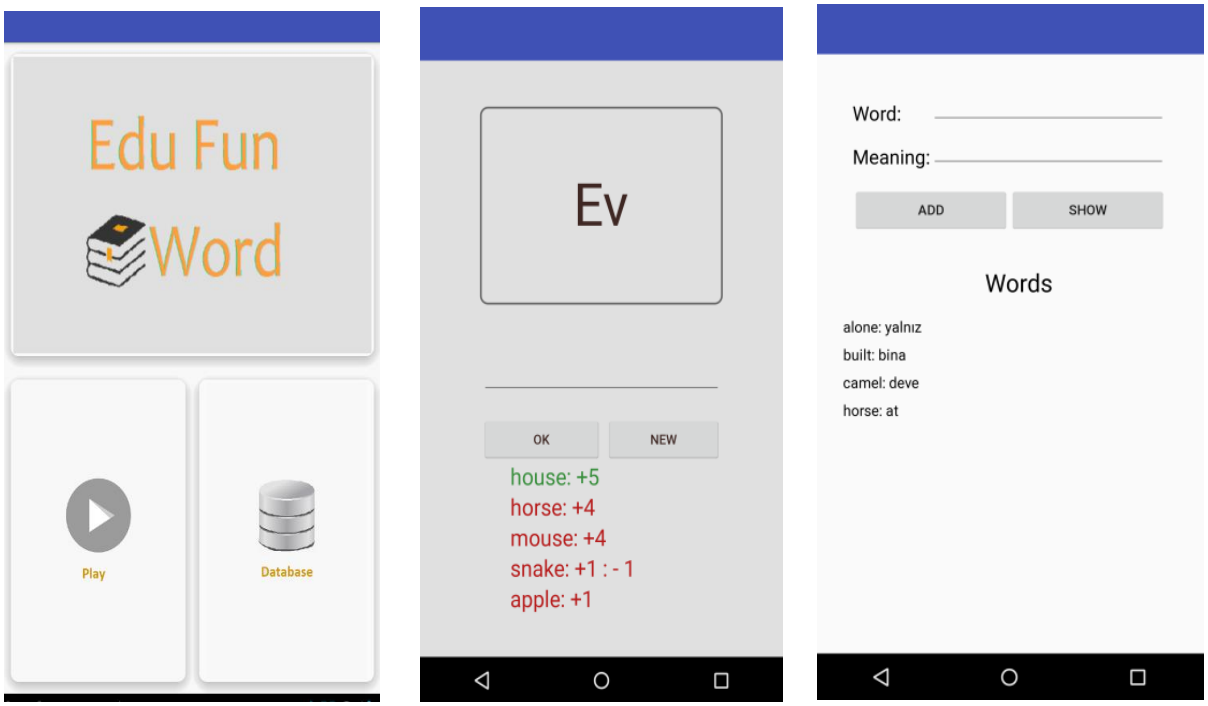
Prediction 5: house
Points: +5
You win within 5 steps. Congratulations!!!!!

Operating Environment

The application is developed via Android Studio and available for mobile devices which have the android OS. SQLite database is utilized for the storage procedure. There is a local storage system which a user is able to supply interested words and manage them to do practice with.

User Interface

The game includes three screen which are shown in Figure 1.



(a) Main screen (b) Game screen (c) Database screen for users

Figure 1. The designed user interface of mobile learning game

In (a) we see main screen which is firstly opened when application is started by user. There are two buttons and a symbol of game in this screen. Play button directs to user game screen (b) so the game starts by this way. The second button is to open the database screen (c).

There is a panel that shows the meaning of the word to be estimated at the top of the game screen (b). At the below of this panel, there is an edit text to type a word which is expected to be correct. There are also two buttons one of which is to submit the word and see whether choice is correct or how much closer to real and the

other is for selection a new word to be guessed. Lastly the bottom section of this screen has a scroll view that shows guessing words and points of them.

The last screen (c) is for database operations. This panel opens to user directly. There are two edit text and two buttons. By using Edit texts and add button, player can add words that he wants to memorize and show button will help to see to user words that are added with scroll view at the last part of this screen.

Conclusion

Mobile learning is among state of the art issues in education. With the revolution of technology, learning without dependency to time and place is possible via mobile devices in today's world. Additionally, it is a virtue to have a stimulator inciting people to learn which contributes to game based learning concept. In this study, we designed a game based mobile application assisting people to build up their vocabulary in the process of a foreign language learning. It is a personalized learning tool that a user is able to supply interested words that he/she would like to memorize. Although learning large vocabulary is known as a difficult and boring job, people have fun while extending their vocabulary knowledge by this way.

In the future studies, we want to implement our application as a ubiquitous learning framework in which people can also play the vocabulary prediction game with each other. It will be provided by the framework to enable people share their vocabulary knowledge with each other while trying to find out their secret words. Furthermore, such kind of a game is considered to raise competition and enthusiasm. Vocabulary learning capabilities of the users would be enhanced hereby.

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ROLE OF INDUSTRIES AND HIGHER SCHOOL OF ENGINEERING TOWARDS GREEN INDUSTRIALIZATION AND GREEN ECONOMY: MOROCCO CASE STUDY

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Abstract: The green economy was introduced in recent years at the national and international levels. It has appeared as a way that could assist to achieve sustainability, and it includes economic development. It has the ability to master emissions of gas effects, to make an effective utilization of natural resources and enhance productivity. This paper discusses the role of industries and higher school of engineering as contributors to the development of green economy. Industries are responsible to control the impact of their activities on the environment and on consumers, by the adoption of green technology and developing novel green products, which could in turn create or greening jobs and skills. Such contributions require the presence of manager profiles owning technology skills, thus an understanding of energy and environmental issues. The research presented here is a case study of a Moroccan engineering school. Which conducted a survey aiming to assess the awareness, attitudes, expectations and needs of the engineering students especially in green energy education, and thereby meet the challenges of sustainable development, satisfy to demands of Moroccan industrials and job market in terms of competency. Which requires a review on traditional methods of teaching and learning within school and simultaneously the utilization of E-learning method outside school and break up with the traditional practice disciplines. Moreover, the goal of this study is to train and develop competencies in both technical and environmental aspects and to highlight the utilization of E-learning as an advantageous key for developing countries like Morocco. Results of the realized survey provide a hard argument for a dimensional research to improve students learning ability and meet the needs of industries.

Keywords: Green industrialization, engineering education, green economy, skills, e-learning

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Introduction

The green economy can be considered as a way to achieve sustainable development. It is a strategy consisted of a number of policies and action plans, which promotes a new development paradigm. It is not only desirable to protect and preserve the environment, but also it is economically justified for the reason that development will be stronger in a sustainable scenario. It is based on the integration of three pillars of sustainable development, which are the environmental, social and economic dimensions. Thus, it supports the creation of a strong economy that promotes equity and social well-being. Such promotion is achieved through investments that reduce emissions and pollution, improve energy efficiency, use of resources, and protect the environment by fighting against the degradation of ecosystems. Various definitions of a green economy are to be found in literature (Viesi et al., 2017), (Kim et al., 2016). However, the present green economy has two major dimensions. The first one is seen from a regulation point of view, which in fact defines green economy by the list of activities in compliance with

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environmental regulations. This dimension calls for reflection on the risks that these regulatory constraints are susceptive to weigh on employment, economic growth and the competitiveness. The second dimension is seen from an economic point of view, which says that green economy includes activities generated by companies producing services and goods that help reduce, avoid or remove the environmental damages. Unlike the first one, this dimension highlights the opportunities for profit, investment and growth potential generated by these new activities.

For this purpose, on the one hand, industry will play a major and important role in this green economy because it will meet the needs to support equipment, infrastructure and energy needed for the production of final goods and services (Arouri et al., 2012). On the other hand, to realize the aims of industry, the engineers graduating from the higher school of engineering shall be able to keep up with the growing development in the green economy. In this respect, a survey was conducted to estimate the awareness of students regarding the green energy and green economy, and to assess their basic knowledge in this field that each engineer must acquire before going to the job market.

Method

In-depth, theoretical knowledge of diverse energy technologies and systems has to be provided in energy education programs in university level to form professionals in this field. Besides, formation in renewable energy covers generally hands-on experiences and skills, training, fabrication, installation and maintenance.

Aware of the promising future of green energy sources in Morocco, the education has been expanded in order to develop and improve curricula in the field of renewable energies and sustainable development, in the context to have compatibility and complementarity between training and skills delivered to engineering students in the higher school and core green skills that suits industrial needs. To realize this survey, we have chosen to use the know-How profile strategy (Elenurm, 2008) in the aim to assess learning inputs and outcomes of student and also to display the lack rate of acquisition in sustainable development domain. For this purpose, we are based on questionnaire replies that we have elaborated and received from 120 answers in three academic fields. We could identify 50 answers in Electrical Engineering, 50 answers in Mechanical Engineering and 20 answers in Industrial & Logistics Engineering.

Results and Findings

Table 1. Questionnaire for replies with “Yes” Or “No”

Questions	
Q1	Do you know what E-learning is?
Q5	Do you know what fossil fuels are?
Q7	Are you aware of fossil fuels adverse effects on the environment?
Q8	Do you know what renewable energies are?
Q12	Have you heard about green energy?
Q13	Have you ever studied a course on renewable energies and / or sustainable development in your specialty?
Q14	Be aware of the importance of using renewable energies within industries is there an added benefit to getting a job?
Q15	Do you prefer to have courses in renewable energies via an E-learning platform?

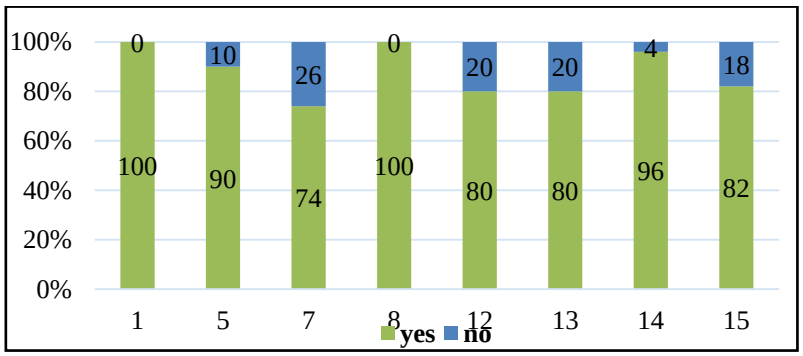

Figure1. Percentage of the Electrical Engineering Student's Replies With Yes or No

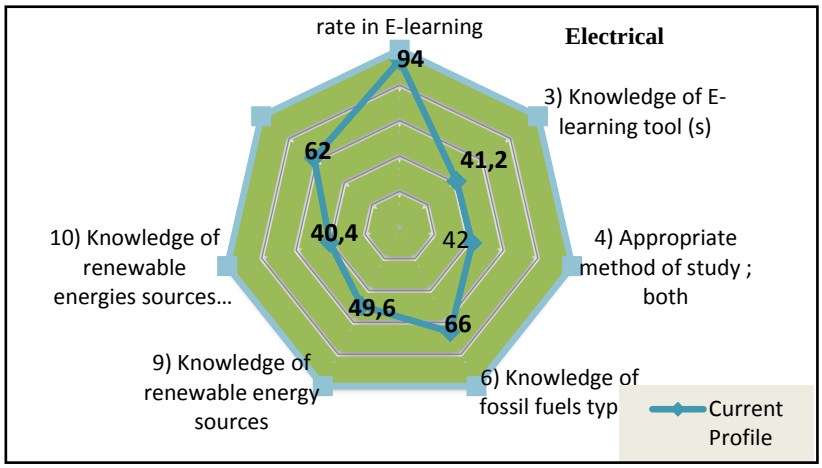

Figure 2. Percentage of the electrical engineering student's replies with multiple choice

The figure 1, exhibits the number of questions on the horizontal axis according to the table 1 and the percentages of the student's answers with Yes or No on the vertical axis for the specialization of Electrical Engineering. The figure 2 shows the percentage of the Electrical Engineering Student's Replies with Multiple Choice. As can be seen, their answers are positive for most of the questions. This is predictable and it seems normal, because, according to this field, they study different kinds of modules element like wind power, quality of electrical energy, audit and energy efficiency, design of industrial electrical networks etc. Which are in line with the demand on renewable energy and energy efficiency. Moreover, the student can boost his chance of consciousness and consolidate his skills in the case of question 7 (about their awareness of the effect of the fossil energies on the environment), and question 12 (green energy benefits). This can be accomplished by the use of E-learning tools. It is going to be with great help especially that 82% of students prefer and hope to have an E-learning platform to strengthen their competencies. In addition, these students are highly interested in E-learning method, they do not know much about it, but they want it to be part of the teaching method in their establishment. They have enough knowledge about fossil energies, they do not know enough about renewable energy, but they are optimistic about its future in Morocco. These students are future electrical engineers, so they know the importance of renewable energy, and they want to fortify their methods of formation to respond to the demands that this sector will be requiring from them in the future, and this through the integration of the E-learning in the teaching methods.

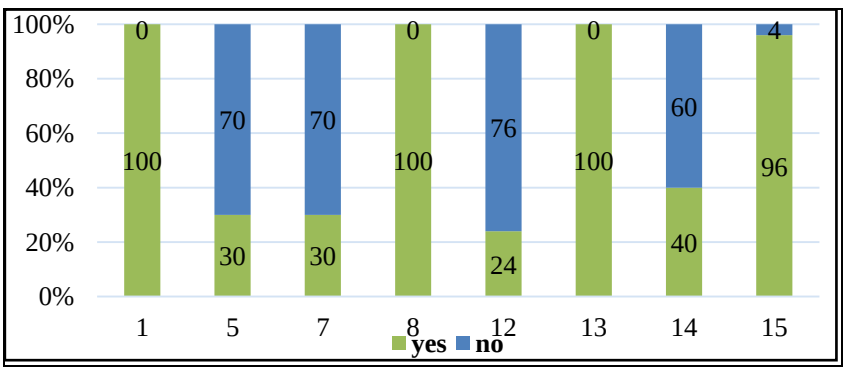

Figure 3. Percentage of the mechanical engineering student's replies with yes or no

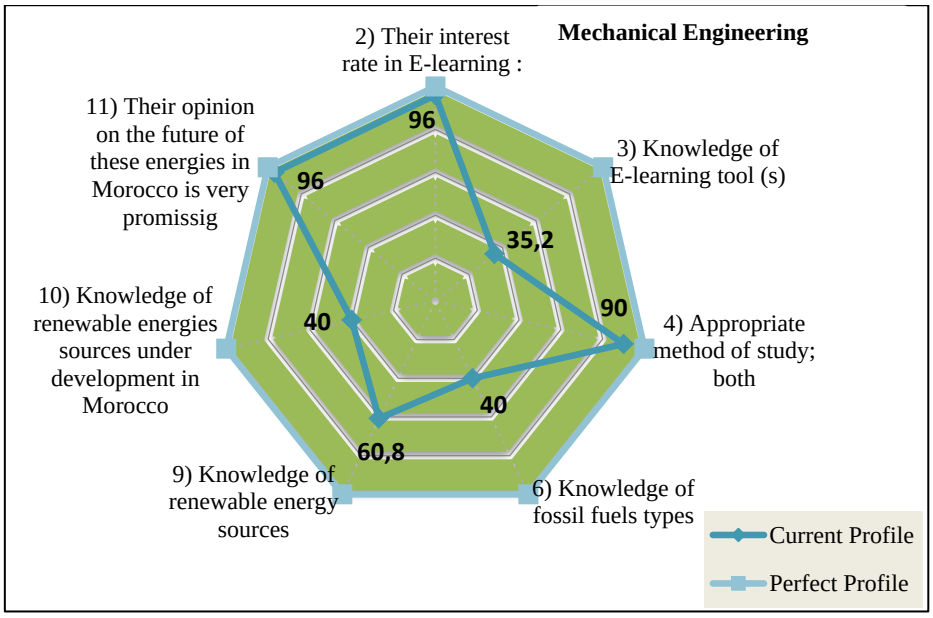

Figure 4. Percentage of the mechanical engineering student's replies with multiple choice

For the mechanical engineering, the figure shows that half of the questions are mostly negatively answered, 70% or more for 3 questions and 60% for another question. These questions related to their knowledge about fossil energies and their harmful effects on the environment, and about the green energies and the necessity of including them into their formation program. Students did not learn enough about renewable energies, this lack reflects the hole in their formation concerning this field. Regardless of their specialization, renewable energies shall have enough share in their formation to keep up with the growing development in the green economy, especially Morocco, for it is undergoing a promising progress in the field of renewable energies. These results arise several questions about the necessity of an alteration in the learning methods and revision of course content which are taught to engineer's students. Like other students, Mechanical engineering students are very interested in E-learning method although they do not know too much about it and its tools, they have poor knowledge regarding fossil and renewable energies, but they are very optimistic about the present and future development of the green energy in Morocco.

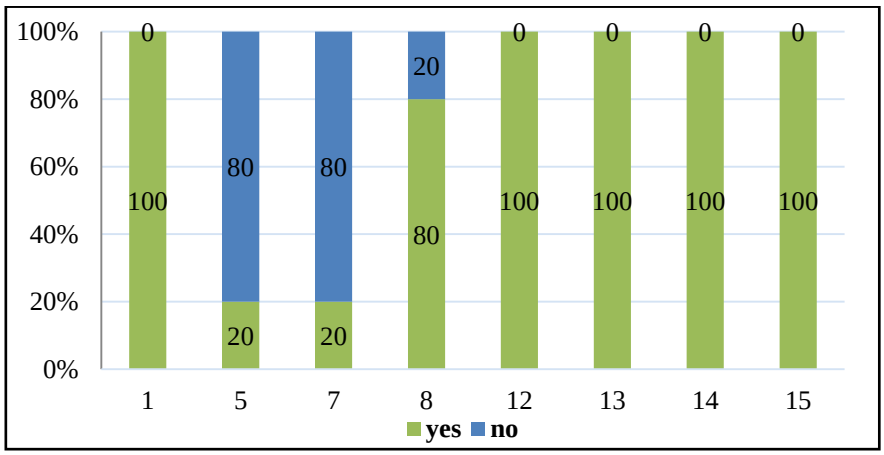

Figure 5. Percentage of the industrial & logistics engineering student's replies with yes or no

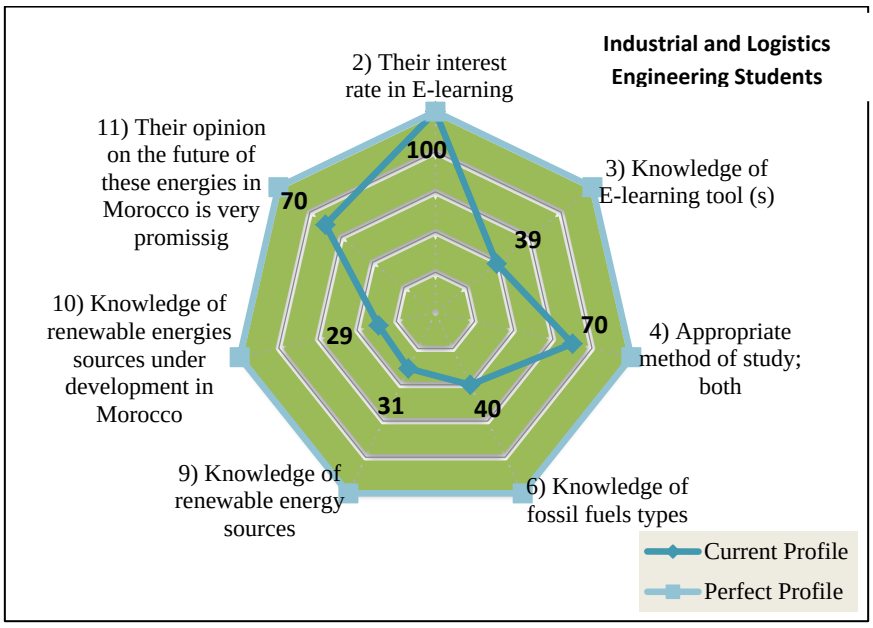

Figure 6. Percentage of the industrial and logistics engineering student's replies with multiple choice

The students of industrial and logistics engineering mostly do not know about fossil energies and their noxious impact, 80% of them are not aware of such a serious matter. In contrast, they have enough knowledge about the green energies, and are conscious about the importance of integrating the renewable energy in their training program. How could they be unconscious about fossil energies and be knowledgeable about green energies? Perhaps this is because students learn about the green energy without being taught the objective for which it was adopted in the first place, and its benefits on the environment in regards to fossil energies. Their formation program is poorly containing energies courses. Even though they do not know enough about E-learning, the industrial and logistics engineering students are all interested in it, they have minor knowledge about fossil and green energies, and they think that the renewable energy sector is promising in Morocco.

Conclusion

In this paper, we have reported the great role of green economy as one that simultaneously promotes and improves the sustainability and economic growth. Then, we have reported the both role of industries and higher school of engineering to awards a green economy. As a result, of the survey realized in the higher school of engineering, we concluded that the electrical engineering does not require any training program modification, their students are already aware about the importance of the green energy, and the needs of the job market, and they assimilate the courses related to this topic. Contrariwise, in the two other specialties, it is necessary to make an adequate change in teaching method inside higher school, we suggest to create a platform to enable students to study outside school, and what's more, 96% of students in the three specialties prefer as has already been said to add the E-learning method to the traditional one. We propose also the integration of supplementary modules in connection with sustainable development and energy efficiency, because the rate of replies is smaller than what it should be.

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USE OF GRAPHIC ORGANIZERS IN SECONDARY CHEMISTRY LESSONS

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Abstract: Graphic organizers are the visual representations that show the organization or structure of concepts as well as relationships between concepts. The effective use of graphic organizers may be a magnificent strategy to help students connect ideas and they can be added to instructional materials to communicate the logical structure of the instructional material. This study aims to show how graphic organizer use within teaching duration by presenting different types of graphic organizers and to provide an overview of the benefits of using the graphic organizers for teaching and learning of secondary chemistry lessons. For this purpose, the graphic organizers which are examples of different types of graphic organizers have been prepared for selected topics from 9th to 12th grade in this study. The graphic organizers (such as semantic future analysis, a flow diagram, comparison contrast matrix, spider web, fishbone, positive and negative-interest diagram, word mapping, persuade map, cause-effect diagram, concept map) have been presented and discussed how they use in the chemistry lessons in this study.

***Keywords*:** Graphic organizers, chemistry lessons.

Introduction

Studies have shown that secondary school students find chemistry topics and concepts difficult. One of the reasons of the difficulties can be that the concepts of chemistry are too abstract for these level students. Additionally, the chemistry includes explanations of invisible interactions between invisible entities. It also includes declarative knowledge, procedural knowledge, relational knowledge and problem solving which can each of them contain low or high levels of cognitive complexity. Students need to construct the relationships between facts, concepts, and or ideas within a learning task.

Graphic organizers are the visual representations that show the organization or structure of concepts as well as relationships between concepts. The effective use of graphic organizers may be a magnificent strategy to help students connect ideas and they can be added to instructional materials to communicate the logical structure of the instructional material. Graphic organizers can help students organize their knowledge and encourage them to become actively engaged in the discussion of a topic and its concepts. Therefore, use of graphic organizer can assist make expository texts which are difficult to understand because of problematic nature of the topics more understandable for the students (Gil-Garcia and Joaquin, 2003). Besides, since graphic organizers are flexible, they can be used before, during, and after instruction.

The cognitive approach seeks to understand how incoming information is processed and structured into memory (Weinstein & Mayer, 1986, in Dye, 2000). Wills and Ellis (2008) indicate that several cognitive theories, in particular, lend support to the use of graphic organizers in helping students process and retain information. They also express that schema theory, dual coding theory, and cognitive load theory provides the basis for explaining the characteristics of graphic organizers that support the learning process. Dye (2000) have also shown the relationship between graphic organizers and how information is processed through the short-term memory and the long-term memory.

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The Aim of the Study

It is important to employ graphic organizers in the high school chemistry lessons to help students better understand abstract chemistry concepts and to construct the concepts each other in a meaningfully way in their cognitive structure. This study aims to show how graphic organizer can use within secondary chemistry teaching duration by presenting different types of graphic organizer examples and to provide an overview of the benefits of using the graphic organizers for teaching and learning of secondary chemistry lessons.

Methods

The preparation of the graphic organizers, their types and selection of the chemistry topics

When the literature about graphic organizers is examined, it is seen that there are a variety of shapes and forms of graphic organizers. The shape of the graphic organizer varies depending on the content of the instruction and its purpose. In this study ten graphic organizers as semantic future analysis, flow diagram, comparison contrast matrix, spider web, fishbone, positive and negative-interest diagram, word mapping, persuade map, cause-effect diagram, and concept map have been selected and prepared for so many topics placed in 9^{th}, 10^{th}, 11^{th}, and 12^{th} grade chemistry courses.

While preparing the graphic organizer, some points have been taken into consideration in the selection of chemistry subjects. First of all, it has been paid attention that it is the most suitable graphic organizer for the selected chemistry topic. Later, chemistry topics and concepts that abstract chemistry concepts or subjects students are difficult to understand are chosen. The graphic organizers and their subjects are: word map about electron, semantic future analysis about elements of periodic table, flow diagram about type of elements, comparison contrast matrix about nuclear energy, spider map about intermolecular forces, fishbone about galvanic cell, positive and negative-interest diagram about acids, persuade map about states of matter, cause-effect diagram about environmental pollution, and concept map about atom. Only three examples from aforementioned graphic organizers have been presented in this study.

Results And Findings

Some of the graphic organizers are explained below briefly and several examples are presented.

Word Map/Concept Definition Map

Students use critical thinking skills and prior knowledge to make connections among new words in this word map graphic organizer. Word maps are especially useful for abstract concepts and academic words. They help the student build upon prior knowledge and visually represent new information. An example word map concerning electron was presented in Figure 1.

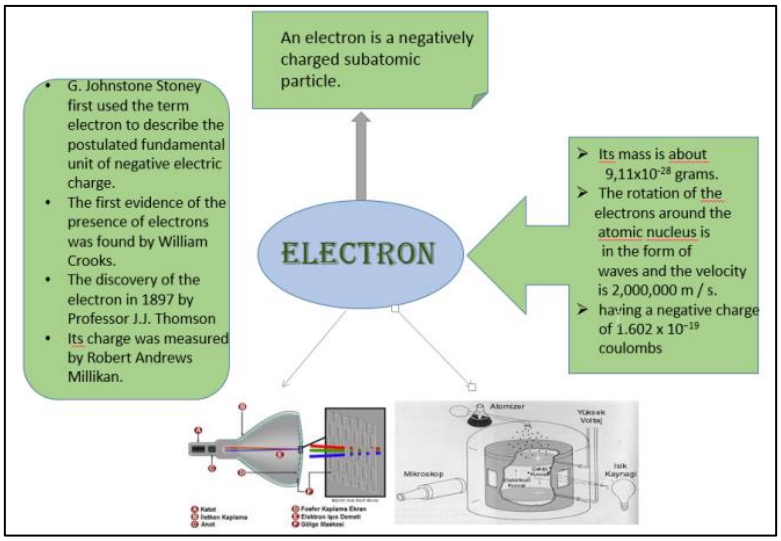

Figure 1. A word map graphic organizer

Semantic Feature Analysis Table

The semantic feature analysis table uses a grid to help kids explore how sets of things are related to one another. By completing and analyzing the grid, students are able to see connections, make predictions and master important concepts. This strategy enhances comprehension and vocabulary skills. Semantic feature analysis can be used, when the task is comparing characteristics among a group of items (Graphic Organizers, 2010). In this study, a semantic feature analysis which has been prepared for the topic "elements of periodic table" placed in 9th and 11th grade chemistry curriculum is shown in Figure 2.

Flow Diagram

Use a flow diagram to show the progression of ideas, thoughts, or steps in a subject or an experiment. In flow diagrams, logic steps that need to be followed for the solution of any problem are expressed visually as symbols or symbols. An example flow diagram has been prepared for Periodic Table topic and shown in Figure 3.

Features	Alkali Metals	Alkaline Earth Metals	Transition Metals	Lanthanides	Actinides	Metal	Nonmetal	Noble Gas
Ca		+						
Ni			+					
Xe								+
Th					+			
Ce				+				
Se							+	
Bi						+		
Fr	+							
Fe			+					
Ga						+		
P							+	
Li	+							
Cr			+					

Figure 2. A semantic feature analysis table

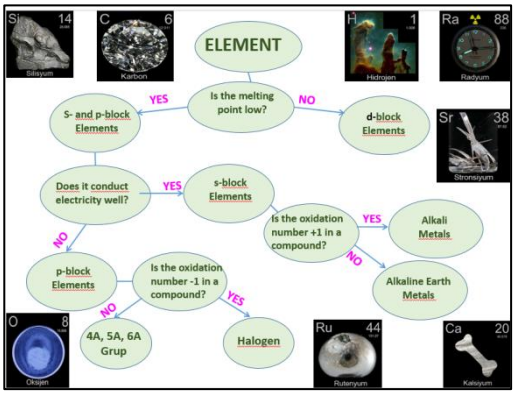

Figure 3. A flow diagram

Spider Map

A spider map is a brainstorming or organizational tool that provides a visual framework for students to use. They can be used to show different aspects of a central idea and the supporting evidence for each of the aspects. For this reason, a spider map has a main idea or topic in the center, or the body, of the diagram. Each detail or sub-topic associated with the main idea has its own leg, or branch, surrounding the main idea.

Compare and Contrast Chart

Comparing and contrasting things is a vital skill that students need to develop during elementary and middle school. Using a compare and contrast chart will help students engage in deep thinking in comparing two concepts, and learn how to use a graphic organizer to visualize likeness and differences between two things. There are lots of designs that can be used for comparing and contrasting.

Persuasion Map

The Persuasion Map enables students to map out their arguments for a persuasive essay or debate (URL-1). Students begin by determining their goal and write their goal in the first box. They then identify three reasons to support their argument and write their reasons in the next boxes. Finally, they list facts and examples in branching boxes.

Cause and Effect Diagram/ Fishbone Diagram

The Cause and effect diagram, also sometimes called the 'fishbone' diagram, is a tool for discovering all the possible causes for a particular effect. (URL-2). This diagram can also help in brainstorming to identify possible causes of a problem and in sorting ideas into useful categories.

Conclusion

In this study, several graphic organizers have been prepared and explained how they can be used in secondary school chemistry lessons.

Recommendations

The use of graphic organizers in the chemistry lessons can help teachers and students enhance meaningful learning and provide learning of complex and problematic topics easily (Hall, Strongman, and Meyer, 2003). Therefore, the graphic organizers are important for lessons. Students can remember concepts and topics easily if a graphic organizer use during the lesson. The students can also be arranged graphic organizers themselves for their lesson when they are taught. If the graphic organizers are taught to chemistry teachers during their education or in-service workshops, they can design their own graphic organizer and use them in their chemistry classes. For this reason, it is recommended that the explanations about how graphic organizers can be prepared are presented in the books or the workshops which will be organized for the in-service chemistry teachers. The courses about graphic organizers can be added to chemistry teacher training programs too.

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THE WAY LEADING FROM THE ADOPTION OF KNOWLEDGE TO CREATION OF KNOWLEDGE AT THE CHEMISTRY CLASSES

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Abstract: According to the curriculum programs, basic knowledge of the subject is planned to be taught within a short period of time. There is weak connection between the topics in the textbooks written on the basis of the program. Knowledge and skills are not learned systematically, knowledge is transferred in a prepared form make students to learn them by heart.
A number of changes should be carried out in order to remove this problem and to teach students to be able to learn by thinking. These include:

- The hours for chemistry classes should be increased at incomplete secondary schools. And it will be the strengthening of forthcoming knowledge.
- Textbooks should be written in a simple, meaningful way and knowledge should be associated with each other systematically.
- Practices carried out by the students can yield effective results. While using the Internet resources, the students have an opportunity to think and to work creatively.
- Constructive learning environment should be created in order to rouse interest for the teaching process, interactive discussions should be organized.

The knowledge presented in the textbook should be compiled in a logical sequence in order to solve the problem. The given knowledge should be compiled in the modules according to the sections.
As the knowledge within the module is logically linked with each other, the modules are also connected with each other. Open-ended tests are also given alongside with close-ended tests, along with the knowledge-oriented questions, thought-provoking questions are also given.
The hermeneutic approach created in constructive atmosphere may result in learning the topic systematically, learning its parts deep, and acquiring the knowledge is replaced with teaching-learning process.

***Keywords*:** Constructive learning, chemistry classes.

Introduction

Very little time was given to chemistry classes at incomplete secondary schools.
According to the curriculum programs, basic knowledge of the subject is planned to be taught within a short period of time. There is weak connection between the topics in the textbooks written on the basis of the program. Knowledge and skills are not learned systematically, knowledge is transferred in a prepared form make students learn them by heart.
A number of changes should be carried out in order to remove this problem and to teach students to be able to learn by thinking. These include:

- The hours for chemistry classes should be increased at incomplete secondary schools. And it will be the strengthening of forthcoming knowledge.
- Textbooks should be written in a simple, meaningful way and knowledge should be associated with each other systematically. Alongside with being knowledge- oriented, the tasks should be practical also and make students to think over them. Thus, students will not learn by heart the course and they will learn the

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material. Students will think over how to coordinate, to replace the old knowledge with the new knowledge and apply practically the new knowledge.

- Practices carried out by the students can yield effective results. While using the Internet resources, the students have an opportunity to think and to work creatively.

Methods

The knowledge presented in the textbook should be compiled in a logical sequence in order to solve the problem. The given knowledge should be compiled in the modules according to the sections. As the knowledge within the module is logically linked with each other, the modules are also connected with each other. Open-ended tests are also given alongside with close-ended tests, along with the knowledge-oriented questions, thought-provoking questions are alsogiven.

For example: in the 8^{th} grade, in the section "Major classes of in organic compounds", the following topics – oxides, bases, acids, and salts are learned without any interrelation. First, brief information about oxides, bases, acids, salts is given. Then knowledge in each topic is divided into previous and future knowledge: "oxygen oxides-bases", "oxides, bases, acids", and "bases-acids-salts", "acids-salts-oxides". The hermeneutic approach created in constructive atmosphere may result in learning the topic systematically, learning its parts deep, and acquiring the knowledge is replaced with teaching-learning process.

If it is possible to carry out experiments, it is necessary to work with the students visually. Because visual experiences are remembered better and they become long-lasting. If there not necessary facilities, it would be better at least to use the internet resources to get students think and approach a question creatively. If students carry out experiments by themselves, they will yield more effective results than by using Internet resources. Example: Oxides should be explained like it: we take three containers for chemical sunstances and place Na2O into the first one, SO3 into the second one, and CO into the third one. Then the students put wet litmus papers into each of these containers. The teacher asks questions in logical sequence about the result of the experiment.

Question: What color do the sunstances in the container paint the wet litmus papers?
Answer:. In the first container the litmus paper bocomes blue, in the second container litmus paper bocomes red, and in the third container litmus paper does not change its color.
Question: Why do you think the color of the litmus papers are changed in the first and second containers, but it didn't change its color in the container where CO was placed?
Answer: The substances in the first and in the second containers had mutual effect with the wet litmus papers because their colors have changed. In the third container, the color of the litmus paper has not changed.
Question: How can you explain the reason of the changes of colors in the first and second container?
The answer to this question was imperfect. The substances in the first and second containers had mutual effect with, and the substance in the third container was not affected by water.
With these answers, they have shown the outcome of the process, but they were unable to explain the cause of the process because they had no scientific knowledge about it yet. Because of it, they could not build a new model of mental knowledge.

The teacher's supplementary explanation:
When the oxide first container is dissolved in water, the base (NaOH) is formed, when the oxide in the second container is dissolved in water, acid (H_2SO_4) is formed. As CO is anoxide that does not generate salt, the color is unchangable. The following questions are posed in order to link these additions with previous knowledge:

Question: - Which metals in the periodic table of chemical elements are interacting with water generate bases?
Answer: - Alkali metals, alkaline soil metals.
Question: Why are they called alkali?
Answer: - They are dissolved in water; they are chemically active and change the color of the indicator, and so on.
As we have seen, we did not pass new knowledge to the students. We generated knowledge with the help of logical questions. In this way, they altered knowledge that they have acquired to the new knowledge.
It is possible to achieve high results by using thought-provoking questions in the learning process.

For example :

Students know the caustic character of the acids as it affects to the human skin. This knowledge can be applied in another circumstance.

Question: The sculptures made of limestone and marble become corroded within short time in the open air. What is the reason of this process?
Answer: -Ecological problems, air pollution caused by cars and by gases s chemical plants, dirty rains affect the sculptures. Especially, the acid contained in the precipitation affects marble and limestone.
The teacher's supplementary explanation to students' previous knowledge:
Some gases in the air are transformed into acid in contact with water vapour and falls when it rains. The sculpture is made of marble or limestone. We know that the content of limestone is CaCO3, which is gradually

corroded by the effect of acid.
An experiment is carried out to get a more effective outcome. We pour distilled water into the chemical glass and acetic acid into another chemical glass. Then certain fragments of marble are placed in each glass.
After some time, the results in these glasses are compared.

Question: What did you observe in these glasses?
Answer: There was no change in the first glass.
The separation of gas bubbles in the second glass indicates that the chemical process occured and the mass of marble is reduced.

Another example:
It happened in the 19th century during the cold winter months. The goods train coming from the Netherlands to Moscow roused interest in everybody. The train was filled with tin beams. Workers at the railway station see that all the metal became gray dust when the train door was opened. The white color of the tin is transferred to gray color at temperatures below -13.2 ℃, and this process goes fast at - 33 ℃. If any grain of the gray tin is interacted with white tin, it is transformed into a gray tin which breaks easily and quickly. It is called "plague of tin".

Question: How can you explain the reason of transforming metal into dust accoding to the information given above?
Answer: In winter, the temperature in Moscow is lower than the modification temperature of the tin, so it changes the modification of the tin.
Practice: Three different containers are in front of you: there is solution of ethyl alcohol in water(C2H5OH) in the first container, NaOH (sodium hydroxide) in the second container, and HCl (chloride acid) solution in the third container. What happens when we conduct an electric current through them?
Answer: In the first container, the lamp does not light, and in the second and third container, lamps light.
Question: Why do the lamps light in two containers and not in the firts one?
Answer: The sunstances in the second and third containers conduct an electric current, while the sunstance in the first container does not conduct an electric current.
Answers indicate that they respond intuitively, dasedon their own experiences. But they need teacher's supplementary scientific explanation.
The teacher: the H + ion separates from the acid and OH-ion separates from the alkali when electric conduct passes through them. However, not all the substances that contain OH group separate OH-ion. When the ethyl alcohol is dissolved in water, it does not separate OH-ion.
What is the role of teaching materials used at the chemistry classes? Our primary goal is to research it with stidents and to realize their knowledge.
For example: "Why are some foods crossed out and does it have any relation with chemistry?"

Responses: - Raw meat is dangerous for life; fizzy drinks react with acid in the stomach; there are glycerine and acids in the composition of damaged oils that cause poisoning in the stomach; there are a large number of bacteria in an unboiled the egg; smoked foods are harmful to the child's organism.
Another example:
In modern vehicles, catalytic converters are used to convert waste gases into gases that are not harmful to the environment and human beings. At this time, 90% of waste gases are converted to less harmful gases. We can see this in the table below:

Gases included	Gases excluded
Nitrogen (N_2)	Nitrogen (N_2)
Carbon dioxide (CO_2)	Carbon dioxide (CO_2)
Water (steam) H_2O	Water (steam) H_2O
Carbon monoxide (CO)	Carbon monoxide (CO) – 10%
	Carbon Dioxide (CO_2)- 90%
NO , NO_2	NO , NO_2 -10%
	N_2- 90%

Question: What coclusion do you draw from this table?
Answer: New substances are generated; some gases do not modify; ew substances were produced; carbon monoxide was converted into less harmful carbon; our environment is less polluted; NO and 90% of toxic substances have been converted into inert gas NO_2.

Recommendations

Thus, when substituting knowledge-based questions with the thought-provoking questions in the educational process, students change their learning behaviors and they are also converted from knowledge acquierer into knowledge creater. Here naturally happens a shift from the acquisition of knowledge to the creation of knowledge

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NEW TECHNOLOGY ADOPTION BY BUSINESS FACULTY IN TEACHING: ANALYZING FACULTY TECHNOLOGY ADOPTION PATTERNS

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Abstract: It is worth mentioning that the use of instructional technology in particular affects positively the students' content acquisition. As well, it plays a great role in enhancing the class performance [Baylor and Ritchie, 2002]. For instance, Beggs (2000), states that the use of technology itself in education is not the big point or the main issue. Instead of that he focuses on using it in an effective way that leads to the advancement of learning and meets the students' interests and abilities. However, if we compare today's' modern life with the past, we will find out that in the past people didn't use to be familiar with the use of technologies especially in the field of teachers training at the Palestinian traditional universities. In other words, the traditional universities in Palestine suffer from a lack of enough awareness and suitable infrastructure in employing the technology in education. The study comes out to highlight and clarify in what manner business teachers employed instructional technologies at these universities. As well, it provides a clear distinction between teachers who employed the modern technology and between the traditional ones who were described as reluctant and worked against adopting the IT in education. Moreover, it determines whether the characteristics of business teachers participates in the prediction of teachers adopter groupings.

***Keywords*:** Technology adoption, diffusion of innovation, adopter categories, business teachers technology use.

Introduction

There is no doubt that in the recent years, the traditional universities in Palestine appears to be more interested in employing the IT and aware the importance of adopting it as a main base of their columns. Hence, they invested widely to support the use and adoption of technology by creating the required infrastructure of the IT field [Green, 1999; Jacobsen, 2000]. Though, even with this huge investment in technology by these universities, the instructional technology has not been adopted by the institutions of business education as required yet [Geoghegan, 1994; Spotts, 1999; Surry, 1997; Albright, 1996; Carlile and Sefton, 1998]. However, there are technical and societal reasons clarify why modern technologies have not been adopted in a comprehensive way. Hence, the main factor behind this failure of using IT reasonably appears to be that most of university level-technology strategies do not take into account the fundamental role that must be initiated by the faculty for the sake of the process of change [Surry and Land, 2000].

The Association for Educational Communications and Technology (AECT) has defined instructional technology (IT) as a complex, integrated process involving people, procedures, ideas, devices and organizations, for analyzing problems and devising, implementing, evaluating and managing solutions to those problems involved in all aspects of human learning [Seels and Richey, 1994]. Despite the AECT definition of IT, in which the emphasis is on IT rather than its' products, many of the debates regarding the use of technology in education continues to focus on products: computers, software, networks and instructional resources [Green, 2000].
Certainly, the use of an adequate technology infrastructure is a prerequisite of IT integration, but the major challenge is to encourage the faculty to adopt these technologies once they are made available. [Goeghegan, 1994] expresses this challenge as follows: [One of the most basic reasons underlying the limited use of instructional technology is the failure to recognize and deal with the social and psychological dimension of

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technological innovation and diffusion**:** the constellation of academic and professional goals, interest, and needs, technology interest, patterns of work, sources of support, social networks, etc., that play a determining role in faculty willingness to adopt and utilize technology in the classroom]. Adoption of or hesitation to adopt new instructional technologies by the business teachers involves a complex system involving multiple variables. As stated by [Spotts, 1999] "the reality of instructional technology use is in the relationship between the new instructional technologies and the faculty members' individual and organizational context and their personal histories".

Conceptual Framework

There have been many attempts to understand patterns of adoption in education. The researcher present one such model in simplified form in order to better understand both traditional and contemporary applications of instructional technology in education. The model, as illustrated in Figure 1, has five phases. The full potential of any educational technology can only be realized when educators progress through all five phases, otherwise, the technology will likely be misused or discarded [Rieber and Welliver, 1989; Marcinkiewicz, in press, 1991]. The **traditional** role of technology in education is necessarily limited to the first three phases, whereas **contemporary** views hold the promise to reach the Evolution phase.

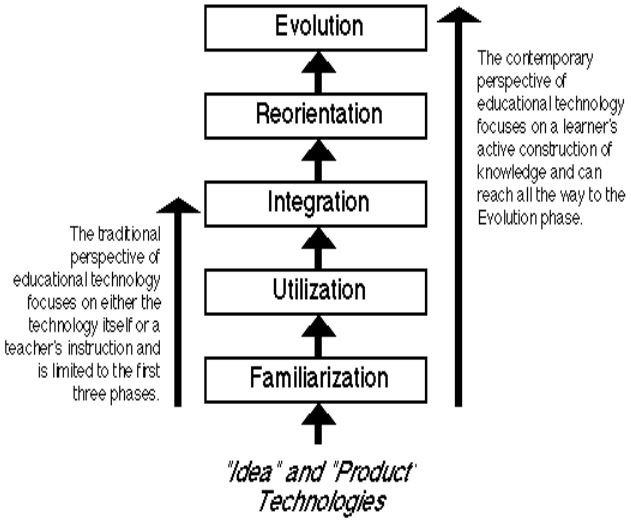

Figure 1. Model of adoption of both "idea" and "product" instructional technologies in education

Study Model

Presented below is the Model of the study based on previous studies that implemented internationally.

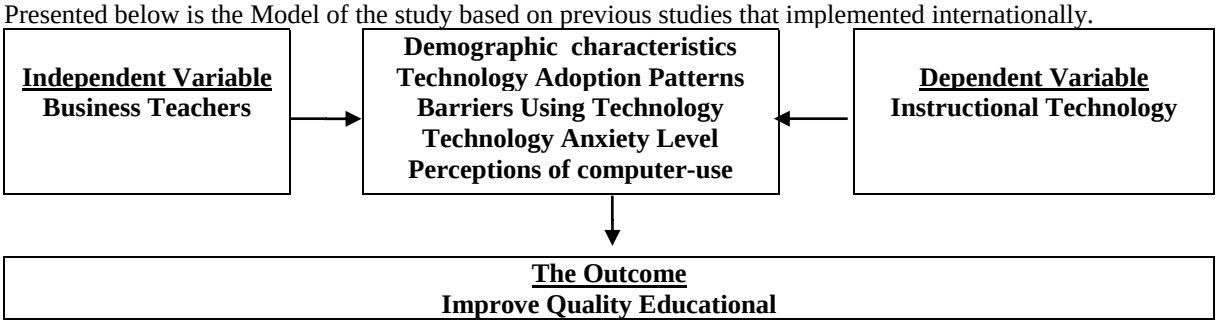

Figure 2: The Model of the study - researcher constructed

Study Questions

This study addressed business teachers' use of technology in their instruction, the results should contribute to efforts to enable the instructional use of technology to achieve its maximum possible impact, the research questions were: 1. What are the personal and demographic characteristics of business teachers. 2**.** To what extend have business teachers adopted technology for use in their instruction. 3. What barriers exist that may prevent business teachers from using technology in their teaching. 4. Do business teachers experience technology anxiety when attempting to use technology in instruction. 5. Do selected variables explain a significant

proportion of the variance in teachers' technology adoption? For the purposes of this study, technology was defined as "high-tech media utilized in instruction such as computers, e-mail, Internet, list-serves, CDROMs, software, laser disc players, interactive CDs, digital cameras, scanners, digital camcorders, etc."

Study Methodology

Method

The present investigation surveyed business teachers in traditional university Palestine. Information gathered about technology use patterns, computer experience and use of technology for teaching, perceived computer use self-efficacy, perceived value of IT, perceived incentives, and barriers. Survey items were adopted or selected from previous investigations of faculty adoption patterns [Anderson, Varnhagen, and Campbell, 1999; Jacobsen, 1998**]** and Microcomputer Utilization in Teaching Self-Efficacy Beliefs Scale **[**Enochs, Riggs, and Ellis, 1993**]**. The survey distributed to 105 business teachers and complete data obtained from 105. 100% participants 98% male and 2% female, holding various academic ranks 5% professors, 7% Associate Professors, 35% Assistant Professor and 53% others, having an average of 10 years of teaching experience. While the average age was 41 years, the largest group 55% was in the 31- 40 age groups.

Table 1. Survey participation percentage

No.	Traditional Universities	No. of Faculty	No. participated	Participation %
1	Arab American University	33	9	8%
2	Hebron University	11	3	3%
3	Palestine Polytechnic University	23	6	6%
4	An-Najah National University	55	14	13%
5	Palestine Technical University Kadoori	43	12	11%
6	Birzeit University	50	13	12%
7	Bethlehem University	12	3	3%
8	Al-Quds University	24	5	5%
9	Al-Istiqlal University	27	7	6%
10	Al-Azhar University	24	5	5%
11	Islamic University Gaza	64	16	15%
12	Al-Aqsa University	29	6	6%
13	Gaza University	12	3	3%
14	Palestine University	14	3	3%
	Total	421	105	100%

Instrumentation

The instrument contained three scales: technology adoption for use in instruction (15 items), barriers to technology integration in instruction (7 items), and technology anxiety experienced while attempting to use technology in instruction (9 items). All scales and other items used in the instrument developed by the researcher after a review of related research literature. The face and content validity of the instruments evaluated by an expert panel of university teachers. The instruments were pilot tested with career and technical education teachers. The reliability of the three scales calculated using Cronbach's alpha: technology adoption, $\alpha = .98$, barriers, $\alpha = .84$, and technology anxiety, $\alpha = .98$. All scales possessed exemplary reliability according to the standards for instrument reliability for Cronbach's alpha by [Robinson, Shaver and Wrightsman, 1991].**Table 2** Analysis of Scale Means for Responses Received from business teachers via Mail versus Responses Received via Telephone Follow-up.

Table 2. Analysis of scale means for responses received from business teachers

Scale	Mail Respondents m (n/sd)	Telephone Follow-up Respondents m (n/sd)	F	Levene's Test for Equality Variances			
				p	t	df	p
Technology Adoption [a]	3.67 (69/1.13)	3.78[b] (35/.99)	.95	.33	-.39	47.45	.70
Barriers to Technology Integration	2.03 (66/.67)	2.06[c] (35/.60)	.65	.42	-.19	62	.85

Technology Anxiety	**1.91 (67/1.01)**	**2.07[d] (35/.85)**	**.77**	**.38**	**-.64**	**63**	**.52**

Notes: [a] Equal variances were not assumed for the t-test for technology adoption because the Levene's Test for Equality of Variances resulted in a statistically significant F value. [b] Technology Adoption Scale: 1 = Not Like Me, 2 = Very Little Like Me, 3 = Some Like Me, 4 = Very Much Like Me, 5 = Just Like Me. [c] Barriers to Technology Integration Scale: 1 = Not a Barrier, 2 = Minor Barrier, 3 = Moderate Barrier, 4 = Major Barrier. [d] Technology Anxiety Scale: 1 = No Anxiety, 2 = Some Anxiety, 3 = Moderate Anxiety, 4 = High Anxiety, 5 = Very High Anxiety.

Variables Related to Technology Adoption

Technology Adoption Barriers

Eminent authors have been illustrated the main obstacles that lead to weaken the process of technology adoption. For instance, Brinkerhoff (2006) illustrates that teachers often are not able to build on technology's instructional potential. This matter of fact relates to barriers such as institutional and administrative support, training and experience, attitudinal or personality factors, and resources as well. Thus, these obstacles are defined as ". . . any factor that prevents or restricts teachers' use of technology in the classroom". In relation to this issue, the British Educational Communications and Technology Agency [BECTA, 2003, 1] states that teacher-level barriers consist of the following factors: lack of time, lack of necessary knowledge, as well as the lack of self-confidence in using technology. However, barriers that surround the administrative level are the lack of: technical support, access to equipment, availability of up to-date software, and institutional support too. On the first hand, BECTA ,2003, [Redmann andKotrlik,2004, and Mumtaz,2000]clarify that technology unavailability comes to be marked as an important element deterring the use of technology by teachers. On the second hand, [Park andErtmer,2008]adds that". . . a lack of a clear, shared vision was the primary barrier. Hence, other barriers may include the lack of sufficient knowledge and skills, unclear expectations, and insufficient feedback".

Technology Anxiety

Technology anxiety has resulted from equipping teachers with technology but failing to provide appropriate teacher training or to consider curricular issues [Budin, 1999]. Technology anxiety has been found to explain variation in technology adoption by career and technical education teachers [Redmann and Kotrlik, 2004]concluded that technology adoption increased as technology anxiety decreased.

Technology Training and Availability

Vannatta and Fordham (2004) found that the amount of technology training was one of the best predictors of technology use. However, it is interesting to note that BECTA (2003) reported that training is focused on teaching basic skills rather than addressing the integration of technology in the classroom. Regarding technology availability, [Mumtaz, 2000and BECTA ,2003] found that a lack of technology availability was a key factor in preventing teachers from using technology in their instruction.

Gender

Anderson (1996) reported in his analysis of studies of computer anxiety and performance that several studies concluded gender was a significant factor in explaining differences in computer anxiety and attitudes toward computers, while other studies found that no relationships existed. [Kotrlik, Redmann, Harrison, and Handley, 2000] found that gender did not explain any variance in the value placed on information technology by agriscience teachers.

Age and Teaching Experience

Waugh (2004) concluded that technology adoption decreased as age increased. In regard to teaching experience, Mumtaz (2000) reported that a lack of teaching experience with technology was a factor that resulted in teachers avoiding the use of technology and an NCES study (Smerdon et al., 2000) reported that more experienced teachers were less likely to utilize technology than less experienced teachers.

Background of the Higher Educational Institutions in Palestine

Table tow summarizes facts of the Palestinian higher education institutions for the academic years (2014/2015 - 2015/2016). These material facilitated researcher's conceptualization of the study.

The Statistics for Higher Educational Institutions in Palestine

Table 3A. The higher educational institutions

	Traditional Universities		Open University		University Colleges		Community Colleges		Total	
	14/15	15/16	14/15	15/16	14/15	15/16	14/15	15/16	14/15	15/16
Higher Educational Institutions										
West Bank	9	9	0	0	13	12	11	12	33	33
Gaza Strip	5	5	0	0	6	5	7	6	18	18
Total	14	14	1	1	19	17	18	18	52	51
New Student: 56969 = Female 33292 and Male 23677										
PhD	28	1	0	0	0	0	0	0	28	1
Master	2.776	2.292	0	0	0	0	0	0	2.776	2.292
Higher Diploma	103	79	0	0	0	0	0	0	103	79
Bachelor	31.422	29.819	11.302	9.801	1.870	2.040	0	33	44.594	41.693
Diploma2 years	1.265	1.373	0	0	4.718	3.577	5.770	4.463	11.753	9.413
Others	621	312	2.495	3.114	84	65	0	0	3.200	3.491
Total	36.215	33.876	13.797	12.915	6.672	5.682	5.770	3.491	62.454	56.969
Enrolled Student: 216028 = Female 130843 + Male 85185										
PhD	40	45	0	0	0	0	0	0	40	45
Master	7.751	6.896	0	0	0	0	0	0	7.751	6.896
Higher Diploma	194	242	0	0	0	0	0	0	194	242
Bachelor	121.008	120.994	57.405	54.316	5.903	6.074	0	175	184.316	181.559
Diploma2 years	2.624	3.538	0	0	10.431	9.208	12.206	10.379	25.261	23.125
Others	832	633	2.825	3.379	112	140	64	9	3.833	4.161
Total	132.449	132.348	60.230	57.695	16.446	15.442	12.270	10.563	221.395	216.028
Academicians: 7011										
Prof	215	282	19	19	5	3	2	5	241	309
Associate Prof	367	387	52	58	8	7	0	1	427	453
Assistant Prof	1.416	1.465	327	306	81	89	13	13	1.837	1.873
Lecturer	566	574	80	93	184	353	123	261	953	1.281
Instructor	1.273	1.435	807	961	17	190	279	175	2.376	2.761
Others	0	66	0	19	357	227	30	22	387	334
Total	4.303	4.209	1.431	1.456	949	869	447	477	7.130	7.011

The Statistics for Traditional Universities in Palestine

Educational Institutions; traditional universities for the Academic Year - 2015/2016

Table 3B. The traditional universities in palestine

No.	Traditional Universities	Professor	Asso. Prof	Assi. Prof	Others	Total
1	Arab American University	2	3	12	16	33
2	Hebron University	0	2	01	08	11
3	Palestine Polytechnic University	0	0	11	12	23

4	An-Najah National University	2	2	20	31	55
5	Palestine Technical University Kadoori	0	1	16	26	43
6	Birzeit University	1	2	18	29	50
7	Bethlehem University	0	0	03	09	12
8	Al-Quds University	0	1	08	15	24
9	Al-Istiqlal University	0	0	16	11	27
10	Al-Azhar University	5	7	07	05	24
11	Islamic University Gaza	9	6	16	33	64
12	Al-Aqsa University	0	0	10	19	29
13	Gaza University	0	1	04	07	12
14	Palestine University	1	1	05	07	14
	Total	20	26	147	228	421

Diffusion of Innovations

Rogers' (1995) provided a rare conceptual framework for analyzing faculty adoption of technology patterns in which it has been provided by the theory of the diffusion of innovations. He states that diffusion is the process of communicated an innovation through definite channels among the members of a social system over time. Also, he states that an innovation is an idea, practice or object that is thought to be new by the individuals. Thoroughly, he explains that diffusion is described as the process of how an innovation indulges with the social system. In relation to the purpose of this study, innovation is defined as an instructional technology that targets teaching and learning. Whereas, diffusion is defined as the extent to which faculties have adopted these innovations. However, *innovativeness* is explained as the degree to which an individual is relatively earlier in adopting new ideas than other members of a system. This becomes a matter of fact because entities and individuals in the social system do not adopt an innovation at the same time. Similarly, Rogers (1995) indicates five adopter categories alongside the continuum of *innovativeness*. These categories are *ideal types* that have been designed so as to make possible comparisons that are based on characteristics of the typical distribution and divided by both the mean deviation and standard deviation. Hence, the respondents of this study were given to either the earlier adopter (i.e., innovators + early adopters = EA) or mainstream faculty (early + late majority + laggards = MF) subgroups by employing a scoring procedure that iscreated by Anderson, Varnhagen, and Campbell (1997). Similar study of faculty adoption patterns by Rogers' demonstrates that Innovator Bell Curve is (2.5%), Early Adopter is (13.5%), Early Majority is (34%), Late Majority is (34%), and Laggards is(16%) as explained in[Figure3].

Figure 3. Adopter categorization based on innovativeness [Rogers, 1995]

Some of the differences that have been cited separating early adopters from the mainstream include:

Differences between Early Adopters from the Mainstream

No	Early Adopters	No	Mainstream
1	Favor revolutionary change	1	Favor evolutionary change
2	Visionary	2	Conservative
3	Strong technology focus	3	Problem oriented
4	Risk takers	4	Risk Averters
5	Experimenters	5	Want proven applications
6	Generally self-sufficient	6	May need significant support
7	Horizontally connected	7	Vertically connected

The differences between people who fall into Rogers' Early Adopter and Early Majority categories create gaps in motivation, expectations and needs. The literature on individual characteristics of the faculty indicated that early adopters of instructional technology share common characteristics such as higher perceptions of efficacy and expertise **[**Anderson, Varnhagen and Campell, 1999; Jacobsen, 1998; Lichty, 2000; Oates, 2001**]**, risk taking and experimentation [Oates, 2001], positive attitude toward technology [Spott, 1999**]** and personal interest in technology **[**Oates, 2001].

Study Results Questions

Question 1: Personal and Demographic Characteristics

The survey of this study has been distributed to 105 faculty members. In which all of the distributed forms have been given back. The complete obtained data forms are105. The survey shows that the gender of respondents is mostly males, (103 out of 105) are males. Statistically, teachers shaped 98% male of the respondents. In contrast, the survey includes only 2 females (2%).It also shows that the respondents hold different academic ranks. For instance, 5% professors, 7% Associate Professors, 35% Assistant Professor and 53% others. However, regarding the ages of the business teachers, the age is from 24 to 70 years. The average age is 48years. The experience of teaching years is from 2 to 35 years. The average experience teacher is 21 years. (Tables 4 and 5) illustrates the above mentioned data in details.

Table 4. Summary of personal and demographic characteristics

Gender	No.	Age	Freq	Academic Rank	Freq	Teaching Experience	Freq
Male	103	24-30	32	Professors	5	5 or less	10
Female	2	31-40	28	Assoc. Professors	10	6-10	30
		41-50	25	Asst. Professor	35	11-15	40
		50 and above	20	others	55	16 and above	25
Total	105		105		105		105

The main source of technology training used by the teachers was 'self-taught' followed by workshops/conferences.(Table 5).

Table 5. Sources of technology training used by teachers

	Source	No.	%
1	Self-taught	100	95.5
2	Workshops/conferences	95	91.0
3	Colleagues	86	82.1
4	College courses	55	52.2

Note: N = 105. The teachers were asked to place a check mark (□) beside each type of technology training they had used.

The technology available to teachers presented in Table 6 shows that over two-thirds had a school email account (97.0%), a computer with an Internet connection both at school (94.0%) and at home (82.1%), and a videocassette, CD or DVD recorder (68.7%). Almost one half had a digital video camera (46.3%) while fewer than one-third had students with school email accounts (28.4%), GPS (Global Positioning System) (19.4%), or a PDA (personal digital assistant) (4.5%).

Question 2: Technology Adoption /Adopter Groups

The adoption and use of technology in instruction by teachers has been measured by using the authors' Technology Adoption Scale. The scale shows that the teachers replied to 15 articles through using an anchored scale: 1 = Not Like Me At All, 2 = Very Little Like Me, 3 = Somewhat Like Me, 4 = Very Much Like Me, and 5 = Just Like Me. Hence, **Table 7** illustrates the means and standard deviations of the technology items adoption scale together with the interpretation scale. The scale shows that the most rated item is "I have made physical changes to accommodate technology in my classroom or laboratory,". This indicates that the item "Very Much Like Me" (M = 4.25, *SD* = .98). In contrast, the second and highest rated item is "I emphasize the use of technology as a learning tool in my classroom or laboratory,". This also indicates that the item "Very Much Like Me" (M = 4.06, *SD* = 1.10). Whereas, the lowest rated item is "I use technology based games or simulations on a regular basis in my classroom or laboratory," in which this result indicates that "Somewhat Like Me" (M = 2.78, *SD* = 1.43). The scale mean is 3.71 (SD = 1.08).This result indicates that the teachers perceived the items in the scale are wholly to be "Very Much Like Me." Therefore, the scale mean indicates that the teachers of technology do not adopt technology in the instructions at the highest level, "Just Like Me".

Table 6 :Types of technology available to technology teachers for use in instruction

No.	Technology Available for Use in Instruction	No.	%
1	Teacher has school email account	102	97.0
2	Teacher has computer with Internet connection at school [a]	99	94.0
3	Teacher has computer with Internet connection at home [a]	86	82.1
4	Video Cassette, CD, or DVD Recorder [a]	72	68.7
5	Interactive DVDs or CDs [a]	63	59.7
6	Teacher has access to enough computers in a classroom or lab for all students to work by themselves or with one other student	60	56.7
7	Laser disc player or standalone DVD or CD players [a]	55	52.2
8	Digital video camera [a]	49	46.3
9	Students have a school email account	30	28.4
10	GPS (Global Positioning System)[a]	20	19.4
11	Personal Digital Assistant (e.g., Palm, IPAQ, Blackberry)[a]	5	4.5

Notes: N = 105. The teachers were asked to place a check mark (□) beside each type of technology that was available for their use in instruction. **[a]** The number of technologies available to each teacher ranged from 0 to 9 and was totaled to create an available technology score for use in the regression analysis for research question 5.

Question 3:Barriers that obstacle using Technologies in Instruction

The researchers developed the Barriers to Integrating Technology in Instruction Scale to be used in determining the scope of barriers that prevent technology education teachers from using technology in the instruction process. Thereupon, the following explanation comes to illustrate the seven items that the teachers responded to by using the following anchored scale: 1 = Not a Barrier, 2 = Minor Barrier, 3 = Moderate Barrier, and 4 = Major Barrier. Thus, **Table 8** illustrates the means and standard deviations of the items in the Barriers to Integrating Technology in Instruction Scale, along with the interpretation scale.

Generally speaking, the teachers experienced minor barriers as they included technology in instruction (Scale *M* = 2.04, *SD* = .64). It shows that the teachers experienced moderate barriers with "Availability of technology for the number of students in my classes" (*M* = 2.64, *SD* = 1.14), and with the "Availability of technical support to effectively use instructional technology in the teaching/learning process" (*M* = 2.59, *SD* = 1.02). In addition to the item of having "Enough time to develop lessons that use technology" (*M* = 2.55, *SD* = 1.13). However, the item that got the lowest rating is "Administrative support for integration of technology in the teaching/learning process" (*M* = 1.83, *SD* = 1.01). This finding indicates that they have just experienced minor barriers.

Table 7: Responses to the items in the technology adoption scale

No.	Item	*N*	*M*	*SD*
1	I have made physical changes to accommodate technology in my classroom or laboratory.	105	4.25	0.98
2	I emphasize the use of technology as a learning tool in my classroom or laboratory.	105	4.06	1.10
3	I expect my students to use technology so they can take on new challenges beyond traditional assignments and activities.	105	3.97	1.28
4	I expect my students to fully understand the unique role that technology plays in their education.	105	3.97	1.13

5	I discuss with students how they can use technology as a learning tool.	105	3.88	0.90
6	I expect my students to use technology to enable them to be self directed learners.	105	3.81	1.22
7	I design learning activities that result in my students being comfortable using technology in their learning.	105	3.81	1.30
8	I expect students to use technology to such an extent that they develop projects that are of a higher quality level than would be possible without them using technology.	105	3.81	1.22
9	I regularly pursue innovative ways to incorporate technology into the learning process for my students.	105	3.70	1.33
10	I incorporate technology in my teaching to such an extent that it has become a standard learning tool for my students.	104	3.68	1.43
11	I am more of a facilitator of learning than the source of all information because my students use technology.	104	3.59	1.36
12	I assign students to use the computer to do content related activities on a regular basis.	105	3.57	1.32
13	I use technology to encourage students to share the responsibility for their own learning.	105	3.43	1.26
14	I incorporate technology in my teaching to such an extent that my students use technology to collaborate with other students in my class during the learning process.	104	3.35	1.43
15	I use technology based games or simulations on a regular basis in my classroom or laboratory.	105	2.78	1.43

Note: *N* = 105. Scale interpretation ranges for the scale means: 1 = Not Like Me at All (1.00-1.49), 2 = Very Little Like Me (1.50-2.49), 3 = Somewhat Like Me (2.503.49), 4 = Very Much Like Me (3.50-4.49), and 5 = Just Like Me (4.50-5.00). Scale *M* = 2.78 (*SD* = 1.43).

Table 8: Responses to integrate technology in instruction scale

No.	Item	N	M	SD
1	Availability of technology for the number of students in my classes.	105	2.64	1.14
2	Availability of technical support to effectively use instructional technology in the teaching/ learning process.	104	2.59	1.02
3	Enough time to develop lessons that use technology.	105	2.55	1.13
4	Scheduling enough time for students to use the Internet, computers, or other technology in the teaching/learning process.	105	2.43	1.05
5	Availability of effective instructional software for the courses I teach.	105	2.37	0.97
6	My ability to integrate technology in the teaching/learning process.	105	2.09	0.87
7	Administrative support for integration of technology in the teaching/learning process.	103	1.83	1.01

Note: *N* = 105. Scale interpretation ranges for the scale means: 1 = Not a Barrier (1.001.49), 2 = Minor Barrier (1.50-2.49), 3 = Moderate Barrier (2.50-3.49), 4 = Major Barrier (3.50-4.00). Scale *M* = 2.04 (*SD* = .64)

Question 4: Teachers Anxiety Caused by Technology

The Technology Anxiety Scale is a researcher-developed scale which is used to determine the anxiety teachers feel when they think about using technology in the instruction process. The teachers responded to all of the 12 included items by means of using the following anchored scale: 1 = No Anxiety, 2 = Some Anxiety, 3 = Moderate Anxiety and 4 = High Anxiety and 5 = Very High Anxiety. Thereupon, **Table 9** illustrates the means and standard deviations for the items of the Technology Anxiety Scale, together with the interpretation scale.
The study shows that the teachers of technology have experienced certain anxiety as they integrated technology in the instruction process. The scale mean is in the item (Scale *M* = 1.97, *SD* = .95) and all item means are in the item "Some Anxiety" range. The findings of this survey show that the teachers of technology are experiencing the highest anxiety level with the question, "How anxious do you feel when you cannot keep up with important technological advances?" (*M* = 2.15, *SD* = 1.09). However, the lowest anxiety level appears when they have been asked the question, "How anxious do you feel when you think about using technology in instruction?" (*M* = 1.75, *SD* = 1.06**).**

Question 5: Explanation of Variance in Technology Adoption

The study uses Forward Multiple Regression to determine whether the selected variables can explain a considerable proportion of the variance in the adoption of technology in the process of instruction. Thereupon, the dependent variable in this analysis is the Technology Adoption Scale mean. The review of literature shows that six teacher demographic or personal variables have been categorized as possible illustrative variables: age, gender, years of teaching experience, and perceived barriers to integrating technology in instruction, technology anxiety, training sources used, and technology available for use in instruction. Hence, **Table 5** illustrates the training sources used by the teachers. The training sources score is calculated by assigning one point for each of the four training sources**. Table 6** illustrates the available technology types for the instruction variable. Hence, the score is computed by assigning one point for each of nine types of technology.

Table 9: Technology education teachers' responses to technology anxiety scale

No.	Item	N	M	SD
1	How anxious do you feel when you cannot keep up with important technological advances?	105	2.15	1.09
2	How anxious do you feel when you are not certain what the options on various technologies will do?	105	2.10	0.99
3	How anxious do you feel when you think about your technology skills compared to the skills of other teachers?	104	2.05	1.27
4	How anxious do you feel when someone uses a technology term that you do not understand?	105	2.04	1.04
5	How anxious do you feel when you hesitate to use technology for fear of making mistakes you cannot correct?	105	2.03	1.06
6	How anxious do you feel when you are faced with using new technology?	104	1.98	1.06
7	How anxious do you feel when you try to understand new technology?	105	1.97	0.98
8	How anxious do you feel when you try to use technology?	105	1.91	1.00
9	How anxious do you feel when you try to learn technology related skills?	105	1.88	0.99
10	How anxious do you feel when you avoid using unfamiliar technology?	105	1.87	0.95
11	How anxious do you feel when you fear you may break or damage the technology you are using?	105	1.76	1.10
12	How anxious do you feel when you think about using technology in instruction?	103	1.75	1.06

Note: *N* = 105. Scale interpretation ranges for the scale means: 1 = No Anxiety (1.001.49), 2 = Some Anxiety (1.50-2.49), 3 = Moderate Anxiety (2.50-3.49), 4 = High Anxiety (3.50-4.00), 5 = Very High Anxiety (4.50-5.00). Scale *M* = 1.97 (*SD* = .95)**.**

Table 10, on the first hand**,** illustrates the correlations of the seven demographic and personal variables with the Technology Adoption Scale score. As a result, it had been determined *a priori* that only those variables that were significantly correlated with the adoption scale score would be utilized in the regression analysis. This finding comes out due to the minimum number of observations needed per variable for the regression analysis.

On the other hand, Table 10 shows that the adoption scale score is moderately correlated with four of the ten variables. Namely, barriers to technology integration (r = -.32), technology anxiety (r = -.42, technology availability (r = .43), and the use of colleagues as a training source (r = -.31). These four variables are utilized in the forward multiple regression analysis. The sample size is suitable for this inquiry. Similarly, Hair, Black, Babin, Anderson, and Tatham (2006), state that minimum of 5 observations per variable was required; whereas, 15-20 observations for each potential explanatory variable were needed in a forward regression analysis**.**

Table 10: Correlations of selected variables with teachers' technology adoption scores

No.	Age	.04[a]	.793	60
1	Gender	.06[a]	.619	67
2	Years Teaching Experience	.02[a]	.859	67
3	Barriers to Technology Integration	-.32[b]	.011	64
4	Technology Anxiety	-.42[b]	<.001	65
5	Technology Available	.33[b]	.006	67
6	Training Sources:			
	Self –taught	-.02[a]	.853	66
	Workshops/conferences	.19[a]	.122	66
	College courses	-.04[a]	.751	66
	Colleagues	-.31[b]	.012	66

Variable	***r***	***p***	***N***

Notes: N = 105 [a] Negligible association according to Cohen (1988). [b] Moderate association according to Cohen (1988).

As a matter of fact, Table 11 illustrates that Multicollinearity did not exist in the regression analysis. For instance, Hair et al. (2006) state that, "The presence of high correlations (generally, 90 and above) is the first indication of substantial collinearity". Thereupon, the independent variables had not a high correlation with other independent variables. Also, Hair et al. (2006) show that, "The two most common measures for assessing both pairwise and multiple variable collinearity are tolerance and its inverse, the variance inflation factor [VIF]. … What's more, a multiple correlation of .90 between one independent variable and all others …would result in a tolerance value of .19. In consequence, any variables with tolerance values below .19 (or above a VIF of 5.3) would have a correlation of more than .90" (Hair et al., 2006, pp. 227, 230). This shows that none of the tolerance values observed rates lower than .19 and none of the VIF values exceeded 5.3. This also states that the three variables that entered into the forward multiple regression analysis explain 37% of the variance (R^2) in technology adoption in instruction. With respect to the variable "technology anxiety" entered the model first and accounted for 17% of the variance. Then, it followed by "technology available for instruction" which accounted for an additional 13% of the variance. Colleagues as a training source entered the model last which explains 7% of the variance. Technology adoption increases as available. (Standardized b =.35) increases, as technology anxiety decreases (Standardized b = -.40).However, when teachers use colleagues as a training sources (Standardized b = -.27). A regression model that explains 37% of the variance represents a large effect size (Cohen, 1988). "Barriers to technology integration" did not explain additional variance in technology adoption. Below**,** Table 11 presents The Multiple Regression Analysis.

Table 11: Forward regression analysis model explaining variance in technology adoption in instruction scale mean

	S	***df***	***MS***	***F***	***p***
Regression	27.57	3	9.19	11.43	<.001
Residual	46.66	58	.80		
Total	74.23	61			

					Change Statistics		
Explanatory Variables in Model	***R***	***R2***	**Adjusted *R2***	***SE***	***R2* Change**	***F* Change**	***P* of *F* Change**
Technology anxiety	.41	.17	.15	1.02	.17	12.01	.001
Technology anxiety, technology availability	.55	.30	.28	.94	.13	11.13	.001
Technology anxiety, technology availability, training source: colleagues	.61	.37	.34	.90	.07	6.68	.012

Excluded variable				
Variable	**Beta In**	***t***	***p***	**Partial *r***
Barriers to technology adoption	.02	.20	.843	.03

Notes: N =105 Dependent variable: technology adoption. Technology Adoption Scale: 1 = Not Like Me at All, 2 = Very Little Like Me, 3 = Somewhat Like Me, 4 = Very Much Like Me, and 5 = Just Like Me. Technology Anxiety Scale: 1 = No Anxiety, 2 = Some Anxiety, 3 = Moderate Anxiety, 4 = High Anxiety, 5 = Very High Anxiety. Technology Available variable potentially ranged from 0 to 9 points, but the actual range was 0 to 8 points since none of the respondents had all nine types of technology. Barriers to Integration Scale: 1 = Not a Barrier, 2 = Minor Barrier, 3 = Moderate Barrier, 4 = Major Barrier.
The combined variables included in the multiple regression model represent a large effect size according to Cohen (1988): R^2> .0196 - small effect size, R^2> .13 - moderate effect size, and R^2> .26 - large effect size**.**

Recommendations

In recent times, the Palestinian higher education institutions are equipped with instructional technology innovation. This means shifting the way in which teachers and students interact; as well as the roles they take. Thus, the traditional universities in Palestine must act in accordance with their drawn goals. So if the goal is to use who use the technology for a transformative change, there must be a clear focus on training the teachers

technology rather than the acquisition of technology itself. However, it is essential to understand and address the required needs of teachers in the faculty development and support systems which would lead to large-scale technology integration to occur in teaching.

At last but not least, the following recommendation must be taken into account by the responsible parties in order to offer the required infrastructure that improve the traditional universities in Palestine; as well as improving their teachers in IT adoption in teaching and using the instructional technology in business education: 1. Develop a long-range technology plan driven by the institutions' overall vision and strategy for its teaching. 2. Establish a promotion system that places a high value on teaching and the use of innovative teaching methods. 3. Design faculty development programs considering the needs of different teachers profiles. 4. Provide training programs not only on the technical aspects of technology, but also about the integration of technology for teaching and learning. 5. Establish an instructional technology center in which teachers can get help from and work together with IT related professionals. 6. Provide systematic technical and professional support.

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METACOGNITIVE AWARENESS IN SECOND LANGUAGE LISTENING AND THE ROLE OF STRATEGY TRAINING

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Abstract: Listening is an essential skill and plays a crucial role in learning and using a second language. It is stated by various researchers that learners become successful and efficient listeners by means of employing strategies during listening (Gilakjani & Ahmadi, 2011). This study included the aim to provide learners with training in two different types of listening strategies, namely note-taking and shadowing. While there is abundant information on L2 learners' metacognitive awareness in listening, there is the need to analyze metacognition in relation to different listening strategies. For this purpose, the present study intends to investigate the influence of note-taking and shadowing as two listening strategies on learners' awareness of their own second language listening process. The specific research question asked was: Is there a significant difference in metacognitive listening awareness levels of students who receive shadowing training and who receive note-taking training? In order to gather data, the Meta-cognitive Awareness Listening Questionnaire (MALQ) was implemented on 82 English as a Foreign Language (EFL) learners who were pre-intermediate level students at the language preparatory classes of a state university in Turkey. Half of the participants had shadowing instruction and practice, whereas the other half had note-taking instruction and practice in their listening lessons for six weeks. All of the participants answered the questionnaire both before and after the treatment period. In order to analyze the data, means were calculated and statistical tests were run. To compare the listening meta-cognitive awareness levels of students in the two groups, the Mann Whitney U-test was employed. Results show a statistically significant difference between the two groups on twelve items in various components of the scale, with the advantage of shadowing group.

Keywords: EFL listening, listening strategies, MALQ, shadowing, note-taking

Introduction and Literature Review

Listening is an essential skill and plays a crucial role in learning and using a second language. Despite its importance, second language (L2) learners usually face great difficulty comprehending spoken English.Two of the innovative ideas in terms of developing listening skills in recent years is strategic listening and metacognition. It is stated by various researchers that learners become successful and efficient listeners by means of employing strategies (Gilakjani& Ahmadi, 2011) and by becoming metacognitively aware during listening (Goh, 2008).While there is abundant information on L2 learners' metacognitive awareness in listening, there is the need to analyze metacognition in relation to different listening strategies.

A listening strategy could be defined as the art of organizing and ordering activities or tactics for learners' utmost benefit in listening to decode, comprehend and interpret the aural input (Gonen, 2009). There are different lists of listening strategies provided by various researchers. One of them is Vandergrift (1997), whose taxonomy of listening strategies is the most widely-used and includes cognitive, socio-affective and meta-cognitive strategies as three categories of listening strategies.

Cognitive strategies involve the direct manipulation of listening tasks or application of specific strategies. Socio-affective strategies associate with strategies utilized by learners in order to reduce anxiety or cooperate with

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other learners. Meta-cognitive group of strategies concerns learners' own perception and thinking of their listening process. Improving one's meta-cognition in listening allows the learner to evaluate, plan and monitor his/her listening process and find the convenient listening strategies to enhance their listening ability (Goh, 2000; Huang, 2005).

Meta-cognitive listening strategies could be discussed through pre-listening planning strategies, while-listening monitoring strategies, and post-listening evaluation strategies. The present study examines two while-listening strategies, namely note-taking and shadowing. Taking notes while listening to a lecture is a routine owned by learners of all ages with the aim of promoting learning and recalling the learned input later (Teng, 2011). Shadowing is a while-listening strategy which requires learners to repeat the aural input without stopping, unlike repetition, while following the in-coming input at the same time (Rongna and Hayashi, 2012).

Despite considerable body of literature on the use of listening strategies in English and metacognitive awareness, there is need for further research. Previous studies on the issue have mainly focused on either the relationship between learners' listening comprehension and meta-cognitive awareness in listening (Coskun, 2010; Goh & Hu, 2014; Vandergrift, 2005) or strategy use and meta-cognitive awareness in listening (Rahimirad & Shams, 2014).

Research Questions

For the above-mentioned reasons, the present study intends to investigate the influence of note-taking and shadowing as two while-listening strategies on learners' awareness of their own second language listening process. The specific research question asked was: Is there a significant difference in metacognitive listening awareness levels of students who receive shadowing training and who receive note-taking training?

Methodology

Context and Participants

This experimental study takes place at the Foreign Languages School of a state university in the Marmara Region of Turkey. The institution serves English preparation education to freshman students before they start their education in their fields. All students are exposed to a skills-based English as a foreign language (EFL) education for at least 22 hours a week. There are seven hours of listening and speaking lessons per week for the pre-intermediate level classes.

Participants in this study consist of 84 students aged between 18 and 20, in four randomly selected pre-intermediate level EFL classes. They have learnt English as a foreign language as a subject at secondary and high schools for almost a period of six years before starting their university language preparatory class. Out of four classes, for this study, two groups were randomly assigned into shadowing and two of the groups were assigned into note-taking training. The training period lasted for six weeks, where both groups were taught by the same instructor who was also the first researcher of this study.

Data Collection

The means of data collection was Meta-cognitive Awareness Listening Questionnaire (MALQ) which was applied right before the training has started and again right after the training period. This questionnaire was generated by Vandergrift, Goh, Mareschal, and Tafaghodtari (2006). With the use of this instrument, the researchers aimed to discover how much awareness learners had of their own L2 listening process. The questionnaire which included 21 items comprised five discrete categories that are problem-solving, planning and evaluation, mental translation, person knowledge, and directed attention. Reliability statistics of the scale was analyzed and Cronbach's Alpha was found as 0,635.

After a pilot training and testing session, actual data were collected in the fall semester of the 2015-2016 academic year. Participants in each group were exposed to listening strategy training sessions for two hours per week for six weeks where the relevant while-listening strategy was practiced and tested. Each training session included instruction on the strategy, followed by practice activities and a test. During the instruction, trainees initially were exposed to detailed information about the strategy, crucial points about it, and different techniques to implement. Then, as modelling, learners were shown videos of young adult foreign language learners who were describing that strategy. Lastly, they had a listening comprehension practice and test.

Data Analysis

Data obtained through MALQ, were analyzed by calculating means and running descriptive statistical tests. The listening metacognitive awareness levels of the two groups were compared with the help of a Mann-Whitney U Test.

Results

The purpose of this study was to explore the use of shadowing and note-taking as two distinct while-listening strategies to find out about their possible influence on learners' meta-cognitive listening awareness. In order to analyze the pre-training responses of learners, the normality was determined by Shapiro-Wilk test. As a result of this test, the distribution of the data for the two groups was not normal. Therefore, Mann-Whitney U test was used to compare the learner responses to MALQ before the treatment, and it was found that responses to the items of the scale were not statistically different, indicating homogeneity between the two groups.

MALQ was implemented again at the end of the data collection, subsequent to the treatment sessions, and learner responses were analyzed. The normality of the data was tested by Shapiro-Wilk test, and the distribution of the data for note-taking and shadowing groups was not normal, necessitating the use of Mann-Whitney U Test. As a result of this test, learner responses were found statistically significantly different in items 4, 5, 6, 7, 8, 10, 11, 14, 15, 18, 20 and 21 for the two treatment groups. The median, maximum and minimum values indicate that the shadowing group had higher level responses to all statistically significant items in the scale (as can be seen in Table 1).

Results indicate that there was a statistically significant difference between four of the five items in the Planning-Evaluation category. This finding shows that learners in the shadowing group had a plan in their mind about their upcoming listening process more than the note-taking group (item 10). Additionally, shadowing learners analyzed how they listened and what they needed to do next time more than the other group (item 14). Furthermore, the shadowing group learners questioned their satisfaction with their listening comprehension more than note-takers (item 20) and they were in a more purposeful listening process than the other group (item 21).

The second meta-cognitive awareness listening category was Directed-Attention category, and there were four items in this group. However, a statistically significant difference was found in learner responses to only the sixth item. This finding shows that the shadowing group learners were better at concentrating on their listening when they lost their attention.

Person-Knowledge strategies were included in the third category in the scale and responses to items 8 and 15 demonstrate a statistically significant difference between the two groups. In other words, learners who considered listening as a challenge but not a problem exist more in the shadowing group (item 8), and the shadowing group learners were more relaxed than the note-taking group during listening (item 15).

The fourth category which reflects statistically significant difference among two items is the Mental-Translation strategies group. This result indicates that the shadowing group translates the aural input more than the note-taking group (item 4). In addition, there exists a small difference between the two groups which displays that the shadowing learners do translation during listening more than the other group (items 11 and 18).

Finally, the fifth category, named as the Problem-Solving group, included five items and responses to two of its items demonstrated a statistically significant difference between the two groups. This finding indicates that shadowing learners make more use of the words they comprehend so as to guess the meaning of unknown words (item 5). Furthermore, shadowing learners make more comparison between their background knowledge and their listening context compared to the note-taking learners (item 7).

Table 1. Post-MALQ comparisons between groups

MALQ Categories	**MALQ Items**	**Note-taking group** Median (Min:Max)	**Shadowing group** Median (Min:Max)	**P**
Planning-Evaluation Strategies	1	5(1:6)	5(2:6)	0,520
	10	3(1:6)	6(6:6)	**<0,0001**
	14	5(3:6)	6(5:6)	**<0,0001**
	20	4(1:6)	6(6:6)	**<0,0001**
	21	5(2:6)	6(6:6)	**<0,0001**
Directed-Attention Strategies	2	4(1:6)	4(3:6)	0,216
	6	4(1:6)	6(5:6)	**<0,0001**
	12	4(2:6)	6(1:6)	0,377
	16	5(4:6)	6(2:6)	0,282
Person-Knowledge Strategies	3	3(1:5)	2(1:6)	0,742
	8	2(1:6)	5(4:6)	**<0,0001**
	15	5(1:6)	6(1:6)	**<0,0001**
Mental-Translation Strategies	4	5(1:6)	6(6:6)	**<0,0001**
	11	5(3:6)	6(2:6)	**0,012**
	18	2(1:6)	6(1:6)	**<0,0001**
Problem-Solving Strategies	5	5(3:6)	6(6:6)	**<0,0001**
	7	4(1:6)	6(4:6)	**<0,0001**
	9	5(1:6)	6(1:6)	0,127
	13	5(4:6)	6(2:6)	0,282
	17	5(2:6)	1(1:6)	0,158
	19	4(2:6)	6(3:6)	0,495

Discussion and Implications

The main aim of this study was to explore whether there are any significant differences in meta-cognitive listening awareness of students in the shadowing and note-taking training groups.

Findings demonstrated that there were statistically significant differences between the two treatment groups on twelve MALQ items, and it was the shadowing group who had higher level responses to all of these items. This

finding indicates that shadowing as a while-listening strategy has a bigger influence than note-taking on L2 learners' meta-cognitive listening awareness.

To sum up, responses to planning-evaluation category items of the MALQ suggest that shadowing seems to improve learners' self-evaluation of their own listening process, and thinking of their background before listening, their satisfaction about their listening comprehension ability during listening, and analysis of their listening performance subsequent to listening. Furthermore, shadowing group could concentrate better after they had confusion. Findings also confirm that shadowing group had a more positive and relaxed attitude towards their strategy. Interestingly, shadowing group considered L2 listening as a challenge more than the note-taking group. Even though this finding seems as a negative attitude, this reflection could reveal that shadowing listeners placed more importance and emphasis on listening, which indicates a high level of awareness. Finally, shadowing appeared to be more helpful than note-taking in supporting learners to find practical solutions to their problems during listening.

Past studies in literature mostly include studies which sought the effect of meta-cognitive strategy treatment on learners' listening comprehension performance. However, the current study emphasizes the influence of two distinct listening strategies and its training on students' meta-cognitive listening awareness, which makes this study and its design a contribution to the field. Further studies need to be conducted with other participants in other settings to shed more light on shadowing and note-taking.

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EFL STUDENTS' REFLECTIONS ON EXPLICIT AND IMPLICIT WRITTEN CORRECTIVE FEEDBACK

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Abstract: Written corrective feedback given by the teacher on students' essays plays a significant role in the development of language and writing skills of second language (L2) learners. Whether explicit (direct) feedback or implicit (indirect) feedback should be given to students' errors in essays, and which of these is more beneficial to learners has been a concern of L2 writing researchers for some time. However, the issue of learners' preferences on the types of written corrective feedback has been overlooked. This paper aims to investigate Turkish speaking English as a Foreign Language (EFL) students' ideas about explicit and implicit written corrective feedback. The authors attempt to answer the following questions:

1- What are Turkish secondary school students' attitudes towards writing in English as a foreign language?
2- What are their preferences in relation to two different types of written corrective feedback (explicit and implicit)?

In order to shed light on the students' opinions and preferences in terms of written corrective feedback, a study was conducted at a Turkish state secondary school in Istanbul. Seventy (70) seventh-grade female students, whose ages were around 12, participated in this study. Half of the students received explicit feedback on their essays, while the other half received implicit feedback. Students' opinions were collected via a questionnaire comprised of nine Likert-type items and one open-ended question during the fall semester of 2016-2017 academic year. The closed items were analyzed by conducting descriptive statistics, while qualitative data analysis was used for the answers to the open-ended item. Results reveal that students in both groups preferred one type of written corrective feedback more than the other type. Various factors that might play a role in this result as well as suggestions for EFL teachers will be discussed.

***Keywords*:** L2 writing, EFL learners, explicit feedback, implicit feedback

Introduction and Literature Review

Feedback to written work is an essential part of writing activities in second language classes and is an area of attention for many teachers. Feedback has been examined and studied for a considerable amount of time by many researchers as well. Whether feedback makes learners better writers and the influence of different kinds of feedback have been the concern of researchers. Feedback in writing has been divided into two main types. First of them is *explicit corrective feedback*, where there is explicit correction of the L2 writers' work by the teacher. Second type of feedback in writing is *implicit corrective feedback*, where learners are expected to make an inference and self-correction about the errors based on the teacher's comments and signs (Bitchener, Cameron & Young, 2005)

There are limited studies on students' reflections on explicit and implicit written corrective feedback types in the area, and most of these studies were carried out with adult learners. There are very few studies conducted in a Turkish context with secondary state school EFL students with low proficiency levels. Based on the lack of

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research on this issue, this paper aims to investigate Turkish speaking EFL students' ideas about explicit and implicit written corrective feedback.

Learner Attitudes Towards Different Types of Written Corrective Feedback

Although the need for written corrective feedback and effectiveness of the different feedback types have been widely researched, learners' attitudes towards and preferences for different types of written corrective feedback have not been researched extensively.

Available research shows that learners are pleased with teacher written corrective feedback and they have positive attitudes towards it (Hosseni, 2015; Leki, 1991; Zhang, 1995). However, in these studies, which type of written corrective feedback is more preferable by the students is not specified. Rotim (2015) asserts that students favour written corrective feedback and state that it helps their learning and is influential on their language acquisition.

With regard to this issue, Kalra and Tangkiensirisin (2016) studied students' reflections on the feedback type they received. They expressed that whilst students who received direct corrective feedback were quite content and asserted that direct written teacher corrective feedback led to improvement in their business writings, the second group who received indirect corrective feedback claimed that they felt confused about the feedback and held negative feelings towards it. Atmaca (2016) who conducted a study with 34 teachers and 34 students about their perceptions of written corrective feedback in a Turkish context asserted that some of the students preferred explicit written corrective feedback to implicit written corrective feedback. They especially indicated that they would rather have content and organizational feedback on their written products. In Chandler (2003), although students would rather choose explicit written corrective feedback due to its easiness and rapidity, they acknowledge that they benefit more from self-correction. Lee (2005) claims that students' preferences on different types of written corrective feedback have not attracted as much attention as the efficacy of different feedback types on student writings. In her research dating to 2005, Lee found out that students preferred their teachers to correct all of their errors rather than giving implicit written corrective feedback. Besides, students hold the idea that it is the teachers' responsibility to correct errors. Kahraman and Yalvaç (2015) who conducted a study with Turkish university students revealed results showing that while students prefer implicit written corrective feedback in the first drafts and try to do self-correction, they would rather have explicit written corrective feedback in the final drafts in case they could not find answers to their errors on their own.

Research Questions

Erel and Bulut (2007) also state the necessity for further research on types of written corrective feedback from students' perspectives and reactions. Therefore, this study aims to investigate the attitudes of the students to writing in English and their preferences on explicit and implicit written corrective feedback types. The specific research questions are:

1- What are Turkish secondary school students' attitudes towards writing in English as a foreign language?
2- What are their preferences in relation to two different types of written corrective feedback (explicit and implicit)?

Methodology

Context and Participants

This study took place in a vocational state secondary school located in Istanbul, Turkey. In order to ensure homogeneity, two similar seventh grade female student classes out of eleven seventh grade classes were chosen.

Class H was comprised of 33 female students; 32 of them were Turkish citizens, one of them was a Syrian student who had migrated to Turkey four years ago. Class K contained 37 female students all of whom were Turkish citizens. All of the participating students were around 12 years old and were pre-intermediate level English learners.
In both classes, except the Syrian student, all students had been taking English lessons since fourth grade, where they received two hours of English lessons in a week. At fifth and sixth grades, they had three hours of English lessons in a week. During the year of data collection, at seventh grade, they had four hours of English lessons per

week. The Syrian student stated that she had been taking English lessons since first grade, however, she had forgotten most of what she learned due to personal reasons.

Both classes had numerous non-native English teachers in fourth, fifth and sixth grades. The students were not exposed to organized and detailed writing instruction prior to 7th grade. At the time of the data collection which is the third month of the term of seventh grade, both groups had the same non-native English teacher, who is also the first researcher of this study (henceforth Teacher S). Teacher S had graduated from the Foreign Language Education department of a competitive state university in Istanbul and had more than two years of experience in teaching primary and secondary state schools.

Data Collection

The data collection started in the middle of the fall semester and lasted for four weeks. The research process began with the assignment of a writing topic to the students in both classes and provision of fifty minutes for the students to write. The students worked for fifty minutes, and Teacher S collected all the essays at the same time. During week two, Teacher S analysed the essays, giving explicit corrective feedback to essays of Class H, while giving implicit corrective feedback to essays of Class K. One week later, she distributed the first drafts back to students and assigned them to write the second drafts by taking the corrections into consideration. At this stage, fifty minutes of class time were allocated to the students to write their second drafts. At the end of fifty minutes, both first and second drafts of essays were collected from the students. During the third week, Teacher S distributed a questionnaire to the students. The questionnaire was comprised of nine Likert-scale statements and one open-ended question to elicit students' ideas and preferences on two different types of written corrective feedback. Even though there were 70 students in both classes, a total of 46 students answered the questionnaire.

Data Analysis

Open-ended and closed items were analysed differently. For the nine Likert-Scale items, reliability analyses were run and the results showed that the questionnaire has internal consistency. Then, a test of normality was conducted and normal distribution was found. Therefore, an independent samples t-test was applied using the statistical data analysis program. For the item analyses, nine statements have been grouped into three main headings:

- Students' attitudes towards writing in English
- Students' attitudes towards implicit written corrective feedback
- Students' attitudes towards explicit written corrective feedback

For the analysis of the open ended question, all student responses have been read, coded and grouped under relevant themes. Five major categories were deduced from the data which are the main highlights from the student answers. For each feedback type, these categories are 'awareness raising benefit of the feedback', 'dealing with that type of feedback', 'long-term effect of that feedback type', 'positive attitudes to that feedback type', and 'negative attitudes to that feedback type'.

Students' answers for these five main categories were counted and frequencies in the form of percentages have been calculated. During the analysis of the open ended question data, two raters worked together in order to ensure inter-rater reliability, with 90% consensus rate.

Results

First of all, there were two Likert-type items under 'Students' Attitudes to Writing in English' category. Mean scores for the explicit feedback group is 8.38 and for the implicit feedback group 9.40. In other words, the mean scores of the students' attitudes to writing in English is around 9 out of 12, which means that the students' are mostly positive (74%) about writing in the L2. It is also seen that the scores of the two groups are quite similar. There is no statistically significant difference between the two groups, which means that students who received different types of feedback have similar attitudes towards writing in English.

Secondly, four statements existed in the 'Students' Preferences for Implicit Feedback' category. In this category, scores are 15.07 and 15.80 for explicit and implicit written corrective feedback groups respectively out of a total

score of 24. This means that students' preference for implicit feedback is around 64% positive. Moreover, t-test results show that there is no statistically significant difference between the two groups on this issue.

Finally, three statements were related to 'Students' Preferences for Explicit Feedback' category. The mean scores are 14.23 for the explicit feedback group and 13.90 for the implicit feedback group. It can be stated that around 78% of students in both groups rated explicit feedback positively. In addition, the comparison between the two groups' ratings did not yield any statistically significant differences.

In conclusion, it can be said that explicit and implicit feedback groups share similar ideas about writing in English, and implicit and explicit feedback types. The general attitude towards writing in English seems to be positive for most students in both groups. It can also be expressed that explicit feedback is slightly more preferred compared to implicit feedback by both feedback groups. Detailed results can be seen in Table1.

Table 1. Attitudes of feedback groups compared

Themes	**Feedback Groups**	**n**	**Mean**	**Std. Deviation**	**df**	**Sig. (2-tailed)**
Students' Attitudes to Writing English (2 items)	Explicit F. Gr	26	8,3846	2,95401	44	,207
	Implicit F. Gr	20	9,4000	2,23371	43,995	,191
Students' Preferences for Implicit Feedback (4 items)	Explicit F. Gr	26	15,0769	3,79392	44	,625
	Implicit F. Gr	20	15,8000	6,13532	29,858	,647
Students' Preferences for Explicit Feedback (3 items)	Explicit F. Gr	26	14,2308	3,52486	44	,750
	Implicit F. Gr	20	13,9000	3,38573	41,805	,749

Qualitative analysis methods were used for the open ended question. First of all, two independent raters read all the answers and formed categories from the students' answers. Similar categories were then combined under main headings and themes. The three most frequently mentioned themes are 'awareness raising benefit of the feedback', 'dealing with that type of feedback', and long-term effect of that feedback type'. The results can be seen in Table 2 below.

Table 2. Opinions about feedback types

Ideas	**About Implicit Feedback**		**About Explicit Feedback**	
	n	**f (%)**	**n**	**f (%)**
Awareness raising benefit	21	45%	9	20%
Develop strategies	35	76%	4	8%
Long term effect	4	8%	14	30%

Out of 46 students who answered the open-ended item, 21 students (45%), mentioned the awareness raising benefit of implicit written corrective feedback ("I notice my error"). However, half as many, only nine students (20%) mentioned the awareness raising benefit of explicit written corrective feedback. 35 students out of 46 (76%) stated that they tried to correct their errors in various self-discovered ways and developed strategies when they received implicit feedback ("I look for ways to correct my errors"). Yet, very few, only four students (8%) mentioned the strategic development effect of explicit feedback. Participants also stated the long term influence of written corrective feedback in their answers to the open-ended question ("I try not to repeat my errors"). Only four students (8%) highlighted this feature of implicit feedback while this feature was attributed to explicit feedback by almost three times more, 14 students (30%).

Discussion and Implications

The results of the quantitative data present that students in both feedback groups have a high level of positive attitude towards writing in English. Although their proficiency level is low, they are quite enthusiastic about writing in English. This result might motivate English teachers who work with lower level students to do more writing activities. Even if the number of errors are quite high in students' essays, their effort and willingness to write in English is praiseworthy. Besides, practice may make their writing skills better.

Secondly, it was found from the questionnaire ratings that both groups of students gave higher credit to explicit written corrective feedback. This result is in line with the findings of Chandler (2003), Lee (2005), Kalra and Tangkiensirisin (2016) and Atmaca (2016) whose participants also favoured explicit written corrective feedback more. Students in both implicit and explicit feedback groups seem to be in favour of explicit feedback. This might stem from the reason that their proficiency level is low, thus they might find explicit WCF more helpful and easier to them and that they might feel confused when they get implicit feedback.

According to the analysis of the open-ended item, it was noticed that although students prefer getting explicit feedback to their written work, they are aware that implicit feedback leads to more awareness, exploration, autonomy and self-improvement. This result coincides with the findings of Chandler (2003) who claimed that even though students prefer explicit feedback because of its rapidity and easiness, students accept that they learn more from implicit feedback and benefit more from self-correction. Therefore, it can be inferred from the results that even if students would rather have explicit written corrective feedback for their essays, they find implicit written corrective feedback more effective in terms of awareness raising and discovery and implementation of strategies to correct their errors.

All of these findings suggest that teachers need to create a balance between explicit and implicit written corrective feedback in their EFL lessons. In addition, students need to be trained in terms of various strategies to deal with implicit feedback.

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THE VIEWS OF SOCIAL WORK STUDENTS ON VOLUNTEERING: THE ANKARA UNIVERSITY SAMPLE

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Abstract: The objective of this work is to reveal the views of the social work students on volunteering. The research has been conducted with the participation of 223 Ankara University Faculty of Health Sciences Department of Social Work students. Through complete inventory, the data were gathered from volunteering students; and analyzed with frequency distribution (f) and chi-square (X^2) techniques. The female student count is 74% of the participants, whereas 26% are male. Additionally, 23.8% of the students are freshman, 30% are sophomore, 22.9% are junior and 23.3% are senior students. The students' perception on volunteering follows mostly as sharing quid pro quo, providing all kind of needs, emotional support and working at an enterprise free of charge. While 33.6% of the students have been involved in certain volunteering activities during the past year, the percentage of students who have registered to one or more non-governmental organizations (NGO) are more than the half. Moreover, the fields where the students mostly attend to volunteering works are children welfare, disability, youth and poverty. The reasons why the participants attend to volunteering activities are significantly love for people, the wish to accomplish something for the society and gaining information and experience. The social work education has a positive affect onmost of the students regarding volunteering, due to course contents (field study, NGOs, poverty and social work, sociak work with disabled) and field studies. The participation of female students during the past year is higher than the male students. Social work education influences the thoughts of students on volunteering in a positive direction. Adding a different course on volunteering to the schedule, more active student societies and academicians and more effective coordination with NGOs may have more improving results on the thoughts and attitiudes of students regarding volunteering.

***Keywords*:** Social work, social work education, social work students, volunteering.

Introduction

Along with the developments in the world, volunteering has been becoming more prominent with the lead of the universities and NGOs in Turkey. Today, attending to volunteering activities has become to require being more equipped comparing to the past. Therefore volunteering activities at universities started to become more important.

When analyzing the literature, although there is no single definition that has been reached with unanimity on volunteering, each definition emphasizes a different feature which one can argue there is no difference among them. Hence, even though the definitions seem to be different than each other, whileunderlining those differences they actually approach to the integral body differently. When considering the common points of the definitions together; in general, volunteering is a set of activity/activities of an individual with no expectation of

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interest (material or non-matterial) using his/her time, energy, knowledge, skills and sources with one's own will and consciousness of social responsibility to help to those who are in need (except for the near kins) (Fazlıoğlu, 2013,p.69; Güder, 2006, p. 4).

Yet, according to Çakı (2014, p.187)"The principal of no financial gain expectation does not mean there will be no payment to the volunteer. On the contrary, there can be occasions where the travel and fundamental needs have to be covered (specifically in international volunteering programs) for."

There are different opinions whether the volunteering activity shall be on an individual level or institutional level.While some authors emphasize that volunteering activities should be on an institutional level for the benefit of the society rather than individual efforts [at this point authors state that volunteering should not be understood as an activity of free-time, but distinctly from philantrophy, volunteering performed under an institution provides social and economic return] (Betil, 2013, p.16; Ege, 2011, p.7, Güder, 2006; Law & Shek, 2009, p.857; Palabıyık, 2011, p.90; Saran, Coşkun, Sherr & Straughan, 2005, p.99; Zorel & Aksoy, 2011, p.3736), some authors on the other hand evaluate activities that does not happen under an institutional framework but on an individual basis on an informal level as volunteering (Abban, 2016, p.5; Palabıyık, 2011: 90). Other authors remark both levels under this scope and volunteering can be performed directly to those in need as well as submitting oneself to a mission in an aid institution with the no-gain principle (Tiltay & Torlak, 2015, p.9). Another fraction of authors argue volunteering with regard to a system. According to Agerhem (2004, p.9), "Volunteerism is the principle or system of doing something by, or relying on, voluntary action or volunteers".

Having the definitions analyzed, it is possible to reach certain common features. Volunteering is not compulsory, it is not performed against a fee, it is done in an institutional structure with the purpose of social benefit (Palabıyık, 2011, p. 90). Volunteering is a complex behavior and social phenomenon that changes in time (Sherr & Straughan, 2005, p.99).Some authors argue that volunteering can be varying depending on the society's social, cultural, historical and religious structure (Çakı, 2014, p.187; Fazlıoğlu, 2013, p.69). Having argued faith influencing volunteering, they state the common religion of a country is the most prominent factor affecting volunteering activities (Agerhem, 2004, p.8) and that religious beliefs and practices play the most important role on understanding volunteering (Sherr & Straughan, 2005, p.99). According to Yönten Balaban and Çoban İnce (2015, p.150) "volunteering appeared in many countries intertwining with traditional beleifs and community customs". Adding to this, volunteering is not influenced only by religious beliefs; culture, history, geographical location and politics are also among the factors that influence volunteering (Agerhem, 2004, p.8). Even though the reasons are different, there are factors that drive people to volunteer and put constrains in front of them to help others with no-gain.

Factors that Motivates Volunteering

The reasons that drive people to volunteer are grouped under different topics in the literature. Taking into account the common features of these reasons, at the core base, it is appropriate to categorize them under two topics of individual and social reasons (Abban, 2016, p.14; Akman, 2008, p.85; Çakı, 2014, p.188; Ege, 2011, p.8; Fazlıoğlu, 2013, p. 70; Güder, 2006; Güngör & Çölgeçen, 2013, p.167; Kurt, 2015, p.207). Those are:

Individual reasons: Showing commitment to a belief, making change in one's life, feeling better by helping other people, removing loneliness, sharing what one has, improving knowledge and skills, sharing experience, earning credit and appreciation by being a role model to other people, achieving qualification on a certain topic, considering oneself someone who is needed, earning special status, getting respect, meeting new people, making social connections and status, doing something different and exciting (having a change from the routines of life like work and education), living the feeling of belonging, being a member of a teamwork, improving oneself, choosing profession, testing one's limits, self-actualisation.
Social reasons: social benefit, contributing to activities, finding solution to a social problem, supporting a work or an institution that one believes and trusts, contributing to the need of human resource, mediating the introduction of institution/society/group that one represents.

When looking into the individual reasons driving people to volunteering, even though expectation of no-gain is emphasized, one can understand that volunteering is actually a two-way process. According to Güder (2006, p. 4) "activities that are done as a volunteer make one gain various qualifications, even thouh there is no expectation of gain. These gains in one sense, does coincide with the reasons that drives people to volunteer". With other words, volunteering provides benefit for both the volunteer and the person who has been served (Abban, 2016, p.5), and contributes to the psychological and social improvements of the volunteers (Ling & Chui (2016, p.2316). Whike the individual is helping others with their volunteering work; they also with their volunteering actions satisfy their needs of belonging and love, being respected, self-actualisation, which is

mentioned in Maslow's Hierarchy of Needs (Bjerneld, Lindmark, McSpadden & Garrett, 2006, p. 50).With this aspect, volunteering creates positive gains for both the servant individuals and to those who demand service (Güngör & Çölgeçen, 2013, p.167). As a result, volunteering influences positively the well-being of individuals and societies as a whole (Ling & Chui, 2016, p.2316).

Factors that Obstruct Volunteering

Although there are factors that encourage people to volunteer, there are other factors that disable them to do so. Age, economic insufficiencies, place, time, not being ready, the instance that the perception of volunteering by individuals usually occurs to be a financial aid or expecting an interest, not to know to start volunteering how and when, not willing to take responsibility, prejudice and lack of confidence, finding it boring, lack of self-confidence, not having a tradition or habbit, not having someone from the family or environment or having had a bad experience could be put as some examples as factors that may obstruct individuals to attend volunteering activities (Abban, 2016, p.36; Fazlıoğlu, 2013, p.72; Kurt & Taş, 2015, p.208).

"One of the factors that direct an individual to volunteer is education. The more the education level increases, the more individuals become involved to problems. As emphaty and self-confidence rises, one can see these individuals are being more volunteering."(Palabıyık, 2011, p.92)

Volunteering in the Youth

Among the individuals participating volunteering works, the youth and university students have a different place. Considering Turkey has a young population, this becomes more important. As stated by Yönten Balaban and Çoban İnce (2015, p.150): "At the point where volunteering activities happen, the youth as a dynamic power have a principle role as in many other fields." The late adolescence or late youthness period,which also contains university students, is a period where psychological criteria becomes more vivid which will probably not change in the future, therefore is an essential era for taking part in volunteering roles If volunteering actions will enable them to develop altruistic identities, then they can spare an important amount of volunteering time in their future lives (Kirkpatrick Johnson, Beebe, Mortimer, & Snyder, 1998). "The purpose of life is not to be happy. It is to be useful, to be honorable, to be compassionate, and to have it make some difference that you have lived and lived well." (Ralph Waldo Emerson; cited in Law and Shek (2009a, p.855). In the daily life, people tend to reach to a higher goal. According to the theories of development youthness is an important period where one can invest in order to reach the higher goal. The living purpose of the young generations is closely related with pro-social norms and behaviors (Law and Shek, 2009a, p.856-867).

Social Work and Volunteering

Social work as a profession of solidarity and aiding is socio-focuses; aims to help people with scientific principles, methods and techniques (Duyan, 2012, p. vii). The beginning of professionalisation of social work is based on volunteering works that are social well-fare oriented. The education of social work has begun at late 1800s. First appeared in England and then in the United States of America, the pillars of social work were constituted by the volunteering works of the members of religious groups and wealthy philantrophists with no official education, with no knowledge on human behavior; at the charity foundations aimed to provide the needs of the poor people in urban areas (Alptekin, 2016, p.10; Saygı Doğru, 2011, p.67; Zastrow, 2014, p.2). These untrained proto-social workers who are also known to be friendly visitors were supporting the poor people with moral persuasion and have tried to find ways helping them (Tannenbaum & Reisch, 11.06.2017, paragraph 3). Sherr and Straughan (2005, p.100) have explained this with the following statement: "Simply stated, the profession of social work owes its existence to volunteerism".

Within this context, social work is the leading profession which has the closest relation with volunteering. Thus the volunteering level of social work students is utmost important (Özkan et al., p.94). Inside the social structure due to the reason that at the head of the disadvantaged groups which are served by the NGOshave complex problems, volunteering activities have been increasing and thus volunteering has become to require more equipped human resource(Güngör & Çölgeçen, 2013, p.165-166). Turkish Educational Volunteers Foundation (TEVF) research also addresses this issue and participants suggested certain fields which require volunteer activity fields by 100% as poverty, women and children.

Consequently, having the disadvantaged groups in the society prioritized, social work which aims to help individuals is one of the professions for volunteering. Therefore this work was conducted to find out the views of the candidate social workers, who have a very important role among the aiding professions.

Methods

The research was performed during fall of 2016 with 223 freshman (53), sophomore (67), junior (51) and senior (52) undergraduate students studying in the Ankara University Faculty of Health Sciences Department of Social Work. The data were gathered by the volunteering students, through a questionnaire form consisting of two sections which was developed by the researchers. The first part includes socio-demographic questions, whereas the second part asks questions on volunteering. In order to create the questions on volunteering, a question form was given to 49 students from different classes that had open-ended questions. The answers received turned into a close-ended questionnaire of 13 articles. The data were analyzed using the frequency distribution (f) and chi-square (X^2) techniques.

Results and Findings

Socio-Demographic Findings

Female students are forming 74% of the population, whereas 26% is formed by male students. The participants who were below the age of 18 forms 5.4% of the population: 29.6% between the ages of 18 and 19, 43.9% between 20 and 21, 18.4% between 22 and 24, 2.7% above the age of 24. The freshman students are 23.8%, sophomore students 30%, junior students 22.9% and senior students are 23.3% of the population. While 3.6% of the students' mothers are illiterate, 2.7% are literate; 40.7% are elementary school graduates, 19.3% are primary-middle school, 22.9% highschool, 10.3% institution/faculty graduates and 0.9% has completed post graduates studies.

Findings on the Participation and Motivation of Students to Volunteering Activities

One can observe that the students with the highest rate considers volunteering (71.7%) as "sharing with no gain", and respectively the following considerations follow: "satisfying all kinds of needs" (64.1%), "emotional support" (41.7%), "unpaid working" (35.9%), "non-matterial aid" (34.1%) and "material aid" (28.3%) [Table – 1]. According to the reaearch results of Abban (2013, p.59), among the reasons why university students are taking part in volunteering institutions, the first one is consciousness of social responsibility (76.4%). This is followed by: the need to feel good (55.8%), wish to gain experience (53.8%), spending free time (34.2%) and new friendships (24.4%). According to a study of the Foundation of Private Sector Volunteers (FPSV)[2005, slide 9] conducted with 586 civil servants and 157 private sector employees, volunteering means to help each other (41.5%), to work willingly (19.7%) and social solidarity (12.2%).

Based on the research results, while 33.6% of the students participated to volunteering activities during the past year, 64.4% did not commit themselves to volunteering work. TEVF research (2012, p.17) on the young people ages varying between 18 and 35 reveals the participants to volunteering works during the past year does not exceed 4.8%. This result clearly indicates that social work students have a higher participation rate than Turkey average. 43.9% of the participants declared that they were aware of volunteering works prior to university yet they did not attend any, 38.1% on the other hand told they were aware of volunteering activities prior to university and they attended time to time.

In the research, 42.7% of the students indicated they are not a member of any NGO, whereas 57.3% announced they are member of one or more NGO. Rose and Özcan (2007, p.43) have revealed in their research that based on 2003 Turkish Statistics Institution input, approximately 45% of the population in the EU member state countries are members to a volunteering NGO, this percentage in Turkey shows to be 9%. A similar result from another TEVF research (2008) can be observed. Among 55 countries, the participation of the young in Turkey to NGOs is 8% with the lowest (cited in TUSEV,2011,p.79).In this work, the membership rates of the students are significantly higher than Turkey average, which this occasion is a clear indication of the influence of social work education.

The question whether how much time the students spend time on volunteering was asked which turned out with the following result: 28% of the students spend more than 2 hours a week, 22.7% of the students spend 1-2 hours a month, 20% of the students spend 1-2 hours a week, 5.3% of the students spare more than 2 hours a year.

According to Abban's research result, which has been conducted over 225 university students on the volunteering levels of the young, 48% of the subjects spend 1-2 hours, 33.8% spare 3-4 hours, 10.7% spend 5-6 hours of volunteering work time (2016, p.58).

Analyzing the fields where they volunteer, one can say social work students mostly take part in (72%) children welfare, which is followed by: disability (20%), youth (18.7%), poverty (17.3%), old age (12%) and women welfare (10.7%); nonetheless, the least fields which the students take part as volunteers are criminality (2.7%) and LGBT-Q (2.7%). Abban's work (2013, p.58) suggests university students participate mostly in the field of education (41.3%). This is followed by health (37.8%) and culture-art (34.7%).

Among the factors that positively influences the motivation of the students on volunteering, the primary can be argues is "humanity" (66.7%); the wish to accomplish something for the society/living environment (66.7%); the wish to gain development, knowledge and experience (66.7%); emphaty (60%), acquiring social relations (29.3%); friends and family (20%); the fact that it will look good on a job application (20%); religious belief (17.3%) and guided by the instructors (4%). Ma et al. (2007) argue that positive family environments and positive friend relationships increase the tendency of the young to to take part in pro-social works (cited in Ling & Chui, 2016, p.2316).

When looking into the factors that obstructs the volunteering motivation of the students, approximately half of them (49.3%) express they do not have time, 36.8% states they do not know to do it where, for whom and with what purpose; 18.8% carry some anxiety, 15.2% do not know (Table 1)

Table 1.Participation of the students to volunteering activities and their motivations

		Number	**%**
Having Participated to an Activity as a Volunteer During the Past Year	Yes	75	33.6
	No	148	64.4
	Total	223	100
Having Participated to an Activity as a Volunteer Before University	I had not any idea, I was not participating	34	15.2
	I had an idea, I was not participating	98	43.9
	I had an idea, I was participating time to time	85	38.1
	I had an idea, I was participating oftenly	6	2.7
	Total	223	100.0
The Number of NGOs which the Students are registered	None	32	42.7
	1	20	26.7
	2	13	17.3
	3	6	8.0
	4	1	1.3
	5+	3	4.0
	Total	223	100.0
Average Time Spending on Volunteeting Activities	1-2 hours a week	15	20.0
	More than 2 hours a week	21	28.0
	1-2 hours a month	17	22.7
	More than 2 hours a month	5	6.7
	1-2 hours a year	7	9.3
	More than 2 hours a year	4	5.3
	Other	6	5.3
	Total	75	100.0

		Yes		**No**	
		Number	**%**	**Number**	**%**
Participation of the Students to the Fields of Activity	Children	54	72.0	21	28.0
	Criminality	2	2.7	73	97.3

	Women	8	10.7	67	89.3
	Aging	9	12.0	66	88.0
	Disability	15	20.0	60	80.0
	Immigrants	4	5.3	71	94.7
	LGBT-Q	2	2.7	73	97.3
	Poverty	13	17.3	62	82.7
	Youth	14	18.7	61	81.3
Factors that Positively Influences the Motivation of Volunteering	To achieve something for the society	50	66.7	25	33.3
	Friends and family	15	20.0	60	80.0
	Emphatetic thought	45	60.0	30	40.0
	Making social connections	22	29.3	53	70.7
	Religious belief	13	17.3	62	82.7
	Humanity	50	66.7	25	33.3
	Benefit for job application	15	20.0	60	80.0
	The wish to develop, gain information and experience	50	66.7	25	33.3
	Guidance by the instructors	3	4.0	72	96.0
Factors that Obstructs the Motivation of Volunteering	I do not know	34	15.2	189	84.8
	Because of my financial insufficiencies	15	6.7	208	93.3
	I am not interested	19	8.5	204	91.5
	I have no time	110	49.3	113	50.7
	I do not want	13	5.8	210	94.2
	Not knowing where it is done, for whom and with what purpose	82	36.8	141	63.2
	I have no worries	42	18.8	181	81.2
Thoughts on Volunteering	Financial aid	63	28.3	160	71.7
	Non-financial aid	76	34.1	147	65.9
	Emotional support	93	41.7	130	58.3
	Sharing with no gain	160	71.7	63	28.7
	Unpaid working	80	35.9	143	64.1
	Providing any kind of needs	143	64.1	80	35.9
	I have no information	1	0.4	222	99.6
	Other	1	0.4	222	99.6

Even though most of the students (81.3%) think that social education had positively influenced their views on volunteering, more than half of the students express (58.3%) the volunteering activities organized in the department of social work is not enough. Additionally, again more than half oof the students thinks (59.2%) the student participation to these volunteering events are too low. When looking to the contribution of the department of social work to volunteering activities, the most important factors are thought to be as: course content (54.7%), field studies (52%), friend circle from the department (41.3%) and finally, the contributions of the instructors (21.3%). (Table 2)

Table 2. The influence of social work education on volunteering

		Number	**%**
The Status of the Influence of Sociak Work Education on the Views Regarding Volunteering	Yes, positive	61	81.3
	No, negative	12	16.0
	I have no idea	1	1.3
	Other	1	1.3
	Total	75	100.0
The Status of the Students Finding the Volunteering Activities Organized in the Department Sufficient	Sufficient	24	10.8
	Insufficient	130	58.3
	I have no idea	69	30.9
	Total	223	100.0
The Status of the Students Finding the Participation of Students to the Volunteering	Sufficient	17	7.6
	Insufficient	132	59.2

Organizastions	I have no idea		74	33.2
	Total		223	100.0
The Contribution of the Department of Social Work to the Participation of Volunteering Activities	Instructors	Yes	16	21.3
		N	59	78.7
	Content of Course	Yes	41	54.7
		N	34	45.3
	Friend Cricle from Department	Yes	31	41.3
		No	44	58.7
	Field Studies (internship/course applications)	Yes	39	52.0
		No	36	48.0

The findings related to the influence of the social work education to the views of students on volunteering are shown in Table 3. According to these results, most of the students (89.2%) took history of social work; more than half of the students took field study (65.9%), poverty and social work (57.8%), communication skills (56.5%), social work with individuals (52%), social work practice with individuals (50.2%); approximately half of the students took social work with groups (47.5%), summer internship (46.6%), social work with families (46.6%), social work with disabled individuals (46.6%), Non-governmental organizations (44.8%), social work with immigrants and refugees (44.8%), community health and health systems (44.4%) courses.

Among the courses mentioned above, most of the students who took the field study (81.6%), non-governmental organizations (77%), poverty and social work (72.1%), summer internship (71.2%), social work with disabled individuals (70.2%) courses; also have registered to the following: social work practice with individuals (68.7%), child rights and law (63.1%), history of social work (62.8%), juvenile delinquency and social work (57.3%), communication skills (57.1%), social work with individuals (56%), social work practice with groups (55.9%), social work with groups (55.7%), social work practice with society (55.6%), social work with children (53.6%), social welfare and sociak work (52.8%), social work with youth (52.1%), social work with families (50.7%), family law (50.7%), social work with society (50.6%); and argue that these courses positively influence their being volunteers.

Table 3. The influence of social work courses on volunteering

Courses	**I took the course**		**I did not take the course**		**Influenced Positively**		**Influenced Negatively**		**Did no affect me**	
	Number	**%**	**Number**	**%**	**Number**	**%**	**Number**	**%**	**Number**	**%**
History of Social Work	199	89.2	24	10.8	125	62.8	3	1.5	71	35.7
Poverty and Social Work	129	57.8	94	42.2	93	72.1	3	2.3	33	25.6
Communication Skills	126	56.5	97	43.5	72	57.1	4	3.2	50	39.7
Community Health and Health	99	44.4	124	55.6	42	42.4	3	3.0	54	54.6
Social Work Literacy	115	39.5	135	60.5	47	40.9	2	1.7	59	51.4
Field Study	147	65.9	76	34.1	120	81.6	3	2.0	24	16.4
Non-Governmental Organizations	100	44.8	123	55.2	77	77.0	1	1.0	22	22.0
Equity and Diversity in Social Work	86	38.6	137	61.4	40	46.5	4	4.7	42	48.8
Drama	74	33.2	149	66.8	28	38.8	2	2.7	44	59.5
Social Security System in Turkey	81	36.3	142	63.7	28	34.6	2	2.5	51	62.9
Social Work with Immigrants and	100	44.8	123	55.2	44	44.0	8	8.0	48	48.0

Refugees										
Juvenile Delinquency and Social Work	75	33.6	148	66.4	43	57.3	4	5.4	28	37.3
Social Work with Disabled Individuals	104	46.6	119	53.4	73	70.2	4	3.8	27	26.0
Gerontological Social Work	69	30.9	154	69.1	33	47.8	3	4.4	33	47.8
Social Work with Individuals	116	52.0	107	48.0	65	56.0	6	5.2	45	38.8
Social Welfare and Social Work	89	39.9	134	60.1	47	52.8	1	1.1	41	46.1
Child Rights and Law	84	37.7	139	62.3	53	63.1	2	2.4	29	34.5
Family Law, Problems of Women and Social Work	71	31.8	152	68.2	36	50.7	3	4.2	32	45.1
Home Care Services	67	30.0	156	70.0	26	38.8	2	3.0	39	58.2
Social Work with Groups	106	47.5	117	52.5	59	55.7	2	1.9	45	42.4
Social Work with Families	104	46.6	119	53.4	55	52.9	3	2.9	46	44.2
Social Work in Business Life	71	31.8	152	68.2	31	43.7	2	2.8	38	53.5
Social Work in Rural Areas	57	25.6	166	74.4	16	28.0	1	1.8	40	70.2
Disasters Social Work	70	31.4	153	68.6	34	48.6	0	-	36	51.4
Substance Abuse and Social Work	70	31.4	153	68.6	35	50.0	3	4.3	32	45.7
Social Work with Society	83	37.2	140	62.8	42	50.6	4	48	37	44.6
Mobbing with Psycho-Social Dimension	56	25.1	167	74.9	13	23.2	3	5.4	40	71.4
Social Work with Children	69	30.9	154	69.1	37	53.6	3	4.4	29	42.0
Social Work with Youth	69	30.9	154	69.1	38	52.1	2	2.9	29	42.0
Case Management in Social Work	60	26.9	163	73.1	17	28.3	1	1.7	42	70.0
Ethics in Social Work	80	35.9	143	64.1	39	48.7	0	-	41	51.3
Medical Social Work	71	31.8	152	68.2	24	33.8	0	-	47	66.2
School social Work	78	35.0	145	65.0	36	46.1	1	1.3	41	53.8
Analysis of Art in Social Work	54	24.2	169	75.8	11	20.4	1	1.8	42	77.8
Forensic Social Work	59	26.5	164	73.5	20	33.9	1	1.7	38	64.4
Sociak Work Practice with Individuals	112	50.2	111	49.8	77	68.7	1	0.9	34	30.4
Social Work Practice with Groups	84	37.7	139	62.3	47	55.9	2	2.4	35	41.7
Social Work Practice with Society	81	36.3	142	63.7	45	55.6	3	3.7	33	40.7
Summer Internship	104	46.6	119	53.4	74	71.2	2	1.9	28	26.9

The courses were taken from the following web-site: http://socialwork.health.ankara.edu.tr/dersler-akts-kredileri/ (Access:11.01.2017)

Variables with Significant Differences

Looking at wheter there is any significant differences among the variables; one can find significant differences ($X^{2=}$7.554, p<0.05) between gender and participating a volunteering activity during the past year (Table 4). Female students have been attending to volunteering events more than the male students in the recent year. On the other hand, the study of Özkan et al. (2015, p.106) on "Determining the Social Responsibility Levels of Social Work Students" reveals a different result. This work shows that there has been no sifnificant difference found between gender and participating a volunteering activity in the recent year.

There has been a significant difference found between the field practice based on classes and influence on volunteering ($X^{2=}$11.491, p p<0.05) [Table 4]. The field studies have been found to influence mostly the junior and senior students on their participation to volunteering events, than the sophomore and freshman. This is followed by the sophomore students. Lastly, the number of students indicating positive influence of field studies to participating volunteering events is zero. The reason of this result is argued to be the facts that, the last semester of the second year in Ankara University Department of Social Work offers students summer internship; first semester of third year offers "social work practice with individuals" and second semester offers "social work practices with groups"; final year first semester offers "social work practice with society" and second semester offers "block practice". These practice studies provides students the opportunity to work face to face with the applicants in the social work institutions. Working with the applicants enables the students to realize their needs.

Table 4. Variables with significant difference

			Having Volunteered in the Recent Year		Total	
			Yes	No		
Gender	Female	Number	64	101	165	$X^{2=}$7.554 P=0.006
		%	38.8	61.2	100.0	
	Male	Number	11	47	58	
		%	19.0	81.0	100.0	
Total	Number		75	148	223	
	%		33.6	64.4	100.0	
			Field Studies (Internship/Course Practices)		Total	
			Yes	No		
Grade	Freshman	Number	0	6	6	$X^{2=}$11.491 P=0.009
		%	0.0	100.0	100.0	
	Sophomore	Number	11	16	27	
		%	40.7	59.3	100.0	
	Junior	Number	14	7	21	
		%	66.7	33.3	100.0	
	Senior	Number	14	7	21	
		%	66.7	33.3	100.0	
Total		Number	39	36	75	
		%	52.0	48.0	100.0	

Variables without Any Significant Difference

Based on the chi-square (X^2) analysis results, there has been no significant difference found (p>0.05) between the following: 1- educational status of the parents and thoughts and attitudes on volunteering prior to the university; 2- grade and a) being member of a non-governmental organization, b) average time spent on volunteering activities, c) influence of social work to volunteering, d) contribution of instructors to being volunteer, e) influence of the course content to volunteer, f) contribution of the friend cricle from the department to volunteer.

Conclusion

According to the results of this work, the social work students perceive volunteering mostly as sharing with no gain, providing all kinds of needs, providing emotional support and unpaid working at a place. More than half of them are members of one or more NGOs. More than half of the participants did not attend to volunteering activities in the recent year. Wheras most of the students have attended to volunteering activities aiming children welfare, the least participation can be observed on the topics of criminality and LGBTI. Among the participants to volunteering events, one can observe that more than two hours a week at most is spent. The leading factors that drive students to volunteer are humanity, the wish to accomplish something for the society/living environment, development and gaining knowledge and experience. Among the prominent factors that obstructs students to volunteer are that they have no time and they do not know where the practice is done, for whom it is done and the goal of the whole action.

Most of the students think social work education positively influences their ideas on volunteering. Whereas the leading contributors to attent to volunteering activities in the department are course content and internship/course practice; the "field study and non-governmental organizations", "poverty and social work" and "social work with disabled individuals" courses have the most influence. Compared to the lower grade students, the field studies (internship/course practices) have considerably more influence on the participation of the junior and senior students to volunteering activities Female students have been attending to volunteering events more than the male students during the past year.

For the young university students, volunteering is an effective method for learning. The skills and perfections acquired with volunteering can help significantly for their professionl development (Bağcı, 2013, p.48). It is found to be important that, the development of the volunteering conscious (Saran et al., 2011, p.3736) of the students who will start their professional lifes after they graduate is closely related in one sense with their participation to volunteering activities during their studies. From this perspective, defending and encouring volunteering is needed (Bağcı, 2013, p.50). One can argue that volunteering, which means in short aiding people without the expectation of gain, and social work which helps people with professional education and discipline are in close relation with each other. Therefore volunteering has an important place in social work education and it is found to be appropriate to make certain initiatives for the purpose of increasing the participation of the students.

Recommendations

Taking into account the results of this work, among the facts that obstructs the social work students to participate volunteering events; they do not know where the practice is done, for whom and how it is done along with certain worries. It is thought that if there will be a separate course on volunteering in their schedules, it will help removing those obstacles.

Although social work students indicate that social work education in influencing their opinions on volunteering in a positive way, they do not find the number of volunteering events enough, organized by many other departments as well. It will be appropriate to find ways for more active academicians and student communities, along with more cooperation with NGOs.

Additionally, it is found to be necessary to have similar works to be performed in comparatively in the various departments other universities.

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RIS3 STRATEGY VERSUS NATIONAL OPEN INNOVATION STRATEGY IN SLOVAKIA

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Abstract: In December 2016 Austria presented to domestic and international audiences in Vienna the National Open Innovation Strategy as one of the first countries in the world. The underlying ambition of this strategy is to contribute to achieving objectives of Open Innovation 2.0 and thus boost Austria in the group of European innovation leaders. It is not only the content and structure of this vision but also approach to its elaboration and its justification which are worth pondering. Within the Europe 2020 Strategy all EU countries elaborated own Research and Innovation Strategies for Smart Specialization (RIS3) for period 2014 to 2020 and implement them. If both Austria and Slovakia follow implementation of their RIS3 Strategies, is there any need for Open Innovation Strategy in Slovakia as well? Slovakia as a moderate innovator in the EU context struggles to make the triple helix model viable (low indices GERD and BERD as % of GDP) and work properly in its economy and society. Therefore the paper deals with analysis of components of RIS3 Strategy and National Open Innovation Strategy. It recommends to enrich the Slovak RIS3 Strategy with facets of OI paradigm in order to make the quadruple helix concept work in the Slovak economy in the next years and move it up in the group of strong innovators.

***Keywords*:** RIS3 strategy, open innovation paradigm, quadruple helix model, open innovation 2.0

Introduction

The paper will focus on comparison of selected aspects of innovation strategies of Slovakia and Austria. According to the Innovation Union Scoreboard (2016) Austria ranks among the strong innovators whereas Slovakia among the modest innovators. Slovakia lags behind Austria in most of the evaluation dimensions nearly achieving the Austrian level in Human resources and surpassing it in Economic effects of innovations as shown on the Table 1 below.

Table 1 Comparison of Austria and Slovakia by dimensions of summary innovation index

Year 2015	Summary Innovation Index	Human resources	Research systems	Finance and support	Firm investments	Linkages & entrepreneurship	Intellectual assets	Innovators	Economic effects
Austria	**0.591**	0..650	0.561	0.538	0.517	0.629	0.707	0.647	0.475
EU	***0.521***	*0.575*	*0.466*	*0.490*	*0.426*	*0.473*	*0.556*	*0.526*	*0.573*
Slovakia	**0.350**	0.642	0.166	0.255	0.267	0.209	0.239	0.415	0.490

Source: Innovation Union Scoreboard (2016).

The reasons of this situation lay in different economic and political development of these countries.Austria had been a market economy in the 20th century and parliamentary democracy from 1918 to 1945. From 1945 until 1955 it was governed by the Allied Commission for Austria. In 1955 it became an independent republic with a neutral status which has been kept up till now. It joined European Union on 1 January 1995 and Eurozone on 1 January 1999. Czechoslovakia was in the period 1948 to 1990 a centrally planned economy and a part of the Soviet economic, political and military bloc. Since 1969 it was a federation of Czech and Slovak Socialist

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Republics. It returned to the market economy and parliamentary democracy again in 1990 and on 1 January 1993 the Czech and Slovak Federal Republic peacefully split into two independent states Czech and Slovak Republics. Both republics became members of NATO on 29 March 2004 and of the European Union on 1 May 2004. On 1 January 2009, Slovakia was admitted in the Euro zone.

Problem Statement

The brief comparison of Austrian and Slovak R&I systems and policies indicates substantial differences in the maturity of the key dimensions of national R&I systems, their strategic ambitions and related long-term focus of R&I policies and their funding which are finally reflected in the R&I performance. Unlike Slovakia Austrian government decided to respond to the challenges of the Open Innovation 2.0 initiative with formulation of the National Open Innovation Strategy as an expansion of its RTI Strategy and RIS3 Strategy.

The RIS3 Strategy for Slovakia represents national innovation strategy for the period 2014 -2020. It does not consider any explicit implementation of the open innovation concepts, methods and models. Open innovation concepts, methods and models are not well-known among Slovak enterprises. However, domestic and international collaboration in innovations is quite frequent especially among Slovak large and medium-size companies, since it is required in the government or EU innovation support programmes. It is not the case for the reszt of the Slovak SMEs where microcompanies prevail (Zajko, 2013). The largest European innovation support service, the Europe Enterprise Network (EEN), active in Slovakia as well, addresses the innovation challenges of SMEs mainly by organising sector-specific brokerage events or clusters. EEN support services are labour intensive, the available resources are small, so the level of support provided to new company collaborations is limited and they often fail to realise their potential.

Since the knowledge about open innovation concepts, methods and models among company managers and their systematic use in the company innovation activities in Slovakia are underdeveloped they deserve more attention in the documents on R&I strategy and in the implementation policies. Therefore the next section of this paper deals with the scope, measures, institutional background and financing of of the National Open Innovation Strategy of Austria in relation to the running implementation of RIS3 Strategy. It leads to recommendations to enrich the Slovak RIS3 Strategy with facets of OI paradigm in order to make the quadruple helix concept work in the Slovak economy in the next years and move the country faster up in the group of strong innovators.

Methods

In the paper there are applied methods of qualitative research in order to explore key characteristics of the Open Innovation 2.0 approach and National Open Innovation Strategy of Austria using the secondary data from websites and related publications.

Results and Findings

Open Innovation 2.0

Since 2008 the Open Innovation Strategy and Policy Group (OISPG) has been uniting industrial groups, academia, governments, and private individuals to support policies for open innovation at the European Commission. OISPG has published annual yearbooks documenting and summarizing current innovation practices in Europe. It distinguishes two development stages of open innovation paradigm. The first stage started in 2003 by H. Chesbrough´s formulation of open innovation concept which strategically leverages internal and external sources of ideas and takes them to market through multiple paths. Open Innovation 2.0. (OI 2.0) is a new paradigm based on a quadruple helix innovation model where government, industry, academia and civil participants work together to co-create the future and drive structural changes far beyond the scope of what any one organization or person could do alone. This model encompasses also user-oriented innovation models to take full advantage of ideas' cross-fertilisation leading to experimentation and prototyping in real world setting. In OI 2.0 there is also a cultural shift away from resisting change and toward innovation and the creation of shared value. Besides the quadruple helix innovation further distinguishing features of the OI2 are i) focus on user involvement and user experience, ii) building of innovation ecosystems as networks of formal and informal groupings based on trust, shared resources, shared vision, and shared value, and iii) innovation co-creation and engagement platforms (Curley, M., & Samelin, B., 2013).

Innovation Policies in Austria

In GCI in the period 2010-2011 to 2016-2017 Austria sank from the rank 15 out of 139 countries with GCI score 5.67 to the rank 19 out of 138 countries with GCI score 5.2. Among its strenths ranks the Innovation pillar of GCI where it holds rank 14/138 with score 5.0 whereas its score in the other GCI pillars ranged from 4.5 to 5.8 (Schwab, K. 2016). Austria has a strong and well-developed research, technology and innovation system at the federal and province levels. The country has been following the Austrian Research, Technology and Innovation (RTI) Strategy for the period 2011-2020 with the ultimate goal to become one of the European innovation leaders. According to its motto "Realising Potential, Increasing Dynamics, Creating the Future: Becoming an Innovation Leader", the strategy addresses measures to strengthen national research structures with a focus on excellence, to foster the innovative capacity of companies, allow for thematic priority setting, raise the efficiency of governance, and link research, technology and innovation to the education system. The strategy was the result of a planned process of several years of discussions and analyses from the nation-wide Austrian Research Dialogue (2007-2008) of stakeholders on further development of the innovation system and knowledge-based society up to the comprehensive expert evaluation of the Austrian research funding system. Finallly, in 2009, the Council for Research and Technology Development made its proposals on further development of the Austrian research and innovation system ("Strategy 2020"). In 2013, ministries responsible for economy and science and research were merged into the new Federal Ministry for Science, Research and Economy which brought increasing prominence of R&I in economic policy.

In December 2013, the newly elected government in its Government Programme confirmed the orientation on the R&I Strategy in order to advance towards the group of the most innovative research countries in Europe as one of its objectives. Within the Europe 2020 Strategy Austria elaborated the Research and Innovation Strategy for Smart Specialization (RIS3) for period 2014 to 2020 complemented by the regional strategies of nine provinces. Only some of these strategies were drafted according to S3 model. As a follow up of the R&I Strategy, an Action Plan for a Competitive Research Area was drawn up by the Federal Ministry of Science, Research and Economy and presented on 25 February 2015. In parallel with it the country was working on the the National Open Innovation Strategy which was presented to domestic and international audiences in Vienna in December 2016. It was the first strategy of this kind in the world with underlying ambition to contribute to achieving objectives of Open Innovation 2.0 and thus boost Austria in the group of European innovation leaders. Development of selected R&D indicators in Austria is represented in the Table 3 below.

Table 3 Selected R&D indicators in Austria

Indicator	**2011**	**2012**	**2013**	**2014**	**2015**	**EU-28 average (2014)**
GERD (as % of GDP)	2.68	2.89	2.96	2.99	3.07	2.03
BERD (as % of GDP)	1.84	2.03	2.1	2.11	NA	1.3

Source: Schuch, K., & Gampfer,R.(2016) , adjusted.

Gross expenditure on research and development (GERD) increased steadily from 2.81% in 2012 to 3.07% of GDP in 2015. Only the GERD of two EU Member States (the innovation leaders Sweden and Denmark) exceeded the level of 3.0% of GDP by then. Business expenditure on research and development (BERD) as a share of Austrian GDP stood at 2.11% in 2014, significantly higher than the EU-28 average (1.3%). In terms of R&D financing, the Austrian private sector funded 46.6% of overall R&D expenditure in 2014 and an estimated 47.2% in 2015. The public share in funding of GERD was 37.7% in 2014 and an estimated 37.3% in 2015. The overall RTI policy target in Austria is to invest 3.76% of GDP for R&D by the year 2020 as outlined in the national R&I strategy and achieve the ratio of public funding versus private funding 1:2.

Research, Technology and Innovation Strategy and Open Innovation Strategy for Austria

The Austrian Open Innovation (AOI) Strategy follows the key current strategic guidelines laid down in RTI Strategy of the Austrian Federal Government. Together with the Start-up Country Strategy, the sixteen open access recommendations made by the Open Access Network Austria (OANA), and further documents under preparation (IP Strategy, Digital Roadmap, Guiding Concept for Public Procurement, Promoting Innovation and the Creative Industries Strategy), it makes a coordinated contribution to the transformation of society, science, business and public administration and to consolidation of Austria's innovative strength and competitiveness. It expands the triple helix model (science and research, industry, public administration and politics) to a quadruple helix model (that includes civil society) in order to increase the innovative capability of the system and reduce the inherent risk of failure through the early involvement of society and the market.

The AOI Strategy follows three core objectives:
1 To open up, broaden and further develop the Austrian research and innovation system and in particular to develop new sources of innovation and strengthen the networking capability of the participating actors and organisations;
2 To increase the involvement of citizens (end users) in generating innovation. This may also contribute to significantly raising the value attached to innovation, research and development by the public;
3 To increase the efficiency and result orientation of the Austrian innovation system by implementing innovative forms of knowledge transfer and incorporating to a greater extent the needs of society, business and public administration into the research and innovation system.

The development of this strategy followed the open innovation principles as well. It was one-year, open-ended process involving more than 400 stakeholders in formulating the vision for 2025 and strategic tasks related to existing challenges in three key areas of action: (1) "Culture & Competences", i.e. development of a culture of open innovation and teaching open innovation skills among all age groups; (2) "Networks & Cooperation", i.e. formation of heterogeneous open innovation networks and partnerships across disciplines, branches of industry and organisations; (3) "Resources and Framework Conditions", i.e. mobilisation of resources and the creation of framework conditions for open innovation.
For these areas there were formulated the following fourteen measures which can be assigned to one or several action areas:

1) Create open innovation and experimental spaces;
2) Embed open innovation elements at kindergartens and schools as well as in teacher training;
3) Further develop public administration by means of open innovation and greater public involvement;
4) Set up and operate an open innovation platform for social/societal innovation and as a contribution to overcoming global challenges;
5) Set up and operate an innovation map including a matchmaking platform for innovation actors;
6) Build up research competence for the application of open innovation in science;
7) Establish incentive mechanisms for research partnerships with non-traditional players in research funding to strengthen open innovation;
8) Increase involvement of users and members of the public in RTI funding programmes;
9) Develop fair sharing and compensation models for crowdwork;
10) Further develop and provide open innovation methods and open innovation instruments specifically for small and medium-sized enterprises (SMEs);
11) Develop and implement co-creation and open innovation training programmes;
12) Embed principles of open data and open access in research;
13) Gear the IP and exploitation strategies of companies, universities, research institutions and intermediaries to open innovation in order to optimise innovation potential;
14) Implement a comprehensive communication initiative about open innovation to raise awareness and create networks.

The measures set out in the AOI Strategy will be implemented by the individual ministries in the areas of their competence as well as by various actors at the provincial and municipal level who are urged to do their utmost to bring the strategy to life. The implementation progress and further development of the AOI Strategy will be tracked by a monitoring group and its findings will become a part of the annual Austrian Research and Technology Report which is submitted to the Austrian parliament. The implementation of this strategy will require extensive education of the prospective participants and combination of top-down and bottom-up approaches which will foster the bottom-up ownership and deeper learning. Since there is no mention of any specific funding mechanism i tis supposed that this strategyy will be funded by the mechanisms stated in the Austrian RTI Strategy. In order to support and encourage the interaction of government authorities with citizens and organisations in the implementation of this Strategy the information portal „Open Innovation – an Initiative of Federal Government" http://openinnovation.gv.at/open-innovation/ was set up.

Innovation policies in Slovakia

The area of research and innovations is a weak link within the Slovak economy. It is reflected in long-term adverse trends (1989-2011): (1) Decrease of total expenditure and the number of labour force and especially the decline of enterprise research. The number of employees in research and development dropped from 60,548 to 28,596 and expenditures in research and development as percentage of GDP from 3.88% to 0.68% in the 1989-2011 period; (2)
Increasing share of public funding of research and innovations. The share of enterprises in total expenditures in research and development dropped from 69 % to 34 % in the 1993-2011 period; (3) Loss of target-orientation in

research accompanied by growth of general research without clear thematic priorities. The share of untargeted and general research increased from 38 % to 58 % in the 1993-2011 period; (4) Increasing share of basic research at the expense of applied research: The share of basic research in the total funding of research and development grew from 22.6 % to 48.9 %, while the share of applied research decreased from 49.4 % to 24.6 % in the 1994-2011 period (RIS3 SK, 2013). This has been confirmed also by development of ranking of Slovakia in the Global Competitiveness Index (GCI). In the period 2010-2011 to 2016-2017 where Slovakia sank from rank 60 out of 139 countries with GCI score 4.25 to rank 65 out of 138 countries with GCI score 4.30. The weakest evaluation among twelve GCI (2016-2017) pillars achieved Slovakia in the pillar Innovation with score 3.3 and rank 68/138 whereas its score in other GCI pillars ranged from 3.5 to 6.0 (Schwab, K. 2016).

The Slovak R&I system is highly centralised and funded mainly from the government and business resources. Central government has been a major provider of research funding through several agencies in 2000s. Since 2007 responsibilities for the R&I policies have been divided between the Ministry of Economy and the Ministry of Education, Science, Research and Sport. In this year government also passed the Innovation strategy of Slovakia for the period 2007 – 2013, which was specified in more detail in Innovation Policies in 2008 and then in 2011. In contrast to the original intention this first Slovak innovation strategy was not allocated sufficient financial resources and was funded predominantly from the EU Structural Funds. Inspite of negative impacts of the economic and financial crisis the structure of the national system of innovation management and financing was set up and the EU Operational Programmes helped build linkages between the academia and industry sectors and technology transfer offices at universities. However, the share of domestic innovative enterprises remained at the level of about 30%, R&D system was underfunded and planned regional innovation centres were not set up which weakened the regional innovation policies. The main directions of the current development of R&I were set out anew in the RIS 3 Strategy for the Slovak Republic passed in 2015 which is analysed in the further section of this paper. Development of selected R&D indicators in Slovakia is represented in the Table 2 below.

Table 2 Selected R&D indicators in Slovakia

Indicator	**2011**	**2012**	**2013**	**2014**	**2015**	**EU-28 average (2014)**
GERD (as % of GDP)	0.67	0.81	0.83	0.89	1.18	2.03
BERD (as % of GDP)	0.25	0.34	0.38	0.33	NA	1.3
R&D (in %) with foreign funding	14.2	18.6	18.0	23.7	39.8	NA

Source: Baláž, V., & Žifčiaková, J. (2016)., adjusted.

According to Baláž, V., & Žifčiaková, J. (2016) the Slovak GERD made 1.18% of GDP in 2014 (2012: 0.81% of GDP). The 2014 National Reform Programme for the Slovak Republic set modest but realistic targets for GERD to 1.2% and for the BERD to 0.8% in 2020. There were some significant increases in business research spending since 2008 (albeit from a lower base). The public funding of R&I has been prevailing compared to the business and private funding in the period 2014 to 2008. The business and private-non-profit research bodies funded 32.7% vs. 34.7%, HEIs 2.0% vs. 0.3%, government 41.4% vs. 52.3% and foreign funders vs. 23.7% vs. 12.3% of the total research funding in these years. The business funding of innovations is very low, one of the lowest among countries that joined the EU in 2004. Since 2010 business funding from abroad (European Commission) significantly increased in importance. The Eurostat data on business research spending indicated that the foreign owned businesses performed 78% of the total intra-mural research in the Slovak Republic in 2011 (latest available data). The overall R&I policy target in Slovakia in GERD is to invest 1.2% of GDP for R&D and in BERD 0.8% of GDP by the year 2020 and achieve the ratio of public funding versus private funding 1:2.

RIS 3 Strategy for Slovakia

The Slovak Republic is a small and very open economy. Its size is comparable to the size of regions in large EU countries. Therefore the concept of smart specialisation was applied only at national level and not in a regional dimension as well. The basis for the Slovak RIS 3 Strategy for period 2014-2020 are analyses of strenths and weaknesses in export trends, innovation environment, business sector, R&D potential, research and science areas, and human resources in Slovakia. This led to identification of four key areas of economic specialisation: a) automotive and mechanical engineering industries; b) consumer electronics and electrical equipment; c) information and communication technologies and services, and d) production and processing of iron and steel, as well as some areas of prospective specialization. The vision of the RIS3 was formulated in general terms, as "to drive a structural change of the Slovak economy towards growth based on increasing innovation capability and R&I excellence to promote sustainable growth in income, employment and standard of living." It was translated into four strategic objectives: (1) Deepening integration and embeddedness of key major industries increasing

local value added through the cooperation of the local supply chains and turning local supply chains into embedded clusters. (2) Increased contribution of research to the economic growth via global excellence and local relevance. (3) Creation of a dynamic, open and inclusive innovative society as one of the preconditions for the increase in the standard of living. (4) Improvement of the quality of human resources for an innovative Slovakia.

Each of these objectives was specified by several partial objectives and related measures to achieve it. However, there is no explicit mention of any open innovation concepts, methods and models neither among the partial objectives nor the measures. Open innovation concepts would fit in well in the measure 1.1 on development of innovative capacities through cooperation between enterprises and research institutions in key sectors of the Slovak economy and foster realization of the measure 1.3 on support for building research and innovation capacities in Slovak enterprises. Moreover, open innovation concepts tie in well with the following measures: 2.3 on linking universities, Academy of Sciences, research institutions with business partners, 2.4 on support and stimulation of international cooperation in science and technology, 3.4 on support of open and inclusive society, 3.5 on support of dynamic business environment favourable to innovation, and 4.5 on stronger emphasis on education in fields relevant to the RIS3 priority areas.

In the field of governance and management of implementation of the RIS3 Strategy there were set out the following tasks (1) merging eight R&I government agencies into two and change of support to basic and applied research from current ratio of 2:1 to 1:2 by 2020, (2) introducing 'mandatory indicator of the state support to R&D as percentage of GDP in the State Budget Law', and (3) reorganisation of HEIs and transformation of the Slovak Academy of Sciences. In line with (4) the Slovak Government in the meantime renamed the Agency for the Structural Funds of the EU (ASFEU) to the Research Agency which RA should, inter alia, create conditions for participation of the Slovak research teams in the European Research Area and the Slovak Innovation and Energy Agency to the Technology Agency charged with coordination of implementation of the RIS3 Strategy. The strategy is clearly orientated to the triple helix innovation model without considering citizens as end users in generating innovation as well as further features of the Open Innovation 2.0 approach, though in the concluding section there is a formal reference to quadruple helix model.

The Strategy will be implemented by means of two-year action plans. The most important was the „Action plan for the RIS3 implementation for the years 2014 – 2016" which specified necessary operational programmes (especially Operational Programme (OP) for R&I, OP Human Resources and other), financial frameworks with indicative allocations by measures, sources of financing and types of financial instruments, and basic legislative changes necessary to achieve the RIS3 objectives. The Standing Committee of Government Council for Science, Technology and Innovation is responsible for the monitoring of implementation progress of the RIS3 Strategy. Monitoring of relevant measurable outputs, results and impact indicators, tools and measures for RIS3 is carried out by the Analytical Unit of the Government Office of the Slovak Republic in cooperation with central state authorities, especially the Ministry of Economy and the Ministry of Education, Science, Research and Sport of the Slovak Republic. However, the document does not state the periodicity and format of reporting the monitoring results to the Slovak parliament and to the public.

This strategy was supported by the elaboration of the Slovak start-up strategy in the document 'Concept paper for the support of start-ups and the development of the start-up ecosystem in the Slovak Republic' passed by the Slovak Government in June 2015. It set out the following measures: a) developing legal concept of start-up in Slovakia; b) passing government strategy on start-ups; c) introducing new form of business entity, with basic capital of 1 euro; d) introducing tax reliefs for start-ups and business angels; and (e) introducing start-up visa for the third country nationals in Slovakia. Another support measure – the tax reliefs for R&D entered into force on January 1, 2015. However, their implementation is limited and administration-intensive. The Slovak Government has not set up any internet portal to inform the public about the implementation progress of the RIS3 Strategy or even encourage professional and public discussions and citizen involvement on this topic.

Conclusion

At present there is not a single country that has a national open innovation strategy, not even among innovation leaders. However, in several countries there can be observed a trend towards embedding open innovation in strategies and also involving civil society. This is the case in Germany, Finland, the United Kingdom, Sweden, Spain, Hungary and the USA, where open innovation methods and principles are referenced in key innovation policy strategy documents and where there is at the same time a relatively strong tendency towards the quadruple helix model. "Transparency and Participation" are two key pillars of the German High-Tech Strategy (2014), the USA also stress in its latest Innovation Strategy (2015) the orientation towards the principles of open innovation in accordance with the open government focus already initiated in 2012. The Hungarian innovation strategy (2013) likewise describes involving users through open innovation as one instrument to intensify the exchange

of knowledge in the country. The Spanish innovation strategy also expresses an intention to strive towards open innovation and provided for submitting comments on the draft strategy in an open consultation process.

The current innovation strategies of Austria, Bulgaria, Denmark, Estonia and the Netherlands make no explicit mention of open innovation, but there are indications of efforts to involve civil society here, e.g. the Estonian strategy points to the need to improve public participation without suggesting any strategic approaches how to achieve this. In the current relevant strategy documents of countries Lithuania, Croatia, Romania, Switzerland, Singapore, Slovakia and Slovenia, there is neither a mention of open innovation, nor clear statements on development towards a quadruple helix model. It is surprising for the innovation strategies of such advanced innovation-driven countries as Switzerland and Singapore. Although Switzerland stresses the importance of cooperation and networking with other countries, it makes no mention of civil society involvement. Singapore likewise focuses solely on the transfer of knowledge between industry and science (Austrian RTI Strategy, 2011).

Recommendations

1 Formulation of fourteen measures stated in the Austrian Open Innovation Strategy can serve as an inspiration on how to consider the Open Innovation 2.0 approach in the objectives and measures of the Slovak RIS3 Strategy.
2 The complementary elaboration of the Open innovation strategy as an expansion of the Slovak RIS3 Strategy including supporting funding mechanisms would a) open up for Slovak businesses and organizations of Slovak science and research sectors as well as citizens and public institutions, b)foster collaboration and co-creation options for faster implementations of ideas of quadruple helix innovation model and higher innovation performance of the country.
3 The Slovak RIS3 Strategy needs systematic reporting of the monitoring results on an annual basis. Inspiration: the Federal Ministry of Science, Research and Economy publishes the Austrian Research and Technology Report annually.
4 The prerequisite of efficient implementation of quadruple helix innovation model is a networking and communication platform for interested citizen and organisations powered by an information portal operated on behalf of the government ministries by the Slovak Innovation and Energy Agency and complemented by the use of social media.

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PRINCIPALS, PRE-SCHOOL TEACHERS AND PARENTS' VIEWS ON THE EFFECTIVENESS OF THE LIFE-FOCUSED FOREIGN LANGUAGE ACQUISITION PROGRAM WHICH IS DEVELOPED FOR PRE-SCHOOL AGED CHILDREN

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Abstract: The present study was carried out to determine the views and thoughts of school principals, teachers and pre-school children's parents about the Life-Focused Foreign Language Acquisition Program (LFFLAP.) The research was carried out qualitatively. In order to collect the qualitative data, a semi-structured interview form, which was developed by the researcher, was used. The collection of qualitative data was between December 1, 2015 and February 19, 2016. Interviews were done with 38 participants. The participants were as follows: one principal, one assistant principal, four teachers and 32 parents. The qualitative data obtained in the study was analyzed by "content analysis" technique. Word Clouds Program was used to determine the relevant concepts and distributions that emerged during the interviews. As a result of analysis of various data obtained from parents, teachers, and the school principal and assistant principal in the study, positive opinions regarding the Life-Focused Foreign Language Acquisition Program were found. The themes that emerged during the interviews are as follows: active foreign language use, active transfer of foreign language, self-confidence in using foreign language, active interest/positive attitude towards foreign language, improvement in self-expression/pronunciation, sharing whatever is learned effectively, making progress actively in the foreign language and multiple experiences in foreign language learning (visual, auditory, etc.).

***Keywords*:** Pre-school, life-focused foreign language teaching, foreign language acquisition.

Introduction

The early childhood period is a time of rapid development for children, in which they display significant mental, physical and language developments. In this period, covering between the ages of 0-6, a child acquires basic knowledge and skills, is best prepared for life and learns to adjust to the community in which s/he lives in (Oktay, 1999). For that reason, through qualitative and quantitative education the children of this age can acquire and practice social values such as beliefs, culture, and citizenship, internalize and pass them to future generations, as well as protect the environment and national values (MNE, 2013).

It is a common belief that children who encountered a foreign language at early ages tend to be more successful at learning and mastering languages (Asher and Garcia, 1969**;** Kuhl, 2004; Sparks and Ganschow, 1991). It is argued that adults are at a disadvantage regarding native–like speaking proficiency, since they are not exposed to language at very early ages (Gass and Selinker, 1994).

Numerous factors which are effective in the process of second language acquisition should be mentioned. When the literature is examined, it is seen that age, gender, social distance, socio-economic status, motherhood competence, parental education, mental and psychological factors and numerous environmental factors play a decisive role in this process (Demirel, Kaya, Ada, Dağlı, Ergun, Sünbül and Hoşgörür, 2001).

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However, an effective foreign language teaching program for preschoolers is not mentioned in research literature. For the study, English is chosen as the target foreign language for the program due to its global benefits, families' willingness and priorities, as well as their financial support in their children's learning English. The lack of a standard foreign language program and model suggests that it is left to chance.

Education will be more realistic and meaningful for children when the topics required to be taught at pre-school are related to real life. It is even thought that such a program would help children feel more responsible and empowered emotionally. It is thought that a program prepared with such an approach will support the development of intelligence and social skills and the formation of community consciousness. Education is a basic purpose for a better life (Olsen and Clark, 1975).

The intention of the experience-oriented program is to ensure the persistence of knowledge. By making the new learnings meaningful, based on the traces that remain as the result of the individual's interaction with the environment, it makes it easier to establish and learn by associating new information with existing information. Otherwise, learning is ineffective without this framework. Interaction with elements in the teaching and learning environment is possible when the learning curve is over the threshold of experience (Senemoğlu, 2013). According to John Dewey, education is a lifelong process. For this reason, learning by doing and experiencing is the most effective type of learning. It is thus possible to divest from traditional techniques such as a memorizing and presenting information that prevent the child from discovering and thinking (Bender, 2005). The Life-Focused Foreign Language Acquisition Program has considered every moment of real life as an educational environment, and everything in the environment serves as fun learning materials.

Teachers and families have important roles in achieving the goals of the Life-Focused Foreign Language Acquisition Program. The primary role of the teacher is to get close to the students with a mother's affection and make them feel loved. The second role is to be a good model as a person (Korkmaz, 2012; Dağlıoğlu, 2012). The teacher has significant responsibilities in maintaining the interest of the child, not only with her personality as a role model, but also with her posture, gaze, movements and eye contact with the children (Çalışkan and Yeşil, 2005). Failure to use the target language outside the classroom is a major factor that negatively impacts learning a foreign language. For that reason, family support is important. Information about the child's family is useful in increasing their success. To help their children, it is not a big problem anymore whether families know a foreign language or not. Today, technology offers all the opportunities for language support activities at home—especially for students who want to learn English (Bekleyen, 2016). Research shows that a supportive approach of learning by the family and participation of the family in school activities have an effect on the child's school success. More than half of school success comes from the contribution of the family (Çelenk, 2003).

For this reason, the views of parents and teachers have been consulted to achieve stable outcomes regarding the effects of the LFFLAP process. In this way, foreign language education implemented by centering on the child during the pre-school years, when language development is especially critical, will support all of these aims to contribute to the success of the child's educational future.

The present study was carried out to determine the views and thoughts of school principals, teachers and pre-school children's parents about the Life-Focused Foreign Language Acquisition Program. For this purpose, in this research the effects of the LFFLAP on the ability of pre-school children to understand English and to use it actively in life is examined from the perspective of pre-school principals, teachers and parents. In the study, answers to the following questions were sought:

What are thoughts of school principals, teachers and parents on LFFLAP, its effectiveness, and on the ability of pre-school children to learn a foreign language?

What were any problems encountered in LFFLAP?

Method

The present study was carried out to determine the views and thoughts of school principals, teachers and pre-school children's parents about life-focused foreign language acquisition program. For that reason, this study was carried out within the context of the "case study" pattern widely used in qualitative research, and children's "foreign language acquisition" constituted the scope of the study. The most basic feature of a qualitative case study is the in-depth investigation of one or more cases. In short, factors related to a situation such as individual, environment, and process are investigated with a holistic approach. Here researchers focus on how these parameters affect the situation and how they are affected by it. It is expected to create examples and experiences for understanding similar situations rather than reaching general conclusions about the situation. In the study, the

holistic one-state pattern, one of the case study designs, was used. There is only one analysis unit in the comprehensive one-state patterns. This unit can be an individual, an institution or a program. According to Yıldırım and Şimşek, if there is a well-formulated theory, it is possible to use a holistic one-state pattern for the confirmation and refutation of it (Yıldırım and Şimşek, 2013).

Participants

The children participating in LFFLAP were comprised of 18 girls and 18 boys. The mean age of these 36 children, aged between 50-74 months, was 62 months. The participants of this study consisted of parents of the children in the LFFLAP, teachers, and principals. One principal, four teachers, and thirty-two parents participated in the study. When the characteristics of pre-school teachers, who were among the participants, were taken into consideration, it was seen that all of them were female. When these teachers' professional background was checked, two of them had twenty years of preschool teaching, one year in state schools and nineteen years at private schools. The third participant had two years state school and six years private school experience; the fourth participant teacher had fifteen years state school and one-year private school kindergarten and pre-school experience. Also, all of these four teachers had their masters in Child Development and Education.

The principal that participated in the study had ten years of experience as a Child Development and Education teacher at a Girls Vocational High School, one year of department chief experience, and ten years of experience as a principal at the school (a private school) where this research was conducted. Concurrently, she works as a lecturer at a state university. Also, she participated in projects such as Nutrition of Early Age and Montessori Education and holds a Ph.D. in Child Development.

Another group that took part in the study was comprised of parents. In the study, 32 parents were interviewed. When the education level of the participant mothers was checked, 11 of them (34.35 %) were elementary school graduates, 7 (21.8%) were high school graduates, and 6 (18.75%) were university graduates, and 8 (25%) had a master's degree. Similarly, 11 of the participant fathers (34.35%) were elementary school graduates, 4 (12.5%) were high school graduates, 7 (21.8 %) were university graduate and 10 (31.25%) had a master's degree. 3 (9.3%) of the parent participants in the study group had their master's degrees abroad.

The preparation and application of Preschool Life-Focused Foreign Language Acquisition Program

During the preparation of LFFLAP, the needs of children aged 50-74 months and the language skills they need to possess were determined. In tandem with these skills, a pool of achievements and demonstrations was created together with experts. From the created pool, common themes were identified by defining experience-focused and noticeable gains. Then, the draft of the foreign language program, which includes a total of 150 hours with a 10-week session and 3-hour sessions per day, was also discussed with the experts. Then, activities and materials were designed based on determined themes and achievements. In addition to this, experiences form the focus of this program. For that reason, the program is carefully designed to be continuous and flexible, responsive to the needs and interests of the children. Also, unlike other programs, the following aspects were built into the format: *Games, music, painting, dance, drama, nutrition, gesture and mimics, technology, love, respect, sharing, appreciation, teacher devotion, and patience.* These themes became the routines of the prepared program, and these parameters were focused in each session. It was ensured that the language was given in learning bits and that the lexicon was the focal point. The key role of communicative words in the teacher's conversations, how they are formed, coded and organized, were primary sources for the students. In tandem with these aims, each week student-centered activities program was applied according to the prepared plans.

Data Collection Tool and Analysis

Interviewing is an effective method frequently used in "qualitative research" and "case studies." For Stewart and Cash (1985), it is a mutual and interactive communicative process that is predetermined and has serious purposes based on a questioning and answering style (qtd. in Yıldırım and Şimşek, 2013, p. 147). During and after the implementation of the LFFLAP, the researcher conducted face-to-face interviews with the children's parents, teachers and the school principal to determine the program's effect on the second language learning skills. In face-to-face interviews, Patton's (1987) "standardized open-ended interview" technique, which takes place on the interview classification, was used (qtd. Yıldırım and Şimşek, 2008, p. 121; Yıldırım and Şimşek, 2011 p.123).

Interviews were held between December 2015 and February 2016 via the implementation of the interview form to the principal, teachers, and parents. The interviews took between 35 to 117 minutes. The following questions

were directed to the participants: “How do you think the foreign language acquisition program applied to your child has affected his/her foreign language ability?” and “What are the problems encountered during the application of LFFLAP?”

During the qualitative data collection process, data from WhatsApp correspondence, teacher and parent letters, video and audio recordings, telephone interviews and from the researcher’s s impressions based on the researcher’s daily notes were consistently collected. This data is used as additional evidence in the clarification of general points. According to Yıldırım and Şimşek (2013), since the individuals in the environment that the study focused as data sources have different experiences, perspectives, and perceptions, these differences need to be identified and interpreted by analyzing the documents consisting of sources such as telephone interviews, letters, photographs, diaries, and correspondences. Confirmation of the data obtained by different methods, which is diversification, increases the validity and reliability of the study.

The frequency of opinions collected from school administrators, teachers, and parents has been generated by semi-structured interviews. In this way, the number of repetitions of ideas is ordered from the highest to the lowest. The obtained qualitative data was then analyzed by the "content analysis" technique. The participants' consistency about the interview from the beginning to the end, their frequency of repetition by their other discourses supporting their views or opinions, and similar views expressed by the majority of participants were taken into consideration. (Baş and Akturan, 2013)

In the analysis of the data, first all the interviews were transcribed, transcripts were repeatedly read, and the most important expressions were identified and listed. During the content analysis phase, opinions were grouped under eight themes (given in the “findings” section). After being systematically and explicitly described in the context of these themes, the views were explained and interpreted, and results were obtained. After each participant's interview data and the daily WhatsApp correspondence are marked on the theme frame, the data containing the same theme are analyzed and reported together.

In describing the essential elements in the acquisition of foreign language, the participants’ words and sentences, and therefore “lived experiences,” play a significant role (Jasper, 1994). Therefore, a direct citation is included in the description of the themes.

Findings

Research Question 1: What are the views of school principals, teachers, and parents about LFFLAP and children's foreign language learning?

The effects of the Life-Focused Foreign Language Acquisition Program on children's learning of foreign languages have been attempted to be revealed via quantitative findings as well as quantitative results. In the study, eight subjects were reached as a result of analysis of various data obtained from parents, teachers, school principal, and assistant principal. The themes are:

1. Active usage of a foreign language
2. Active transfer
3. Confidence in using a foreign language
4. Effective interest/attitude towards a foreign language
5. Self-expression/ pronunciation
6. Active sharing of learned topics
7. Active improvement in a foreign language
8. Multiple experiences in a foreign language (Visual, audio, etc.)

Below are frequency analysis for the theme and direct citations from the participants.

Table 1. Views on theme 1: Active usage of a foreign language

Theme 1. Active usage of a foreign language			
Parents	**-f-**	**Teachers and Principal**	**-f-**
Uses, speaks and says English concepts	32	The students first started to count numbers and say the colors among themselves in the class.	5
Sings English songs/ repeats	30	First, they acquired to say their names and last names	5
Asks and answers names of the objects in English	23	I observe now that students can ask each other their names and respond to questions.	5
Frequently uses English phrases "Good morning, good night, yes, no, hello," etc.	19	Since the classes started, students have been using the following phrases frequently: 'teacher, good morning.'	2
Can count in English	18	When numbers and colors are asked, they sometimes prefer to respond in English.	2
Sometimes speaks English when s/he needs to use the restroom when his/her nose runs when s/he wants to drink water, eat food.	14	I heard they're asking about the color in English during art class.	2
When initiating a dialogue with someone, can introduce themselves and understands the questions	13	When I asked them to come here in Turkish, they respond in English: "Come here please!"	2
Asks questions or vocabulary with his/ her siblings	7	They translate to me what their English teacher is telling to them	2
With the program, vocabulary has improved	5		
Understands questions related to animals, colors, fruit, and shapes and answers in "yes/no" format.	3		
Responds to some instructions such as "Shut the door, open the window, turn off the light" and does what is asked.	3		
Tries to teach us English at home.	2		

When the opinions of teachers, parents, and principal were analyzed, the active use of the foreign language with a life-orientation was the first theme that emerged on the effects of LFFLAP. In this context, when the participants' opinions are analyzed descriptively, it is seen that 12 views from families and seven views from teachers and school principals have come to the foreground. The most common opinions from the families about the effect of the program were: "She/he uses English concepts and words, speaks and says them," 32 participants; "Sings English songs /repeats songs," 30 participants; and "Asks and says the names of the objects in English," 23 participants. On this theme, the five ideas of the school principal and teachers are as follows: "The students started to say numbers and colors in English in the classroom when they talk to each other," "In English class they first started to say their last names and names, and greetings." The teachers observe that "the students ask each other their names and last names in English." According to the views of the participants, it was seen that students actively involved in activities conducted during the classes. One of the parents explained her ideas about active involvement in the following manner:

…. S/he learned daily phrases and words faster than I expected and I observed that s/he used them effectively in everyday life situations. For example, when s/he wants some water, s/he used to say "Father, I want water." In addition to that, it is surprising and fascinating to use the phrases "close the door" or "be quiet" appropriately. I believe that your attitudes and managerial skills were useful in this success (Parent/Female).

One of the teacher participants states the following on the same theme:

As soon as they started to join the English class, they began to use last name and name greetings in the class. They began to say numbers and names in English. When I asked them to come here in Turkish, they responded in English "Come here, please." (Teacher/ Female)

During the application of Life-Focused language teaching program, the students were kept active in every stage of the class. It has been observed that English language skills have improved to the extent that they participated in the activities. This situation has also been confirmed by the participating teachers.

Table 2. Views on theme 2: Active transfer

Theme 2. Active Transfer			
Parents	**f**	**Teachers, Principal**	**f**
They use what they have learned in the class	31	They use English phrases during the breaks between activities.	5
Learned daily vocabulary and phrases faster than I expected	25	Families report that the students use English phrases at home.	5
Uses the following phrases during the day when talking to us: "good morning, good night, brush your teeth, drink some water."	16	Most of them speak English during lunch break or breaks.	3
Sometimes substitutes a concept with its English meaning during a daily conversation.	9		
Repeats what s/he learned at school in real life situations.	8		

In Table 2 the frequency distributions of the views of managers, teachers, and parents, which are determinative in the emergence of active transfer contact are seen.

According to the qualitative findings of the research, it was seen that in the context of "active transfer," children use the learned skills in different situations efficiently, especially in daily life and extracurricular processes. Interviews with parents, teachers, and school administrators, and WhatsApp correspondence are the most critical views on the transfer of children's learning: 31 of the parents stated that their children use in their daily life "what they have learned in class." 16 of them reported that there was a high learning transfer related to self-care skills, as the students frequently used phrases such as "good morning, good evening, brush your teeth, drink some water." All of the participating teachers, as well as the principal, stated that students use vocabulary actively during breaks, lunch break, and between activities.

Below are some thoughts of some teachers and parents on active transfer:

I think when compared to classical learning, you have shown that a foreign language can be learned like a mother tongue more effectively when it is used for daily situations, with songs, messages (WhatsApp), and activities. (Parent/Female)

We have seen that English does not consist only of grammar. Through practice, students achieved learning through experience. I believe that this will be permanent with reinforcement. (Teacher/Female)
Today, one of the boys went to a dentist and tried to say that the word dentist by connecting "teeth" and "doctor" together to form the word "teeth doctor." (Researcher)

Table 3. Views on theme 3: Self confidence in using a foreign language theme

Theme 3. Self Confidence in Using a Foreign Language			
Parents	**f**	**Teachers, the principal**	**f**
Tries to learn English	32	They got rid of their shyness during these activities.	5
Confidently uses English phrases	31	I observed that they had self-confidence during the activities.	5
Trusts himself/herself in English	30	They are aware that they can express themselves better while speaking English.	2
Active and audacious in using English words.	24	During the activities in English class, they share what they know with joy.	2
Self-confidence improved. Can use English phrases in crowded environments	21	During the activities, they say the words loudly without hesitation.	
Without our support and help, s/he started to use the language and respond to the situations	14		
With this research, the student realized that s/he could learn English and internalized it.	10		

In the table, the frequency distributions of the opinions of the principal, teachers, and parents are shown in the context of self-confidence in using foreign languages. In this regard, three premises that parents expressed were: 32 parents declared that "students try to learn English," 35 participants stated that "the students use English concepts without hesitation," and 31 participants said that "the students have self-confidence in English." The views that the principal and teachers declared on this theme are as follows: "the students lost their hesitations in English activities;" "I observed that they have self-confidence in English classes;" "They are aware that they express themselves better when they speak English" and "during class activities, they share what they know with joy."

In this respect, participants expressed that children had a high level of self-confidence in their use of foreign languages through the practice of foreign language teaching based on experience. Regarding self-confidence in using a foreign language, parents expressed their views as follows:

> *We did not have any effort to contribute to his/her learning of English at home (even after we started classes.) The only thing that we did after the classes started was to listen to the messages that you had sent regularly and encourage the students to respond your questions. After a while, s/he already wanted to answer herself, and she started to do so without us directing what she wanted to say.* (Parent/Female)

> *Our son was an introvert kid. We noticed that he was using the English words he learned during the classes. This made him proud of himself. Hesitated to say his name… changed suddenly. This 10-week education, taken by a 6-year-old child, began to create a fun dialogue at our home with half of Turkish and half English dialogues as if it were a Turkish family living in Europe and came here for a vacation.* (Parent/ Male)

A teacher expressed her observations on the increase of self-confidence in foreign language learning of the students as follows:

> *The students love to participate in English classes…I observed that the students express themselves better with confidence. Especially (name of a student) became more expressive and social. Those who were quite in the class began to participate and express themselves.* (Teacher/Female)

It has been seen that with the Life-Focused Foreign Language Acquisition Program, children showed intense self-confidence, expressed themselves better at school and in daily situations, were eager to show what they have learned, and were happy while they were learning.

Table 4. Views on theme 4: Effective interest/attitude towards a foreign language theme

Theme 4. Effective interest/attitude towards a foreign language			
Parents	**f**	**Teachers, the principal**	**f**
They enjoy English activities	30	They are very much interested in classes.	5
They go to school with joy the day they have English class.	29	They participated in the activities with joy. They loved learning English.	5
They wonder English equivalence of everything they know.	28	They want to speak English	5
They are so happy while doing English activities at home.	25	They look forward to their English classes.	3
English activities have contributed significantly to social and emotional development.	23	They are interested in English.	3
S/he especially likes English songs	22	They are interested in all the activities in the class.	2
They had great fun during English training.	20	They are so active during English class.	2

In the table, the frequency distributions related to the opinions of the principal, teachers, and parents, who appear to be influential in the emergence of a positive attitude/attention to foreign language courses, are seen. According to the analysis, 3 important opinions that emerged on the basis of the attitude towards LFFLAP are as follows: 30 participants "are enjoying English activities happily"; 29 participants "enjoy reading the day that they have an English course" and 28 participants expressed their opinion that "Everyone is curious about English." The views expressed by the principal and the teachers on the same theme are as follows: 5 participants stated they were "very interested in the classes"; "I enjoy the class with pleasure" and "I like English."

Throughout the process, the students have shown these attitudes by participating in lessons, enjoying activities, mumbling the songs prepared for this program, engaging and enjoying lessons. The views of two parents on these behaviors in and out of school are as follows:

> *(Student 1) and (student 2) enjoyed themselves a lot during English education. The fact that their English education developed in a very natural process brought them out of a classroom atmosphere and they unconsciously got used to the language.* (Parent/Female)

> *It is honorable that you have shown that English education is not a fearful dream, but rather a piece of life, a most important part of life, and a natural phenomenon... Knowing more than one language gives that person awareness and confidence...We started asking English words to each other at home.* (Parent/Male)

Table 5. Views on theme 5: Self-expression/pronunciation

Theme 5. Self-Expression/Pronunciation			
Parents	**f**	**Teachers, the principal**	**f**
As the lessons progressed, the number of English concepts used increased, the pronunciation improved	31	All of the students can use the English concepts they studied in class	5

Uses English concepts and words appropriately	27	Each week expressions and pronunciations improved	5
Constantly uses English phrases and concepts	25	The study improved the students' pronunciation	5
Communicative skills both in Turkish and English languages have improved	15	They can easily express what they have learned	2
Addresses in English to those around	13	They frequently repeat English concepts	2
His/her Turkish improved a lot thanks to English.	11	When they speak Turkish, they make better sentences	2

In Table 5 frequency distributions of the principal, teachers and parents related to self-expression/pronunciation are seen.

According to the analysis, 3 important opinions emerged on the basis of self-expression and pronunciation are as follows: 31 participants stated "as the lessons progressed, the number of English concepts used increased, the pronunciation improved"; "Uses English concepts and words appropriately," and "Constantly uses English phrases and concepts." The views expressed by the principal and the teachers on the same theme are as follows: 5 participants stated "all of the students use the concepts they have learned during the classes;" "Each week their expressions and pronunciations improved."

According to the opinions of parents, teachers and school principal, children's English has a high rate of regular speaking, pronunciation, and vocabulary. For this development, in their letters the parents expressed their views as follows:

> *Sometimes he cannot remember the Turkish word he wants to say, and he speaks English. He shook his toes and said to his father, who says "finger," "no, they are not fingers—toes," and he laughed a lot when his father did not know the difference between fingers and toes.* (Parent/Female)

> *The impact of English on my child is high. My child was able to speak Turkish more smoothly thanks to English... He could not express himself. At the end of the session, self-expression was the most developed skill.* (Parent/Male)

It was seen that with the application of LFFLAP, children effectively used basic expression skills such as recognizing the language, pronouncing English words correctly, using words appropriately, and placing words correctly into a sentence. Also, the school principal and assistant principal stated that activities based on life-focused learning and dynamic interaction was effective in children's speaking skills and pronunciation. Speaking only English during the application, encouraging the students to speak in a natural flow, their ability and care to use the words appropriately contributed to this outcome.

Table 6. Views on theme 6: Active sharing of learned topics

Theme 6. Active sharing of learned topics			
Parents	**-f-**	**Teachers, the principal**	**-f-**
They share at home what they have learned in English class.	29	Class participation is high.	3
Share with his/her friends what s/he has learned at school.	22	Shares with his/her friends and with me.	3
The whole family uses the phrases s/he learned at school.	19	They take pleasure in sharing with their friends.	3
S/he asks me (mother) the words they covered during the day and repeats them.	16	The student's participation in the activities and sharing is high.	3

S/he uses English words with people s/he encounters.	15	Sometimes they ask what a specific word means in English. Their sharing with me (teacher) is high.	2
Tries to teach us English at home.	6		

In Table 6, frequency distributions of the principal, teachers and parents related to sharing theme are seen. The most common views from the parents are as follows: 29 participants stated that the student "shares at home what s/he has learned at school," 22 participants reported that "they share with their friends what they have learned at school," and 19 participants stated that "the whole family uses English at home." When the responses of the principal and teachers are analyzed (3 participants), all participants indicated that the participation of the classes and activities were high and the students shared with each other what they know.

All participants expressed their children's progress in learning English by pointing out that the students are positive and eager to share what they have learned at home and school.

In this regard, the opinions of parents, teachers and the school principal are as follows:

> *(Student's name) did not know even a word in English before the research study began. Now s/he can use the "I want….." sentence structure. S/he has learned a lot of vocabulary and shared this with his/her sister. During his/her visit to her grandmother, asks for "banana" using the English word. Then starts teaching the phrases s/he knows to his/her grandmother.* (Parent/Female)

> *The students participated in the English class with great enthusiasm. They shared every new concept they have learned. In group work and class activities, sharing level was high* (Teacher/Female)

Table 7. Views on theme 7: Active improvement in foreign language

Theme 7. Active Improvement in Foreign Language			
Parents	**f**	**Teachers, the principal**	**f**
Their English improved.	32	The development in English was rapid.	5
English vocabulary has developed with the classes.	30	After a few classes, all of the students started to use English words and concepts.	5
The method applied here was the reason this fast improvement.	23	Inactive students became active in English in subsequent weeks.	2
Quickly adapted to the foreign language and used some words on his/her own.	14		
Started to use many concepts in English during daily activities.	13		
Could use English words above his/her level and age.	10		
In some cases, used English rather than Turkish words.	5		
As the foreign language developed, verbal and nonverbal communication skills improved too.	3		

In Table 7, frequency distributions of the principal, teachers and parents related to progressive improvement in the foreign language (Theme 7) are seen. According to the analysis, all of the parents expressed the view that with LFFLAP, their children's "English improved, progressed, and was enriched." 30 of the parents stated that, "With the classes, their vocabulary was enhanced." 23 of them stated that, "The applied program was the reason behind the students' rapid improvement." When the responses of the principal and teachers were analyzed related to the same theme, all the participants (5) stated that, "Improvement in English was so fast," and, "after a few classes all the students started to use English words."
In this regard, the opinions of two parents are as follows:

I think that this productive process and the child's improvement in English is the result of the method you applied here. It was more a sort of activity rather than a traditional class, and the students learned the language unconsciously in the natural environment. (Parent/Male)

My child who used to know only "yes" and "no" in English, now tries to understand when somebody talks to him/her in English. S/he tries to answer, and most importantly s/he loves English. (Parent/Male)

Table 8. Views on theme 8: Multiple experiences in foreign language (visual, audial, etc.)

Theme 8. Multiple Experiences in Foreign Language			
Parents	**f**	**Teachers, the principal**	**f**
Tries to use English outside classroom settings.	**30**	They started to use English in all learning environments.	**5**
They sing songs in English and play games in English.	**28**	English visuals attract their attention.	**5**
Listens to musicals on TV in English.	**19**	They sing songs in English.	**3**
They use the English words for their belongings.	**18**	English became a common communication language during meals eaten together	**2**
They are interested in English books with illustrations.	**17**	Learning English with game activities was enjoyable.	**2**
They say the names of the objects in the street and at shopping.	**15**		

In Table 8, frequency distributions of the principal, teachers and parents related to multiple experiences in foreign language learning (Theme 8) are seen. According to analysis, 30 parents stated, "They try to use English in everyday situations outside of class settings"; 28 stated, "They sing songs in English and play games in English"; and 19 said, "They listen to English or musicals on TV in English." The opinions that the principal and teachers expressed on this theme is that "They use English in all learning environments" and "English visuals attract their attention."

In this regard, opinions of parents, teachers and the school principal are as follows:

I believe that the songs you gave them to listen to, photos from your past, the fruits you have eaten together, the games you played in the playground, WhatsApp messages sent to participants every day, your constant speaking of English, and the fact that you had classes not once a week but every day from 12:30 to 14:30 contributed to rapid and satisfactory improvement in the program. (School Principal/Female)

S/he is trying to answer questions in English every day. S/he sings the songs on his/her own, more courageously. S/he is trying to speak English, asking questions, and wants to learn the names of animals, colors. S/he does this in the form of play. The most important things are that s/he got used to English sounds. S/he can sound them well. (Parent/Female)

Within the context of life-focused activities, Multidimensional environments created for the classes were carried back to the children's homes through WhatsApp applications and songs that were specifically written for this program. English game activities and recommended films created multi-dimensional experiences for the students and improved their exposure to the target language. Even the student sharing these experiences at home with their siblings, parents, and grandparents turned their experiences into a teaching experience. Thus, it was seen that language is alive and active.

Research Question 2: What are the problems that arise in the practice of LFFLAP?

Table 9. Views about the problems arising in the implementation of the Life-Focused Foreign Language Acquisition Program

Problems and difficulties encountered in implementing the program	**f**
We had difficulties in implementing the program for the first few weeks.	12
Some parents could not help their children since they do not know English.	10
Some students had adjustment problems at early stages of the study.	8
We had difficulties in implementing some activities during the first few weeks.	5
Some students had little participation during the first few weeks.	3
They had stress during the first few weeks.	3
It took time to learn some concepts during the first few weeks.	3

In Table 9, frequency distributions of the principal, teachers and parents related to problems encountered during the implementation of LFFLAP are seen. Since the number of views about this theme was low, all respondents were evaluated together. According to the analysis, 12 participants stated that, "We had difficulties in implementing the program for the first few weeks"; 10 participants stated that, "Some parents could not help their children since they do not know English;" 8 participants said that, "Some students had adjustment problems at early stages of the study;" 5 participants stated that, "[They] had difficulties in implementing some activities during the first few weeks;" 3 participants stated that, "Some students had low participation during the first few weeks;" 3 participants stated that, "Students had stress during the first few weeks;" and finally, 3 participants stated that, "It took time to learn some concepts during the first few weeks of the study."

In this regard, one parent and one teacher expressed their views as follows:

> "S/he had difficulty in expressing himself/herself and was shy. Now s/he looks forward to texting you and talking to you in English." (Parent/Female).

Below are some notes taken from the diary of the English teacher:

> *We are in week four, and they can understand 70% of my speech.* (23/11/2015)
>
> *At first, the students did not know any words yet now most of them are aware of the foreign language, and they try to find similarities between the target language and their native language; they also try to understand these differences they have noticed. Their pronunciation improved. At first, they only texted "Hello, teacher," which later improved to "See you at school."* (27/11/2015)
>
> *Students who were faltering at first can speak fluently now.* (8/12/2015)
>
> *The improvements I have observed so far are excellent, and in week ten, with 150 hours of classes, we brought the students to this level together. Their knowledge has improved from a few words, numbers, and colors to "I want some water," "Be Quiet!," "I have to pee," "See you tomorrow," and much more. They expressed themselves appropriately and correctly.* (8/1/2016)

According to the findings obtained from the participants of the research, it has been observed that children were silent in foreign language activities at first, and tried to understand the process by observing it. However, after a few sessions, they got involved and adapted to the program and started using the target language. It was confirmed by all attendees that the number of concepts that the children used at home and school increased during the following weeks. Also, it has been observed that this development was stress-free and took place without any need for an individual effort. This process has also contributed to the development of children's use of foreign languages as well as the use of their Turkish and non-verbal skills.

Result and Discussion

According to the qualitative findings of the study which focused on the effects of the Life-Focused Foreign Language Acquisition Program, the students:

- Used what they have learned actively, either at school of out of school
- Increased their self-confidence
- Transferred what they have learned
- Developed a positive attitude towards English and English classes
- Shared what they have learned with their peers and families
- Could express themselves using English with correct pronunciation and precision
- Showed rapid improvement in learning the language
- Learned English more effectively through multiple experiences

According to Doğan (1997), making knowledge meaningful for the child is the first condition of effective learning.

It is one of the important tasks of the teacher who is responsible for organizing teaching processes to establish a relationship between the content being processed and everyday life skills of children in the developing age. One of the main mistakes that many teachers make is to force children to learn only for the sake of learning without specifying the area of application that students can understand. Real life experiences which connect with the subject teachers are instructing in make great contributions to the relationship between the subject and real life. One of the general objectives of LFFLAP is to apply the gains of the classroom into life, and to transfer them to real life experiences. In this process, foreign language skills will develop to the extent the students internalize what they have learned and how much they use it during daily life. For this reason, LFFLAP has provided a rich, stimulating environment for the children to transfer the foreign language into the language of daily life.

Another qualitative finding of this study is the effectiveness that emerged during the Life-Focused Foreign Language Acquisition Program.

The place of powerful features in learning foreign languages is emphasized in numerous studies such as in the studies of Bağçeci and Yaşar, 2007; Cadwell, 2011; Kara, 2004. Children's affective behavior throughout the process improved conditions like the self-confidence that children gained during the process, more participation in lessons, enjoying activities, high interest and taking pleasure in English lessons. This has led to higher achievements in learning.

In Life-Focused Foreign Language Acquisition Program applications, a major goal was to improve multiple learning environments through applying different teaching methods and techniques, real objects, materials, tools and equipment that were used in school and classroom environments as well as through applying communication technologies outside the school. It is thought that children can understand language more effectively in the real world and therefore experience rich learning environments. Participants had positive views on the effects of these multidimensional experiences on language learning.

In addition to these positive results, administrators, teachers and parents stated that there were difficulties in implementing the program in the first weeks, low participation in class, difficulties for children to do certain activities, and that some parents were unable to help their children because they did not speak a foreign language. However, it was seen that during subsequent weeks, such problems have diminished and all students have realized the goals of the program.

Consequently, according to the qualitative findings of this study, which aims to research the effects of LFFLAP on learning English, it was determined that the applied program had a high impact on language learning. Through the letters and interviews, the principal, teachers and parents expressed their satisfaction and praised the success of the program. According to the findings of the teachers about the success of the program and the results of the discussions, all class teachers stated that the students learned rapidly in English classes and that they used it in their other lessons. They also expressed the advantages of LFFLAP. Parents stated that the students shared with them what they have learned at school. The researcher’s designing LFFLAP was based on the needs and interests of the children which included real-life materials such as music, sports, and pictures. These considerations made the classes functional and increased the success of the program because they connected with their interests and sparked the enjoyment of learning a foreign language, which became a channel for communicating their enthusiasms. Also, parents’ insistence that the program should continue after the research has been completed can be read as a sign of the success of the program.
Based on the findings of this research, the following suggestions are made for future researches:

1. Teachers and parents can be trained in the Life-Focused Foreign Language Acquisition Program that can be applied to pre-schools.
2. Teaching materials and tools appropriate to the core principles of LFFLAP can be prepared.
3. The LFFLAP developed for preschoolers can be adapted for higher grade levels.
4. Regarding their developmental characteristics, pre-school children are at an age when they are more open to learning a foreign language, and they can acquire a foreign language more quickly. It will facilitate teaching a foreign language more efficiently in higher grades if children begin learning a foreign language at this early age. However, to ensure equality of opportunity in education, it is suggested that English education should be included in state-affiliated pre-school institutions.
5. Experimental and qualitative studies can be conducted for the implementation of LFFLAP in schools with children from different socio-economic levels.

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EDUCATION AND WAGES ACCORDING TO REGION, AGE AND GENDER. THE ARGENTINIAN CASE

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Abstract: This work focuses on estimating the Mincer salary equation by segregating the labor market according to the level of instruction, gender, experience and region in order to explain the wage differences and therefore, the inequality. Moreover, it is also desired to find a correlation between the economic cycle and the real wages, tendencies for each variable and the evolution of the Gini index.

The econometric model is estimated by minimum ordinary squares method due to the database number of observations show the characteristics needed to find a coherent and correct output. Dummy variables are used and the age is a proxy variable for the experience. The database was obtained from the "Encuesta Permanente de Hogares" (Permanent home statistics) gathered by argentine's INDEC (National Institute of statistics).

The main econometric objective is to find a statistic significance of each variable and their relation between the economic cycle. Besides, the economic objective is to analyze the data and bring conclusions about the wage level for each region, the gender gap and specially the relevance of education showed by the levels of instruction.

As a conclusion it was found that education is an extremely determinant factor of salaries and income. Also it was found that between regions in Argentina there are significant differences in wages, moving far from Buenos Aires means lower wages. Regarding the gender gap, it is clear that females earn less, but young females suffer a greater inequality.

***Keywords*:** Education, inequality, gender, wages, income distribution.

Introduction

Jacob Mincer is considered as the founding father of Labor Economics. He was born in Poland, survived the Holocaust and achieved getting his Ph. D degree at the University of Columbia. Even though he did not win a Nobel Prize, he had been Chief at the Chicago School of Economics and elaborated the first theories of Human Capital. Decades ago, when the equation that has his name was first used, the labor market was simpler than now. Men were widely majority, monetary policy was different (gold pattern), and the economic cycle more predictable. Moreover, the education structure has evolved and there are several more careers, masters and skill-development faces. Those are the main reason why the original equation just explained wages with experience and education. With the time, mainly at the U.S.A., race, city size, political party inclinations and gender were also considered.

The equation has been implemented in research papers all over the world due to the desirable characteristics that it has. It is easy to gather the information needed because most of the national bureaus of statistics made wage and working questions in their polls, follows the law of large numbers having a normal distribution and as a result ordinary least squares method can be applied for the regression (most software's use them). A visible

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outcome is that the equation is the most used in OCDE countries and scientist and investigators use the word "mincerized" when any other equation has desirable characteristics too.

They still exist discussions about the wage's variables that explains it. The most used theory is the one PSACHARAPOULOS and TZANNATOS (1991) published, which includes Mincer's variables plus gender. Also the Human Capital theory (BECKER 1983) is adopted for the econometric estimation due to its scientific approval through dummy and proxy variables to implement ordinary least squares. Empirical experience provides unbiased, coherent and significant variables (María Teresa BLACONA 2001).

The Econometric Model

Based on BECKER (1983) Human Capital model (education, experience and gender) adding "region" and "labor dependence". The freedom degrees' loss is no problem due to the size of the sample and avoid a selection bias.

$$lnW = \alpha_0 + \beta_1 Education + \beta_2 Gender + \beta_3 LaborDep + \beta_4 Region + \beta_5 Age + \beta_6 Age^2 + \mu$$

W represents wages measured in current US Dollar prices. Due to the absence of negative values logarithms were applied to reduce the variance and obtain accurate estimators (log-linear model with ordinary least square regression). The constant α_0 avoids common origin regression problems. Education was divided in three levels (elementary, high school and college). In Gender males are represented with 1 and female with 2. Labor Dependence was divided in three (independent, employed, high labor dependence). Regions were assigned from northwest to south, from 1 to 6 (Northwest, Northeast, Cuyo, Pampa, Buenos Aires province, Patagonia).

At first instance it is expected to find statistical significance in all variables except labor dependence which is applied for the first time in Argentina and it is unknown. Although the semi-elasticity can be easily find, it is not the study focus of this paper so it is going to be compared qualitatively between periods of time, the economic cycle and the Gini coefficient.

The Argentinian Case

The work was centered on the last 4 federal governments periods (2003, 2007, 2011 and 2015 third quarters) to analyze how the variables change and their relationship with the economic cycle. Into the equation has been added the variables "region" and "labor dependence" (not often used in Argentina). The reason is that Argentina's working system and laws firmly protects the workers' rights and have deep economic consequences; the country is the seventh in size in the world and has specialized each region according to the natural resources available, causing big wage differences. In addition, the Gini coefficient has been calculated to measure inequality between regions and its evolution in time. The data used was taken from the INDEC (National Bureau of Statistics).

Macroeconomic data

For further analyses a major economic analyses were needed. The economic cycle was vital for the evolution of the variables and Gini coefficient measure. The GDP and Potential GDP were obtained from the last corrected measure made by the federal government.

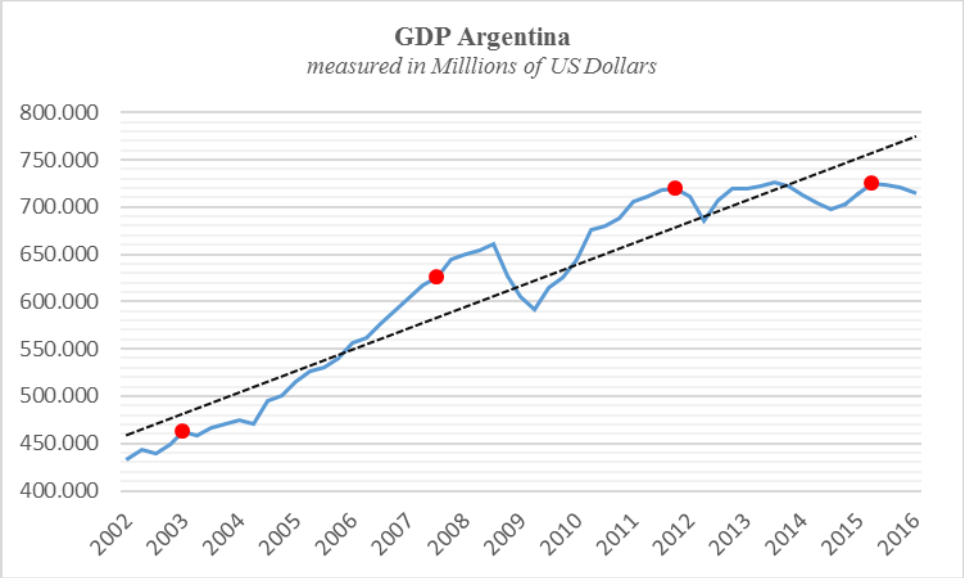

Figure 1. Argentina's GDP. Source: Ministerio de hacienda

In Figure 1 can be observed that the GDP fluctuates as the economic theory indicates. The periods 2003 and 2015 are below the potential GDP, a valley. On the other hand, the 2007 and 2011 periods above, a peak After the 2002 macroeconomic crises the GDP began recovering, especially due to the commodities higher prices and debt default. Until 2007 the GDP growth was incredibly high, the world economy was growing, the global demand for argentine products was bigger and the expansionary fiscal and monetary policy. The Financial Crises of 2008 affected the country's exports, but a great deal of domestic consume measures were taken. Finally, in 2011, the country was still growing but at a high price. The monetary expansion was huge and so the inflation rate, fiscal deficit began being unsustainable and the central bank reserves were going down due to a virtual fixed exchange rate. The 2015 period meant an end to the *Partido Justicialista's* government of 12 years, and the outcome of populist measures were visible. The country was at a stagnation-inflation period, with big fiscal issues and the world's economy recovering slowly from the 2008 crises.

To summarize, the economic model began in a valley period, was effective until 2015, when the measures taken had rough countermeasures to be taken in order to fix the economic course. There are two periods of valley and two periods of peak.

Then the Gini coefficient was calculated from the Lorenz curve method. Although the limitations the coefficient has to be compared, it is compared between periods of time to have an idea of the income distribution evolution. The index is between 0 and 1, being 0 perfect equality.

Table 1. Gini coefficient

REGION	2003	2007	2011	2015
ARGENTINA	0,492	0,474	0,487	0,465
NORTHWEST	0,330	0,329	0,393	0,307
NORTHEAST	0,316	0,268	0,306	0,244
CUYO	0,402	0,368	0,374	0,383
PAMPA	0,484	0,462	0,467	0,461
BUENOS AIRES	0,607	0,517	0,507	0,491
PATAGONIA	0,638	0,680	0,671	0,695

The index shows mixed data. There is a notable correlation between the economic cycle and the coefficient (inequality is reduced during economic growth) in the metropolitan area of Buenos Aires, but in the other regions is different. Tax promotions helps some regions, meanwhile others suffer the fixed exchange rate and lose considerably competitiveness for their export.

Wages have, instead, a bigger and clearer correlation with the economic cycle. The country average and the regions have similar behavior.

Table 2. Wages by region

REGION	2003	2007	2011	2015
ARGENTINA	7.775	9.462	9.733	9.049
NORTHWEST	5.618	4.686	7.411	6.994
NORTHEAST	5.578	7.019	7.462	7.188
CUYO	6.511	8.268	8.295	8.133
PAMPA	7.796	9.406	9.653	9.022
BUENOS AIRES	10.225	10.349	10.942	9.285
PATAGONIA	11.523	14.503	14.122	13.713

The economic analyses was crucial for amplifying the outputs given by the econometric data. The continuity of measures implemented directly to improve equality, growth and development have to be studied deeply in order to rate the efficiency of the politics.

Econometric Estimations

The econometric model was worked with the software Eviews 9. The following tables show the outputs from the regressions for each period of time.

Table 3. Output regression by period

2003				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	6,15	0.072211	8521920	0.0000
Education	0,23	0.004178	5518538	0.0000
Age	0,07	0.002769	2493035	0.0000
Age2	-0,001	3.19E-05	-2072311	0.0000
Region	0,12	0.004001	3006400	0.0000
Gender	-0,46	0.013313	-3487333	0.0000
Labor Dependence	0,13	0.012242	1022356	0.0000
R-squared	0.297038		F-statistic	9351664
Adjusted R-squared	0.296720		Prob(F-stat)	0.000000
Durbin-Watson stat	1,78			

2007				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	6,81	0.057789	1177852	0.0000
Education	0,22	0.003233	6844791	0.0000
Age	0,07	0.002294	2871265	0.0000
Age2	-0,001	2.68E-05	-2524982	0.0000
Region	0,15	0.002852	5175577	0.0000
Gender	-0,54	0.010133	-5281193	0.0000
Labor Dependence	0,04	0.009248	4812521	0.0000
R-squared	0.329748		F-statistic	1622960
Adjusted R-squared	0.329545		Prob(F-stat)	0.000000
Durbin-Watson stat	1,74			

2011				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	7,04	0.058806	1197100	0.0000
Education	0,20	0.003378	5960626	0.0000
Age	0,06	0.002414	2559470	0.0000
Age2	-0,001	2.80E-05	-2222063	0.0000
Region	0,13	0.000856	8347784	0.0000
Gender	-0,49	0.010382	-4731265	0.0000
Labor Dependence	0,18	0.009463	1927450	0.0000
R-squared	0.229603		F-statistic	1009478
Adjusted R-squared	0.229376		Prob(F-stat)	0.000000
Durbin-Watson stat	1,77			

2015				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	6,47	0.054834	1180635	0.0000
Education	0,19	0.003115	6050381	0.0000
Age	0,06	0.002198	2810815	0.0000
Age2	-0,001	2.52E-05	-2436268	0.0000
Region	0,11	0.002674	4190705	0.0000
Gender	-0,47	0.009351	-5062820	0.0000
Labor Dependence	0,22	0.008761	2518212	0.0000
R-squared	0.282011		F-statistic	1330396
Adjusted R-squared	0.281799		Prob(F-stat)	0.000000
Durbin-Watson stat	1,74			

The output regressions show how the Mincer equation adjusts correctly (R-Squared 0.28; Prob (F-Stat) 0). Each variable, including Labor Dependence, are statistically significant and have the expected sign (positive or negative). The results and findings are statistically satisfying.

The research from Luciano DI CRESIA and Alberto PORTO “Gasto Público Social” (2011) helps explaining why Labor Dependence was significant and countercyclical. The fiscal spending in Argentina has grown considerably, and continued until 2016, and near 30% of the whole estate expenditures are assigned to salaries.

The permanent workers in the argentine estate has been doubled since 2003 and the real wages improved. The legal structure in the country creates a bias towards the employee (especially estate employees) making difficult and expensive to fire an employee. Due to it, the unions succeeded protecting the labor force, establishing a considerable stability for workers, but slowing down the new hiring.

Besides, the Region variable was also significant. As it was explained in the introduction, Argentina has a diversified economic structure. Also it can be seemed that were poverty and inequality is higher, wages are lower (it will be shown further on this paper). In recent literature about georeferention linked with the economic structure, exchange ratio, fiscal correspondence and federal expenditures show how the income distribution and federal investment is irregularly spent and has historically been disorganized.

Results and Findings

The econometric analysis was not wide in order to focus it on the economic relation. The economic cycle affects directly most of the activities in different ways. Making inferences without the proper data may imply design political measures to contain the economic cycle consequences incorrectly.

Economic Cycle

The following table shows how each coeffcieint varies according to the economic cycle status.

Table 4. Coeffcient behavior according to the economic cycle

VARIABLE	2003	2007	2011	2015
Gini Banco Mundial	0,535	0,474	0,436	0,546
Gini EPH	0,491	0,478	0,471	0,465
C	6,15	6,81	7,04	6,47
Education	0,23	0,22	0,20	0,19
Age	0,07	0,07	0,06	0,06
Age2	-0,00066	-0,00068	-0,00062	-0,00062
Region	-0,46	-0,54	-0,49	-0,47
Gender	0,12	0,15	0,13	0,11
Labor Dependence	0,13	0,04	0,18	0,22

The traditional Mincer equation variables have different correlation with cycle than expected. The C constant behavior means that the wage increases as a result of the economic bonanza. The Education factor, which only takes into account the formal education, has descendant tendency. According to the World Economic Forum's recent reports, the labor market demand is changing, considering not also the college degree but also other skills like idioms, computer related, social networks, multitasking, etc. Argentina is extremely competitive in areas like agriculture research and software development. Adding the new service export structure this new skills explain why the country is also affected by the worlds tendency even though in the last years the country partially closed its borders. Experience, represented by Age, has a similar behavior like Education due to the grater management of the recent explained skills that young people has. Also the TIC's and Computing jobs are very well paid in Argentina making the coefficient act this way. The gender inequality has been treated in several laws in the las periods, affecting the coefficient and closing the gap between male and female employees. However, the gap is still big and the legal structure cannot fix it completely.

On the other hand, the added variables had an expected behavior. The region variable is widely cyclical. The Pampa, Patagonia and Buenos Aires regions are beneficiated by the cycle, having considerable tax cuts when economy is doing well and implemented when the federal government has an increasing deficit. But the rest of the regions suffer the lack of strong markets for their exports and the exchange rate volatility make and amplifying effect on their cycle. Therefore, the previously mentioned lack of federal policies, makes the difference between regions is wide and the variable to behave cyclical. Labor Dependence also showed to be correlated to the cycle but negatively. In periods of prosperity the company's do not have economic stimulus to share the profits with the employees because during valley periods the legislation in labor obliges them to keep the employees on their expenses even if the company may shut and go to bankruptcy. In effect, when the cycle is in a peak moment the Labor Dependence is worst, but the stability during the valley period compensates it.

The next table shows in a chart the behavior of all the variables in order to predict a future continuity and elaborate correct policies.

Table 5. Variables behavior

VARIABLE	BEHAVIOR
Education	Descendant
Age	Descendant
Gender	Descendant
Region	Ciclical
Labor Dependence	Ciclical

Gini Index

It is clear enough to acknowledge that the Gini index has a strong relation with salaries. Part of the income of individuals (most of it) comes from their job. However, the data used in the research refers to income and not just wages, mainly because in Argentina exists a big portion of non-permanent income sources such as housing rental, limited time contracts and season jobs.

The table shows two Gini indexes, one calculated from the data collected and used in the regressions, the other from the World's Bank.

Table 6. Gini index

GINI	2003	2007	2011	2015
Gini Banco Mundial	0,535	0,474	0,436	0,546
Gini EPH	0,491	0,478	0,471	0,465
ARGENTINA	7.775	9.462	9.733	9.049

At first glance it can be seemed that inequality is cyclical. The following table provides a deeper look sorted by region of the index and the average income.

Table 7. Gini index and average income by region

REGIÓN	2003	2007	2011	2015
Argentina	7.775	9.462	9.733	9.049
GINI	0,491	0,478	0,471	0,465
Northwest	5.618	4.686	7.411	6.994
GINI	0,330	0,290	0,343	0,307
Northeast	5.578	7.019	7.462	7.188
GINI	0,316	0,268	0,306	0,244
Cuyo	6.511	8.268	8.295	8.133
GINI	0,402	0,368	0,374	0,383
Pampa	7.796	9.406	9.653	9.022
GINI	0,484	0,452	0,437	0,451
Buenos Aires	10.225	10.349	10.942	9.285
GINI	0,607	0,517	0,507	0,493
Patagonia	11.523	14.503	14.122	13.713
GINI	0,638	0,680	0,610	0,695

Regarding the Gini Index correlation with the economic cycle there are two aspects to take into account. In first place, the regions follow the national tendency, when economy gets better also the inequality and the region inequality. Secondly, the inequality and the general individual income are strictly related, having both the same behavior. In order to expand the certainty for this, a regression analysis was made for Gini Index and Average Real Income.

Table 8. Gini index & average real income regression output

Dependent Variable: AVERAGE REAL INCOME				
Method: Least Squares				
Included observations: 28 after adjustments				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	1.163.702	8.215.016	1.416.555	0.1685
GINI	17501.20	1.787.456	9.791.118	0.0000
R-squared	**0.786651**	Mean dependent var		8.918.607
Adjusted R-sq	0.778445	S.D. dependent var		2.451.294
S.E. of regressi	1.153.815	Akaike info criterion		1.700.828
Sum squared r	34613498	Schwarz criterion		1.710.344
Log likelihood	-2.361.160	Hannan-Quinn criter.		1.703.737
F-statistic	9.586.600	Durbin-Watson stat		1.788.594
Prob(F-statisti	0.000000			

Figure 2. Regression analysis. Gini index & average real income

The regression shows how related the two variables are, the R2 coefficient was 0,786, an statistical high correlation. At higher income average, higher inequality. The highest inequality is in Buenos Aires metropolitan area, were coexists the biggest service indsutry Head Quartes for the country and region, the industrial area and the largest poor areas of the country (including Villa 31). Therefore, high wages and great income distribution issues.

An intuitive answer exists for it. While the average rises, and the basic wage does not in the same proportions, it is clear that the high earners get more and distribution get worse. GASPARINI (2012) researched about this issue and the correlation between education and inequality. He concluded that in Argentina the access to education is not completely equal and it is a big resposable for inequality. In first place, Buenos Aires

concentrates the most prestigious and expensive universities, creating regional differences. On the other hand, certain jobs and companies exclude some universities from their labor force selection.

Predictions

From the econometric coefficients obtained, some predictions were made to show a sample of the relevance that education and gender has in the labor market actually.

Education in Argentina is incredibly cheap and in some areas and universities completely free. Moreover, there are several financial aids besides the free fee. However, the opportunity cost of studying still keeps a big portion of society away from college. The following charts explains how it affects the income earn and the timing of it.

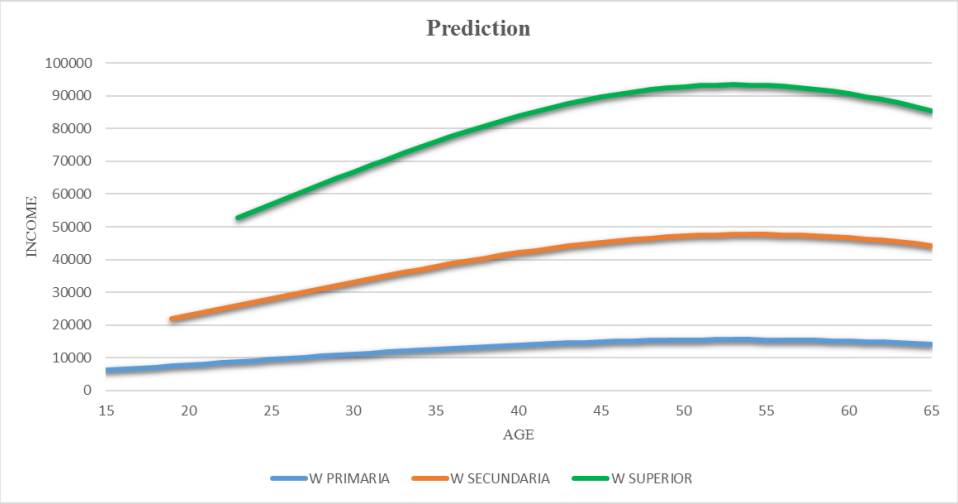

Figure 3. Income according to education level

In the figure can be observed that the biggest gap is between the College degree and the High School. It is a considerable difference, not only in the average wage, also in the maximun wage gain age. The reason why at college degree incomes decreases faster is that the hours worked and the retirement age is earlier due to a bigger saving capacity. Also it can be seen that the working years are less. The entrance to the labor market is later (time spent studying and the opportunity cost is higher) but it is highly rewarded. In this line, Rober LUCAS work on "The Mechanics of Economic Development" reflects education as an productivity engine.

In gender inequality the gap is big in Argentina. Although this period has been well known for working agaisnt it, the labor market still has a male bias towards hireing and wages.

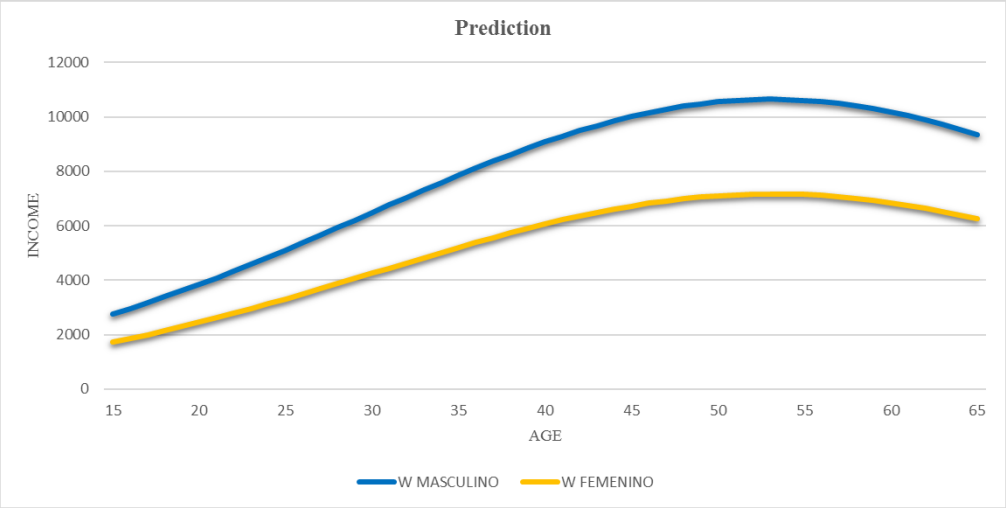

Figure 4. Gender income gap

Some explanations have been provided in several papers. Argentina has a maternity license and it keeps women away from working for a year; it is thought that this makes men have an advantage in company's structure, and gives an economic incentive to recruiters to hire men. Besides from the patriarchal culture that the country has.

Conclusion

After the Macroeconomic and Econometric analysis, it can be inferred how the investment in Human Capital is highly rewarded both for companies and individuals, despite the opportunity cost. Experience is still being considered as an attribute and are reflected in wages. On the other hand, in a dynamic analysis it can be appreciated that the relevance of them are slowing and other skills are beginning to be considered. The gender gap has to be treated more aggressively from the federal government via economic stimulus theory, not only with legislation that sooner or later, the labor market finds a way to avoid it.

Another consideration to take into account is the Labor Dependence behavior regarding the economic cycle. It has been correctly accomplished to insure stability for workers, but the opportunity cost for it is a higher natural unemployment rate, a big young unemployment and higher cost structure; while independent workers and non-regulated jobs earn less due to natural compensation.

Regarding the regional factor, it is clear that regional economies suffer more from the cycle variances, mainly for unregulated and disorganized federal policies. In Argentina the North and West areas are not being take into account for macroeconomic planning.

The Gini index gives a wide specter of the national and local inequality. Disregarding the country has not a serious inequality problem compared to other neighbor countries like Chile and Brazil, inner inequality and a high correlation between the cycle and the income distribution must alert the central government to fix their agenda. Very few measures are implemented to avoid cycle issues, many that can be easily put into practice and it is vital like a saving fund (like Chile's Copper Saving Fund).

Finally, the Development Paradox presented by GASPARINI (2012) alerts that the free education is more a mean than an end and the education monopoly of Buenos Aires principally has to be treated with a long term vision.

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THE ROLE OF RESEARCH-BASED CURRICULAR UNIT ON STUDENTS' SYSTEMS UNDERSTANDING OF HUMAN IMPACT ON THE ENVIRONMENT

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Abstract: The research-based curricular unit presented in this proposal is a response to the new tide of educational reforms in the United States. This curricular unit represents an attempt to frame K-12 science curriculum around three dimensions: crosscutting concepts, disciplinary core ideas and scientific practices recently released in the report on a Framework for New K-12 Science education (National Research Council, 2012). Integration of three dimensions into the development of agriculture-related curricular unit reflects complexity and logic inherent in science education facilitating systems understanding of environmental issues. The development of this learning unit takes place under the initiative of the National Science Foundation (NSF) funded project to explore the efficacy of the agriculture-related unit on high school students' systems understanding of the human impact on natural systems. The presented unit embodies characteristics that identify research-based curricular unit (Clements, 2007). Preliminary results presented in this study demonstrate potential of close adherence to features identifying research-based curriculum in supporting systems understanding of environmental problems. Mediation results of this nature have larger implications on future efficacy of curriculum intervention.

***Keywords*:** Crosscutting concepts, disciplinary core ideas, systems understanding

Introduction

Educational Standards

The ongoing development of the curricular unit presented in this proposal is a response to the demand of framing K-12 science curriculum around multiple dimensions recently released in the report on a *Framework for New K-12 Science Education* (National Research Council [NRC], 2012), which served as a foundation for the development of *Next General Science Standards (NGSS*; NGSS Lead States, 2013). Articulating science standards has been central in creating a vision of what subject matter content had to be taught and identification of learning goals (Clements, 2007; Krajcik et al., 2008). To that extent, national science standards have historically served as a starting point in identifying scientific ideas that would optimally contribute to the development of students (Krajcik et al., 2008). However, the translation of science standards into curriculum materials is not without challenges. Multiple aspects need to be taken into consideration when framing curriculum around standards (Debarger et al., 2016; Taylor et al., 2015). With the release of the *Next Generation Science Standards (NGSS*; NGSS Lead States, 2013) emerged the need to integrate new disciplinary core ideas, crosscutting concepts, and scientific practices into the curriculum design (Debarger et al., 2016; Taylor et al., 2015).

In the current study, we draw parallel between these three dimensions and features that identify research-based curriculum to outline potential avenue for the development of the learning unit that promotes integrated vision of agricultural impact. Thus, crosscutting concepts exemplify intellectual tools by which scientists connect

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scientific ideas across science disciplines (Krajcik et al., 2014). For instance, *cause and effect, or systems* crosscutting concepts serve as unifying themes by which scientists connect scientific ideas. To that extent crosscutting concepts represent syntactic structure of science that is reflected in the hierarchical representation of disciplinary content consistent with the logic of science (Fenstermacher, 1980). Disciplinary core ideas are central to each science field as they provide an explanation for a host of discipline-specific phenomena (Krajcik et al., 2014). For instance, *Human Impact on Earth Systems* is a disciplinary core idea that explores influences of human actions on the environment and requires students to engage in evidence-based scientific practices in order to counteract adverse effects of poor management of planetary resources (NRC, 2012). The impact of intensive agriculture on the environment provides a relevant example of human-induced influence on natural systems communicated in current educational reforms and a real-life context to investigate mechanism underlying this interference. This paper argues for the integration of *NGSS* standards into curriculum development as the potential avenue for a design of research-based curricular unit that supports systems understanding of environmental issues (Taylor et al., 2015).

Systems Understanding

Despite the growing recognition and interest towards systems thinking, little is known about the ways to assist students in developing systems understanding (Kali, Orion & Eylon, 2003). This interest stems from advantages that systems thinking offers to the field of education (Kali et al., 2003). To develop an understanding of systems thinking, we need to provide a departing definition for systems. Definition of systems by O'Connor and MCDermott (1997) presents system as an entity that maintains its existence and functions as a whole through the interaction of its parts. The difficulty of understanding complex systems is evident in students of all ages (Assaraf & Orion, 2005; Kali et al., 2003). It has even been argued that systems thinking is an innate ability rather than something that can be taught (Gudovich, 1997). Yet another camp of researchers address ways of overcoming student tendency to compartmentalize knowledge (Assaraf & Orion, 2005; Kali et al., 2003; Orion, 2002). These researchers argue that students rarely spontaneously integrate knowledge presented in isolation and need to be assisted in integrating knowledge and developing systems understanding of complex scientific phenomena (Songer & Linn, 1991). Despite the obvious advantages that systems understanding has to offer, its potential remains largely unexplored in science education (Kali et al., 2003). The need to explore the potential of developing systems understanding among students becomes even more critical during the current educational paradigm emphasizing complex environmental issues in the science curriculum (Assaraf & Orion, 2005).

A new vision set forth by The National Research Council's *Framework for K-12 Science Education* (NRC, 2012) focuses on smaller number of disciplinary core ideas (DCI) that creates space to explore particular phenomena using crosscutting concepts. Crosscutting concepts, such as *cause and effect* or *systems*, serve as intellectual tools by which scientists explore fundamental aspects of the nature and connect important ideas across all science disciplines. Use of crosscutting concept exploring causal relationships between materials allows students explore processes at the lower level in order to provide explanations for observable macroscopic phenomenon (Williamson, 2011). This use of crosscutting concepts as the way to explore mechanism underlying human impact on the environment closely parallels the definition for skills that promote system-thinking: (a) understanding the parts of a system, (b) understanding the connections/process among these parts, and (c) understanding the system as a whole (Kali et al., 2003). Research-based curricular unit presented in this paper closely adheres to the level definition of system-thinking skills by exploring crosscutting concept of causal relationships within biogeochemical cycles to uncover mechanism and facilitate systems understanding among students.

Critical Features Identifying Research-Based Curriculum

Educational scholarship recognizes constructivism, coherence, and 'educativeness' as three critical characteristics identifying research-based curriculum (Clements, 2007; Taylor et al., 2015). In arguing for the adherence to these characteristics during curriculum development, we draw heavily on the main general principles inherent in Curriculum Research Framework (CRF) developed by Clements (2007) and proposed for the construction of research-based curriculum in science education. While developing theoretical underpinnings for the features of research-based curriculum we explore the extent to which they overlap with the three dimensions.

Intersection of Constructivism and Crosscutting Concept Dimension

Recent re-emphasis in cognitive psychology on the active role students play in constructing knowledge individually and by interacting with the social community has spawned a renewed interest toward constructivism and its potential in contributing to curriculum theory and practice (Osborne, 1996). Much of the newly embraced constructivism emphasizes the importance of social interaction that generates a community of inquiry. However, as inspiring as social constructivism sounds, it fails to provide any specific guidelines for creating communities of inquiry (Osborne, 1996; Terwel, 1999). Research categorizes different interpretations of constructivism and inconsistency of vision surrounding its role in education as key reasons for this lack of specificity in identifying guidelines under which a community of inquiry can flourish (Terwel, 1999). As a result, researchers resort to the description of ideal educational circumstances under which constructivism could be utilized to its optimal potential (Taylor et al., 2015; Terwel, 1999). According to Clements' CRF (2007), the instructional model defines the sequence of activities structured in accordance with the model of students' cognition based on the principles of constructivism. Therefore, employment of various learning models, such as the 5E or its predecessor the Learning Cycle, is a main path in which research on curriculum development attends to constructivist learning (Taylor et al., 2015).

Similar to constructivism, crosscutting concepts represent strategies attending to general epistemology of knowledge construction, for they apply to all sciences and address the way humans attempt to understand the fundamental aspects of nature (NRC, 2012; Sandoval & Reiser, 2004). The emphasis on the overlap between constructivism and crosscutting concepts underscores the importance of utilizing crosscutting concepts during the process of curriculum development as the dimension attending to the principles of constructivist learning. The implication of this connection should reflect on the way curriculum developers and teachers structure curricular components and arrange sets of activities into an instructional sequence (Taylor et al., 2015). Throughout the sequence of cognitive tasks, students apply the canonical strategy of establishing patterns or causal relationships and learn to recognize similarities among science disciplinary core ideas that are united by the means of crosscutting concepts, thus attending to general epistemological commitments of constructivism reflected in *NGSS* (NRC, 2012; Osborne, 1996; Sandoval & Reiser, 2004).

Intersection of Coherence and Disciplinary Core Ideas

Although general epistemological commitments are consistent with principles of constructivism, they lack key organizing concepts of a particular single discipline that typify the discipline-specific concepts involved in descriptions, explanations, and predictions of natural phenomena (Krajcik et al., 2014; Sandoval & Reiser, 2004). As the dimension central to each science, disciplinary core ideas provide an explanation for a host of discipline-specific phenomena and typify substantive structures that ensure coherence in the discipline (Krajcik et al., 2014). Therefore, it is through the adherence to disciplinary core ideas that curriculum developers would be attending to the coherence of the research-based curriculum materials (Taylor et al., 2015).

In promoting coherence, curriculum developers arrange learning activities within coherent conceptual framework that reflects the logic of the science discipline from which the subject matter derives (Schmidt et al., 2005; Taylor et al., 2015). Similarly, Clements' CRF defines subject natter as a foundation that plays central role in generating students' development of future understanding (Clements, 2007). Adherence to the conceptual framework becomes instrumental in integrating disciplinary core ideas with scientific practices and unifying crosscutting concepts while coordinating learning goals, cognitive tasks and assessments (Krajcik et al., 2014). One of the ways of strengthening coherence of the curriculum development process is the use of conceptual flow graphics (CFGs) (Taylor et al., 2015). Curriculum developers use CFGs to overlay a constructively arranged sequence of cognitive tasks with disciplinary core ideas creating conceptual storyline (Fig. 1).

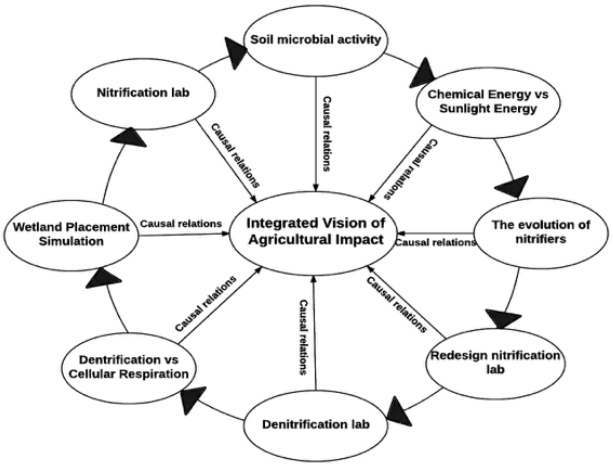

Figure 1. Conceptual Flow Graphic (CFG) of the activities

Adherence to 'Educativeness'and Carving Space for Collaboration

Clements' framework refers to 'educativeness' as 'educationally effective' achieved via employing certain pedagogical strategies (Clements, 2007). Clements' substantiation of 'educationally effective' draws upon the research that discuss instructional strategies emphasizing conceptual development (Hiebert, 1999; Schneider et al., 2005). Following Clements' substantiation of 'educativeness', we ground the discussion on 'educativeness' of curriculum materials by focusing on the explicit teacher support for learning, such as pedagogical support, which is embedded in the curricular materials (Schneider & Krajcik, 2002; Taylor et al., 2015). However, current research points to the imminent tension arising as a result of having to incorporate particular curriculum despite clear pedagogical support (Krajcik et al., 2008; Taylor et al., 2015).

Professional development and collaboration can mitigate this tension by providing opportunity for teachers to study materials thus increasing teachers' knowledge of the rationale underlying instructional decisions embedded in the curricular materials (Taylor et al., 2015). Collaboration opportunities provide teachers with higher level of engagement, which leads to frequent interactions with curriculum materials and teachers' improved ability to design tasks and questions that would promote student thinking (Webb, 2005). Therefore, professional development and collaborative learning with the curriculum developers carve the space for teachers to interact with the educative nature of curricular materials and to take full advantage of research-based curriculum materials. These collaborative learning opportunities and educative provisions should account for potential difficulties that teachers face when adapting curriculum materials into their existing curricular repertoire (Davis & Krajcik, 2005; Remillard, 1999).

Method

Participants

The study was conducted in a paired pre-test-post-test design with 31 senior high school students enrolled in the elective course of ecology at Mankato East High School. Majority of the students 28 out of 31 had General Biology background. 3 students out of 28 had Chemistry background. The school is located in Blue Earth County which has been under intensive agricultural development.

Research-Based Curricular Unit

The agriculture-related curricular unit developed for this study coordinates leaning goals, cognitive tasks and assessments around *NGSS* dimensions and exemplifies a tension between social system and the environment (NRC, 2012). The unit includes lab studying the intersection of two biogeochemical cycles (nitrogen and carbon) and the use of agriculture-related software simulation interspersed with discussion and knowledge integration activities. The implementation of this learning unit took place after 10 lessons committed to traditional approach of rote memorization towards learning carbon and nitrogen cycles in isolation. The aim of

this study was to investigate the influence of a research-based learning unit in mediating students' systems understanding of human influence on water quality and greenhouse gas effect.

Attendance to Critical Features During the Development of Agriculture-Related Unit

As an educational offshoot of the NSF funded research project, the proposed agriculture-related unit stems from the collaborative efforts between the science education researcher and high school biology teacher. The significance of sound understanding of environmental problems becomes central for citizen participation in addressing issues stemming from human interference with natural systems (Mohan et al., 2009; Gunckel et al., 2012). Therefore, in order to gain agency in evidence-based decision-making on environment-related issues from a scientific perspective, students need to develop integrated understanding of the agricultural impact on ecological systems.

Attendance to Coherence and Disciplinary Core Ideas

Selection of agricultural impact on the environment resonates with the environmental challenge relevant to students' community which provides the potential for significant environmental education and defines substantive structures creating conceptual storyline. Thus, integration of disciplinary core idea of *Human Impact on Earth Systems* ensured attendance to the feature of coherence during the development of the unit Krajcik et al., 2014; Osborne, 1996). One of the nutrients implicated in the impact of agriculture is nitrogen. The unit intended to explore molecular components involved in the nitrogen cycle and variables that influence the processes connecting these components within the context of agriculture. Since biogeochemical cycles do not operate in isolation, the unit focused on the intersection of the nitrogen cycle with the carbon cycle as a mechanism underlying agricultural impact on the environment.

Attendance to Constructivism and Crosscutting Concepts

By engaging crosscutting concept of *cause and effect*, unit attended to the general epistemological commitments of constructivism (Sandoval & Reiser, 2004). By exploring causal relationships linking molecular components of the nitrogen cycle and carbon cycle, students discover biological processes that link molecular components. Such an approach intends to facilitate students' understanding of lower level activities and encourage students to use causal relations to construct evidence-based explanations about higher level observable phenomenon (Williamson, 2011). Detailed study of an intersection of two biogeochemical cycles that accounts for variations in the interactions among molecular components helps to promote understanding of a feedback loop that connects the cycles with the environment (Raia, 2008).

Attendance to 'Educationally Effective' Pedagogical Support-Collaboration

The ongoing collaboration between the high school biology teacher and the researcher has been critical in helping the teacher develop more content specific knowledge on ecological concepts that the teacher previously considered outside of her expertise area. This collaborative experience provided the teacher with opportunities to study the materials and to make instructional decisions regarding the arrangement of the cognitive tasks, instilling the teacher with the sense of ownership of the curriculum materials that will be implemented in spring 2017 (Davis & Krajcik, 2005; Schneider & Krajcik, 2002). The critical importance of collaboration between the teacher and the researcher has been especially pronounced during the collaborative development of questions and tasks to accompany a software simulation exploring the effectiveness of wetland construction. This computer-based simulation is based on the rate of denitrification of the local watershed. Research indicates the advantage of using computer-based simulations in manipulating variables that are outside of user's control in the natural world (Huppert et al., 2002; Trey& Khan, 2008). To such extent the use of this computer simulation intends to promote students' sense of agency in implementing the best land use management practices. At the same time, the effective use of computer simulation is closely connected to the teacher guidance that supports the simulation use (Sandoval & Reiser, 2004; Webb, 2005). The ongoing collaboration with an active involvement of an expert scientist aims to develop a set of questions and tasks to facilitate students' ability in constructing explanations on wetland effectiveness by eliciting evidence-based causal links highlighted throughout the curricular sequence. These collaborative learning opportunities with curriculum developers enable the teacher to capitalize on the embedded educative nature of the unit materials and to participate in the development of cognitive tasks that encourage systems understanding of environmental issues.

Results and Discussion

Pre and post data collected included pre-structured concept maps, free-flowing connection diagrams and written essay concerning the implications of intensive agriculture and wetland as a strategy to counteract those influences and is available only for 24 students out of 31. Preliminary analysis presented in this study focused on the pre and post results of pre-structured concept maps. Pre-structured concept maps included molecular components and macro-level components involved in nitrogen and carbon cycle. Macro-terms, such as plant, amphibians and soil organic matter identify living and non-living entity which connect two cycles at a very conceptual macro-level.

Average number of connections between nitrogen containing molecular components and macro-level entities have increased significantly from pre to post assessment, which at the very least indicates higher efficacy of the research-based unit in comparison to canonical rote memorization. More interesting results show increased number of connections linking molecular components from two cycles-nitrogen and carbon. Students who had higher number of connections linking molecular components from nitrogen and carbon subsystems (cross cycle), demonstrated appreciably higher number of links connecting molecular components within nitrogen cycle (Fig. 2). Conversely, majority of the students who have made higher number of nitrogen connections by linking molecular components that belong within nitrogen cycle to each other, were more likely to connect molecular components belonging to two separate cycle (cross cycle connections). An interesting finding shows that not all students who successfully linked two cycles on the molecular level connected molecular components within the nitrogen cycle. This anomaly requires further investigation to see what other connections might be conducive to the improved understanding of cross cycle connections at the molecular level. These connections are particularly interesting because they reflect links between cycles and potentially indicate systems understanding on the molecular level.

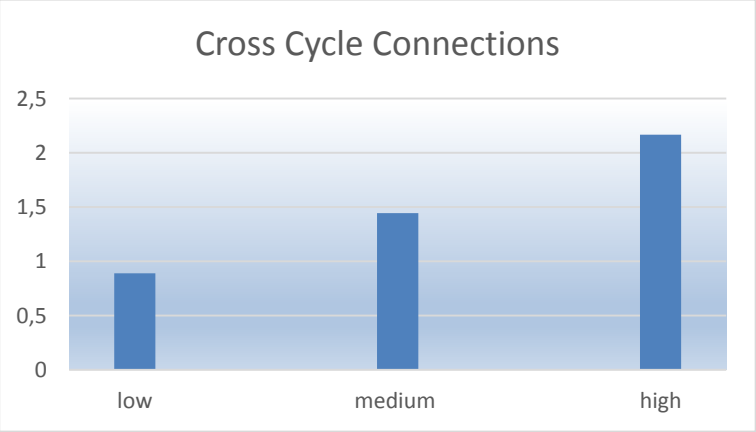

Figure 2. Categories of students based on cross cycle connections

In order to connect the understanding of these processes within biogeochemical cycle with the systems understanding of the agricultural impact on the environment, we need to further our analysis and triangulation of the results from concept map analysis with other pieces of assessment.

Conclusion

This research project intends to explore the avenue of framing curriculum around multiple dimensions recently released in the report on a *Framework for New K-12 Science Education* (NRC, 2012). This study argues for a close parallel between three dimensions and the features that identify research-based curriculum. Moreover, integration of new dimensions into the curriculum holds potential for promoting systems understanding among students. This possibility of developing systems understanding is more promising under the greater emphasis on environmental awareness since systems understanding translates environmental problems into more coherent understanding of the environment (Assaraf & Orion, 2005). The uniqueness of this study stems from testing the impact of coherent agriculture-related curricular unit encouraging students to explore causal links among entities in mapping out the interactive nature of nutrient cycles underlying the human interference with natural systems (Williamson, 2011). The interdisciplinary nature of this project has the potential to show how close adherence to features identifying research-based curriculum and collaborative learning opportunities can support development of coherent curricular unit mediating students' integrated vision of environmental issues. Having coherent curriculum materials consistent with educational reforms and a teacher prepared to use these materials in an

intended manner are critical in enacting opportunities that mediate considerable impact on students' conceptual understanding. Mediation results of this nature have larger implications on future efficacy studies of curriculum intervention.

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LOW-COST REAL-TIME ELECTROMYOGRAPHY (EMG) DATA ACQUISITION EXPERIMENTAL SETUP FOR BIOMEDICAL TECHNOLOGIES EDUCATION

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Abstract: Electromyography (EMG) is a technique used in electro-diagnostic therapy by recording and evaluating the skeletal muscle electrical activity. When muscle cells are activated, electric potential, which is produced by these cells, is detected via an electromyography. These signals can be use analyzing of medical activation levels, anomalies and detection of recruitment order. At the same time they can used to make analyses of biomechanics motions of human or animals. In this study, it was developed a real time EMG data acquisition system based on threshold level. Firstly, it was generated an EMG sensor and it was obtained EMG signals by communication between Arduino and LabVIEW interface by using muscle electrodes. It was purposed to use for developing of a low-cost real-time application in laboratory for biomedical technologies education.

***Keywords*:** Real-Time Electromyography (EMG), experimental setup, LabVIEW, biomedical technologies education.

Introduction

Electromyograph (EMG) makes a diagnosis by measuring and recording electrical activities of muscles. These electrical signals of active muscles are easily obtained with electrodes, which are placed on surface of the skin to identify neuromuscular diseases, kinesiology and motor control disorders in medicine.
In literature, there are several studies based on different algorithms. Classification of EMG signals based on PSO-SVM, artificial neural network and radial bases functions for pattern recognition, and analysis depicting the superiority of ANFIS model (Adaptive Neuro-Fuzzy Inference System) were worked. These signals based on algorithms were used for controls of some type motors like stepper motors, in robotic applications.

In this study, it was developed a low cost real time EMG data acquisition system based on threshold level. Firstly, it was generated an EMG sensor and it was obtained EMG signals by communication between Arduino and LabVIEW interface by using muscle electrodes. It was purposed to use for developing of a low-cost real-time application in laboratory for biomedical technologies education.

- Selection and peer-review under responsibility of the Organizing Committee of the conference

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Methods

Muscle Sensor / EMG Circuit Designing

In designing of EMG sensor, it is exploited from "http://www.instructables.com/id/Muscle-EMG-Sensor-for-a-Microcontroller/", but it is used INA 122 instead of INA106 because it is obtained good results from the study of "ANDRYNOWSKA A., KLEKIEL T." and the signal was boosted 7 times by using resistors.

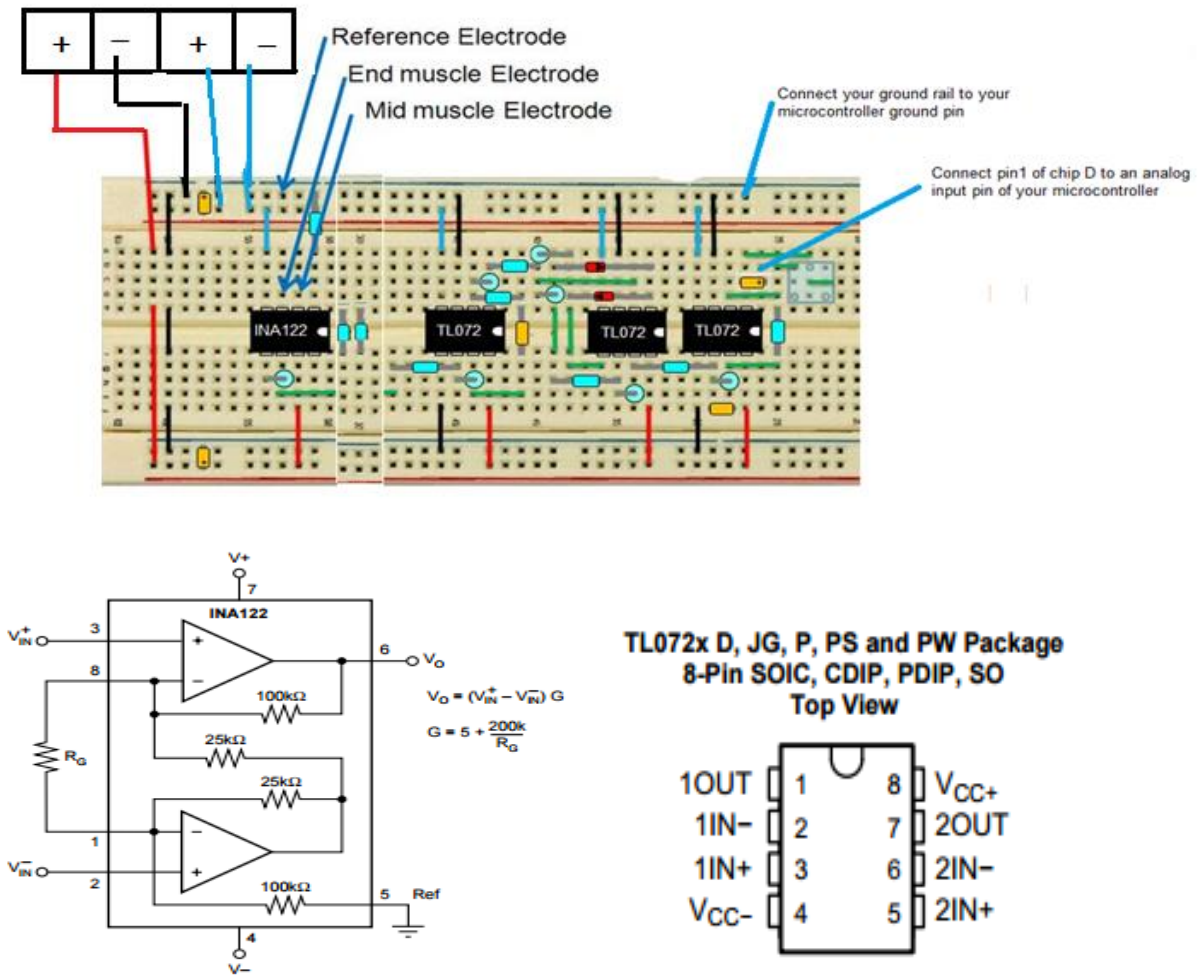


Figure 1. EMG Circuit / Muscle Sensor, INA122 and TL072 pin configurations

As Circuit Chips, three TL072 IC Chip and one INA122 IC Chip were used and, as Cables and as Electrodes, one EMG Cables (set of 3) and three EMG Electrodes were used. As Capacitors, two 1.0 uF Tant, one 0.01 uF Ceramic Disc and one1.0 uF Ceramic Disc were used and as Resistors three 150 kOhm (1%), two 1 MOhm (1%), two 80.6 kOhm (1%), six 10 kOhm(1%), three100 kOhm Trimmer and one 1 kOhm (1%) were used. As Misc, two 1N4148 Diode, some Jumper wires, three Alligator clip cables were used. Above figure, it is given circuit schema and, INA122 and TL072 pin configurations. Next figure shows the EMG circuit design.
Figure 2 shows the EMG circuit design.

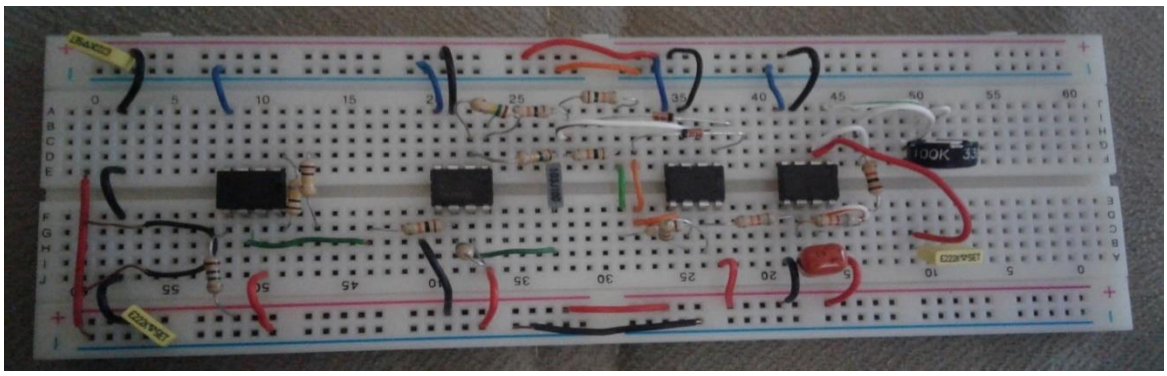


Figure 2. EMG circuit design

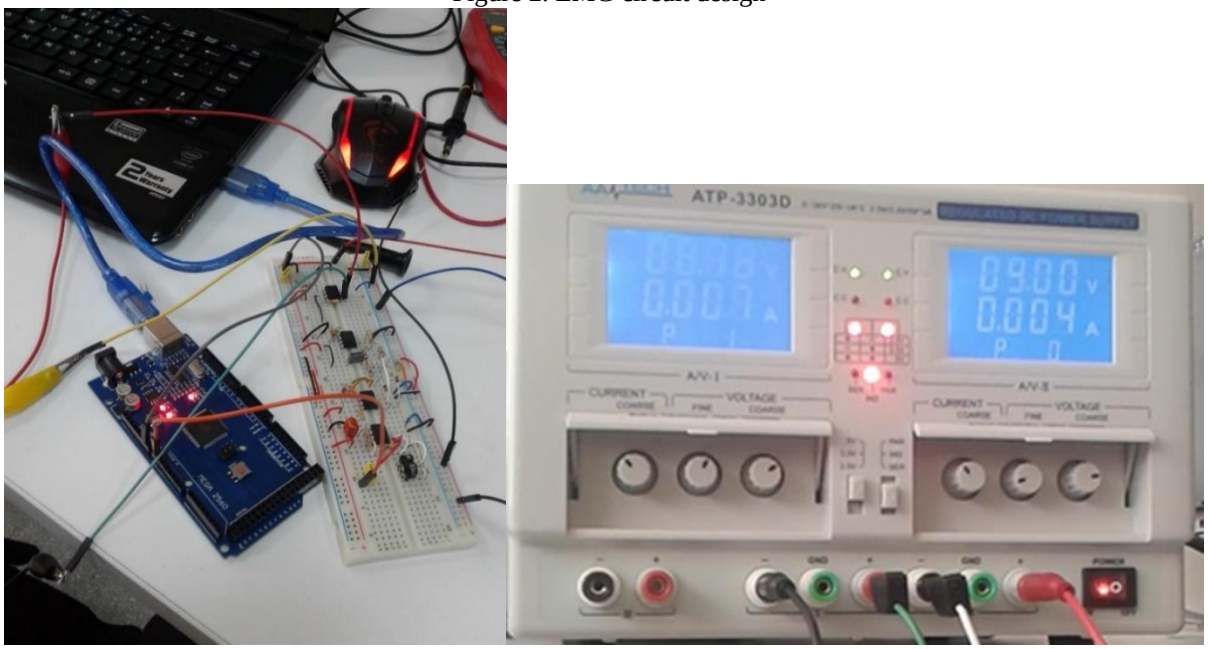


Figure 3. Connection of EMG circuit design and Arduino

EMG Thresholding Algorithm By Using LabVIEW

It was used VISA in NI LabVIEW (2016) programming for taking of EMG raw signal. Figure 3 shows VISA code. In this system, it is needed a +9V and a -9V power supplies. If it is connected two 9V batteries as series, it is gotten a +18V power supply. To obtain -9V, battery1's positive terminal is connected to battery2's negative terminal and it is chosen ground or reference point. Thus, it is obtained +9V as positive terminal of battery 2 and -9V as negative terminal of battery 1 as seen in Figure 3.

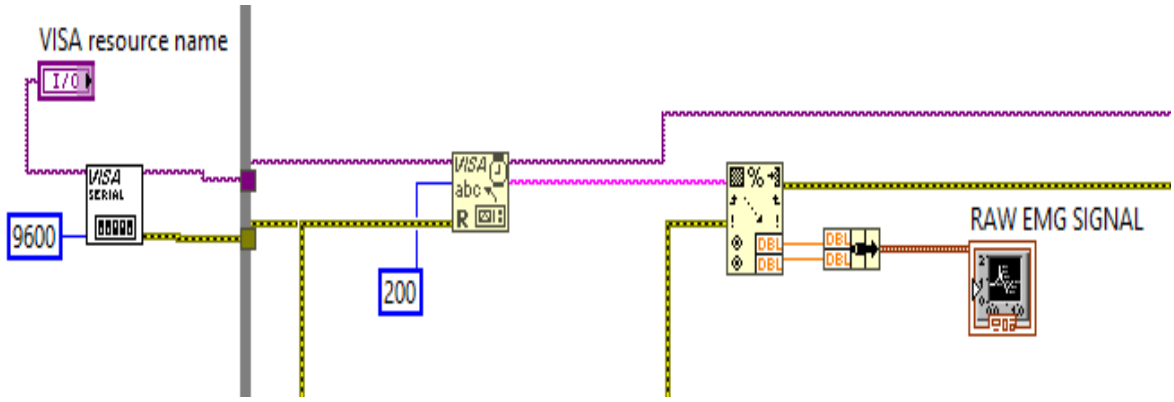


Figure 4. Taking of EMG signal by using VISA in LabView

Above block diagram displays real EMG signal and it is fed into with low pass filter as what is wanted in the EMG acquation system. Obtaining sample data with providing 200 sampling frequency is important in this step.

This signal bases on FFT and FFT is a system makes spectral measurements which include the power spectrum, averaged magnitude spectrum and phase spectrum. At the same time, it is needed high pass filter which has equi-ripple characteristics for obtaining this signal. In Figure 5, it is shown the wavelet denose and it is benefit for reduction of the noise both in 1D and 2D. Filtered signal is given by using Building Waveform and this signal is used as an input signal for multiscale peak detection. In this step, a treshold value of this filtered EMG signal is set for EMG thresholding Peak Level. In this algorithm, initial value is set 0.001 and it can be choosen as per needing of muscle potential.

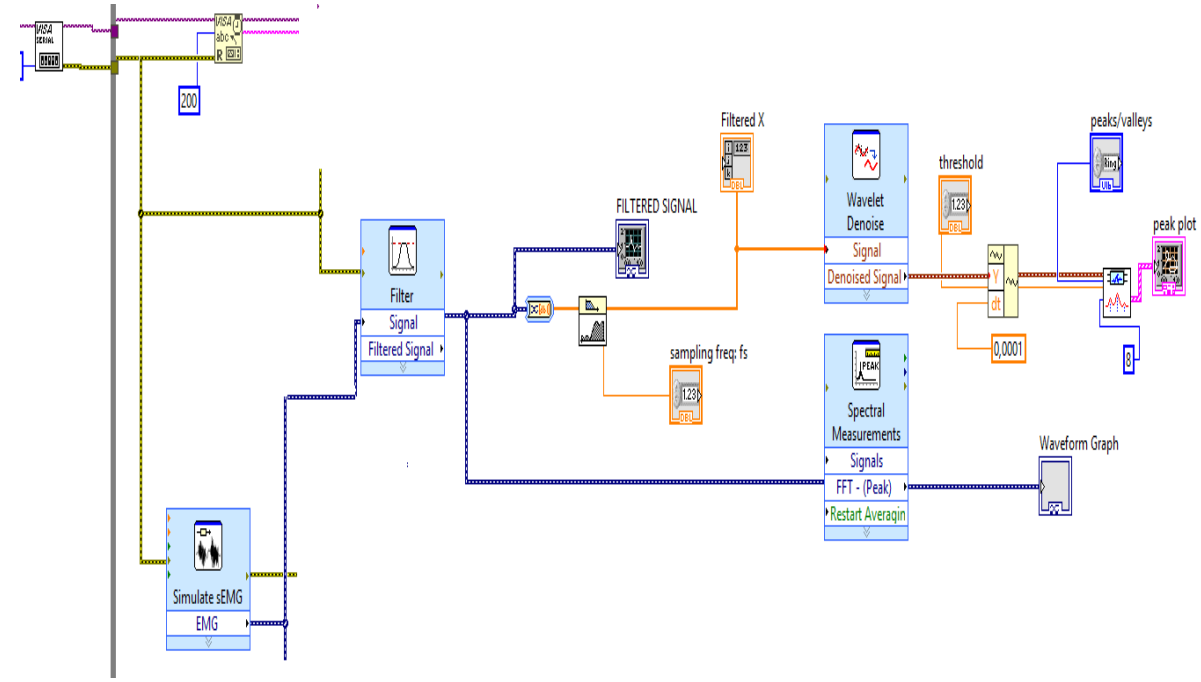


Figure 5. EMG thresholding algorithm by using LabVIEW

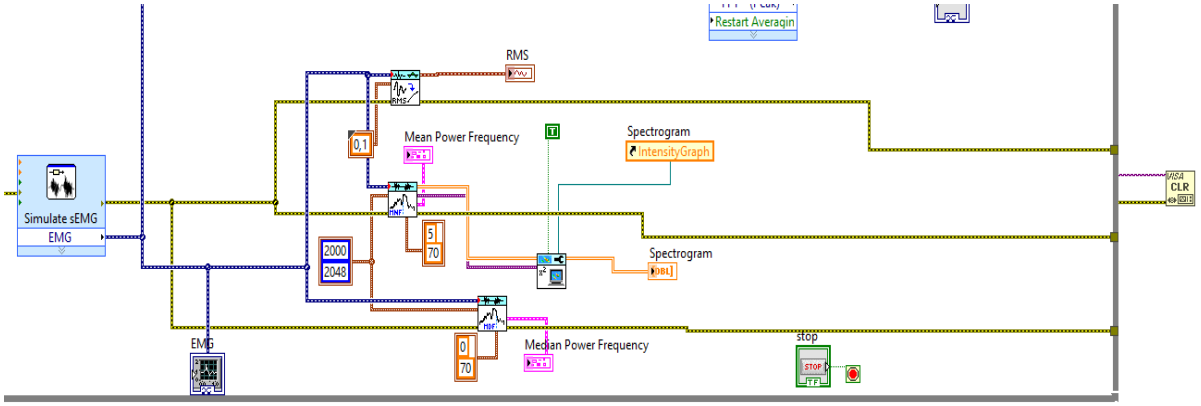


Figure 6. EMG signal mean calculating

Bio signal RMS VI is used to calculate the RMS of EMG signal. EMG Median Power Frequency VI and EMG Mean Power Frequency VI are used to calculate the MDF and MNF. They also provide the spectrogram of EMG signal, which can be visualized using TFA Configure Spectrogram Indicator VI in LabVIEW Advanced Signal Processing Toolkit. Bio signal RMS VI is used for calculating EMG signal's RMS and, EMG Median Power Frequency VI and EMG Mean Power Frequency VI calculates MNF and MDF. Also, it can be obtained the spectrogram of EMG signal by using TFA Configure Spectrogram Indicator VI in LabVIEW Advanced Signal Processing Toolkit. Figure 6 shows these steps.

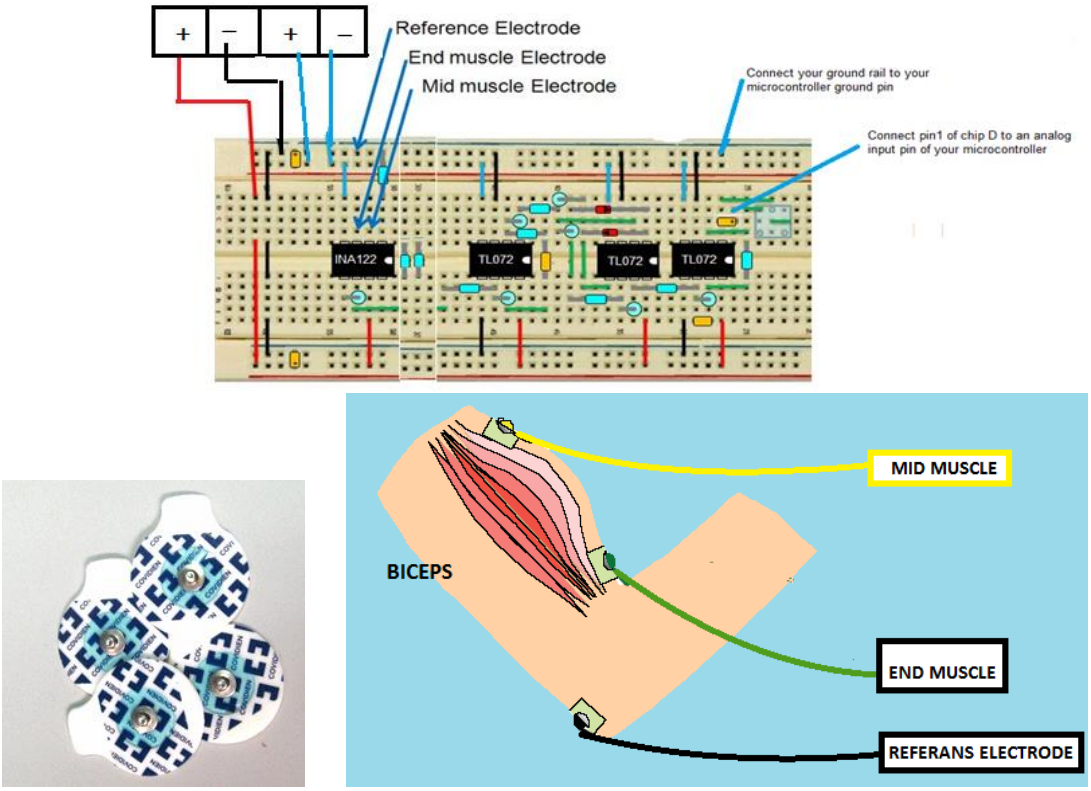
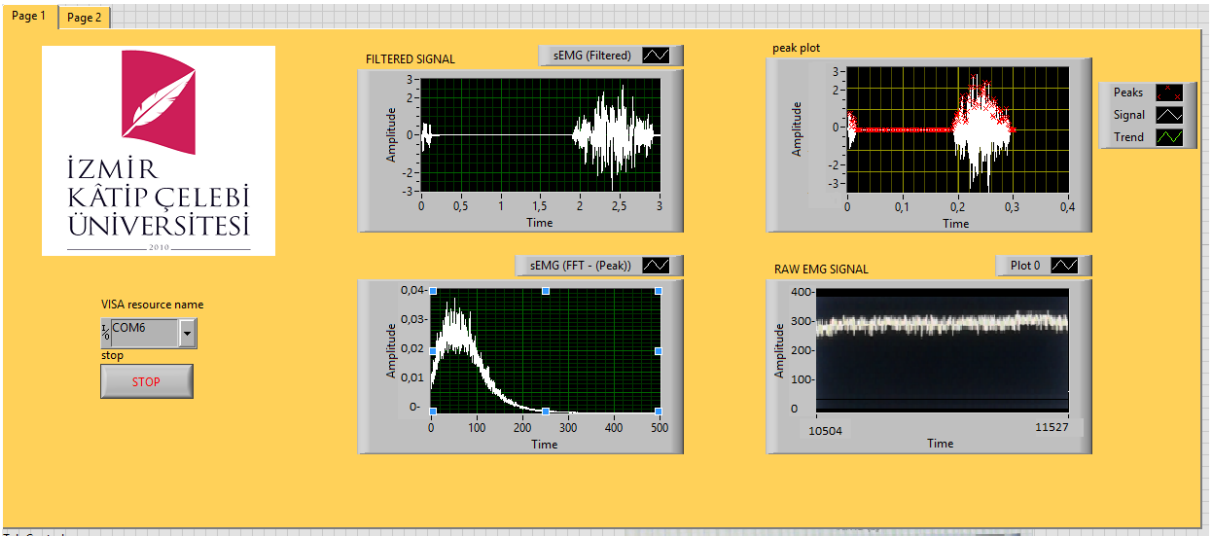


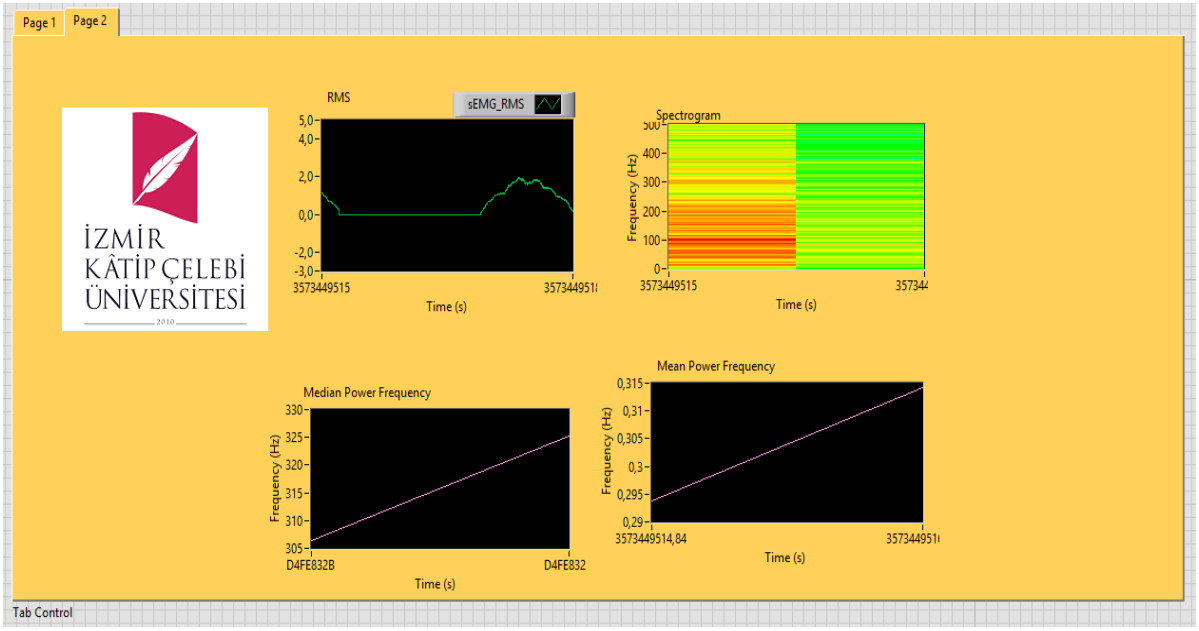
Figure 7. Low-cost real-time electromyography (EMG) data acquisition experimental setup system working schema

*Introduction of the **Low-Cost Real-Time Electromyography (EMG) Data Acquisition Experimental Setup***

Interfaces of the system were designed in LabVIEW programming. EMG signals is taken via Arduino by making connection between EMG electrodes and Muscle Sensor and Arduino with alligator cables as in Figure 7. It was used VISA in NI LabVIEW (2016) programming. It is chosen resource name and the system is started. In Page 1, Filtered Signal, peak plot, sEMG(FFT-Peak) and Raw EMG Signal are obtained as in seen Figure 8 (a). In Page 2, RMS, Spectrogram and Men Power frequency and median Power Frequency Analyses of EMG Signal can be seen as in Figure 8 (b). Arduino codes is given in Figure 9.



(a)



(b)

Figure 8. Interfaces of low-cost real-time electromyography (EMG) data acquisition experimental setup

Figure 9. Arduino codes of the data aquation system

Results and Findings

Obtained EMG signals can be analysed easily and interfaces give clear results to student understandable way. These interfaces permit students with an opportunity to understand about relation and connection between Raw EMG signal and filtered EMG signal. At the same time, it can be seen some evaluations of EMG signal in LabVIEW program.

Conclusion

In this study, it is designed Low-Cost Real-Time Electromyography (EMG) Data Acquisition Experimental Setup for biomedical technologies department. It can be used by the biomedical engineering students to understand of EMG signal analysis and obtained data can be used favor for different studies and analysis. It is hoped that this system can be benefit for student who makes investigation in this area.

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LOW COST REAL-TIME MEASUREMENT OF THE ECG, SPO_2 AND TEMPERATURE SIGNALS IN THE LABVIEW ENVIRONMENT FOR BIOMEDICAL TECHNOLOGIES EDUCATION

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Abstract: Electrocardiography (ECG) is to measure the electrical activity of the heart. Doctors diagnose various cardiac diseases by analyzing this signal. The ECG signal is one of the best diagnostic devices for heart diseases. The purpose of this work is to display the ECG signal in the LabVIEW (Laboratory Virtual Instrument Engineering Workbench) environment. Lowering the cost by designing your own ECG circuit. The program can also easily process the ECG signal in various ways. There is no need to setup any electronic circuit. In addition to the ECG signal, modules with pulse oximeter and temperature indicating oxygen saturation are added. In this study, low cost ECG, temperature and pulse measurements were performed in our own laboratory environment. The measurement circuit was communicated with the LabVIEW program via Arduino. The data received with Arduino is shown after processing in the LabVIEW environment. The program also shows the patient's heart rate and alerts when the patient enters a heart attack.

Keywords: Real-Time Electrocardiography (ECG), temperature, pulse oximeter, LabVIEW, biomedical technologies education.

Introduction

Electrocardiography (ECG) is the process of recording the electrical activity of the heart over a period of time using electrodes placed on the skin. These electrodes detect the tiny electrical changes on the skin. It is a very commonly performed cardiology test. This signal can be used to diagnose heart diseases. But it is difficult to design this measurement system. Because in the conventional method, the electrical signal is picked up by wired electrodes. The electrodes sense the voltage at the mV level. The ECG signal is very small volts, so it is easy to signal the noise. Noise problems arise in cable ECGs. Various filters must be used to prevent this noise. The filtering process may be hardware and software. In this study, both hardware and programmatically filter added. But programmatically adding filters is better because many parameters can be changed. Thus reducing cost by eliminating the need for electronic devices such as capacitors and resistors.

Pulse oximeters measure how much of the hemoglobin in blood is carrying oxygen (oxygen saturation). It has become one of the indispensable devices especially in anesthesia and intensive care units. Normal oxygen saturation level is between 95% and 100%. The device includes a light source and a light sensor. This sensor can be easily measured by a finger the apparatus. The sensor uses its color to detect the blood oxygen ratio. Two different wavelengths of light are sent to the finger using infrared led and red led. The difference of these waves received by the photodetector gives oxygen saturation. In addition, pulse measurements are made.
Temperature is an important parameter for diagnosis. The temperature varies depending on the disease. Temperature measurement is done in this system. These three parameters are very important for the health of the

- Selection and peer-review under responsibility of the Organizing Committee of the conference

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person. In this study, ECG, Temperature and SpO_2 (Pulse) circuits were integrated into the Arduino. The received data was displayed in the LabVIEW environment.
ECG signal is shown in biomedical education in the course of instrumentation. Biomedical signal processing course contains these signals. It is important to learn this signal for biomedical engineers. ECG devices are usually used in biomedical engineering education laboratories. Because the devices are developed, maintained and repaired by biomedical engineers. The instrument is also calibrated by biomedical engineers. But this device is very expensive. In this study, it was developed a low cost real time ECG, Temperature and SpO_2 data acquisition system.

It is clear that personal computer based signal acquisition and analysis is an effective and cost-effective method for patient biomedical signal acquisition and monitoring.
There are many software packages available for the acquisition and display of electrical signals in general. Of these packages LabVIEW, by National Instruments, is one of the most popular and powerful tools available. Therefore, this study was planned to be done with LabVIEW program in computer environment.

Materials & Methods

1-ECG Circuit Designing

Cell ion exchange generates small voltage. This signal is at millivolt level. First the signal is picked up by the electrodes. Then this signal is amplified. The INA129 integrated was used to design the circuit that received the ECG signal. This is an op-amp to boost the integrated low voltage.

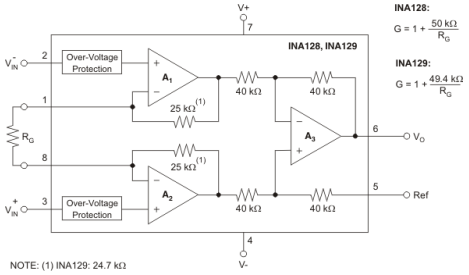

Figure 1. INA129 Functional diagram

DESIRED GAIN (V/V)	INA128		INA129	
	R_G (Ω)	NEAREST 1% R_G (Ω)	R_G (Ω)	NEAREST 1% R_G (Ω
1	NC	NC	NC	NC
2	50.00k	49.9k	49.4k	49.9k
5	12.50k	12.4k	12.35k	12.4k
10	5.556k	5.62k	5489	5.49k
20	2.632k	2.61k	2600	2.61k
50	1.02k	1.02k	1008	1k
100	505.1	511	499	499
200	251.3	249	248	249
500	100.2	100	99	100
1000	50.05	49.9	49.5	49.9
2000	25.01	24.9	24.7	24.9
5000	10.00	10	9.88	9.76
10000	5.001	4.99	4.94	4.87

Figure 2. INA129 Gain ratios

This system used 100 gain ratios. A resistance of about 560Ω was used. It was tried to clean up the signal using the low pass filter because it contains amplified signal noise. The frequency of the ECG signal is between 0 and 150Hz. Band Pass filter is used to prevent noises. Then the signal is amplified again.

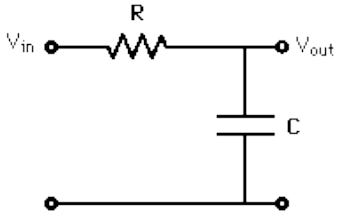

Figure 3. Low pass filter circuit

Band-reject filter was used to clean the noise. A noise-free ECG was obtained using a final filter to prevent the latest 50Hz network noise.

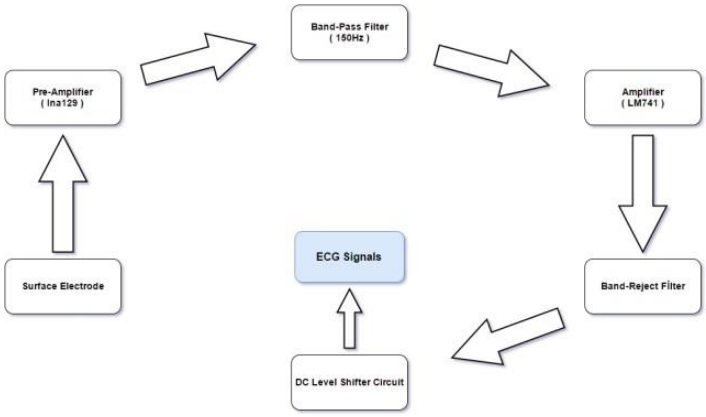

Figure 4. Block diagram of ECG measurement circuit

Figure 5. ECG signal is displayed as seen in the oscilloscope

1-Pulse Oximeter and Temperature Circuit Designing

The pulse oximeter (SpO_2) circuit and the temperature circuit were designed. A simple outer mold for the finger probe was prepared. It was drawn in the SolidWorks program. A ring-type probe is designed for a completely wrapped finger and for the passage of rays. A compact and comfortable design for the shape of the fingers was considered.

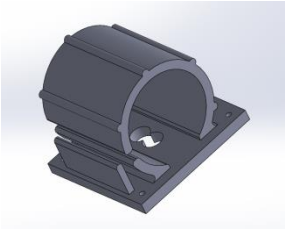

Figure 6. Finger probe design in solidworks

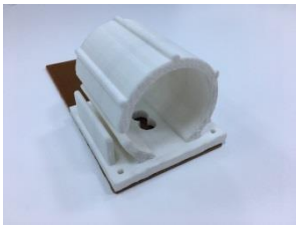

Figure 7. Finger probe printed in 3D printer

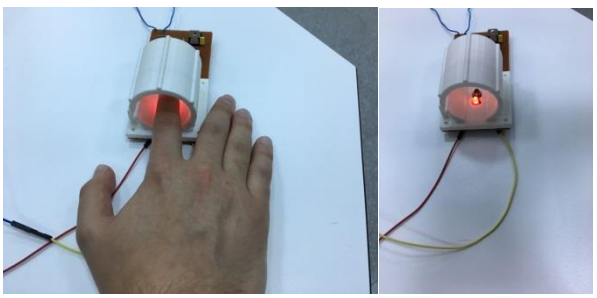

Figure 8. Probe with integrated circuit and leds

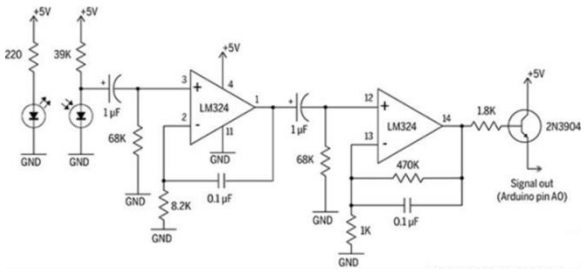

Figure 9. Pulse oximeter circuit

In designing of pulse oximeter sensor, two types of leds were used. One of them is red led, the other is transmitter led. Pulse oximetry uses light to work out oxygen saturation. Light is emitted from light sources which goes across the pulse oximeter probe and reaches the light detector. Finger is sent rays. If a finger is placed in between the light source and the light detector, the light will have to pass through the finger to reach the detector. Part of the light will be absorbed by the finger and the part not absorbed reaches the light detector. The received analog data was amplified. For this, two LM324 op-amps were used.
The LM35 sensor was used for temperature measurement. Measurement was taken from the finger. Temperature information was obtained as analog data.

Figure 10. LM35 Temperature sensor

1-Communication with Arduino

Arduino is a microcontroller card. It is a small fast and practical control card. But the received data was between -2.5V and + 2.5V. The Arduino's ADC converts between 0 and 5 V. So a DC level shifter circuit was used. This circuit is shown in figure 6. It carried the incoming signal between 0-5 v. The level shifted signal is shown in figure 12. Three analog data, ECG, pulse and temperature, were taken by Arduino. The received data was processed and made ready for LabVIEW. Also the buzzer was added for the audible warning. The buzzer will sound when the temperature rises excessively or the heart rhythm becomes irregular.

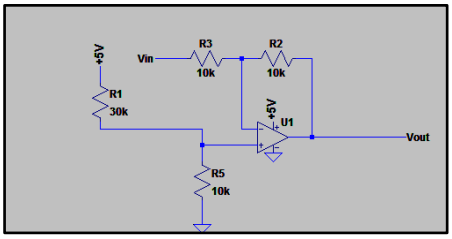

Figure 11. DC level shifter circuit

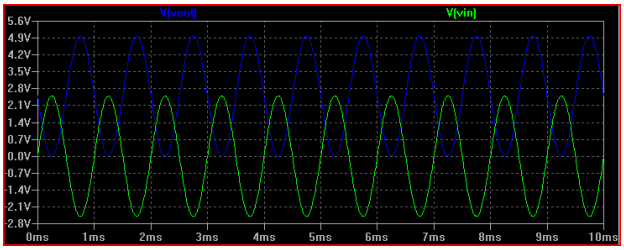

Figure 12. Level shifting a +/- 2.5V signal to 0 - 5V

1-LabVIEW Program Communication with Arduino

LabVIEW is a kind of programming language. Visual programming is done via LabVIEW. The difference from c is that the codes are processed in parallel instead of serial. This program communication with Arduino was provided by serial port method. The received analog data was graphically displayed in the LabVIEW interface. As a result, ECG, SpO_2 and temperature data were displayed in a computer environment. Arduino toolkit was installed from VI Package Manager. VI is the tool setup program in LabVIEW itself. This tool facilitates the visa protocol between Arduino and LabVIEW.

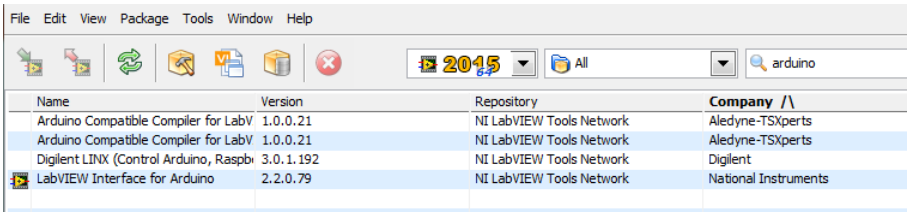

Figure 13. VI Package manager

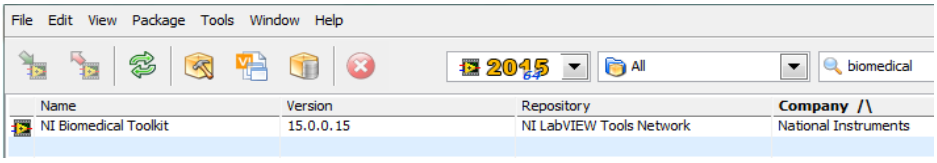

Figure 14. Biomedical toolkit was installed from VI Package manager

Biomedical toolkit allows many signals to be processed and adjusted. For example it can make ECG simulations. USB port must be set to connect to the Arduino. Then the baud rate and Arduino type should be entered. A baud rate of 9600 was considered adequate. It should be notified that the connection will be USB or wireless. XBee is required for wireless connection. XBee is a kind of module that can be integrated into the Arduino. After these settings the Arduino can be connected to the LabVIEW. It is shown in figure 15.

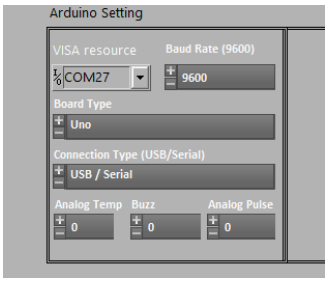

Figure 15. Various setting parts for Arduino and LabVIEW in communication

Human temperature is normally 36.5 degrees. If the temperature rises above 38 degrees, it is given a warning. And also the buzzer sounds when there is a warning. In addition, the program can simulate the ECG signal. Many parameters can be set for this signal. The benefit of this simulator is that students learn the signal in many ways. For example, noise can be added to the signal. Then the student can programmatically prevent this noisy. In this way students learn noise prevention methods. This simulation is quite instructive for the basic ECG signal.

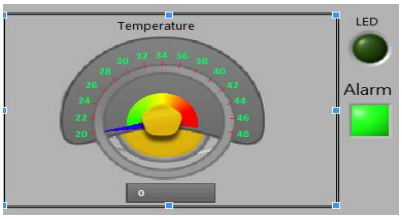

Figure 16. Temperature display and alarm led

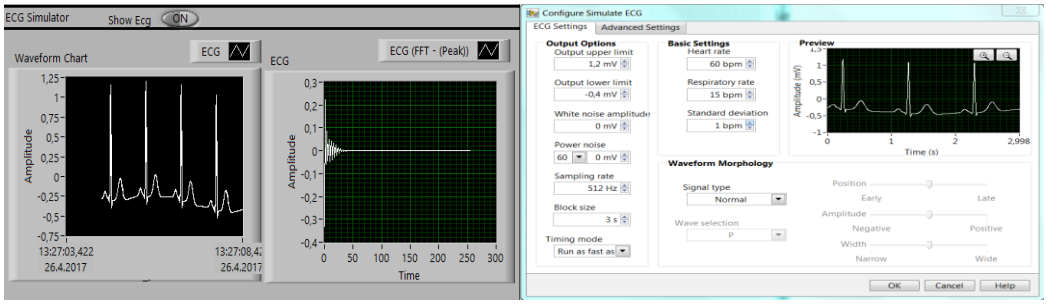

Figure 17. ECG simulator and configure simulator

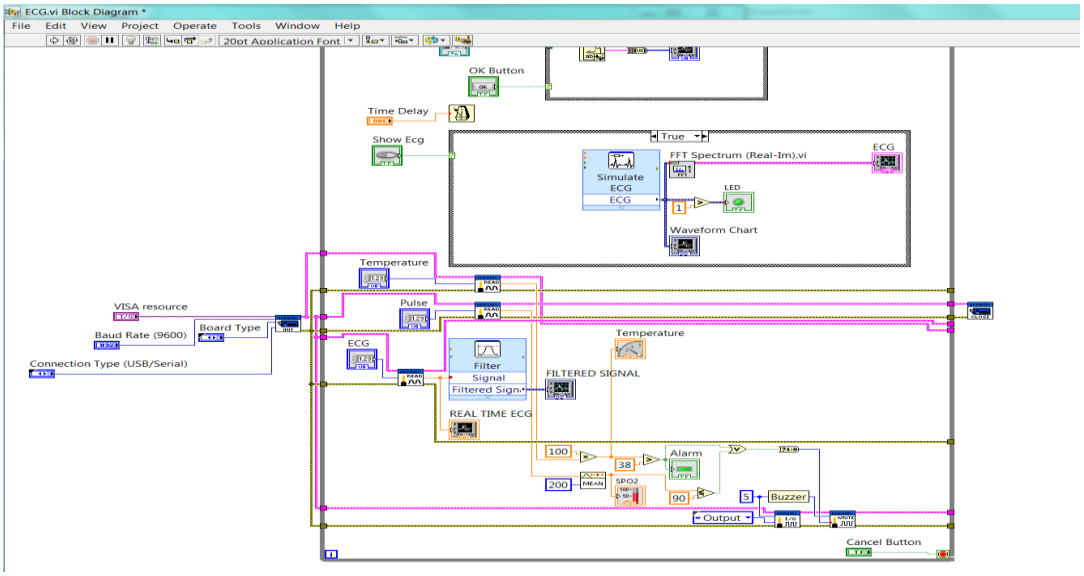

Figure 18. Designing the LabVIEW diagram

Real time ECG recording is shown in figure 19. At the same time temperature and SpO_2 measurements were made. The Fourier of the ECG signal can also be examined. The sampling rate of the real time signal can be changed. Also any ECG file can be imported. The student can filter the ECG signal using various filters.

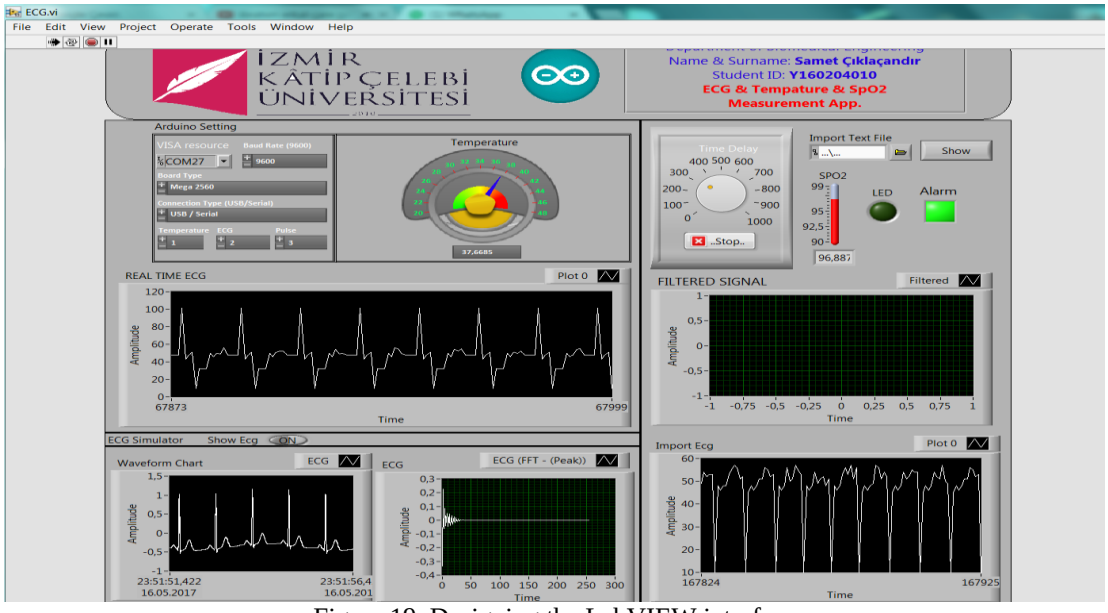

Figure 19. Designing the LabVIEW interface

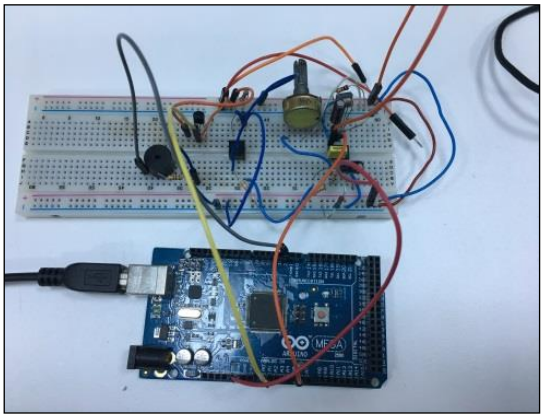

Figure 20. Taking ECG signals with Arduino

Conclusion

ECG devices are usually used in biomedical engineering education laboratories. But these devices can be taken in small amounts because it is expensive. It cannot be seen the circuits in devices, because this device is a closed box device. Additionally, students can only obtain measuring of the ECG signal so they do not know how the device works. As a result, they do not get the skills. The number of students per ECG devices is about 8 in any university. So the quality of education given is falling. In this study, low cost ECG, Temperature and SpO_2 measurement system was developed to solve all these problems. In addition, students can modify the program for their on studies or works. Programming skills of students develop with this method. It is hoped that this system can be benefit for student who makes investigation in this area.

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THE EFFECT OF PROBLEM SOLVING SKILLS AND RESILIENCE TO THE MARITAL ADJUSTMENT IN OLD AGES

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Alp Caglan Mackan
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Abstract: This work was conducted on the 210 elderly members of the Ankara Metropolitan Municipality – Elderly Services Center which serves to approximately 32,000 elders in 7 towns, whose problem solving abilities and resilience effects were to be studied on their marital adjustments of those who are currently married and have been registered in the last decade to the Ankara Metropolitan Municipality – Elderly Services Center.
In order to determine the problem solving abilities and resilience of the participants, the Interactional Problem Solving Inventory" (Lange et al., 1991) and "Connor-Davidson Resilience Scale" (Connor & Davidson, 2003) have been used in the research, which were adapted to the Turkish language by Maçkan (2014). In order to measure the cohesion levels of the spouses, the "Dyadic Adjustment Scale" was used consisting of 32 items, developed by Spanier (1976) and adapted to Turkish by Fışıloğlu & Demir (2000). In consequence of the research, when analyzing the dual and partial correlations between the predictor variables and marital adjustment, problem solving skills ($p<0.001$) and resilience ($p<0.001$) were found to have impact on the marital adjustment.

***Keywords*:** Old age, marriage, marital adjustment, problem solving abilities, resilience

Introduction

Researches and theories on aging, related with lifespan, argue that social and emotional behaviors and experiences can change. These changes have an important impact on the relationships, including marriage, of the elderly individuals (Henry et al., 2007).

For many individuals, marriage is the most lasting and most intimate relation type among the affiliations (Levenson et al., 1993). Whereas the social and emotional support which marriage provides contributes the physical, spiritual and social well-being; a happy and adjusted marriage in the contemporary sense is possible if the two individuals complete each other, namely by an integrative adjustment of the spouses (Kalkan & Ersanlı, 2008). The concept marital adjustment has a significant position in the researches on marriage and family relations (Spainer, 1976).

Marital adjustment is an important factor that affects the physical and psychological health of the whole family members given that it is a concept that its necessity is recognized for having a harmonious and effective marital relationship. It can be argued that those who have bilateral communication, who can find consensus on the topics that concerns the marriage and family and spouses that can solve their problems in a positive way, have an adjusted marriage (Soylu & Kağnıcı 2015). The quality of marriage governs the private evaluations of the spouses on their relationship. One can state that a quality marriage is related with good cohesion, sufficient communication, high satisfaction from marriage and happiness. In addition to above, this description revives the problem solving skills for discussion. Likewise, the problem solving interaction between the spouses are also considered to be in relation with marriage (Cheung, 2002). Crises and problems are common issues of the families. The skill to solve issues and conflicts with a good cooperation are seen as a key factor in resilient families (Black & Lobo, 2008).

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One of the issues within the family dynamics that is very hard to comprehend is that, whereas certain families continue to coexist and respond in the affirmative against challenges, other families in the similar states cannot cope with their challenges. Families' successful overcome of the transitions, stress or challenges in life are described as the resilience of family (Black & Lobo, 2008). It is known that during the elderly ages, in case the spouses receive necessary attention, provide rigorous care and continue their emotional, economic and social relations with intimacy; they will experience more happiness and during old ages, married couples are better-off than unmarried individuals where spouses can provide useful and efficient support on enjoying life, being happy, spending good free time, nursing and caring in case of a sickness and social support (Özgür,1991; Güven, 2002; Özer & Fadıloğlu, 2006; Altıparmak, 2009).

In the recent years, the fact that strong marriages do not exist anymore is very thought-provoking from the views of the continuum of life and the future individualization with its potential problems arising from it. Although the positive-negative indicators of marital adjustment are known, researches have been limited regarding the drive of healthy marriages. This limited state scales up even more when the old ages are included in this equation.
By taking into account the emotional and cognitive features of the old ages, the purpose of this research which analyze the marital satisfaction of this period is; to determine the effect of the problem solving skills and resilience in the old ages to the marital cohesion, and finding out suggestions towards the problems arising in the marital relations of this period.

Material and Method

The research area is limited with the city of Ankara. The research population is comprised of the registered 65+ elderly spouses who are currently married, and have been registered in the last decade to the Ankara Metropolitan Municipality – Elderly Services Center who are known to provide care to 60+ elders in Ankara. The research applied the simple random sampling method which is one the probability sampling techniques. Including the losses in the last decade, the number of elders that are registered in 7 different towns is 6889. According to these data, the sample size has been determined as 210 at the confidence level of 95% (Bayram, 2009) which is usually a recognized value in the researches.

While gathering the research material, a form has been used comprising of 4 sections which was created by utilizing the related resources in the literature and from several previous researches (Spainer 1976; Lange et al., 1991; Fışıloğlu & Demir, 2000; Connor & Davidson, 2003; Demiray, 2006).
In order to determine the problem solving abilities and resiliencies of the individuals who were under the scope of this research, the Interactional Problem Solving Inventory" (Lange et al., 1991) and "Connor-Davidson Resilience Scale" (Connor & Davidson, 2003) have been used, which were adapted to Turkish by Maçkan (2014). For the purpose of measuring the cohesion levels of the spouses, the "Dyadic Adjustment Scale" was used consisting of 32 articles, developed by Spanier (1976) and adapted to Turkish by Fışoğlu & Demir (2000).

Evaluation of the Data

The first part of the research contains a survey on the socio-demographic data regarding the participants, whereas the second part includes the evaluation of the following scored choices that are a part of the 17 article Interactional Problem Solving Inventory's positive sentences (1, 2, 6, 9, 11), strongly agree (5), agree (4), neutral (3), disagree (2), strongly disagree; and negative sentences of (3, 4, 5, 8, 10, 12, 13, 14, 15, 16, 17) strongly disagree (5), disagree (4), neutral (3), agree (2), strongly agree (1).
In order to measure the resiliencies of the individuals, the "Connor-Davidson Resilience Scale" (Connor & Davidson, 2003) was adapted. For the answers given regarding the 25 articles in the scale, the following have been scored and evaluated: always valid (5), usually valid (4), occasionally valid (3), rarely valid (2), and never valid (1).
In order to measure the cohesion levels of the spouses, the answers to the sentences in the 32 article "Dyadic Adjustment Scale" were scored and evaluated (We always agree – we never agree, always – rarely, every day – nevermore, all of them – none; never – once a day).
In the second and third part of this research, charts have been created that shows absolute and percentage values and the t-test has been applied by only taking into account the gender variable.
In the last part multiple-linear regression analysis has been conducted through the SPSS 16 Statistical Package for the Social Sciences software that allows scientists to do multidimensional examinations on the relation between the variables in experimental and survey researches, for the purpose of finding the effects of resilience and problem solving skills on the marital adjustment.

Findings and Discussion

Identifying Socio-demographic findings of the elderly participants are given in Table 1.
The 55.7% of the participants were female and 44.3% were male. The ages of the elders were varying between 60 and 80 and the average age was 67.89±5.72. One can see that 9.5% of the elders were illiterate, 1.0% were literate, 56.2% were elementary school, 21.9% were middle school, 11.0% were high school and 0.5% were university graduates. The elders that were included in the scope of the research had marriage durations varying between 30 and 60 years, and average marriage duration was found to be 46.51±7.19. A significant number of the elders (95.0%) are members of multi-child large families and approximately one third (31.9%) have 3 children. As one can comprehend from the chart, 87.1% of the elders who participated in the research stated they had pre-arranged marriage. When looking into the frequency of the elders meeting with their families, 41.4% were found to meet once in a week, 22.9% were found to meet twice or thrice in a week (Table 1).

Table 1. Socio-Demographic data of elderly participants

Illustrating Features	n	%
Gender		
Female	117	55,7
Male	93	44,3
Total	210	100,0
Age		
65-69	150	71,4
70-80	60	28,6
Total	210	100,0
$\bar{X}$ = 67.89±5.72		
State of education		
Illiterate	20	9,5
Literate	2	1,0
Elementary School	118	56,2
Middle School	46	21,9
Highschool	23	11,0
University	1	,5
Total	210	100,0
Duration of marriage		
30-40	49	23,3
41-50	113	53,8
51-60	48	22,9
Total	210	100,0
$\bar{X}$ = 46.51±7.19		
Number of children		
No children	2	1,0
1	2	1,0
2	32	15,2
3	67	31,9
4	46	21,9
5	31	14,8
6	30	14.2
Total	210	100,0
$\bar{X}$ = 3.84±1.44		
Form of marriage		
Pre-arranged Marriage	183	87,1
Acquainted Marriage	27	12,9
Total	210	100,0
Meeting frequency with family members (e.g. children, grandchildren)		
Once in a Week	87	41,4
Twice-Thrice in a Week	48	22,9
Once in a Month	31	14,8
Twice or more in a Month	34	16,2
Only on important days	10	4,8
Total	210	100,0

The average scores on the problem solving skills scale of the elder who participated are given in Table 2.

Table 2. Total scores of the problem solving skills scale of elder based on gender and T-Test results

	Gender	n	$\bar{X}$	sd	t	p
Problem Solving Skills	Female	117	54,57	1,22	3,198	,002**
	Male	93	60,90	1,65		
	Total	210	57,38	1,46		

The problem solving skills scale total scores, based on gender variable, was found to show a significant difference (t= -3.382, p<0.05), and male's problem solving skills scale scores were found to be higher than female's. It is known that problem solving is related to one's purpose, requirements, values, faith, skills, habits and tendencies; furthermore one converging to problem solving is in relation with courage, desire and self-confidence (Akkapulu, 2005).

Anderson (1980) focuses on cognitive operations and identifies the problem solving process as aiming cognitive operations respectively to a target. The author states that the problem solving process starts only when an individual realizes s/he has to react at certain levels and hence the person must have a target in order to give efforts on problem solving.

Heppner and Krauskopf (1987) argues on the other hand, the approach-avoidance mode of individuals, self-control and confidence for the resolution of problems can effect solving problems with success and coping strategies; and problem solving can be changed via certain skill trainings.
The average scores of the participating elders on resilience perception scale are given in Table 3.
The average scores of the sub-scales of "Individual competence, high standards and determination", "Confidence on instincts, Safe Relations and Coping with Negative Emotions" and "Control of Life", showed discrepancy in the statistical level of p<0.001 based on gender variable; while males scored higher than females in the test. Yet, the sub-scale of "Positive recognition of the changes in life" showed no discrepancies amongst the participants, based on gender variable (p>0.05).

Table 3. Total scores of the resilience perception scale of elders based on gender and T-Test results

Resilience Perception	**Gender**	**N**	$\bar{X}$	**sd**	**t**	**p**
Individual competence, high standards and determination	Female	117	25,16	5,63	6,954	,000***
	Male	93	29,83	3,57		
	Total	210	27,23	5,35		
Confidence on instincts, Safe Relations and Coping with Negative Emotions	Female	117	17,72	4,69	4,421	,000***
	Male	93	20,25	3,26		
	Total	210	18,84	4,29		
Positive recognition of the changes in life	Female	117	22,53	3,51	,713	,476
	Male	93	22,96	5,15		
	Total	210	22,72	4,30		
Control of Life	Female	117	13,19	2,52	5,794	.000***
	Male	93	15,08	2,08		
	Total	210	14,03	2,51		
Scale Total	Female	117	78,61	12,58	5,992	.000***
	Male	93	88,11	10,39		
	Total	210	82,81	12,56		

The average scores of the participating individuals on marital adjustment are shown in Table 4.

Table 4. Total scores of the marital adjustment scale based on gender and T-Test results

	Gender	N	$\bar{X}$	sd	t	P
Marital Adjustment	Female	117	115,009	21,201	1,041	,299
	Male	93	117,731	15,305		
	Total	210	116,214	18,826		

The marital adjustment scale total scores based on gender variable of the elder individuals participated in the research, were found to be statistically not significantly different.
The Multiple Regression Analysis result on marital adjustment is shown in Table 5.

Table 5. Multiple regression analysis on marital adjustment

Variable	**B**	**Standard Failure**	**β**	**T**	**p**	**Dyadic r**	**Partial r**
Constant	102,988	7,595	-	13,561	,000	-	-
Resilience	-,358	,091	-,239	-3,935	,000	-,064	-,264
Problem Solving Skills	,747	,078	,578	9,521	,000	,506	,552
R=0.554, F (2, 207)=45.938,	R^2=0.307 p=.000						

When the dual and partial correlations between the predictor variables and marital adjustment are analyzed, one can find the following: problem solving abilities and marital adjustment have a positive and medium-level relation between each other (r =.51); whereas there is no binary correlation between resilience and marital adjustment (r=-.06).

According to the standardized regression factor (β), the relative priority order of the predictor variables on job satisfaction are problem solving skills and resilience. When analyzing the t-test results on the regression factors' expressiveness, both problem solving skills (t=9.51, p<0.001) and resilience (t=3.935, p<0.001) are significant predictors on marital adjustment.

Resilience and problem solving skills together was found to produce with the marital adjustment scale scores a medium-level and significant relation (R=0.554, R^2=.307, p<.001). The mentioned two variables, namely resilience and problem solving skills, can explain 31% of the total variance in marital adjustment. In the recent years it can be stated that there are no works studying directly the effect of resilience and problem solving skill in old ages to the marital adjustment, yet there are researches that indirectly argues these topics.

Margolin and Wampold's (1981) works on marital relations and conflicts in the flirting period reveals that, spouses who are happy in their marriage have more competence in problem solving compared to unhappy couples. Additionally they argue that negative behaviors such as complaining, constantly expressing negative emotions and defensive behavior are in relation with the lack of happiness in marriage. Fichten and Wright (1983) have also stated similarly to the findings of this research, there are differences between the happy and problematic spouses on problem solving behavior; happy spouses have better behavior on solving their problems compared to the turbulent spouses, which dispute the most and demonstrate inappropriate communication methods.

Günay (2000) argues in the work where he researches for the relation between the way of thinking of the married couples and marital adjustments; those spouses who describe their marriage process as inharmonious, have less union of idea than discordant couples, less emotional expression, less commitment and less marital satisfaction level. Hünler and Gençöz (2003) expresses that the perception of deadlock in marriage issues has an important role on the embarrassing behavior and marital satisfaction, and one's embarrassing behavior increases the tendency to see the situation unsolvable or increase the unilateral faith of one's having lack of skills on finding solutions; thus this state may cause the individuals experience a decrease of marital satisfaction.

Güven and Sevim (2007) have researches finding that the problem solving skills in marriage predicts marital satisfaction as primary. In the above mentioned researches the findings in general suggests, inter-personal communication and cohesion are effective in explaining marital satisfaction, thus can be argued that they are coherent and related with the findings of this research.

Results and Suggestions

Consequently, the elderly male attended the research, compared to the elderly female, have higher average scores on problem solving and resilience scale; both problem solving skill and resilience have been found as a significant predictor on marital adjustment.

When considering the old age losses, in order for the spouses to put their marriage relations into an order, educations should be provided on; coping against inter-spouse conflicts and discords; to be prepared for the future problems and enhance coping skills; which will contribute to the sustain and develop the relation.
In addition, even if not remove the problem completely but decrease to the lowest levels, protective/preventive programs such as "marriage education", "family life education", "occupational training" will contribute to decrease the problems emerging in the old ages and reduce the individual, social and economic costs; if spread by state support.

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SOCIAL WORK STUDENTS ATTITUDES TOWARD ELDERLY PEOPLE: SAMLE OF ANKARA UNIVERSITY

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Abstract: Although respecting the elderly people and devotion to them is one of the fundamental social rules in Turkey, this fact is being affected by the regional and traditional conducts. Considering the demographic changes, attitude towards the elderly people turns into an important status.

This work was planned in order to determine the attitudes of the university students towards the elderly people was and conducted on the Ankara University Department of Social Work students. In the research, the attitudes were measured with the attitude scale developed by Kogan (1961) and t-test was applied to determine the differences between genders.

The result of the research revealed that; the elderly people need more compassion and trust compared to anyone else; even though there are minor exceptions, most of the elderly people are found to be sympathetic; individuals grow in experience as they age and that it is hard to make the elderly feel sincere. Additionally, the results show that female students have more positive attitudes towards the elderly people than the male students ($p<0.05$).

***Keywords*:** Old age, discrimination against the elderly, attitude, university students

Introduction

Prevention of sicknesses and providing diagnosis and therapy in early stage with the developed active diagnosis and therapy methods, causes decrease in infant deaths and the fertility rate along with the development of preventive health services, and the developing dietary habit, results in increase of expected average life span (Konak and Çiğdem, 2005; Bahar et al. 2009). Old age is a relative concept and can show differences from one society to another and time; it is natural, inevitable and an applicable process to all humanity. This status in general is a period where one experiences the following: decline in; one's physical and cognitive functions, health, fertility, income, reputation, roles and statuses, independence, social entourage, spouses and close relations, social life and social support (Kocataş et al. 2004; Bahar et al. 2009;Yılmaz and Özkan, 2010).

In our current day, the tendency in the decline of the population growth rate and increase of the expected average life span is causing in an increase of the old age population in the general population and thus our world drives into a process of elderly growth in demography (Çilingiroğlu and Demirel, 2004; DPT, 2007; Danış, 2008). The effects of this demographic change, which is also called as the ageing of the population, are observed in different ways in the societies. The socio-cultural structure of the society, changes in the attitudes and manners and the perception of elderliness of the individuals and society affects the services provided to the elderly people and causes several problems. Amongst these problems one can observe the discrimination against the elderly people which especially occurs during the advanced ages (Yılmaz and Özkan, 2010). The term of discrimination against the elderly people refers to the prejudice via attitudes and manners towards the elderly people. In general, it is based on a chronological conceptualization; emphasizes the incapability, limits and negative changes as one gets older and older (Çilingiroğlu and Demirel, 2004).

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When one speaks of "the old" in the society, the following thoughts come to the mind: one in need of care, experiencing gait disturbance, closed to change, unhappy, alone and having weak social relations. By overlooking the positive aspects of old age such as wisdom and experience, a constant emphasis is made on the negative parts and many elderly people are considered to be irrelevant to asses while they experience an active and healthy old age. Under the stereotype judgements of the societies, an individual may have fears such as decline of health, decline of control and independence or becoming an outcast off the society. The facts that the elderly people indigenize the negative features which the society attributes, and the fear of becoming dependent to other people on the execution of their fundamental functions and supplying their needs by losing their independence, affects their quality of life in a negative way (DPT, 2007). In addition to this, discrimination against the elderly is not a universal but a cultural phenomenon. The positive attitudes towards the elderly declines as the modernization level rises in a society. The West does not perceive death as a natural phenomenon of the life cycle, whereas the East considers life and death as a continuum; hence the old ages are considered as "the peak of life". On the other hand, the western societies do not esteem the individuals after retirement as productive in terms of economy and perceives them as a financial burden.

When analyzing the stereotypes of the elderly and elderliness in Turkey; although respect to the elderly, giving value to their words and protect seems to be a traditional and constant expectation, in time the status of the elderly in the society and reputation is changing. Urbanization, rise of migrations and industrialization, economic difficulties, employment of women, change in the social life and the transition from the paternalistic family structure to nuclear family (modern) structure have been important reasons of change in the family structures, especially in big metropoles. In this state, becoming an outcast from the society causes depression on the elderly individual who is experiencing lack of productivity, emotion of uselessness, decline in mental functions, less attention to the environment, delay in response to new occurrences or not responding at all, short-term memory impairment, resentfulness, egocentric attitudes, skepticism from time to time, dependent on other in order to continue their daily lives (Akdemir et al. 2007; DPT, 2007; Bahar et al. 2009).

Today, the discriminative attitudes towards the elderly are shown mostly by the youths. Although there are studies showing university students having negative attitudes towards the elderly, there are also studies showing students having positive attitudes towards the elderly people (Çilingiroğlu and Demirel 2004; Akdemir et al. 2007; Yılmaz and Özkan 2010). In order the society to gain an equalitarian perspective of the discrimination against the elderly and to develop its thoughts, behaviors and attitudes; the youth needs to have a positive feeling about the elderly individuals. Van Dussen and Weaver in their work (2009) revealed that the young people, who are communicating with the elderly via friendship or voluntarily studies, are more willing to work in the senior care services. In this work which aims to find out the attitudes of the university students towards the elderly people, resulted that the more developing positive, respectful and tolerant attitudes and manners towards the elderly and aging; the more the young people be helpful in their future professional lives to the elderly people in delivering service.

Method

In this work, a quantitative methodology was adopted which used a questionnaire form that was developed by utilizing the previous studies.

Study Group

In the academic year of 2016-17, by adopting complete inventory method, 270 students from the Ankara University Faculty of Health Sciences Department of Social Work were interviewed. The ages of the students under the scope of this research are varying from 18 to 27 (21.81±2.29).

Data Acquisition Tools

In collecting the research material, in order to determine the attitudes of the students toward the elderly, the Attitudes toward Old People Scale developed by Kogan (1961) was used. The scale is an adaptation work developed by performing legitimacy and reliability analyses.

Data Acquisition Process

In the first stage of the research, the scale was evaluated where it was applied to 100 students; structure legitimacy and reliability analyses were conducted. In order to control the structure legitimacy of the scale, the Varimax Principal Components Analysis was used, which is a factor analysis technique.

Table 1. Factor and item analysis results based on the attitudes of the university students toward the elderly

	Total Item Correlation	Factor Load Value
It would be better if most of the elderly lived in places where the young also lived	.356	.324
Most of the elderly live as they wish and cannot change **R**	.345	.317
Most of the elderly are not different from anybody; understanding them is as easy as understanding the young	.340	.407
There is something different with most of the elderly: it is difficult to understand what makes them restless/tick **R**	.313	.400
Most of the elderly can adopt themselves to the changes required by the conditions	.335	.287
Most of the elderly tend to let their houses untidy and unkempt **R**	.349	.422
. Most of the elderly can keep their houses clean and tidy	.374	.477
. It is foolish to say that wisdom comes by old age R	.343	.435
. People grow wiser with coming of old age	.344	.464
. It is quite relaxing to be with the elderly	.394	.505
. Most of the elderly bore others by talking about 'good old days' **R**	.375	.343
. One of the most interesting and entertaining qualities of most elderly people is to tell about their past experiences	.514	.627
. Most of the elderly spend too much time mix into other people's business (stick their noses) and giving unsought advice	.317	.306
. Most of the elderly tend to keep their opinions to themselves and give advice only when asked **R**	.359	.323
. You can be sure to find a nice atmosphere if there is a sufficient number of elderly people in your neighborhood	.308	.420
. There are a few exceptions, but in general most old people are pretty much alike	.460	.582
. It is evident that most old people are very different from one another	.331	.428
. Most of the elderly have a clean and tidy personal appearance	.344	.334
. Most of the elderly are irritable, grouchy and unpleasant **R**	.497	.588
. Most of the elderly are cheerful, agreeable and good humored	.470	.588
. Most of the elderly need as much love and reassurance as other people	.370	.368
Eigenvalue: 4.193	Variance: %55.32	Alpha:.784

As a result of the analysis, the questions were determined that measures the same and different structure; whether the questions remained under a single structure were analyzed via item factor load value. In the factor analysis, the load values remained below 0.30 are left off the scale. For the reliability of the scale, the Cronbach Alpha was calculated which is a coefficient of internal consistency. In addition to this, the discernment power of the questions on distinguishing the positive and negative attitudes was measured by item analysis. With this purpose, the correlation between item scores was calculated.

The following sentences were left off the questionnaire due to having factor load values less than 0.30: "1. It would be better if most of the elderly lived with their coevals in the same place R", "7. Most of the elderly prefer to get retired as soon as entitled to it or their children are able to look after them R", "8. Most of the elderly would like continue to work as long as possible rather than be dependent on anybody", "13. The elderly have too much power in business life and politics R", "14. The elderly should have power in business life and politics R", "19. Most of the elderly spend too much time mix into other people's business (stick their noses) and giving unsought advice R", "20. Most of the elderly tend to keep their opinions to themselves and give advice only when asked", "22. When you think about it, old people have the same faults as anybody else", "27. Most of the elderly should take care of their personal appearance; they are too untidy R", "31. Most of the elderly constantly complaining about the behavior of the younger generation R", "32. Most of the elderly rarely complaining about

the behavior of the younger generation", "33. Most of the elderly need more love and reassurance as other people R", and thus renewed.
In order to determine the attitudes of the young toward the elderly, the factor load values of the 22 items inside the scale vary between 0.31 – 0.63; item total correlation vary between 0.31 – 0.49. The alpha calculated regarding the reliability of the scale is 0.78, whereas the variance is 55.3% (Table 1).

Analysis of the Data

The findings of the research were gathered in a database by using the SPSS (Statistical Package for Social Sciences) 16.0. The arithmetic and logical process ability of the software provided categorization and scaling of the information. All necessary arithmetic means were calculated for each question and t-test was applied to test the differences based on gender.

Findings

When taking the average scores into account, the young were observed to agree more on the following sentences: "Most of the elderly need as much love and reassurance as other people" ($\bar{X}=3.98\pm1.12$), "There are a few exceptions, but in general most old people are pretty much alike" ($\bar{X}=3.96\pm1.54$), "People grow wiser with coming of old age" ($\bar{X}=3.83\pm1.09$), "Most of the elderly live as they wish and cannot change" ($\bar{X}=3.75\pm1.02$). Female students, compared to male students, think that the elderly needs more love and faith than anyone else and most of the elderly are quite symphatic ($p<0.01$, $p<0.05$).

Amongst the people who agree more on the following sentences, female average scores are higher than male average scores and the difference was found to be statistically considerable: "You can be sure to find a nice atmosphere if there is a sufficient number of elderly people in your neighborhood" ($p<0.001$), "It is evident that most old people are very different from one another" ($p<0.01$) and "Most of the elderly can keep their houses clean and tidy" ($p<0.05$) (Table - 2).

Although it is statistically not considerable; it was found that male students agree more on the following attributes than female students: when conditions require, the elderly people have an ability to adapt to the new conditions; wisdom cannot be acquired through age; individuals get experienced as they age; most of the elderly are annoying, uneasy and unsympathetic (Table 2).

Table 2. Attitudes of the students towards the elderly based on gender and T-Test results

	Gender	n	$\bar{X}$	S	t
2. It would be better if most of the elderly lived in places where the young also lived	Female	106	3.14	1.02	.502
	Male	164	3.07	1.04	
	Total	270	3.11	1.03	
3. Most of the elderly live as they wish and cannot change	Female	106	3.75	.97	.000
	Male	164	3.75	1.06	
	Total	270	3.75	1.02	
4. Most of the elderly are not different from anybody; understanding them is as easy as understanding the young	Female	106	3.45	1.22	1.582
	Male	164	3.22	1.19	
	Total	270	3.33	1.21	
5. There is something different with most of the elderly: it is difficult to understand what makes them restless/tick	Female	106	3.26	2.86	.159
	Male	164	3.22	1.18	
	Total	270	3.24	2.20	
6. Most of the elderly can adopt themselves to the changes required by the conditions	Female	106	3.07	1.12	.941
	Male	164	3.19	1.13	
	Total	270	3.13	1.12	
9. Most of the elderly tend to let their houses untidy and unkempt	Female	106	3.85	2.85	1.294
	Male	164	3.51	1.18	
	Total	270	3.68	2.19	
10. Most of the elderly can keep their houses clean and tidy	Female	106	3.67	.95	1.945*
	Male	164	3.42	1.15	
	Total	270	3.54	1.06	
11. It is foolish to say that wisdom comes by old age	Female	106	3.34	1.29	1.169
	Male	164	3.51	1.25	
	Total	270	3.42	1.27	
12. People grow wiser with coming of old age	Female	106	3.79	1.12	.640
	Male	164	3.87	1.05	
	Total	270	3.83	1.09	
16. It is quite relaxing to be with the elderly	Female	106	3.44	1.07	.390
	Male	164	3.39	1.02	
	Total	270	3.41	1.04	
17. Most of the elderly bore others by talking about 'good old days'	Female	106	3.11	1.27	.605
	Male	164	3.19	1.22	
	Total	270	3.15	1.25	
18. One of the most interesting and entertaining qualities of most elderly people is to tell about their past experiences	Female	106	3.80	1.14	1.551
	Male	164	3.58	1.18	
	Total	270	3.69	1.16	
21. Most of the elderly spend too much time mix into other people's business (stick their noses) and giving unsought advice	Female	106	3.35	1.11	1.154
	Male	164	3.19	1.07	
	Total	270	3.28	1.09	
23. Most of the elderly tend to keep their opinions to themselves and give advice only when asked	Female	106	3.47	1.16	.366
	Male	164	3.42	1.21	
	Total	270	3.44	1.18	
24. You can be sure to find a nice atmosphere if there is a sufficient number of elderly people in your neighborhood	Female	106	3.42	1.02	3.353**
	Male	164	3.14	1.19	
	Total	270	3.28	1.12	
25. There are a few exceptions, but in general most old people are pretty much alike	Female	106	4.25	1.87	2.089*
	Male	164	3.67	1.04	
	Total	270	3.96	1.54	
26. It is evident that most old people are very different from one another	Female	106	3.57	1.15	3.176**
	Male	164	3.32	1.21	
	Total	270	3.44	1.19	
28. Most of the elderly have a clean and tidy personal appearance	Female	106	3.37	1.00	1.729
	Male	164	3.28	1.08	
	Total	270	3.32	1.04	
29. Most of the elderly are irritable, grouchy and unpleasant	Female	106	3.38	1.11	.731
	Male	164	3.48	1.17	
	Total	270	3.43	1.14	
30. Most of the elderly are cheerful, agreeable and good humored	Female	106	3.49	1.01	.362
	Male	164	3.45	1.01	
	Total	270	3.47	1.01	
34. Most of the elderly need as much love and reassurance as other people	Female	106	4.16	.96	2.659**
	Male	164	3.80	1.24	
	Total	270	3.98	1.12	

*p<0.05 **p<0.01 ***p<0.001

Table 3. T-Test results of the general views based on gender

	Gender	N	$\bar{X}$	S	t
Comments	**Female**	150	76.94	11.19	2.037*
	Male	150	74.24	10.91	
	Total	300	75.61	11.12	

*p<0.05

Generally, when observing the views of the students on the elderly individuals, female students were found to have more positive attitudes towards the elderly, compared to the male students. According to the t-test results, the score difference between the male and female students are statistically considerable (p<0.05) (Table 3).

Discussion

In our world today, in most of the societies the elderly individuals are facing discrimination. Discrimination against the old is defined only as the different attitude, prejudiced action and institutional regulations toward a person due to the age. This discrimination arises due to the negative attitudes of the family members and society itself towards the elderly individuals and aging. States like senility, labefaction, unhealthiness, derogation, tired and functional stress are seen as bad or even that one should avoid. Factors like urbanization, transition from extended families to nuclear families, employment of women, economic difficulties, migration to metropoles and its burdens causes the elderly people who are a fundamental part of their family and who has a voice in the family, are considered today as a burden. Failing to adapt to the swiftly changing world, technology and pace of the new life causes the opinions on the elderly to turn to negative. In the societies where youngness, dynamism and physical appearance are highly valued, elderly people are living more and more alone, struggle more with economic and health problems, isolated more from the society and experience decline in self-esteem (Prudent and Tan, 2002; Akdemir et al. 2007; Erden Akıand Özer, 2009; Vefikuluçay Yılmaz and Terzioğlu, 2010).

Nevertheless, especially the support, trust, compassion and care provided by the family is highly effective for the elderly, to accept old age, to observe oneself still as a loved, respected and important person in the society, and to experience a healthy, happy and satisfying old age period by coping with the problems of this period (DPT, 2007).

The studies in the literature shows the young people who have constant communication with the elderly individuals in their families have more positive attitudes toward them (Kogan, 1961; Lee, 2009).
In the works of Cherry and Palmore (2008) which is aiming on the evaluations of the elderly on the old age period stated, females compared to males have more positive opinions. Similarly the findings of the work of Rupp et al. (2005) have been found supportive of the above results; males were expressed to be more discriminative than females towards the elderly. Lee (2009) on the other hand found that, the scores of male students on negative attitudes are higher than female students and detected that the positive attitude scores and average scores on the discrimination towards the elderly were not different.
The attitudes of the young people reflect the values and judgments of a society. By remaining insensitive to the concept of elderliness, the young people today have prejudgments towards the elderly (Kogan, 1961). To prevent the isolation from society and subjectivity to violence of the elderly, the young people must be guided to show positive emotions and good will towards the elderly (Lee, 2009). Gorelik et al. (2000) revealed that the attitudes of the university students towards the elderly are affected by the quality of the communication with the elderly in the family, whereas female students care more with the elderly in the family and depending on this fact they have more tendency to select a profession that is concerned with elderliness in the future compared to male students.

According to the study of Prudent and Tan (2002), most of the students described the elderly as unhappy, unproductive, sick, stubborn/rigid, conservative, pessimistic, unbearable, intolerant and problematic. Likewise, Özdemir's study (2009) found that most of the students of the nursing school perceive elderliness with the following concepts: illness, compassion, weakness, loneliness, dependent, servitude and wisdom. Yılmaz and Özkan (2010) stated that the students of the nursing school have positive attitudes towards the elderly, and as the students age older, based on the maturing level, they show more and more positive attitudes toward the elderly.
The works of Kimuna et al. (2005) on the perception of the university students of the elderly individuals and elderliness suggests, most of the students think that the physical strength of elderly individuals decline due to age; the service programs for the elderly are fruitful and as one ages the person has more money. Even though the study revealed that there is a rising tendency of awareness and sensibility of the students towards the elderly rights, their attitudes towards the elderly have not changed. Therefore spending more time for the young with the elderly must be supported. Activities like visiting nursing homes, voluntary work, sharing knowledge, skills and

resources with the elderly will contribute the youth to develop positive attitudes toward the elderly. In addition to this, for sharing the accumulation of knowledge, including the elderly to the schooling system will lead to more harmony with the society (DPT, 2007).

Intervention to maximize the coping and problem solving skills of the elderly is the most fundamental and vital extends of the gerontological social work. (Duyan et al., 2005). The targets of this strengthening process contains, in parallel to the gerontological social work, to alter the environment in order to remove social pressures that effects the power, participation, social awareness and lives of the individuals (Kam, 1996). Hence, preparing courses and programs in the universities on the topics of gerontology is important for the youth who will work in the fields of social work, sociology, psychology and health and nursing services; in order to achieve knowledge and awareness of gerontology.

Conclusion

The young people under the scope of the research mostly think that the elderly people needs more love and trust compared to an ordinary person; most of the elderly are sympathetic; individuals gain experience as they age. In addition to this, it was observed that female students agree more to these views than the male students. The female average scores are higher than male scores for the following sentences: "You can be sure to find a nice atmosphere if there is a sufficient number of elderly people in your neighborhood", "It is evident that most old people are very different from one another" and "Most of the elderly can keep their houses clean and tidy" ($p<0.05$).

The rapid growth of the elderly population in Turkey, as in other societies as well, neccessitates to priorly determine and provide for the requirements of this group. The services to be provided to the elderly should support to the extent of physical, psychological and social health and easy access. Therefore in order to ensure wellfare of the elderly, certain fundamental and universal criteria must be improved, such as; appropriate housing conditions and apparatus, sufficient and healthy nutrition, providing health and clothing needs, establishing healthy family communication; and sufficient income and rational management of economic resources.

The education programs in the fields of health and social nursing do not cover working with individuals; but covers more the topics of the categorization of business management, clinical issues and nursing statuses. An education provided on these topics leads to the end where the professionals see the patients or applicants not as individuals in the future. Targets on education should cover; along with the improvement of the social nursing of the elderly; initiatives on changing the thoughts, emotions and behaviors about the elderly.
In the practices of social work, the teaching program module on the elderly is argued to be contributing to the evaluation of the elderly, improvement of the knowledge on intervention and especially the young university students to develop positive attitudes towards the elderly.

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ENVIRONMENTAL LITERACY OF THE SLOVAK UNIVERSITY OF TECHNOLOGY STUDENTS

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Abstract: The paper addresses the level of environmental and ecological literacy of the students of Slovak University of Technology in Bratislava. The authors deal with literacy in stated area in three synergetic dimensions: cognitive, emotional and conative. In the cognitive level are mapped the general knowledge of students regardless of the technical field of their studies. They analyze students' views on teaching at the Technical University from the viewpoint of the need for clarity and acceptability of the effect of technology on the environment not only "here and now", but with a time lag of several years or decades. By the Semantic differential method, they try to find the answer to the question about the quality of students' attitudes to the issue of development and environmental protection. They identify explicit and implicit factors (family, society, training and education process or teacher-student interaction, issues of pattern) which are dominant in the formation of positive and negative attitudes of students of university of technology to the creation and protection of the environment. Conative dimension corresponds to measure of subjective activities of students in this area and refers to the relationship between power factor, evaluation factor and the activity factor in the semantic differential.

***Keywords*:** Environmental education, ecological literacy, cognitive dimension, emotional dimension

Introduction

Any meaningful human effort is determined by close link between past and future. This bond has distinct contours in many, if not in all, aspects of human action. The close link between past and future gives the clear sense to the life of man. The sense of being in the process of realization, which is always transformed externally into a consistent effort delivering the intended results. The life is no longer only finding of ready or fitting items? but in the sense of this continuity it is especially creating of desirable and needed items? In no area of human effort and endeavour, it has no desirable or necessary such clear and bright contours as in the field of environmental creation and protection.

The state of the environment nowadays is no longer allowing the possibility of choice or conscious postponing of problem solving to later. Needed becomes necessary, it is *modus vivendi* of human existence. While the past was giving the wide range of possibilities and procedures to man and society, nowadays the only alternative of human behaviour is the model of "homo ecologicus".

F. Fukuyama, in seeking the roots of human nature, and in the process of finding the answers to the question of the re-establishment of social order, states that one of the most important sources of social capital in present societies is the educational system. Educational system should not only provide students with knowledge and skills. It is intended to develop specific behavioural patterns and models of such existence of each individual that are the result of the so called instrumental and terminal values. Instrumental values are related to professional and ethical dimension of a man and to the suitability of his actions (be honest or be logical).

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Terminal values determine current and future goals of personality, there are the ideals determined by the status of social acceptance reflected to the individual goals, conditioned by personal hierarchy. If we have previously stated, the necessity of "homo ecologicus": it is up to schools to reflect this requirement to the maximum extent. Abstracted from geographical or historical conditionality, the dominant efforts of each school system should be to incorporate young people into society so as to be able to understand "their" time and focus their individual professional efforts not only on the subjective benefit but also on the benefit of the society and especially to the benefit of the Earth.

Methods

In the article we present the results of the research carried out at the Department of Supplementary Pedagogical Education at the Institute of Management of the Slovak University of technology in Bratislava. The main objective of the research was to find out how future graduates of University of Technology perceive the state of the environment, how they identify themselves with environmental load or with possible technological threats. We have tried to find the answers to the question of how the knowledge about the environmental burden are elaborated by students and how are they reflected into their attitudes and reasoned actions in terms of persuasive action.

For research purposes, we used the questionnaire method and the masked semantic differential method to measure the connotative meaning of concepts, the valence of the cognitive and emotional component of attitude. Authors analyze students' views on teaching at the Technical University from the viewpoint of the need for clarity and acceptability of the effect of technology on the environment not only "here and now", but with a time lag of several years or decades. By the Semantic differential method, they try to find the answer to the question about the quality of students' attitudes to the issue of development and environmental protection. They identify explicit and implicit factors (family, society, training and education process or teacher-student interaction, issues of pattern) which are dominant in the formation of positive and negative attitudes of students of university of technology to the creation and protection of the environment. Conative dimension corresponds to measure of subjective activities of students in this area and refers to the relationship between power factor, evaluation factor and the activity factor in the semantic differential.

Respondents were students of all faculties of the Slovak University of Technology – Faculty of Mechanical Engineering, Faculty of Materials Science and technology, Faculty of Electrical Engineering, Faculty of Architecture, Faculty of Civil Engineering, Faculty of Informatics and Information Technologies and Faculty of Chemical and Food Technology.

Results and Findings

Krech understands the attitudes as "knowledge, emotional and tendentious action in relation to the various subjects that are organized into the systems during the individual's development". Attitudes are open, dynamic complexes of feelings, knowledge and tendencies to act; they form the psychic reality of individuals. They are the source and regulator of an individual's social activity and they influence the social interaction.
As can be seen from the above, the attitudes have these three components:

- the cognitive component expresses the views of the individual on the subject; its core is the assessment of the opinions, assessing the favourable or unfavourable characteristics of the subject;
- the emotional component contains emotions that bind to the subject;
- the tendency to act component represents the behavioural readiness or tendency in the direction of attitude.

The attitude as such may develop in a very heterogeneous form in each component due to valence, versatility and intensity of attitude. In the socio-pedagogical-psychological literature the issue of attitudes is a topic discussed with a constant mild tension between the behavioural and mentalist concept of the interpretation of human behaviour. One group of authors emphasizes cognition; another group emphasizes rather the state of readiness to act in a certain way. Behaviourist-oriented authors consider as the base of attitudes the affective and constitutive elements of attitude and emphasize the role of activation and motivation factors, while the mentalist approaches emphasize at the formation of attitudes, the exploration of information and ways in which the information received are modified, i.e. the cognitive components of attitude.

The issue of ecologisation or environmentalisation lies in the dynamic context of qualitative changes at one of the leading places of education process at the STU. At all faculties, environmental education has been

introduced, the objectives of which are clearly aimed at the qualitative shift of the environmental consciousness of (MSc-engineers-technicians) graduates of University of technology (MSc-technicians).
Students evaluated seven notions, typical for the issue of creation and protection of the environment. The notions were judged by eighteen pairs of bipolar adjectives, confirmed by factor analysis as relevant for the appropriate assessment factor, force factor and activity factor, with a seven-point evaluation period (-3 ... 0 ... +3). Considered concepts or statements were: harmony, mother, environmental protection, pollution of the environment, ozone hole, environmentalism (as a teaching subject), technique or technology, human in the environment.

The following adjectives were used in the rating factor, which is the attitude of the person and describes the focus on the object: cold - hot, unhappy - happy, lifeless - lively, dark - light, unpleasant - pleasant, brutal-kind. The force factor is consistent with the feelings of severity, hardness, generalized as tension or release. Adjectives: Rare - frequent, blurry - clear, shallow - deep, weak - strong, small - big, powerless - powerful. The activity factor shows the dynamics and variability in the time which is required in the interaction with the object. Adjectives: quiet - noisy, jerky - fluent, pale - fresh, blunt - sharp, peaceful - excited, balanced - passionate.
If we proceed from the premise that the positive attitude of human is determined by his inner harmony and love, and at the same time the goal of being is harmony and love, then the notions of harmony and mother were understood as a standard against which we compare the degree of quality of attitudes to other notions. Judging from the polarization profile, the attitudes of respondents to these notions are highly positive - these notions characterize the adjectives alive, happy, pleasant, loving, strong, quiet, and balanced. From gender polarization profiles, women's emotionality is more readable.

The adjectives - unhappy, brutal, unpleasant, but also frequent, big, strong – express the negative attitudes of respondents to ozone hole. The subject of environmental education induces positive attitudes in respondents, characterized in particular by adjectives alive, pleasant, loving. The force factor has the minimum in the dimension of helpless - which is a warning, but in the present situation unfortunately the true signal.
The quality of attitude to pollution of environment is negative. It may be characterized by adjectives -unpleasant, unfortunate, in the factor of force adjectives- frequent, deep, helpless, in the factor of activity - excited. Similarly, negative are the attitudes to the statement - man in the environment while we state the high degree of similarity of polarization profiles.

We examined the quality of attitudes in relation to three pairs of bipolar adjectives: blurred - clear, powerless - powerful, peaceful - excited. Protection of the environmental may be characterized as "poorly" visible, the dimensions helpless-powerful, peaceful-excited are the reflection of more or less neutral attitude, with a minimal shift in the positive direction. Attitudes to the protection of environment are highly positive.

Conclusion

It is shown that in creating the environmental consciousness of technicians, its integrity and complexity guarantee not only rational arguments and facts but the enforcement of a qualitatively new system of values. This system takes care of moral redevelopment of students with well-developed eco-ethics and self-reflection. It is precisely the aspect of homogeneity that we consider to be positive in terms of the perspective of solving the environmental problems of technicians. The homogeneity of the polarization profiles encourages us to believe that the connotative meaning of terms is an absolute degree of agreement among students. On the part of us, the teachers, this is a homogeneous field of attitudes and the development of such targeted activities, which will be reflected in the current behaviour of technicians in the future. It is about developing effective programs, while we understand efficiency in particular as a high degree of acceptability and clarity with the aim of qualitative changes in consciousness of students, with subsequent modification of everyday, not just professional, behaviour and action.

Part of the core curriculum of engineer-technician must be a quality-defined ecological or environmental profile. The dynamics of environmental phenomena cannot be mastered without adequate knowledge, skills and desirable attitudes. The professional preparedness is not enough just as enthusiasm and sacrifice is not enough. The common denominator for success is to link professional preparedness and personal involvement with a feeling of responsibility. Responsibility towards our self and our surroundings, responsibility towards the profession, responsibility towards future generations, and, last but not least, responsibility towards the Earth as the bearer of life.

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A DESIGN OF SOCIAL MEDIA ANALYSIS SYSTEM BASED ON MOBILE PLATFORMS

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Abstract: Along with the developing technology, social media technologies have become widespread and the number of internet users has increased rapidly. In addition, social media platforms have become very popular and the number of active social media users has increased considerably. As a result of the increased use of social media, there has been a trend towards mobile platforms. In this paper, a design of a social media analysis system is developed using mobile platforms based on Android. By this way, important data about social media users will be able to gathered and analysed.

***Keywords*:** Social media analytics, android, tweet analysis, user analysis

Introduction

With technology taking an important role in people's lives, some social media platforms such as Twitter have become popular. People can easily share their feelings and thoughts with other users using these platforms. These platforms provide the opportunity to interact with and influence other people. By this way, social media users can share simple text messages, pictures and videos via those social media platforms.
The Twitter platform is a social media platform with has most users from all of these social media platforms. Twitter is a social network where users can write “tweets”, delimited by 140 characters and these tweets can be seen by other users too. Also, users can send not only text messages but also images videos, audio files and so on.

On this perspective, too much data is shared on Twitter, and when this data is analysed, meaningful results may emerge. Therefore, Twitter data can be thought that has important value to be analysed. Separately, social media platforms generally provide feedback on current events, companies, and other things and also provide some opportunities to evaluate their products or other things. When a new event occurs or a new technology emerges, many users start to tweet and retweeting about these events on Twitter. In this way, Twitter becomes a social data repository and information about the users and events can be accessed by this data repository.

The developed Android application accesses this data repository and performs data analysis. The analysis process is based on viewing and analysing all the data on Twitter about a keyword that the application user wants. With this mobile application, application users can view tweets on Twitter about any keyword and names of users’ profile pictures, locations can be displayed as examples of users who posted tweet about this keyword. In addition to these, all tweets that are shared on Twitter in real time can also be displayed. These real-time tweets are displayed with user names and text content without any limitations.

The mobile Android application provides a system that collects, stores and analyses the tweets that users posted. This application is suitable for all Android-powered devices and requires internet connection so that the application can run without errors. When the application is started, it connects to the Twitter platform via internet and interacts with Twitter data. Due to the application is mobile based, it can be used easily wherever the internet connection is available regardless of the location. Today, with the development of mobile devices with

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powerful hardware resources, high level processing is possible on mobile devices. In this respect, similar mobile applications are needed and mobile application that performs social media analysis as an example.

Related Works

The emergence of mobile devices and the reduction of the cost of the internet made it easier for people to use more than one social networking service at the same time. Web search methods such as Google search are not enough for Twitter content search. Many companies, researches, developers focused on tweets content analysis by applying some techniques on tweets.

In the business world, commercial companies, banks and similar organizations need systems that conduct social media analysis in order to receive feedback and improve themselves for the commercial or non-commercial products they have developed for potential customer. Governments also use similar systems to obtain information and feedback about on their own policies and on the opinions of their citizens. These example systems are generally server-based or desktop based applications.

Some works are being done and developed around Twitter analysis. In 2012 [1], a group of researchers identified a software architecture that aggregated tweets submitted in a given geographical location and within a specified time periods. This tweet gathering process was performed using Twitter Streaming API. In another study at Arizona State University [2], Twitter data was analysed and the detection of people using harmful substances was studied. The other study in 2012 [3], a group of researchers described their architecture to analyse Twitter data with using Twitter Rest API and Twitter Streaming API in PHP language and then MySQL database is used for storing data that coming from Twitter. In 2010 [4], a study is conducted to determine trends using the Twitter Streaming API. In this way, the most posted words in the tweets were instantly analysed on Twitter. In [5], tweets are posted by the users are analysed and displayed user's city level locations as results.

The common feature of all these studies is that they are implemented on desktop based platforms. These kinds of works require high speed internet connection and high quantity of hardware resource. Such studies are possible with cloud computing technologies [6] that are popular with the developing technologies. The cloud computing [7] technologies include inside of some technologies such as Apache Hadoop platform [8][9] Apache Spark platform [10][11]. As a result of the literature survey, there is no social media analysis work on mobile platforms. However, since the use of 4.5G has become widespread, mobile devices can perform as good quality work as some desktop devices.

Methods

Twitter provides API resources [12] to the usage for developers. Programmers are use the Twitter API to develop own applications or other projects that interact with Twitter. These applications talk with the Twitter API over Hyper Text Transfer Protocol and HTTP is a protocol that browser uses to visit and interact with web pages. For that reason, when using Twitter APIs, the internet connection is needed. Generally, these APIs are like as bridge between application and Twitter. There are many Twitter API libraries built for the Twitter platform. These API libraries have been implemented in different programming languages. Examples of these languages are Java, C++, ASP and C# programming languages. Within these libraries, Twitter4J library has been implemented in Java programming language.

Twitter basically provides two API to programmers. These are Streaming API and Rest API [13] [14]. The Streaming API is for application developers who want to receive a real-time stream of the public Tweets on Twitter. In this way, Streaming API provides to observe what is going on in the world. Tweet which is displayed with Streaming API is displayed in real time. The Rest API provides implementing access to read and write Twitter data. Rest API provides especially creating a new tweet, reading user profile and displaying follower data, and more. In addition to the Rest API, the Twitter API includes the Restful methods to send and receive twitter data. These methods are "Get" and "Post" methods. Get methods provides to obtain information such as user direct messages and post methods provides sending information such as sending to new direct messages from an application with Rest API which generally provides user information such as friendships, messages, statuses etc. so tweet text analysis is not suitable with Rest API. Both Streaming API and Rest API is important APIs for using and implementing Twitter data.

Twitter uses OAuth to provide authorized access to its API while sending secure authorized requests to the Twitter API. In this wise, Twitter provides security and standardization. Because, the users of Twitter are not

required to share their passwords and any other information with other applications or software. Many client libraries are compatible with Twitter's OAuth implementation. There are two types Twitter API authentication model. These are user authentication and application-only authentication [15]. With application-only authentication, the applications can access Twitter server to obtain any information about it. But with user authentication, it is allowed to reach only user information such as reaching own Twitter profile, sending direct message, displaying coming message, displaying friends list and follower list etc. to making analysis on Twitter, application-only authentication is needed.

Twitter data is a repository about getting some answers from tweets written all around the world. When data is used correctly and effectively, Twitter data will carry a great value. To realize the analysis of Twitter data is needed to searching, storing, analysing and visualizing steps. Tweets are needed to be downloaded for an efficient data analysis. So that it uses Twitter API to collect tweets from Twitter server database. Analysing Twitter data focuses on two key aspects of Twitter data: network analysis and text analysis. Network analysis is based on actions between users about following, followers and retweets. It tries to find answers out of user network on Twitter and network analysis is important for individual analyses. Text analysis is based on tweets which users posted on Twitter. Text analysis tries to find tweet's topics, any special words, owners and obtain any other information. For successful Twitter data analysis, searching, storing, analysing and visualization steps are required. After first three steps, Twitter data is downloaded, stored and analysed to obtain significant data. At this point, the purpose of analysis has completed. In visualization step, obtained Twitter data can be displayed via visualization tools.

The designed application is a mobile based android application that includes analysis and visualisation operations and uses the native API of Twitter. The mobile application gives services to a wide range of people, organizations or companies which need in public opinion pool about any subjects.

Design Of Social Media Analysis System Based On Mobile Platforms

The proposed system has four basic processes which are storing, searching, analysing and visualizing. Application searches Twitter cloud and results are downloaded from Twitter cloud. After that data goes into storing process to be stored in application's data structures. In storing process, data may be applied to some filtering operations to eliminate spams, advertisements and other unrequired and unrelated data. Due to time limitations of Twitter API to reach its own database, crawling and storing operations are batch processing operations performed in background at regular intervals. The system architecture is shown at Figure 1.

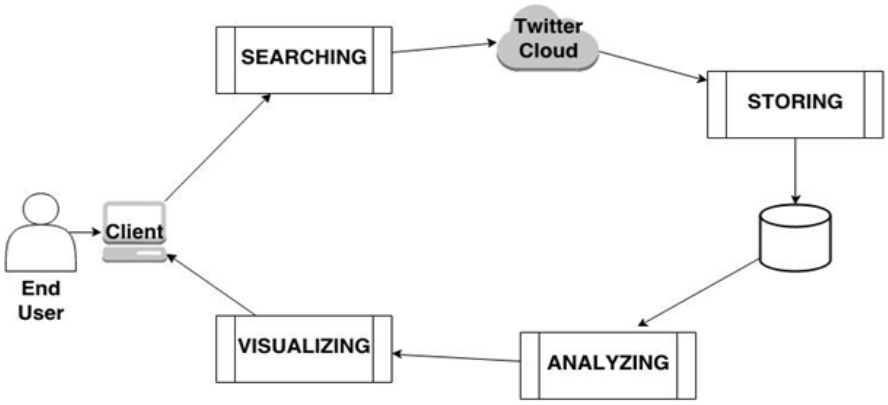

Figure 1. The proposed system architecture

The system collects data obtained from Twitter and analyses them in accordance with the requested topics.
The proposed system:

- Allows users to collect Twitter data posted with given keyword.
- Allows users to collect real time Twitter data.
- Allows users to retrieve relevant tweets from the collected data using textual queries.
- Allows users to display user profile image.
- Allows users to search tweets and retrieve user information.
- Allows users to analyse tweets which posted on Twitter.
- Allows users to visualize the results of analysed tweets.

The use case diagram shown in Figure 2 illustrates how users are expected to interact with the system.

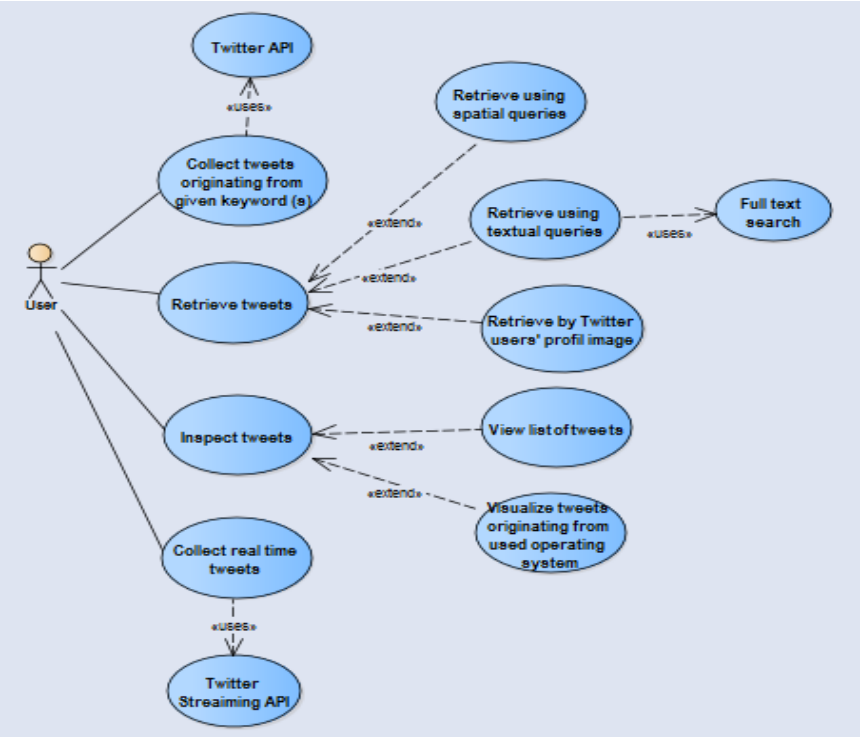

Figure 2. Use Case Diagram showing the expected usage of the proposed system architecture

The system has some functionalities. These functionalities are related with tweets obtained from Twitter. The first feature is getting tweet of a user. After a tweet is obtained, the same operation is continuously repeated, and the captured data is displayed on the screen as list view. Some pseudocodes of the system are given in Figure 3.

```
Get the tweets of a user:
Input Parameters: user id.
Returns: list of tweets(id)
Initialize tweetsIDs list with the tweets of the user input id
ListTweets
Sleep()
Foreach tweet in tweetsIDs
Begin:
Tweets.add(tweet id)
End:
Return Tweets.
End
```

(a) Getting tweet of a user

```
Avoid collecting same data for same tweet:
Input Parameters: tweet id
Returns: Boolean, true if the tweet id exist, false otherwise
Begin:
List tweets;
Foreach user in users
Begin:
Tweets.add(user.tweetID);
End:
If (tweet id is in tweets)
Return true;
Else
Return false;
End
```

(b) Avoiding to collect same data for same user

Figure 3. Some pseudocodes of the system

Conclusion

As a conclusion, technology developments in this century made communication and blogging shifts through social websites and platforms like Twitter. And this made social media platforms such as Twitter a valuable information resources in the important events like natural disasters, elections.

On this paper, it was aimed to gather important information via Twitter by making a smart crawler. This crawler will collect and store tweets and related information based on search with given keywords and other parameters. Then, the collected tweets are analysed with textual measures and a simple graphic chart was provided to the end

user as visualization. With the application design, the data coming from Twitter is planned to be evaluated in meaningful way. This application is hoped to give the important clues in about many things such as the people's social behaviour, personalities and characters. At this point, a lot of data can be obtained which may have beneficial results on behalf of our country. As the years are progressed, Twitter and similar social platforms will become even more popular and the number of active users will increase. So, the data obtained from social platforms will be very important and as the technology continues to evolve and social media usage increases, the more of this kind of work will be required.

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"WHO AM I?" – A REFLECTIVE EXPERIENCE ON THE SENSE OF SELF OF INTELLECTUALLY CHALLENGED ADOLESCENTS WITHIN FAMILIAL RELATIONSHIPS

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Abstract: This study explored intellectually challenged adolescents' experiences of their sense of self within familial relationships. An embedded, mixed methods approach was used – semi-structured interviews were conducted with 12 adolescents, who also completed an emotional intelligence measure, the BarOn Emotional Quotient Inventory: Youth Version. The participants' scores indicated average emotional intelligence, supporting their capacity to recognize, understand, and manage emotions experienced by the self and others. The adolescents provided corroborating qualitative evidence that they recognized the influence of family relationships, and positive and negative broader social experiences (e.g. peers in school) on their sense of self. Exploration and self-reflection facilitated the formation of strong, stable selves, and creates awareness that some adolescents need supportive reinforcement to construct a positive sense of self.

***Keywords*:** Identity, adolescence, familial relationships, intellectual developmental disabilities, mixed methods.

Introduction

"Sense of self" is a general term used by many theorists in describing human development and self-theories. Theorists such as Erikson (1963/1993), Polster (2005) and Rogers (1961) prefer the term "identity", "self-concept" and "selves". Jung (1947) and Rowan and Cooper (1999) regard the self as the center of the total personality, which includes the conscious and the unconscious. The self is also seen as the core part of a person and a sense of awareness a person has of him-/herself (Cottle, 2003; Crocetti, Rubini, Luyckx, & Meeus, 2008; Yontef, 1997). There is no consensus among theorists regarding the "self", but most agree that the self is a complex psychological structure and that the primary function of the self is to integrate, organize and unify a person's behavior, experiences and future ambitions (Erikson, 1968; Freud, 1923/1974; James, 1890/2010; Mead, 1962).

Forming a self-identity has long been considered a central developmental task during adolescence and emerging adulthood. This period is marked by many physical, mental, emotional and social changes. It is referred to as the identity cohesion stage versus a confusion stage, as adolescents ask "*Who am I?*", "*What am I to become?*" and "*What is my place in society?*" (Erikson, 1968). Oswalt (2015) believes that the configuration of a self during adolescence and adulthood creates a sense of psychological well-being, a feeling of being "at home" in one's body. According to Papalia and Feldman (2012), it includes a sense of knowing where one is going. Adolescents struggle to find answers to the questions that they ask about the self, and, according to Erikson (1968), the search for a coherent identity implies the forming of a coherent conception of self, which is made up of goals, values and beliefs to which a person commits firmly.

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Gergen (2011) argues that the formation of a self does not take place in isolation, but that the self is *socially constructed and re-constructed* through realities, external social influences, and dynamic forces of the field. It involves our experiences of the world and our relationships with others (Yontef, 1997; Hutchinson, 2003). These experiences take place through social processes, such as everyday interactions between people, and conversations as they unfold (Young & Colin, 2004). The family is one such place where interactions occur. Furthermore, the family constitutes a complex structure of interconnected relationships and interdependent individuals, none of whom can be understood in isolation from the system (Anderson & Sabatelli, 2011; Baron & Byrne, 2000; Pillay, 2010).

Adolescents are part of a family system, which provides socialization experiences, and also contributes to the development of each family member's personal identity by providing information about the self (Formby & Osborn, 2010; Krekula, 2002). Becvar and Becvar (2013) and Berk (2006) point out that this network of interdependent relationships constantly evolves, and is a relational and intricate part of people's personal and social lives (see also Brah, Hickman, & Mac an Ghaill, 2004). In this sense, adolescents with intellectual and developmental disabilities appear to be no different from other developing adolescents, as they too seek answers about themselves, their abilities, social acceptance and close relationships with their families and friends.

Intellectual and development disability (IDD), previously known as mental retardation, refers to a neuro-developmental disorder that occurs before the age of 18. The terms "intellectually disabled" or "intellectually challenged" are now preferred by most English-speaking countries (American Association of Intellectual and Developmental Disabilities, 2010; World Health Organization, 2014), and these are also the terms chosen by the researcher for this study. The term "intellectual and developmental disabilities" refers to a more general and broader concept, whereas the term "intellectually challenged" is used to refer to the specific adolescents who participated in this study. The disability is characterized by an intelligence quotient (IQ) of 70 or below, with approximately two standard deviations below the population, with significant limitations in *intellectual functioning* and *adaptive behavior* (American Association of Intellectual and Developmental Disabilities, 2013). The *Diagnostic and Statistical Manual of Mental Disorders V* (*DSM-V*) classifies the disability into five categories, as mild, moderate, severe and profound, or unable to classify (APA, 2013), based on intellectual functioning measured by means of standard tests of the intelligence quotient (IQ).

Previous research on people with disabilities has found that this population often do not talk about their disabilities, but are well aware of society's reaction towards their disabilities; their perceptions and views of themselves are also often restrained by the way society constitutes them as strangers in a modern world (Gwernan-Jones, 2008; Michailakis, 2003; Reeve, 2002). Michailakis (2003, p. 209) points out that "one is not born a disabled person – one is observed to be one". Similarly, Goodley and Tregaskis (2006) report that young persons with disabilities in particular seem to be aware of their differences and their exclusion from society. However, Hughes, Russell, and Paterson (2005) and Taylor (2000) have found that some people with intellectual disabilities construct a world for themselves in which the disability is not stigmatized, and suggest that their experiences of the disability and the formation of their self depends largely on the relationships they have with family members and significant others. Gill (2001), in an overview of prior studies, suggests that people with disabilities may experience a sense of estrangement even within their families and that their sense of self-acceptance and self-formation are significantly related to how friends and family members *react t*owards their disabilities.

Gill (2001) and Watson (2002) assume that the formation of the self can be structured on shared experiences, but that the self in a person with disabilities is fixed. By contrast, Terry and Campbell (2009), as well as Woodbridge, Buys, and Miller (2011) reject this argument, claiming that the self or selves of people with disabilities are fluid, not stagnant, and continuously evolve and become within family relations. Some studies indicate that emotional autonomy is reached in adolescents' relationships and that it often includes the development of more mature emotional connections with adults and peers (Reeve, 2002; Steinberg, 2011). Only through self-exploration can adolescents discover who they are, recognize their natural abilities and uniqueness, and construct a positive sense of self, reaching identity achievement and optimal functioning.

Despite these prior studies, there is still a lack of research on how intellectually challenged adolescents experience and see their sense of self within familial relationships. Hence, the present study explored these experiences and the influence of familial relationships on the configuration of an identity – a self. Key questions raised in this study were whether intellectually challenged adolescents' emotional intelligence (EQ) is affected by their limited cognitive abilities, whether their sense of self is stagnant, and to what extent family relationships and the perceptions of others influence the configuration and perception of these adolescents' sense of self. On the basis of the literature discussed above, the following research question was formulated: What are the experiences of intellectually challenged adolescents of their sense of self within familial relationships?

Method

Participants

The sample consisted of 12 intellectually challenged adolescents between the ages of 11 and 14 (M =12.17, SD = .94), living in the Ekurhuleni Metropolitan Area, in the Northern Region of the Gauteng province in South Africa. Of the 12 participants, four were female, and eight were male. The racial distribution was Black (n =5) and White (n =7). Potential participants were identified by teachers and therapists at a school for learners with mild to moderate intellectual and learning disabilities. The participants represented broad socio-economic strata. They were raised in intact two-parent families, single-parent or divorced families, extended three-generational or skip-generational families.

Measures

Qualitative interview questions

A semi-structured interview schedule was used to elicit responses from the participants. Questions focused on how the adolescents experienced their sense of self (their identity) and their relationships with family members. The following guiding questions were used to provide a framework for each interview: Tell me about yourself. How do you see yourself? Is there anything that you want to change about yourself? Tell me how you experience (see) yourself within your family. What do you enjoy about your family? How do you think your family view/feel about you? The order in which the questions were asked depended on the conversational flow of each interview.

Quantitative questionnaire

In this study, quantitative data were used to support the qualitative data. There is no instrument that measures sense of self as a construct, so the BarOn Emotional Quotient Inventory: Youth Version (BarOn EQ-i:YV) was chosen as a measure of certain components of sense of self, namely *self-awareness* and *self-perception*. The BarOn EQ-i:YV, developed by Bar-On and Parker (2000), was used to measure the social and emotional competencies of the participants. The inventory contains 60 Likert-type items anchored at 1 (*very seldom or not true of me*) and 4 (*very often true or true of me*). The items are divided into six subscales. Four subscales combine for a total measure of emotional intelligence (EQ): (a) Intrapersonal (six items – e.g., "It is easy to tell people how I feel"), (b) interpersonal (12 items – e.g., "Having friends is important"), (c) stress management (12 items – e.g., "I can stay calm when I am upset"), (d) adaptability (10 items – e.g., "I am good at solving problems"). The remaining items cover two scales: (e) general mood (14 items – e.g., "I feel sure of myself"), and (g) positive impression (six items – e.g., "I think I am the best in everything I do"). For each scale, higher scores reflect superior emotional and social abilities.

The factor structure found in the initial development and validation of the BarOn EQ-i:YV (Bar-On & Parker, 2000) has been supported in a subsequent study (Parker, Saklofske, Shaughnessy, Huang, Wood, & Eastabrook, 2005). Research has provided evidence of the discriminative power of the measure, showing that the BarOn EQ-i:YV is able to differentiate between primary and high school students with different academic achievement (for example, grade point average) levels. Higher scores for students clustered into more successful groups (Eastabrook, Duncan, & Eldridge, 2005; Parker, Creque, Barnhart, Harris, Majeski, & Hogan, 2004). Internal consistency estimates for the BarOn EQ-i:YV scales have been acceptable to strong (a = .65 to 90) across several studies (for example, Bar-On & Parker, 2000; Harrod & Sheer, 2005; Parker, Taylor, Eastabrook, Schell, & Wood, 2008). Acceptable test-retest reliability has also been found at an interval of three weeks for the EQ scales (r = .70-.89) and the general impression and positive impression and general mood scales (r = .60-.77) (Bar-On & Parker, 2000; Hassan & Sader, 2005).

Based on the purpose of this study, only those scales that combined for a measure of the total EQ were used. Two of the sub-scales that were important for this study were the intrapersonal and interpersonal scales, which are closely linked to self-awareness, self-perceptions, feelings and relationships with others.

Procedure

Institutional ethical approval was sought and granted to conduct the study (NWU-00060-12-A1, and formal permission was obtained from the South African Department of Education to access the relevant school. The

school gave permission to access the participants. Informed consent was obtained from the participants' parents. Assent was obtained from the intellectually challenged adolescents. The participants and the participating families were fully informed of the purpose and nature of the study, the conditions of participation, the fact that participation was voluntary, that confidentiality and anonymity would be maintained, and that participants had the right to withdraw.

The BarOn EQ-i:YV was administered to the adolescents individually (one-on-one) at a school for learners with intellectual and learning disabilities. Because of these learners limited English capacity, the test (which is in English) was read out aloud to each adolescent by the test administrator. In order to accommodate the unique abilities of the adolescents, visual cues and prompts were provided when questions were presented to them. The instrument took approximately 15 to 20 minutes per person to complete. After the completion of the BarOn EQ-i:YV, semi-structured interviews were conducted with the adolescents at the school in a quiet and comfortable area at the school. Each interview took about 45 to 60 minutes. Family photographs taken earlier with the adolescents' families and genograms drawn by the adolescents were used during the interviews to stimulate dialogue between the researcher and each adolescent.

Data analysis

Qualitative data

The interview data were analyzed using a six-phase thematic analysis, as described by Boyatzis (1998) and Braun and Clark (2012), using the following thematic analysis steps: data gathered through narratives and observations were familiarized, coded and verified by two independent therapists with post-graduate research experience. They looked for themes relevant to the research question, then reviewed, identified and named the themes.

Quantitative data

EQ-i:YV raw scores were converted to standardized scores and descriptive statistics were computed for each of the relevant scales. Differences between sex and race groups on each scale were examined, using independent sample *t*-tests, and one sample *t*-tests were performed using the total sample by specifying a comparative standardized mean value (that is, 100) for each variable (see Table 1). Before proceeding with parametric testing, all hypothesis testing assumptions were tested and appropriately fulfilled. An alpha level of .05 was used for all statistical analyses. Cohen's (1992) effect size guidelines of .2 (small), .5 (medium), and .8 (large) were used to evaluate the strength of differences (or a lack thereof) between the comparisons that were made.

Results

A mixed method embedded design was selected for the study, which included both quantitative (embedded) and qualitative results. According to Creswell and Plano Clark (2011), a mixed methods design provides a more holistic picture of the research question, and enhances data triangulation, validity and the congruence of findings (cf. also Menon & Cowger, 2010). Delport and Fouché (2011) argue that the advantage of an embedded design is that two types of data collected concurrently can be compared and interpreted to determine the effectiveness of an intervention. The findings are reported in Table 1.

With regard to the quantitative analysis, the majority of the participants (67%-75%) scored within 1 standard deviation of the mean across each scale (see Table 1). There were no statistically significant differences between the participants on each of the scales based on sex or race. However, on the intrapersonal scale (negligible effect size), small to medium effect sizes were found for each of the comparisons, with the exception of race. The total sample did not display statistically significant differences from the specified standardized mean value, but large effect sizes were found on the interpersonal and general mood scales. In particular, the sample in this study seemed to score markedly lower on the interpersonal scale, and markedly higher on the general mood scale, than average members of the population.

Table 1. Descriptive and T-test statistics for EQ-i-YV scales

Variable	Sex		Race		Total		
	Female (1)	Male (2)	Black (1)	White (2)		Below 1 *SD* from *M*	Above 1 *SD* from *M*
Intrapersonal						1	3
M	100.25	105.50	104.00	103.57	103.76		
SD	5.19	14.96	7.48	15.79	12.51		
t-test	*t* (10) = -.67, *p* = .52		*t* (10) = .06, *p* = .96		*t* (11) = 1.04, *p* = .32[a]		
d	.47		.03		.63		
Interpersonal						3	1
M	91.00	95.00	90.00	96.29	93.67		
SD	8.17	13.98	5.39	15.16	12.10		
t-test	*t* (10) = -.52, *p* = .61		*t* (10) = -.88, *p* = .40		*t* (11) = -1.81, *p* = .10[a]		
d	.35		.55		1.09		
Stress management						1	2
M	97.25	101.88	103.80	97.86	100.33		
SD	5.74	18.57	7.95	19.21	15.29		
t-test	*t* (10) = -.48, *p* = .64		*t* (10) = 65, *p* = .53		*t* (11) = .08, *p* = .94[a]		
d	.34		.40		.04		
Adaptability						2	2
M	94.25	99.50	93.40	100.86	97.75		
SD	11.59	19.21	8.44	20.86	16.67		
t-test	*t* (10) = -.50, *p* = .63		*t* (10) = -.75, *p* = .47		*t* (11) = -.47, *p* = .65[a]		
d	.33		.41		.28		
General Mood						0	0
M	102.50	105.50	103.00	105.57	104.50		
SD	8.58	6.87	4.58	8.87	7.23		
t-test	*t* (10) = -.66, *p* = .52		*t* (10) = -.59, *p* = .57		*t* (11) = 2.16, *p* = .05[a]		
d	.39		.36		1.30		
Total EQ						2	2
M	96.00	102.50	98.60	101.57	100. 33		
SD	8.64	15.17	8.68	16.43	13. 30		
t-test	*t* (10) = -.78, *p* = .45		*t* (10) = -.37, *p* =.72		*t* (11) = .09, *p* = .93[a]		
d	.53		.23		.05		

Note. [a] one-sample *t*-test, *M* = mean, *SD* = standard deviation, *d* = Cohen's d.

The quantitative and qualitative findings are summarized in a joint display in Table 2.

Table 2. Joint display of quantitative and qualitative results

Variable	***N***	**Scale description**	**Adolescents' experiences and awareness on sense of self**
Intrapersonal	**12**	Emotional *self-awareness*: ability to recognize, understand one's feelings.	Self-descriptions were made with reference to several domains with positive and negative experiences.
Very high to extremely well-developed EQ (120-129).	2	Assertiveness: ability to *express feelings*, beliefs, and thoughts.	Characteristics attached to abilities and inabilities (seen as disabilities).
High to well-developed EQ (110-119).	2	Self-regard: the ability to accurately appraise oneself.	Abilities seen as capable selves and accepted by society.
Average to adequate EQ (90-109).	7	Self-actualization: realize one's potential, capabilities.	Disabilities seen as disabled selves and rejected by society.
Low to underdeveloped EQ (80-89).	0	Independence: self-directed and controlled thinking and actions.	Gender, gender roles and physical traits. Religious and cultural selves.
Very low to extremely underdeveloped EQ (70-79).	1		
Interpersonal	**12**	Empathy: ability to be aware of, understand and appreciate *feelings of others.*	<u>Family relationships vitally important for the formation of selves</u>:
Very high to extremely well developed EQ (120-129).	1	Social responsibility: ability to demonstrate oneself as cooperative, contributing and a constructive member of one's social group.	Majority of adolescents expressed the desire to have closer and affectionate bonds with their family members. More important than their disability.
High to well-developed EQ (110-119).	0	Interpersonal relationship: ability to establish and maintain satisfying relationships characterized by emotional closeness.	<u>Relationships with peers, and friends</u>: difficulties in forming and maintain relationships (Disability hinders contact-making)
Average to adequate EQ (90-109).	7		Compared self to typically developed adolescents without disabilities
Low to underdeveloped EQ (80-89).	3		Majority felt rejected by social group and larger

Very low to extremely low underdeveloped EQ (70-79).	1		community

Stress management	**12**	Stress tolerance: ability to withstand adverse events and stressful situations, without falling apart, by positively coping with stress. Impulse control: ability to resist or delay an impulse and control one's emotions.	Stress symptoms noted during the test administration and during the semi-structured interviews with adolescents. were: Anxiousness, difficulties in speech, restlessness and shyness – protecting eyes and ears. Responses by adolescents regarding their experiences after test administration were positive, but there was some stress reaction as they felt that they had not answered correctly. During semi-interviews: narratives revealed that most of the adolescents felt that they needed to perform "better" to get love and acceptance from parents.
Markedly high to atypically EQ (130+).	1		
Very high to extremely well-developed EQ (120-129).	0		
High to well-developed EQ (110-119).	1		
Average to adequate EQ (90-109).	9		
Low to underdeveloped EQ (80-89).	0		
Very low to extremely low underdeveloped EQ (70-79).	1		

Adaptability	**12**	The ability to validate one's emotions and the flexibility to adjust one's emotions, thoughts and behavior to changing situation and conditions. The ability to identify, define problems and generate and implement potentially effective solutions.	Intellectually challenged adolescents required structure and routine to feel safe and secure: Any changes in the school environment, travelling on the school bus, or to be subjected to any changes in their normal routine caused stress. Some adolescents were not able to adapt easily, resistance for the "unknown" such as testing or interviewing.
Very high to extremely well developed EQ (120-129).	2		
High to well-developed EQ (110-119).	1		
Average to adequate EQ (90-109).	4		
Low to underdeveloped EQ (80-89).	4		
Very low to extremely low underdeveloped EQ (70-79).	1		

General Mood	**12**	Optimism: ability to look on the brighter side of life and maintain a positive attitude in the face of adversity. Happiness: ability to feel satisfied with one's life, enjoy oneself and others. Strongly connected to intrapersonal wellbeing.	This scale is connected to the Intrapersonal scale. Most of these adolescents reflected an attitude of being happy and content. A positive and supportive school environment and family relationships contributed towards this finding. Male participants had higher scores than female participants. Female adolescents displayed more concern regarding their physical appearance.
Very high to extremely well developed EQ (120-129).	0		
High to well-developed EQ (110-119).	3		
Average to adequate EQ (90-109).	9		
Low to underdeveloped EQ (80-89).	0		
Very low –to extremely low underdeveloped EQ (70-79).	0		

Total EQ	**12**	The total EQ score reflects an individual's emotional and social intelligence, which consists of the ability to understand oneself and others, relating to people, adapting to changing environmental demands, and managing emotions.	
Very high to extremely well-developed EQ (120-129).	2		
High to well-developed EQ (110-119).	1		
Average to adequate EQ (90-109).	7		
Low to underdeveloped EQ (80-89).	2		
Very low to extremely low underdeveloped EQ (70-79).	0		

Discussion

The participating intellectually challenged adolescents described their selves by referencing to several self-descriptions viewed as "selves". In the discussions, the responses of the adolescent were labelled (A) for (adolescent) and numbered, indicating the particular participant's response, but protecting the participant's identity. Where adolescents responded in Afrikaans (one of the 11 official languages in South Africa), a translation is provided in square brackets.

Most of the adolescents commented on their "competent" or "talented" selves by referring to their abilities, such as the ability to draw, sing, paint, and be helpful to others (A1, A3, A11). Participants referred to their self as "kind" or "responsible", which were important traits for them to be accepted by their family and friends (A6, A10). The participants also connected the self to positive and negative experiences. They connected negative experiences to disabilities – typical comments were: "*I cannot count, read or write. I am slower*" (A1, A7, A10, A11, A12); "*I always hear about the things I cannot do and not what I can do*" (A6); *"I have difficulties in walking carrying things – slower*" (A9, a participant diagnosed with cerebral palsy). According to Polster (2005), such experiences (positive or negative) register, and may evolve and warrant a description, the naming of a self which is recognizable, and lead to inferences for likely behavior and feelings. This is a natural process of configuration that takes place through contact between a person and his/her field. The field is seen as a person's family and contact with others (McConville & Wheeler, 2001; Yontef, 1993).

Selves were attached to *gender*, *gender roles* and *physical appearance*. These self-descriptions and responses from intellectually challenged adolescents were much like those of adolescents without intellectual and developmental disabilities. Most of the participants referred to themselves as male or female, referring to gender roles and physical appearance. Male participants referred to the boys and men being "expected" to play sport, be "manly" and "attractive" (A7, A12). Female participants saw themselves as feminine, with features they regarded as attractive, such as blue eyes and long black hair (A3); others referred to gender-related tasks and roles such as being able to cook and clean (A1), taking care of younger siblings (A4), and having children (A2). These roles and expectations attached to roles were imposed on them by family and society. These intellectually challenged adolescents also compared themselves to adolescents without intellectual and developmental disabilities, and they were aware that they did not meet the expectations of family members and society. Typical responses were: "*I cannot do what other boys do – play sport*" (A6); "*Ek is n meisie maar sal nooit kinders hê nie*" *[I am a girl but will never have children]* (A2 – this adolescent had been sterilized); "*Ek is anders as ander seuns, ek speel met poppe. Ek wil eendag 'n haarkapper word, daarom speel ek met hul hare*" *[I am not like other boys, I play with dolls. I want to be a hairdresser that's why I play with their hair]* (A8).

Female participants recorded slightly lower scores on the Intrapersonal and the General Mood scales of the BarOn EQ-i:YV (which are closely linked) than the male participants. This suggests that the male adolescents were slightly more positive, happier and satisfied with their bodies, looks, and themselves in general. These findings were in line with the findings of the semi-structured interviews with the participating adolescents (see Table 2). Although participants, who experienced difficulty with accepting themselves, did not regard themselves as "disabled", they perceived their disability as an obstacle that prevented them from becoming more independent and from being accepted by their peers and society.

The self was strongly connected to *religion* and *culture*, a finding which supports the arguments of Erikson (1968), Fromm (1992) and Vygotsky (1986), who posit that the central task in identity formation is a consolidation of the emerging self in a **social context**, including cultural background. The participants often mentioned their cultural background and/or home language, which they regarded as an important factor in feeling a sense of belonging to or rejection from their social system or group; for example, some of them said: "*I am Italian*" (A3); "*I speak Sepedi – we come from a proud family. My grandparents live in Lesotho*" (A4); "*I was called after my grandfather – he is a great man. My mother feels ashamed of me. It is shameful in my culture to be different – like me*" (A10).

A religious sense of self provided answers to some participants as to why they were created "differently". Their perceptions of a "religious self" were influenced by the views and values of family members, who did not perceive them to be a burden, but saw them as a blessing from God. These findings are in line with those reported by Fisher and Goodley (2007), who also found that parents perceived children and adolescents with intellectual and developmental disabilities as a gift that brings goodness and mercy. The views of their parents and significant others strongly influenced how participants A1, A2 and A11 saw themselves; they referred to God as the Creator, who should not be questioned, as there must be a reason, and a purpose for their existence: "*Hulle (grootouers) sê dit is Jesus wat my so gemaak het – anders, en Jesus gebruik my om te sing*" *[They (grandparents) say it is Jesus who made me like this – different, and that Jesus is using me to sing]* (A11); "*Ek*

dink ek is special al is ek anders. Ouma sê dit is hoe Jesus my gemaak het" (A2). *[I think I am special, despite being different. Granny says it is Jesus who made me like this]* (A2)

All the participants referred to the importance of having a family, family relations and a sense of belonging. The participants see their families as a safe haven where they can feel accepted, do fun things and be loved. Responses such as the following emphasized relationality and connectivity: "*My family is everything to me – I am nothing without my family*" (A3); "*My family is always there to help me – I'm happy to have a family*" (A6); "*Pappa kom altyd op vir my – hy is my hero. Hy laat my sy naels en toonnaels cutex – ons lag baie saam*" *[My father always defends me – he is my hero. He lets me put nail varnish on his nails and toenails – we laugh together a lot]* (A2).

However, some participants falsely internalized negative experiences and comments from family members and significant others as part of their selves, questioning their self-worth and abilities: "*I think my mother left because of me – I am slow, not normal*" (A7); "*I used to cut myself (self-mutilation), but not now. They (parents) must listen to me. My family keep secrets from me, maybe because they think I do not understand* – dumb *you know*" (A3); "*My boetie is lief vir my, maar hy noem my lelike name* – retard *en* stupid" *[My brother loves me – but he calls me bad names* – retard *and* stupid*]* (A8).

Most participants expressed a desire to be more independent, to be trusted by family members and allowed to explore new experiences, such as making friends, going on school camps and doing chores and activities without being reminded of their "disability". A typical response was "*Dit voel asof hulle my nie hoor of sien nie. Hulle wil alles vir my doen – ek wil dit vir myself doen – al is ek stadig*" *[It feels as if my family do not hear or see me. They want to do everything for me – but I want to do it for myself – despite being slow]* (A1).

A common theme mentioned by all the participants was the important role that peer relationships, friends and the larger social community plays in their functioning, and in how they regard and construct their selves. Their positive and/or negative experiences in this respect influenced how they value themselves. Their main focus was the relationships aspect, rather than the disability, in determining their self-worth and value. Strong bonds and relationships generated positive experiences, whereas rejection and exclusion were more connected to negative experiences. Some responses that reflected their positive and/or negative experiences were the following: "*Maats is belangrik vir my…, van hulle sien my raak*" *[Friends are important to me – some of them notice me]* (A1); "*I have friends who accept me and play with me. I am invited to other children's parties at church*" (A4); "*My friend makes fun of me when I told them I am in this school [referring to the school for intellectual and learning disabilities]. I don't want to tell people where I go to school. We do not have grades in my school, you know*" (A10).

Most of the participants compared themselves with adolescents without intellectual and developmental disabilities and expressed difficulty in socializing with peers or other adolescents during sport gatherings/leadership camps. Participants with noticeable physical features associated with the disability also voiced feelings of rejection because of derogatory comments made to them. Some adolescents (A9 and A11) felt ashamed to be associated with a "special school" and their family and social class. McConville and Wheeler (2001) see this as a natural process, a disembedding process. In that process, differentiation occurs from the field of family relations, towards the peer group that becomes a figural field of influence (Yontef, 1993). McConville & Wheeler, (2001) describes this developing task of adolescence as maintaining a place in the family field (a place of belonging) while also focusing on forming a "self" separate from the family. McConville and Wheeler (2001) argue that to develop a stronger sense of self, adolescents need to take ownership of the self, and explore both the intra- and interpersonal fields – what Phillippson (2009, p. 21) refers to as the "me and not me". It is only through shared realities with family and friends and experiencing love and acceptance that a fully developed self will emerge (Rogers, 1961; Schultz & Schultz, 2005). According to Cottle (2003, p. 99), this emerging self leads to an affirmed self – *"I am that I am".*

Conclusion, Limitations and Recommendations

The purpose of this study was to achieve a better understanding how intellectually challenged adolescents experience their sense of self in familial relations and how this understanding influences the construction of an identity – a self. The results from the quantitative analysis indicate that the majority of the participating intellectually challenged adolescents fell within the *average to adequate range of emotional intelligence.* This implied that most of these adolescents were able to recognize and express their emotions, show positive self-regard and an ability to understand the feelings of others. This finding contradicts the general perception that intellectually challenged adolescents, because of their limited cognitive abilities, reflect low emotional

intelligence (are not in touch with their intra- and interpersonal selves), implying that intellectually challenged adolescents have stagnant identities. This study's findings do not support such assumptions.

The current study has some limitations: the findings should not be generalized across the spectrum of all adolescents with intellectual and developmental disabilities, given the small sample size, and the fact that the study focused on early adolescence as a developmental phase. It is suggested that in future, a longitudinal study be considered in which researchers track children and adolescents with intellectual and developmental disabilities from early to late adolescence. Administering the BarOn EQ-i:YV also had some practical implications, because no norms for children and adolescents with intellectual and developmental disabilities were available to enable comparisons in that cohort. This gap can be explored by researchers, who might check the internal reliability of the BarOn EQ-i:YV on the different scale items (questions) and generate norms for children and adolescents with intellectual and developmental disabilities. Despite these limitations, the study identified several important aspects which practitioners in the field of mental health should to take into consideration in rendering services to children and adolescents with intellectual and developmental disabilities.

A key element to note is the important role that familial relationships play in adolescents with intellectual and developmental disabilities' construction of their self-identity. It is thus vital for practitioners to introduce family-centered approaches based on the principles of positive psychology in rendering support. It is promising that it appears possible for intellectually challenged adolescents' emotional intelligence to be developed by supportive familial relationships and intervention programs.

It can also be concluded that intellectually challenged adolescents' selves are not fixed or stagnant, but dynamic and constantly evolving, like those of developing adolescents without intellectual and developmental disabilities. The participating adolescents understood and perceived their world (field) on the basis of shared constructions of their field, which included family and friends as role models. Role models played an important role in how these adolescents imagine their future selves. Exploration and self-reflection helped the adolescents to ground themselves, feeling less confused, and shaped their perceptions of belonging.

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TRANSITION FROM TRADITIONAL LESSON TO CONSTRUCTIVE LESSON, IE. TRANSITION FROM TEACHING TO LEARNING

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Abstract: At the beginning of the 21st century, educational system in Azerbaijan was reconstructed and modernized. The usage of innovative teaching technologies, ICT and pedagogical technologies, the application of active, project, problem and constructive teaching are considered one of the essential issues. New pedagogical studies should be carried out in order to solve these problems and to find out their being effective. In the traditional way of teaching which was applied for centuries, the teacher was required to transfer knowledge and the students were required to remember and apply their knowledge properly.The traditional way of teaching was based on pragmatism - one of trends of the education philosophy ie. the teacher was in the center of the teaching process, the pupils were acquiring knowledge passively, teacher-student relations were like subject-object.

Therefore, it is right to abandon traditional way of teaching completely because it is a teaching theory and in this teaching process which is based on theory mental skills of cognition such as knowledge, comprehension, and application are improved. If we want to train a high-thinking personality according to the requirements of the technological community, we must build up the training process on the principles teaching theory together with the principles of learning theory.Together with memory, application, comprehension, we must improve the highest level of thinking: That is, we have to put into practice the analysis, creation and evaluation mechanisms which are considered the highest levels of cognition. When we attach much importance to the mental acttivities such as analysis, creation, and evaluation in addition to the knowledge at the lesson, the traditional lesson is transformed into an innovative – constructive lesson

Keywords: Constructive learning, pragmatism, creation, evaluation, Blooom's taxonomy, theory of learning, teaching theory.

Introduction

At the beginning of the 21st century, educational system in Azerbaijan was reconstructed and modernized. The usage of innovative teaching technologies, ICT and pedagogical technologies, the application of active, project, problem and constructive teaching are considered one of the essential issues. New pedagogical studies should be carried out in order to solve these problems and to find out their being effective.

In the traditional way of teaching which was applied for centuries, the teacher was required to transfer knowledge and the students were required to remember and apply their knowledge properly.The traditional way of teaching was based on pragmatism - one of trends of the education philosophy ie. the teacher was in the center of the teaching process, the pupils were acquiring knowledge passively, teacher-student relations were like subject-object. Alongside its disadvantages, the traditional way of teaching had a number of advantages also.

In this way of teaching, much scientific information is provided within a short period of time, difficultly comprehended knowledge is explained to the students in detail (minutely), time is saved and pedagogical processes are managed effectively. Therefore, it is right to abandon traditional way of teaching completely because it is a teaching theory and in this teaching process which is based on theory mental skills of cognition

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such as knowledge, comprehension, and application are improved. The results of the teaching theory are placed at the lowest level of Bloom's cognitive taxonomy.

If we want to train a high-thinking personality according to the requirements of the technological community, we must build up the training process on the principles teaching theory together with the principles of learning theory.Together with memory, application, comprehension, we must improve the highest level of thinking: That is, we have to put into practice the analysis, creation and evaluation mechanisms which are considered the highest levels of cognition. When we attach much importance to the mental acttivities such as analysis, creation, and evaluation in addition to the knowledge at the lesson, the traditional lesson is transformed into an innovative – constructive lesson.

Constructivism being one of the pedagogical - philosophical trends is a theory of learning (J. Piaget) and while delivering a lesson with the help of constructive teaching based on this theory (F. Bunyatova), pupils are given the opportunity of creating new knowledge based on their acquired knowledge. The principles of three philosophical trends - pragmatism, progressiveism and constructivism are used. In pragmatism, ways of teaching, methodological approaches; in progressiveism, pupils' engagement; and in constructivism, pupils' thought and intellectual activity is emphasized. It proes that each knowledge should be understood, consolidated(praqmatism) by the pupil, knowledge should be discussed within the team and at classes (the signs of progressivism), and mental actions should be cariied out to build up new personal knowledge (constructivism).

In this case, teaching (pragmatism) is transformed into comprehension (cognitivism), cognition is transformed into creativity (constructivism), and adds a new level – creativity- to the levels of J.Bloom's cognitive taxonomy (knowledge, comprehension, analysis, evaluation).

Methods

On the example of a constructive lesson we want to show the process of creating new knowledge. 3rd class Azerbaijani language lesson: a fragment from a constructive lesson. The teacher clarifies in advance the logical relationship between the students' knowledge, and determines to which conclusion they will come by completing this relations with other relations, attitutedes, similarities, and how they will elucidate their own acquired knowledge. It was evening. The children returned to the village.
Q: What kind of are sentences they?
A: Simple sentences
Q; Can we combine these sentences?
A: Yes, we can combine.
A: No, they can't be combined.
The answers are different.
T: When we combine two words, we have a compound word. The sentence consists of words. If the words are combined and a compound word is formed, then can sentences combine to form a sentence?

The answers are discussed and they decide that they can be combined.
T: If we combine, what kind of sentences will they be?
A: One sentence with two sentences.
Here is the supplementary information by the teacher:
There are two simple sentences in this sentence. Such sentences are called composite sentences. Composite means that the sentence is composed of several parts. This supplementary information by the teacher creates a complete scheme of their present knowledge with their future knowledge (knowledge from the 5th class).

The teacher asks logically sequenced by going into the theme's sturcture and makes students think while switching from one structure to another. The questions are problematic in order to think over and come to the conclusion. In this fragment, we saw the relationship between acquired knowledge and future knowledge.

Another example. Beginning from the ontogenesis of knowledge about equation till the finding process of the sum are discussed in order to assume the rule. Then multiplicative and substitution operations of constructive teaching are used. In order to apply this rule in another field, pupils are given the following logical task: (primary school, 4th grade)

Generelizing and logically reasoning of the teacher's discussion. Thus, to solve the equation *6 · x = 24,* we divide the sum *24* into multiplier *6* and we had *4* in solution. Then what kind of equation will we have if we replace the multiplier *6* in this equation by the letter a and the sum *24* by letter b?

A: the equation $ax = b$
Q: How do we solve this equation?
A: $x = b : a$
Q: What steps did we take to transform the equation $6 \cdot x = 24$ into $ax = b$ and to solve it?
A: 1) first in order to find x, $\mathbf{24 : 6 = 4}$; $\boldsymbol{x = 4}$;
2) we substituted the numbers for letters and we had got equation $ax = b$; as we substituted numbers, we applied the same rules to the letters we did the numbers. And so we got $\boldsymbol{x = b : a}$.

The pupils created new knowledge based on the given questions, the students were able to draw a new algebraic expression from their knowledge about equation. Afterwards, their acquired knowledge is consolidated. To achieve this goal, to consolidate their knowledge, they are asked to apply this knowledge to the tasks.

1) 10 · x = 50; *2) 28 : x = 14*
3) □ = □ 4) x : =
5) □ □ ; □ : = □ □ □ □ □

The first and second assignments are directed to the consolidating of knowledge. The third and fourth tasks are directed to comprehension and help to discover pupils' mathematical abilities. The fifth and sixth tasks are creative, and the pupils themselves build up examples.

Recommendations

The main purpose of the national curriculum applied in Azerbaijan is to acquire knowledge. Acquiring itself means to reflect the given knowledge. As a result of the research carried out at the lesson, there is a great gap between the acquired knowledge and its understanding and emerging. The main reason for this gap is that the tasks given in the textbooks are inclined to reflect and apply knowledge.

The lack of creation of knowledge means that the students do not possess these mental abilities. If the assignments about these questions are included in the textbook, if the teacher has a mechanism to create them in the classroom, and if they are applied at the classes, then the quality of the teching will significantly increase, and the growing generation will not only acquire knowledge, but also they will be creative persons.

Thus, the transition from teaching to learning is a way from pragmatism to a constructive way of thinking, and in the result the teacher's thoughts and the student's thoughts will also logically improve.

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RESEARCH ETHICS AMONG FACULTY MEMBERS IN IRAN

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Abstract: Research ethics is one of the ongoing issues of universities. The purpose of this paper is to conceptualize the ethics of research among medical academics in an Iranian medical university. Unfortunately, ethics in research among medical academics pay little attention in Iran. Methodologically, qualitative study 2015 in an Iranian medical university discloses the different aspects of ethics in research. Twenty-two academics participated as the key informants to reflect the different aspects of research ethics. The findings of this study disclose that research ethics were configured by core phenomenon of ethical norms with three subcategories These subcategories are jealousy, irresponsibility, and dishonesty. Consequently, recognizing the norms of ethics in research are indispensable to develop research culture as to help academics to improve their research outcomes.

***Keywords*:** Research ethics, academic member, medical university, research norms

Introduction

Basically, along with research contextual and research environmental elements, which are important, to form the nature of research (Collins & Van Dulmen, 2006), research culture is the term that frequently mentioned by several authors (Becher & Trowler, 1989, Hill, 1995, Thompsom, 2003, Girot, 2010, and Dauber et al., 2012). For instance, Becher & Trowler (1989) declared that besides the interactions of values, social, economic, and political factors the impact of ideas and actions of the academic tribes epitomize the main context of research (Becher & Trowler, 1989). It seems that the rule of culture for creating the context of research should be considered in planning for research development. Essentially, according to some experts (Hill, 1995; Schein, 1985; Girot, 2010; Thompson, 2003), there are bilateral directions between research culture and lectures' viewpoints about research and their activities for doing research. Forbes and White (2012) stressed that assumed research culture as the imperative need for academics. In associate with them, Schriner (2007) in his study contended that cultural dissonance in medical centers affects academics' values and norms. Based on his findings, cultural dissonance for medical academics can be improved through mentorship, formal training, and socialization.

Basically, the academics' shared values and norms are common opinions and behaviors in each department created the particular clan culture in the faculties. This values and norms can influence the quality of research (Hann et al., 2007). Moreover, according to Pololi et al. (2009) academics' norms and values are vital to further productivity in medical disciplines. They listed several cultural barriers in medical schools such as lack of consideration to the social mission of providing clinical affairs, a paucity of prioritization of excellence in a medical center, a degrading of teaching roles, problematic ethical behavior in management, and the need for self-promoting actions to succeed.

Other scholars showed the impact of managers' viewpoint about research on research culture in medical faculties (Sean et al., 1993; Pratt et al., 1999). For instance, according to Pratt et al. (1999) the change in managers' beliefs, attitudes, and values, can change the organizational culture. Additionally, they noted that in order to construct research culture, the basic factors of time, precise planning, resources, and environment, should be

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taken into account. However, Reybold (2008) and Yamin, (2010) stress on ethicality that forms the culture of faculties. Moreover, they concluded that cultural issues trigger the psycho-violence among academics in faculties. In contrary to this psycho-violence Conner et al. (2014) provided a model for cultural adaptation among academics.

There are many frameworks for organizational culture, but these frameworks came from particular phenomena or context (Tsui, Nifadkar & Ou, 2007). Logically, based on thinking system organizational culture configures by multidimensionality and complexity of different elements (Bertalanffy, 1969). These elements can be ideologies, groups, rules, structures, and environment (Dauber et al., 2012). According to Sagiv and Schwartz (2007), the values and norms of surrounding society and preferences of different members in line with the duties and tasks can influence the culture of an organization. These factors determine the individuals' actions, and also evaluating others through the norms, preferences and accepted regulations. Additionally, Schein (1985) as the first person that proposed the concept of organizational culture counts six meanings of organizational culture, which agreed commonly. These common meanings are values, rules, philosophy, norms, feeling/climate, and observed behavioural regularities. The components such as values, preferences, and norms that are mentioned by the other studies repetitively, support the findings of the first research question. Sometimes values and norms are considered as the ethical behaviours for having ethical faculty. Ethical community for having any professional development is necessary for universities (Beneveniste, 1987; Andresen, 1996; Reybold, 2008).

In Iran, the government extremely stressed on expanding medical boundaries. Markedly, Comprehensive Scientific Map of Iran (CSMI) and Vision 2025 echo this demand in medical research. Successively, some medical universities in Iran planned their own Scientific Maps corresponding to CSMI to achieve Vision 2025. Based on the universities' Scientific Maps, Iran has to be the first country among middle east countries in medical research both in quality and quantity. Even if Iran achieves the acceptable level of research publications, yet there is an immense uncertainty of the quality in research (Balash, 2017). Karimian et al. (2012) in their study brought the obstacles for doing research at medical universities in Iran. Their findings show inefficient human resources and inappropriate research culture impede to achieve a certain number of publications and satisfactory level of research quality. Research culture is the critical factor that can probably bring quality in research. Research culture has different aspects that research ethics can be one of them. In this study, research ethics in general and research norm, in particular, is examined as one of the dimensions of research culture in an Iranian medical university.

Methods

We used various sources for the data collection such as documentation, observation, open-ended questionnaires, and finally interview. We extracted different factors through three levels of open, axial, and selective coding with constant comparison tactic to analysis.

We chose the ground of the study in one Iranian medical state university. Also, we collected the main data through twenty-two interviews and 44 open-ended questionnaires. Regarding the interviews, seven of them roughly 31.81% of the participants, were high managers, includes two research deans (I[1] -19 and I-20), two deans of clinical centers (I-1 and I-12), two heads of research centers (I-14 and I-17), and one dean of a faculty (I-11). We interviewed an equal number of seniors and juniors, which includes twelve senior lecturers (54.54%), four associate professors (18.18%), and six full professors (27.27%). Fortunately, the snowball sampling helped the researcher to have different types of specialties for interviewing. The specialties comprise of four gynecologists, four cardiologists, two oncologists, three otolaryngologists, four ophthalmologists, two pathologists, one anesthesiologist, one neurologist, and one urologist. The distribution of female and male academicians was not equal. Thirteen female academics 59.09% and nine male academics 40.90% are in the age range of 34 to 61 years old. Moreover, juniors' years of experience varied from four months to four-year experience. The coming section outlines the findings from qualitative analysis and configures the connections of different dimensions of research preference.

Results and Findings

From different angles, several participants complained about the ethical issues. The researcher names some of them as to justify the importance of ethical norms, such as taking a critical test on a human before taking on animals (I-8), filling consent letter by patients for being in sample group (I-8; I-22), receiving the costs of tests

[1]. I, stands for Interviewee

from patients (I-8), 'synthesizing[2]' research in the fast and dirty manner in data collection and analysis by false and facile actions (I-11; I-7), increasing number of ghost authorship because of over-respecting and dealing (I-4), growing of illegal companies due to generating papers for academics (I-7), and reporting false information of research activities in university e-system (SHOA[3]) (I-15/159). On balance, the researcher finds three highlighted concepts in order to categorize ethical norm; namely, jealousy, dishonesty, and irresponsibility.

Regarding jealousy, the expectation of this term among professionals like academics seems meaningless. However, more or less the researcher gets feedback from the participants that probably the issue of jealousy exists among the academics. One typical instance of jealousy reflected by a senior. She said, "*Many of colleagues and heads say that the academics that spent time for research are those that cut off from their main duties. Indeed, they don't like others' work on research because they don't have enough numbers of papers. Probably, they have the sense of heat-burning to other academics who are active in research*" (I-21). It is possible to understand that easily those who do not have enough research activities, they do not like the rest active persons do research. Additionally, several pieces of evidence show that some active researchers indignant of jealousy and they had to give some hush activities to keep passive colleagues and heads satisfying (I-1).

Another ethical norm refers to dishonesty. For some academics, the necessity of promotion, a feeling of competition, and loading of other duties, makes the triangle of the need for publication. In order to achieve the targeted publications, some academics go toward unethical behaviour that is interpreted as dishonesty, such as 'synthesis' from different papers, ghost authorship, and fake reporting (I-3; I-15). Basically, to achieve certain numbers of publication without honesty in providing the publications show that ethical norms seem not internalized among some academics. The researcher found the need for strict audit and evaluation for submitted research activities. Several subcategories exert to support the dishonesty term such as black market, 'synthesis', and assigning authorship.

Regarding black market, when one of the researchers walked around the Book Street (Enghelab[4]) in Tehran[5] . There were some flyers and posters advertised for writing papers and publication services as the way for junior academics to publish in journals. The researcher goes to one of the offices and asks for the price. Upper than two to four impact factor journal they claimed 4000,000[6] to 8000,000 Tomans depends on the topics and journals. According to one interviewed senior "*Most of the works are repetitions. Unfortunately, when you can buy 1000,000 to 10,000,000 Tomans a paper to get the promotion it is not ethical*" (I-2). Also, one of the key accounts said "*A person, who wants to get promotion from the senior lecturer to associate professor, needs publications. You think how much is a difference between these two just 200,000 Tomans, so it is nonsense. … You know here in just pay 5000,000 Tomans to write a paper for you. You know that you have 50,000,000 Tomans and 5% ask someone to write a paper for you. The bowl of the research is too small unless for research lovers*" (I-20). Everything considered, having black markets provide easy-accessibility to accomplish the matter of publications.

Regarding 'synthesis' the researcher heard the word 'synthesis' many times from both juniors and seniors. What the researcher found is that this term is being used for duplication and simulation of the data. Moreover, because of this dominant issue, many academics do not believe on local papers, which are produced by their colleagues (I-6; I-7). For instance, one of the deans said, "*Last week, the junior lecturer came to me and said in my residency, she (the junior) copied her work and synthesized the data. Ethically, I cannot publish their (residents) work as a paper and during my 25 years, I just publish one of the dissertations in the journal. The rest, I don't believe on*" (I-11). According to the dean, mostly lecturers do not trust each other in research. Interestingly, the point is that they know this unethical norm.

Regarding the irresponsibility, the noticeable point that has been detected seems related to the irresponsibility of managers and seniors for juniors' research development. For instance, one typical example can be seen in one participants' expression, she said, "*I go to the hospital ask a senior can I contribute to your research and work for you. Optionally, if she wants, will tell me to come if no, I cannot join her. It depends on connections. So, there is not any systems or regulation to be under mentoring or supervising by seniors*" (I-8). Basically, the major focus on responsibility had been considered for clinical and teaching duties. All the programs for juniors are specified for clinical development and regarding juniors' research development; the feeling of commitment is paled.

[2]. The issue of 'synthesis' is explained in 'synthesis' section

[3]. SHOA is an electronic reporting system that academicians should report all their duties based on given criteria and forms

[4]. Enghelab street is the famous street for book marketing

[5]. Capital city of Iran

[6] .Tomans currency compares to US. Dollars 1 USD = 3000 Tomans

Regarding the last subcategory of dishonesty, several times the issue of authorship or name placing has been marked in this study. It shows the issue looks like a real concern among juniors. Based on different concepts such as expectations (I-1; R -12[7]; I-21; I-14), and power status (I-4; I-18) juniors have to accept the position of seniors, and they accept this ranking for assigning authorship as the norm (See Table 1).

Table 1. Category and subcategories of unethical norms

Category	Subcategories	Sub-subcategories
Unethical Norm	Jealousy	
	Irresponsibility	Managers' irresponsibility
		Seniors irresponsibility
	Dishonesty	Synthesis
		Ghost authorship
		Black market

Regarding research norms, several authors' studies such as Schein (1985), Thompson (2003), and Sagiv and Schwartz (2007) that they mentioned just to the norms as the sign of culture. Also, Thompson believed that research culture is described by several concepts that one of them is the norm. Schein (1985) also counts six meanings to conceptualize organizational culture. He mentioned norms in line with values, rules, philosophy, feeling/climate, and observed behavioural regularities. Moreover, Sagiv and Schwartz (2007) in his study mentioned the norms, preferences and accepted regulations as the scales to determine the individuals' actions, and also evaluating others. The current study similar to Schein (1985), Thompson (2003), and Sagiv and Schwartz (2007) mentioned the norm in order to explain one aspect of research culture or as the main factor in organizational culture. However, the findings of the study are not limited to the term norms to describe one aspect of research culture. Unprecedentedly, the concept of norms in this study is defined by ethical norms. It is mentioned that unethical norms are bunched into dishonesty, jealousy, and irresponsibility. Hence, compared to the other works the dimensions of norms in this study are unique.

Regarding unethical norm as a phenomenon, which is supported by jealousy, dishonesty, and irresponsibility, several sub-factors emerged, that should be considered as the ethical norms. Different reasons such as black market, syntheses, and assigning authorship reinforced the concept of dishonesty. Holistically, all factors have not been mentioned by previous studies as the supportive concepts for research norms in general and ethical norms in particular.

Conclusion

The importance of research norms in order to provide an appropriate condition for academics' research is the main element that research developers and university managers should reflect in their policies for research development. Research is one of the keys of Vision 2025 and CSMI in Iran that research norms accelerate the development of these keys. In order to recognize research norms, bearing in mind the chief constituents of research ethics seem indispensable. Research norms strongly influence the research ethics that are the target component of this study. By dissecting the research norms, the existence of three levels of jealousy, irresponsibility, and dishonesty are noticeable in an Iranian medical university.

Recommendations

On balance, it is suggested that the current unethical norms plan to be seen in the relevant policies for research development. Basically, without attention to ethical issues, the appropriate research culture will not be shaped in Iranian medical universities. Moreover, it is recommended that the evaluation system in medical universities try to give academic freedom to the academic members because by strictly evaluation system the university managers probably encourage to take action for unethical competitions among the faculty members and to generate their publication without considering ethical issues.

[7]. R, stands for Respondent

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PSYCHOLOGICAL FACTORS UNDERLYING UNETHICAL RESEARCH

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Abstract: This study is to cast a light on psychological factors, which force faculty members toward conducting unethical research. Since psychological factors are the key factors to control human behavior, in this paper, they are highlighted as the main purpose of the study. Methodologically, a qualitative approach was applied to reveal the factors. Thematic analysis assisted the researchers discovering the main factors. Ten faculty members were interviewed as to understand the ways that factors could deploy around the phenomenon. By considering Kurt Lewin's force field theory, the factors were directed based on their iterations. Results show that lack of self-control as a result of faculty members' self-interest, lack of moral awareness, self-justification, and negative self-image would lead to a paucity of research ethics.

***Keywords*:** Research ethics, faculty members, psychological factors

Introduction

During the last two decades, ethical misconducts have worried academic world, especially higher education institutes, universities, and research institutions due to the increasing statistics on plagiarism, data fabrication, cheating, and unauthorized help (Gulik & Benette 2014). Ethicality promotes collaboration and cooperation among faculty members, result in advancement in the goals of research, fulfill social responsibilities, and minimize damaging scandals such as a production of remarkable amounts of invalid scientific works and deterioration of authors' reputation, which are caused by unethical behavior (Shamoo & Resnik, 2009). The mentioned crisis can be tackled, through considering many factors, which could be elicited from different contexts.

In that order, the field of social psychology is mainly concerned with the way people's feelings, thoughts, beliefs, intentions and goals are built and how such psychological factors, in turn, affect their relations with others. Among psychological scholars, Kurt Lewin (1890-1947) known as the father of social psychology in his 'field theory' suggests that behaviour is the result of the interaction between a person and his environment: B=f (P, E). He believed that the social environment is a dynamic field, which has an interaction with human consciousness. Consecutively, the person's psychological condition affects the social field. In the field approach, Lewin believed that we need to take a whole situation into consideration in order to make change happen. Consecutively Kurt Lewin's (1951) force field analysis theory illustrates the dynamics at work in the change process. Movement from the present level of performance to the desired level is facilitated by driving or encouraging forces, while at the same time, it is hindered by restraining (or resisting, discouraging) forces. The present situation usually represents a state of equilibrium or balance between these driving and restraining forces (Earle 2002).

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Reportedly in Iran, faculty members are faced with a number of difficulties. On the one hand, a remarkable increase in the number of university branches calls for an excess in recruiting a lot of university instructors. On the other hand, several strict rules and regulations are enacted to elevate the quality of academic work among faculty members. For instance, Under the rule of 'academic decline', faculty members have to produce a fixed amount of research within three consecutive or four alternate years, to be able to obtain any promotions or they will have to leave their jobs. As such time limitation and a heavy load of work put the members of the faculty under a lot of stress. A large number of faculty members strive to make ends meet, despite their academic position. Moreover, the occupation of key positions by insufficiently academic managers has spread a spirit of frustration instead of competitiveness among faculty members. Lack of enough academic knowledge and subsequently lack of ethical awareness in research could namely be of the faculty members' professional intricacy.

Many claim that unethical academic system in universities are also among the motives of academic misconduct among faculty members. Therefore, to be able to face such difficulties, a lot of faculty members set out to pave their ways. Understanding the factors that facilitate wrongdoing as the goal of this study helps to design policies and interventions that work against them, stress high moral standards, and tip the scale of people's internal conflict toward ethical behaviour (Beshears &Gino, 2015).

Methods

This study aims to uncover psychological factors, which underlie academic dishonesty. For efficiently analyzing the factors found in complex problems, such as challenges that faculty members face, we drew on 'Force Field Analysis' developed by Lewin (1951) as a general means to frame problems in terms of factors or pressures that support the status quo as restraining forces and those pressures that support change in the desired direction as driving forces.

Data collection was accomplished through interviews' recording. Semi-structured interviews were conducted with ten faculty members; three males and seven females; one professor, three associate professors, and six assistant professors. Regarding key features and pattern of psychological capacity in the confrontation with academic challenges, thematic analysis was drawn on. 'Thematic analysis' enables the researcher to get acquainted with and be able to arrange patterns in content and meaning in qualitative data. Also, the thematic analysis supports most other methods of qualitative data analysis. Thematizing meaning has been described as a standard ability, which forms the basis of much, if not most qualitative research (e.g. Holloway and Todres, 2003; Joffe, 2012). Three key steps of reduction, selection and simplification were employed as to develop the emerging themes and to link them together (Creswell, 1994; Milles & Huberman, 1994; Hodder, 2000; Yin, 2003). Ultimately, the main themes and sub-themes were constantly compared as to saturate the data.

Results and Findings

The outcomes of the analysis reveal that faculty members need to produce a specific amount of academic work in a limited period of time in order to be able to maintain their positions or get a promotion. Moreover, the information obtained from interview analysis reveals that the unjust system deployed by managers brings about a lot of defect among faculty members academic performance. Performance pressure increases unethical behaviour (Moore & Kouchaki, 2015). Consecutively, it is claimed that academic misconduct has become epidemic among faculty members in order to compensate for all the above-mentioned complexities.
The followings are among the many driving forces that lead faculty members towards academic misconduct and against each a force that might restrain it is introduced:

Self-interest vs. self-control

According to the findings of this study, many Iranian faculty members choose to bypass the ethical rules of research since they restrain them from monetary gains or higher positions.

"The irrational crave for success and improvement would lead to self-control depletion. Many faculty members want to have a rapid rise to stardom. They would ask their students to take care of heavy projects and use their works in their own research without mentioning their names."

Self-interest is an individual's tendency to choose short-term profits over long-term achievements. To decide to behave unethically people need to weigh two divergent forces: the desire to get the most out of self-interest and the desire to maintain a positive moral self-image and future relationships (Gino et al, 2011).

To resolve the internal conflict between the short- and long-term benefits of dishonest acts, individuals must exert self-control (Mead, Baumeister, Gino, Schweitzer, & Ariely, 2009). Self-control is the psychological capacity that enables people to enact behaviours that are consistent with their long-term goals (e.g., of being an ethical person) and refrain from engaging in behaviours that are driven by short-term motives. These findings seem to generalize to the faculty members. Many common stimuli deplete self-control resources (Vohs & Baumeister, 2004), for example, working under a tight deadline. These experiences increase the probability that faculty members will cross ethical boundaries (commit plagiarism, fabricate data, seek unauthorized help).

Negative self-image vs. positive self-image

Based on the interview findings, the inefficient atmosphere of universities and educational institutes brings about a sense of anxiety, bitterness, and shame for several faculty members. Such feelings which lead to negative self-image, in turn, give rise to the probability of taking unethical actions to retrieve their mislaid positive self-image.

"There is an unfair competition aboard universities among the members of faculties. That is the unfair attention of the managers towards a few faculty members, brings about negative self-image along with feelings of shame and inefficacy among the rest. These feelings would consequently lead an individual to look for bypasses to gain back their positive self-view".

Self-image has been defined as the "total subjective perception of oneself, including an image of one's body and impressions of one's personality, capabilities, and so on (Coon, 1994).

Lack of moral awareness vs. self-awareness

When conscious attention is focused on the self, one is said to be in a state of "objective self-awareness;" that is, the self is the object of its own conscious attention (Davis & Brock, 1975). Gino and et al (2011), claim that self-control depletion promotes unethical behaviour and weakens individuals' self-awareness that is the ability to recognize that their behaviour is unethical. Results obtained from the interviews were evidence for faculty members' self-awareness shortcomings.

"A number of faculty members are not aware of ethical dos and don'ts in the field of academic research. For instance, they might assume that translation might be the same as authoring".

Though they claimed they were aware of ethical codes and abide by those rules, many didn't attribute their academic misconducts to immorality. Many faculty members are at risk of failuring to recognize the moral issue involved in the situations they face that is regarded as self-awareness.

Self-justification vs. self-concept maintenance

A number of faculty members who were interviewed with tried to show some of the academic misbehaviors less immoral by trying to justify themselves. They believed that what is called academic misconduct, doesn't seem as dishonest, when a majority of the member of the academic system is doing the same wrong thing.

"Many faculty members have come to the point to believe that in a system where every member is following his/her own interest it wouldn't do any harm to go after your own interest. They would believe if they don't take part in this race, they will fall behind."

Bandura (1986), in his social cognitive theory, suggests that having justifications in access leads to unethical behaviour due to an increased ethical disengagement. This happens because justifications make conducts look less immoral; consequences of the bad behaviour are underestimated, weakened or misconstrued, responsibility for the dishonest act is defused or displaced (Bandura, 1999). In this view, many faculty members downgrade the aftermaths of their wrong-doing by justifying themselves. Self-concept maintenance theory (Mazar, Amir and Ariely 2008) suggests that justifications for unethical performances cause unethical behaviour by allowing individuals not to update their self-image as honest and good (Belle and Cantarelli 2017).

Faculty members' psychological confrontation with job complexities is a multidimensional combat. It can be explained by the conflicting and struggling of diverse forces at different levels. The extracted psychological factors in this study are listed as *self-interest*, *self-control*, *self-image*, *self-awareness*, and *self-justification.*

On the other hand, based on Lewin's force field analysis, interactions among various forces should be considered to conceptualize the psychological factors. Results from the analyses of the interviews revealed a number of psychological factors that influence the decisions to behave unethically. However, in order to have broad conceptualization, the results are categorized under overarching dimensions and properties. The outcomes from the interview analysis can be classified into two groups of driving Forces vs. restraining forces. Driving Forces for unethical research conduct can be subcategorized to negative attitudes namely self-interest, negative self-image, lack of moral awareness, and self-justification, which consequently oppose positive attitudes such as self-control, positive self-image, and self-awareness, self-concept maintenance as restraining forces (See Figure 1).

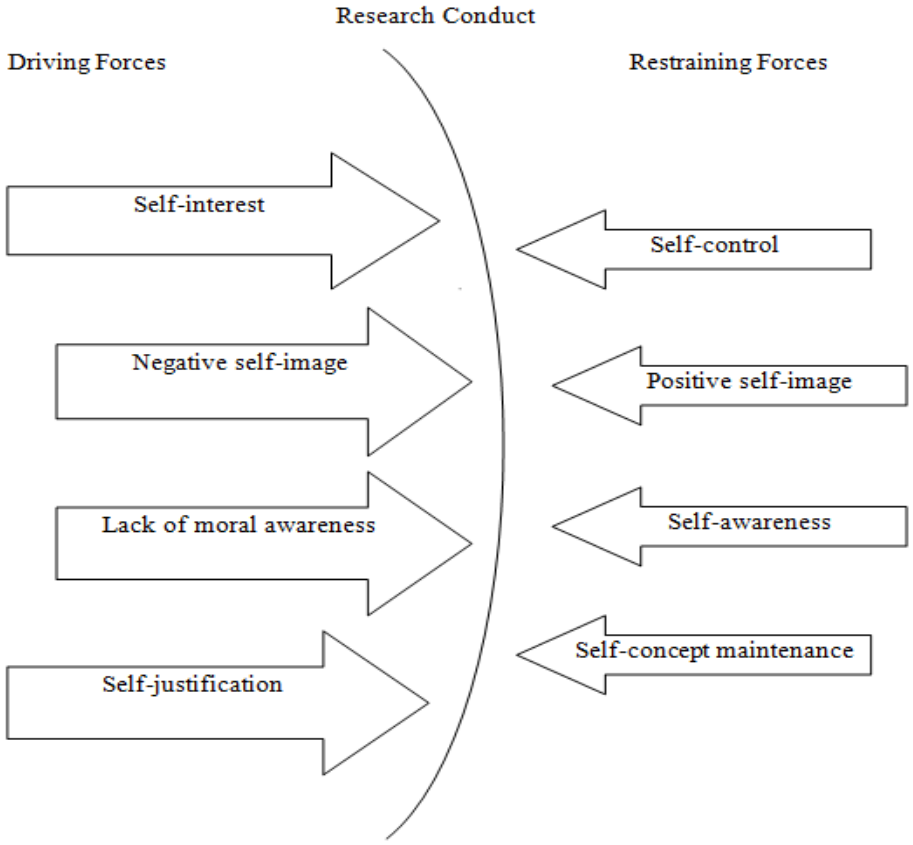

Figure 1. Driving and restraining forces

Conclusion

This study was an attempt to investigate psychological factors among Iranian faculty members which lead to academic misconduct. Different psychological aspects were discussed which were categorized as restraining vs. driving forces. Based on Kurt Lewin's force field analysis when the forces of both are equal individuals move less without any action. When the restraining forces are more than driving forces, there is not any positive or significant action. On the contrary, when the driving forces are stronger than restraining forces, individuals put effort to achieve the goals (Clegg, 1999). Basically, based on the force field analysis, two forces of driving and restraining forces come together in order to give negative and positive reactions. Driving forces that encourage unethical research were negative factors that consist of self-interest, negative self-image, lack of moral awareness and self-justification. On the other hand, restraining forces which impede academic misconduct comprise self-control, positive self-view, self-awareness, and self-concept maintenance.

Recommendations

According to the findings of this study the interactions and interfaces of all finding factors have resulted in academic misconduct. What needs to happen, in the present situation of academic conduct, is a decrease in forces that drive unethical research and an increase in the ones that restrain academic misconduct. Hence future research can be conducted to investigate possible strategies to empower faculty members psychologically and lead them towards academic honesty which in turn will help with the betterment of the quality of future academic products.

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QUALITY IN HIGHER EDUCATION

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Abstract: Quality, understood both as a standard of something as measured against other things of a similar kind or the degree of excellence of something, or even as a distinctive attribute or characteristic possessed by someone or something is one of the key concepts used in evaluating any product or service. Nowadays, quality became a notion almost as important as profit or market share. In the last decades, it became one of the key factors even in the process of evaluating educational institutions, and, among them those in the field of higher education. In our paper we intend to present the actual interpretations of our key notion and how it can be applied in the field of higher education. We also want to present the main techniques that can be used in the quality management of those institutions, with special regard to the European Union. And, last but not least, we want to show some potential trends in the field of quality management.

***Keywords*:** Higher education, quality of education, accreditation

Introduction

In a society with a competitive market, to keep oneself in the market and to be prosperous, one must be competitive, that is, one has to meet customer requirements, to relate to the highest standards and to produce quality, since no one buys products or services lacking quality, no matter how attractive their price may be. Competitiveness is in fact the fundamental requirement for the success of any organization that aims at gaining and maintaining the market segment to which it addresses with products (goods or services) offered in a cost-effective manner. Organizations delivering products of the same kind are in a constant competition with ascending character, and cannot afford to lose competitiveness, as it would certainly mean bankruptcy and disappearance from the market.

Quality is a concept frequently used in all areas of activity, in which the competition of products and services in the market has skyrocketed. A manufacturer or service provider may exist and can develop only if it provides goods and services at a competitive quality level. Without quality there are no sales. Without sales there is no profit and without profit a business cannot survive. Thus, the quality of a product is an important feature of the competitiveness of an organization as well as its personnel, industrial activity, commercial activity and financial activity.

The Importance of Quality

According to ISO 8402:1994 quality means a set of characteristics and features of an entity (product or service) that gives it the opportunity to satisfy expressed and implicit needs of some beneficiaries. Twenty years later, the ISO 9000:2015 adopts a much broader definition, according to which quality means the "degree to which a set of inherent characteristics of an object fulfils requirements." (ISO, 2015) An organization is more competitive if the

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product quality is better, the industrial activity is more efficient, the staff is better trained and more engaged in the work process, the commercial, financial as well as other activities are carried out on the *just-in-time* principle, while securing and sustaining competitiveness is the basic objective of any management model. Moreover, today it is worldwide considered that one of the essential factors for achieving and maintaining performance of an organization is the quality of its products. Application of quality concepts in the field of industry and services is an essential step for any economic entity in order to improve its competitiveness under the competitive circumstances of the market economy and the globalization of trade. Therefore, it is important for their prosperity that organizations and institutions producing or providing services give due importance to the competitiveness and hence the quality of their products or services.

Education is not exempted from the need for quality either, especially higher education, because training successive generations of educables in order to cope with the multiple demands of the modern society largely depends on the quality of the educational offer and services in the academic world. In contemporary society, universities have both a cultural role played through intellectual creation, as well as one of an organization providing educational services. The products offered by the university as an organization providing educational services are knowledge and competence, which are provided to society in various forms: training of specialists in specific areas, research, counseling, expertise, involvement of the academic community in the life of the society. Or, all these products and services offered by the university to its customers (students) and stakeholders (society, companies, organizations etc.), which help them acquire the educational products mentioned above, are meant to be of quality in a free market where universities compete. Only the quality of services and educational products offered by universities as well as their continuous concern to improve quality will ensure the market success of universities and will make their existence permanent.

Higher education has an important role in the development of human society through the characters it forms and the models it promotes. Thus, the quality of education is reflected by the extent to which higher education institutions meet the requirements of internal and external *stakeholders* and, at the same time promote the development of individuals and societies as a whole. Higher education graduates are more likely to find a job than those with a lower level of qualification. However, higher education institutions often have difficulties in adapting to the changing needs of the economy and fail to anticipate or contribute to the modelling of the trends in the labor market.

Globally, however, the quality of higher education is in a process of decline. Concerns about the quality of university education programs are real in this context. Even the most developed countries are affected by this process of quality decline of education. Intensification institutional, national and international concerns regarding quality assurance in education is an indirect recognition of the fact that something disturbing is happening in this area.

In 2006 the European Parliament and the Council adopted the Recommendation on further European cooperation in quality assurance in higher education, which promoted the use of European standards and guidelines for quality assurance. (European Parliament and Council, 2006) This recommendation calls on EU countries to set up the European Quality Assurance Register for Higher Education (EQAR), an independent body that administers the register of quality assurance agencies in higher education. It operates on a European level and contributes to the development of the European dimension of quality assurance. In order to appear in the register, agencies must comply with the European standards in quality assurance.
The European Commission provides support to Member States and higher education institutions in the EU to modernize curricula so that graduates have a high degree of competence as well as sought and transferable skills, enabling them to adapt to a rapidly changing labor market.

To improve the quality and relevance and to increase the number of students, there is a need for flexible and innovative methods and approaches. According to the Communication on Rethinking Education, one of the main modes of action is the exploitation of the advantages of information and communication technologies (ICT) and other new technologies having the purpose to enrich the teaching process, improve learning experiences and support personalized learning. (European Commission, 2012)

The reform and modernization of the European higher education depends on the competence and motivation of teachers and researchers. The recruitment of teachers has not often kept up with the increasing number of students, which has put an even greater pressure on the already limited capacity. There is a need for better conditions of employment, including transparent and fair recruitment procedures, a higher level initial teacher education and continuing professional development as well as a better recognition and reward of excellence in teaching and research in order that Europe can produce, attract and retain the high quality academic staff that it needs.

The High-Level Group on the Modernization of Higher Education published in 2014 a report with important recommendations for improving the quality of teaching and learning in the European higher education. (European Commission - High Level Group on the Modernisation of Higher Education, 2013)
As the dynamics of social development is relatively difficult to predict, a resizing function at the level of higher education institutions was imposed, strengthening the idea that they are providers of educational services and knowledge. A quality and relevant higher education enables students to acquire the transferable knowledge and skills they need to succeed after graduation in a high-level learning environment that recognizes and supports advanced teaching methods. Ensuring quality inspires confidence.

The implementation of the quality management system in education is essential for the mission, goals and objectives of each institution of higher education. Each higher education institution should have strict internal quality assurance systems evaluated by specialized agencies. Introducing the quality management system must be analyzed as part of change management, for at least two reasons:

- higher education reform involves compliance with the aligning requirements of European education and worldwide recognition of diplomas;
- the objective that universities must reach in the immediate future is to use institutional management programs in order to promote performance in terms of quality.

The quality of a specialization in higher education is not defined only by matters of content and structure of the curriculum, but it also must be analyzed from the perspective of the entities to be addressed: students, graduates, academics, competent ministry, various civil society organizations, including future employees as well. As a result, the interpretation of the concept of quality depends on the party that represents the consumer, i.e. the client. Each of the above-mentioned entities sets its own objectives and therefore the concept of quality is defined accordingly. There are cases where the notion of quality has identical connotations in the situation where objectives set by various parties are similar, but one cannot deny that in many instances there is no consensus regarding the definition of quality. Thus, we can talk about the quality of inputs, the quality of the (teaching) process and the quality of outputs.
Quality is even more required in higher education, since in recent decades, in the social, political and economic context of the globalization process and the enlargement of the EU, in this system, there have been relevant changes that have manifested and are still manifesting themselves through a number of factors, namely:

- diversification of national universities;
- digitization of the educational process;
- emergence of virtual universities;
- spreading of transnational universities
- increase in the number of corporate universities;
- massification of higher education;
- universities have lost their monopoly over the production and supply of specialized knowledge and training;
- internationalization of the labor market;
- massification of student and teacher mobility;
- increase of competitiveness in order to occupy a well-paid job, which provides opportunities for personal development;
- the continuous nature of human learning in terms of an ever-changing world;
- democratization of education:
- at a system level (decentralization, autonomy of universities, etc.);
- at a process level (teachers' autonomy, the possibility of carrying out student training programs on individual tracks);
- humanization of education, focusing on the student, ensuring free development of his or her personality etc.

All these factors force the university to operate under the laws of the free market that is specific for postmodern society, demand and supply, economic efficiency embodied in profit, turning it into an institution that provides services for the society, and that is in competition with other education and knowledge service providers in order to obtain financial and human resources necessary for a proper functioning. On such a free market and in such a service providing institution, quality is a sine qua non. Moreover, with the educational reform of the European higher education initiated in 1999 and named the Bologna process, which aimed to create a European Area of Higher Education by 2010, concerns related to the quality development and assurance in higher education have been a priority aspect of the European policy in this area.

Quality Assessment

Quality and performance evaluation should be analyzed in parallel with the implementation of the evaluation methods, aiming at increasing institutional autonomy as well as highlighting responsibilities. The introduction of the systematic assessment, the main purpose of which is a better use of the resources, helps to effectively achieve the policy objectives set in the strategic management. If the distribution of quality is carried out on different levels, the same goes for the quality assessment procedure as well.

A first type of evaluation is performed by the market, a fact that is evidenced in two ways:

- orientation of students towards certain specializations within certain faculties;
- orientation of employers towards graduates with certain specializations within certain universities.

These guidelines confirm the quality of teaching in these institutions.

A second type of evaluation is the bureaucratic one. This can be that performed by the competent ministry and / or other authorities, based on formal criteria. The participation of international experts in the assessment procedure has the purpose to confirm or deny whether the audited program meets the quality requirement at a European level.

A third form of assessment is the self-evaluation that is carried out by the institution itself, which is a process that is meant to be the result of the strategic management of the university, under the conditions of an increasingly larger autonomy conferred to higher education institutions.

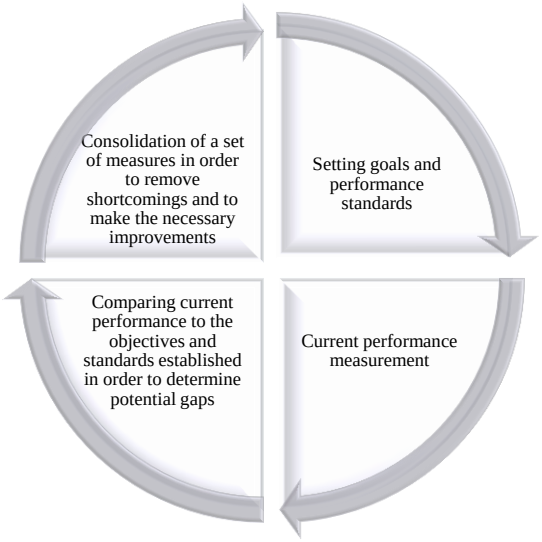
The relation between universities and control authorities can be established on several points of view:

- free market approach: universities, as service suppliers are addressing certification institutions;
- technological approach: universities, as production units have to fulfill some technical specifications and a central quality auditing institution controls periodically their activity;
- classical approach: assuring quality is a matter of academic autonomy and universities have to assure the quality management.

Evaluation is most important connection to the process of quality assurance. The most important points to be covered in the performance evaluation are the following:

- setting goals and objectives:
- their clear definition,
- verification of their need,
- establishment of a consensus in their interpretation,
- assessing the extent to which objectives have been met:
- identification of problems that may occur,
- establishment of certain mechanisms to control inputs, outputs and the whole process,
- identification of the factors that may hinder a satisfactory achievement of goals,
- assessing the extent to which objectives have been achieved:
- definition of the methods for a systematic collection of information,
- identification of the performance indicators.

As a result, the quality assessment is a continuous process that involves several steps, as shown in the next picture:



The factors that usually influence performance assessment and the establishment of the indicators it determines are on the one hand the, often discouraging, costs of obtaining information, on the other hand the principles for establishing scientific prestige, that are often vague, subjective, restrictive and that do not often overlap with the

principles of quality management. When assessing higher education institutions one must make a clear distinction between accreditation and quality assessment. Accreditation is based on a static assessment of the situation in time of the assessment, which is designed to verify the fulfillment of the minimum conditions so that the institution is entitled to issue diplomas of higher education, recognized by the state.

In contrast, the evaluation of quality is aimed at a dynamic assessment aimed at establishing trends for a certain period of time, in contrast to the determination of levels, such as in the case of accreditation. For this reason, quality assessment does not (or should not) lead to the ranking of institutions, but it is an instrument for guiding the universities towards a continuous quality improvement of their processes.

The application of the continuous measurement procedure involves, on the one hand, strengthening of the concept of quality, and, at the same time, makes it possible to improve it by several mechanisms, such as:

- assurance regarding the fact that the customer's requirements (employers, employees, students) have been fulfilled,
- ability to set a number of goals and to track their achievement,
- establishment of certain comparative standards for a continuous improvement of the process,
- imposing transparency and establishing a schedule for monitoring individual performance level,
- identification of certain shortcomings in the standards of quality and prioritizing the elimination of these deficiencies,
- justification for resource utilization,
- obtaining feedback on the efforts to identify weaknesses and eliminate them.

In order to avoid compromising the measurement process, the indicators used to assess quality must meet certain conditions, such as:

- measurability: indicators, such as quality and quantity of results, costs, etc., must allow the achievement of the objectives that are measurable;
- relevance: indicators must serve the establishment of a link between different areas of responsibility and individual performance goals, and must describe the expectations specific for each position or function;
- significance: indicators must be defined for each area of responsibility, as oriented towards activities with a significant impact on the individual results, the results of the department or institution.

Conclusion

In the context of European integration the introduction of quality management systems in the field of higher education has became, as part of the Bologna Process, a priority goal not just for the academic communities of the Union, but also for those of the aspiring countries. In this very complex process higher education can largely benefit from the experience gathered in decades of quality management in the business sphere. Assuring quality means building up confidence in the national higher education systems, showing that they do comply with the customers' expectations, they spend public money in an appropriate way, efficiently, for senseful purposes. The reason to introducing quality management into education in Europe, and not just there, are related to the above mentioned factors: the new status of the universities in the era of mass education, the systemic convergence of European higher education and the globalization of labour markets.

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DETECTION OF COHESIVE SUBGROUPS IN SOCIAL NETWORKS USING INVASIVE WEED OPTIMIZATION ALGORITHM

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Abstract: Social network analysis (*SNA*) is a very popular research area that helps to analyze social structures through graph theory. Objects in social structures are represented by nodes and are modeled according to the relations (edges) they establish with each other. The determination of community structures on social networks is very important in terms of computer science. In this study, the Invasive Weed Optimization (*IWO*) algorithm is proposed for the detection of meaningful communities from social networks. This algorithm is proposed for the first time in community detection (*CD*). In addition, since the algorithm works in continuous space, it is made suitable for solving the *CD* problems by being discretized. The experimental studies are conducted on human-social networks such as Dutch College, Highland Tribes, Jazz Musicians and Physicians. The results obtained from experimental results are compared and analyzed in detail with the results of the Bat Algorithm and Gravitational Search Algorithm. The comparative results indicate that *IWO* algorithm is an alternative technique in solving *CD* problem in terms of solution quality.

***Keywords*:** Community detection, discretization, invasive weed optimization, social networks, *SNA*

Introduction

Community structures in network analysis are focused on relationships among people in real-world networks. Detection of community structures in social networks is a problem of considerable interest that has received a great deal of attention (Girvan & Newman, 2002; Leskovec, Lang, & Mahoney, 2010; Papadopoulos, Kompatsiaris, Vakali, & Spyridonos, 2012; Steinhaeuser & Chawla, 2008). Social networks are based on relationships between people, such as political, formal-informal, regional, religious, friendship, business partnership, common social activities, and relational closeness on the internet. The specific properties of social networks need to be well known in order to be able to determine the structural and functional characteristics of network relationships. People in social networks and their relations are represented with vertices and edges, respectively. Graphs which are used to represent any given networks are referred to as the simplest form of undirected networks. Social network analysis (*SNA*) is an approach that analyzes interactions between interrelated social relationships (Makagon, McCowan, & Mench, 2012). *SNA* is also an analysis that examines social structures on network and graph theory. Many different approaches are proposed in the analysis of social networks. Relations of networks of various persons or groups in the face of important events are mathematically formulated and analyzed by *SNA*. In this study, the *CD* approach was examined to reveal and analyze relational information in networks. According to certain features of social networks, the network can be divided into different subnets. For this purpose, several methods are proposed which determine the community structures in the network. Some of these methods refer to certain features in the network and provide various approaches using graph theory. The detection of communities in networks is a field that is long studied and has still maintained its popularity. Contrary to classical methods (Girvan & Newman, 2002; Newman, 2004; Pons & Latapy, 2005), various optimization methods which do not offer a deterministic approach has been applied to the

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CD (Attea, Hariz, & Abdulhalim, 2016; Li & Song, 2013; Shi, Liu, & Liang, 2009; X. Zhou, Liu, Zhang, Liu, & Zhang, 2015). The modularity introduced in the Newman-Girvan algorithm to determine the stopping criterion initially, quickly became an objective function for many optimization methods to determine the communities of complex networks (Li & Song, 2013). After using this criterion as an objective function, many objective functions similar to this function have been proposed (Leskovec et al., 2010). Many studies have been carried out to identify community structures in social networks. The main purpose of our study is to divide the network into divided relational subnets by an objective function. For this purpose, we focused on the invasive weed optimization algorithm (*IWO*). Also, two additional algorithms were used to evaluate the results of *IWO*. These are bat algorithm (*BA*) and gravitational search algorithm (*GSA*). Four different human social networks were used as test datasets.

Background and Motivation

Structurally or functionally meaningful subnetwork structures, referred to as community structures (Newman, 2004) can be determined by optimization of various objective functions. The optimization of objective functions is related to graph clustering according to the *modularity* measure. When any given network presented by graph structure, obtained communities can be considered as subgraphs which have features like maximum common feature in itself, a number of interactions, positional similarities, and such that. Vertices which are the elements of these structures should have maximum interaction and common properties with vertices in their communities and fewer interactions and common properties with vertices in other communities. Groups of people who have a strong relationship in a social environment, the connections of people in a terrorist attack and collaborations of people using computers that make the most data exchanges are some of the examples that can be given about *CD* in *SNA*.

Modularity is the most used objective function in the *CD* problem. Let's assume that G(V, E) represents an undirected and unweighted social network. V and E represent the set of vertices and the set of edges, respectively.

$$V = \{v_i \mid i = 1, 2, 3, \ldots, n\} \text{ and } E = \{e_j \mid j = 1, 2, 3, \ldots, m\} \quad (1)$$

$$Adj_{(i,j)} = \begin{cases} 1 & \text{if node } i \text{ and node } j \text{ are connected,} \\ 0 & \text{otherwise.} \end{cases} \quad (2)$$

$$Q = \frac{1}{2 \times m} \sum_{ij} \left(Adj_{(i,j)} - \frac{k_i \times k_j}{2 \times m} \right) \times \delta(C_i, C_j) \quad (3)$$

$$m = \frac{1}{2} \sum_{ij} Adj_{(i,j)} \quad (4)$$

$$k_i = \sum_{j} Adj_{(i,j)} \quad (5)$$

$$\delta = \begin{cases} 1 & \text{if } C_i = C_j \\ 0 & \text{if } C_i \neq C_j \end{cases} \quad (6)$$

i, j, n and, m represent the node index, edge index, number of nodes and, total edges number, respectively. Let's define adjacency matrix as *Adj* with nxn size. This matrix shows the relationships of the elements in the set V by the elements of the set E. *Adj* adjacency matrix is generated by Eq. 2 (Clauset, Newman, & Moore, 2004). Q is named as modularity and expresses the objective function to be maximized. Modularity values are calculated by Eq. 3. Also, m in the Eq. 4 demonstrates the total number of edges in network. k_i demonstrates the degree of i^{th} node, k_j expresses the degree of j^{th} node and as an example k_i can be calculated by Eq. 5. C_i and C_j demonstrate communities of the nodes i and j. δ is a value generated by the function in Eq. 6 which indicates whether nodes i and j are in the same community.

In this work, the modularity Q function was used as fitness function for the detection of the most suitable community structures from the social real-world networks used in the experiments.

Invasive Weed Optimization Algorithm

The invasive weed optimization (*IWO*) algorithm is an metaheuristic optimization technique which has been first introduced by Mehrabian in 2006 (Mehrabian & Lucas, 2006). This algorithm is inspired by the survival of the weeds in the nature by constantly strengthening the lineage. In weed ecology, there is a mechanism in which powerful individuals (weeds) can always survive. These properties of invasive weeds are the basis of the *YOA*. The process of the algorithm can be expressed in 4 sections (Y. Zhou, Chen, & Zhou, 2014):

Initialization of Population

The initial population is created by randomly distributing a certain number of individuals to the problem space.

Reproduction

Each individual needs to derive a certain number of new individuals in proportion to its health condition. The formula of weeds producing seeds is given in Eq. 7.

$$weed\mathrm{i} = \frac{fcurrent - fmin}{fmax - fmin} * (Smax - Smin) + Smin \quad (7)$$

where *fcurrent* is the current fitness of weed. *fmax* and *fmin* express the maximum and the minimum fitness values of the population at the current iteration, respectively. *Smax* and *Smin* respectively identify the maximum and the minimum number of weed value to be produced.

Spatial Dispersal

The determined number of individuals in the previous step is distributed to the problem space as randomized according to Eq. 8 and depending on the time-varying parameter.

$$\sigma_{iter} = \frac{(iter_{\max} - iter)^n}{(iter_{\max})^n}(\sigma_{initial} - \sigma_{final}) + \sigma_{final} \quad (8)$$

where $iter_{max}$ is the maximum number of iterations, σ_{iter} is the standard deviation at the current iteration and n is the nonlinear modulation index.

Competitive Exclusion

Since the number of new generated weeds in the populations will exceed the maximum number of populations after a few iterations, the worst individuals will be eliminated and the number of weeds will be reduced to the maximum number of populations initially determined. In this way, weaker weeds will be eliminated from the population and the stronger weeds will survive. This process continues until all iterations have been completed or until the other stopping criterion reaches the limit value. As a results of these operations, the best weed that has managed to survives gives the best solution for the given problem.

Experimental Results

In this study, three different metaheuristic algorithms have been used in order to make analysis of their performances and compare each other. These algorithms are Invasive Weed Optimization Algorithm (*IWO*), Bat Algorithm (*BA*) and Gravitational Search Algorithm (*GSA*). These algorithms have been examined on four different social networks. These networks are called Dutch College, Highland Tribes, Jazz Musicians and Physicians. All of the experimental studies have been conducted under equal conditions and number of maximum function evaluation (maxFEs) has been taken as 10000. The other parameters of experimental studies have been given in Table 1.

Table 1. Parameter values of experimental studies

Parameter Name	**Value**
Number of Iterations	500
Number of Population	20
Number of Runs	10
Number of FEs	10000
***IWO* Parameters**	
Number of Maximum Seeds	5
Number of Minimum Seeds	1
Number of Maximum Population	40
Variance Reduction Coefficient	2
Initial Value of Standard Deviation	0.5
Final Value of Standard Deviation	0.001

The properties of the social networks used in the experiments have been given in Table 2. As shown in the table, four different social networks which have different number of nodes and edges have been used in the experimental results.

Table 2. The properties of the social networks used in the experiments

Network	**Number of Nodes**	**Number of Edges**
Dutch College	32	3062
Highland Tribes	16	58
Jazz Musicians	198	2742
Physicians	241	1098

The comparative results of *IWO* algorithm with *BA* and *GSA* in terms of solution quality have been presented in Table 3. Since the *CD* problem is the maximization problem, the maximum values are marked as bold. According to this table, it can be stated that *IWO* algorithm is successful than both of *BA* and *GSA* in terms of solution quality for all of the datasets. In addition, it is obviously seen that *IWO* method is quite robust than the other two algorithms. While *IWO* yields results close to results of *BA* and *GSA* only for *Physicians* network, for other networks *IWO* has outperformed *BA* and *GSA* in terms of convergence to the optimal solution. Especially, for *Dutch College* network, *IWO* has clearly outperformed the other algorithms.

Table 3. Comparison of *IWO* algorithm with *BA* and *GSA* in terms of solution quality

ataset/Algorithm	***IWO***		***BA***		***GSA***	
	mean	*std*	*mean*	*std*	*mean*	*std*
Dutch College	**0.0254**	**0.0022**	0.0109	0.0045	0.0090	0.0044
Highland Tribes	**0.1641**	**0.0055**	0.1370	0.0212	0.1566	0.0090
Jazz Musicians	**0.4087**	**0.0090**	0.3458	0.0349	0.3755	0.0180
hysicians	**0.6637**	**0.0014**	0.6547	0.0088	0.6561	0.0059

In terms of processing time, comparative results of *IWO* algorithm with *BA* and *GSA* have been given in Table 4. According to this table, it can be expressed that performance of *IWO* has been superior to those of *BA* and *GSA* since *IWO* has completed each experimental study in shorter time. In addition to this, *IWO* has been more robust among the other algorithms.

Table 4. Comparison of *IWO* algorithm with *BA* and *GSA* in terms of processing time

Dataset/Algorithm	***IWO***		***BA***		***GSA***	
	mean	*std*	*mean*	*std*	*mean*	*std*
Dutch College	**39.63**	**0.47**	52.90	1.92	61.83	2.38
Highland Tribes	**10.53**	**0.28**	15.36	0.29	13.26	0.61
Jazz Musicians	**1093.54**	**16.69**	1451.05	77.02	1478.24	22.64
Physicians	**1342.17**	**16.88**	1787.24	41.30	2126.50	39.75

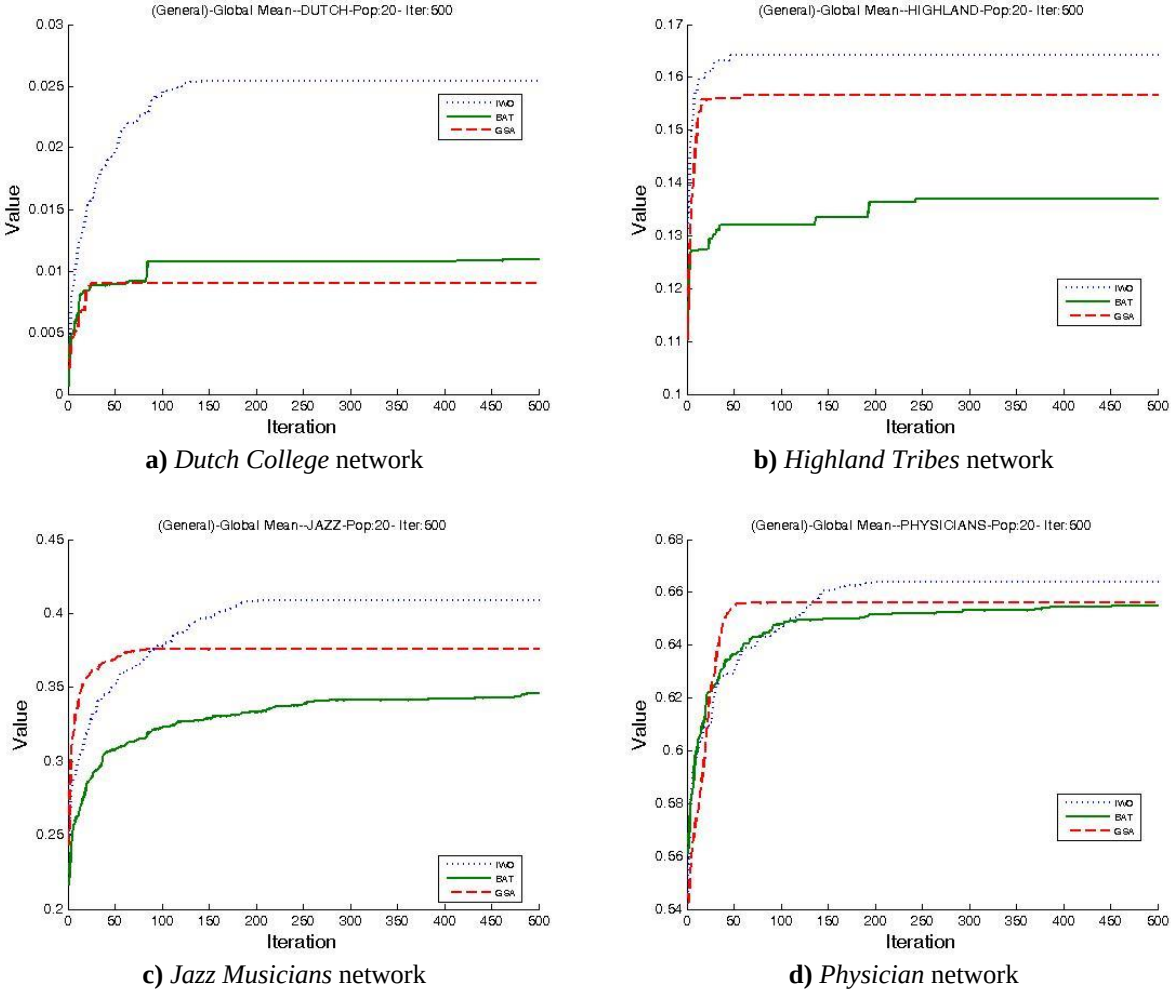
In terms of number of community, comparative results of *IWO* algorithm with *BA* and *GSA* have been reported in Table 5. Minimum values have been marked as bold because it is desirable to have a low number of

communities. Considering the results in the table, in terms of number of community, the algorithms have no advantage over each other. According to these results, it can be deduced that the low number of communities may not maximize the modularity value.

Table 5. Comparison of *IWO* algorithm with *BA* and *GSA* in terms of number of community

Dataset/Algorithm	*IWO*		*BA*		*GSA*	
	mean	*std*	*mean*	*std*	*mean*	*std*
Dutch College	**1.3**	0.483	2.1	0.316	2.0	0.000
Highland Tribes	2.3	0.483	**2.0**	0.000	2.5	0.527
Jazz Musicians	6.2	2.150	4.7	1.636	**4.5**	0.527
Physicians	14.7	2.263	**5.7**	1.059	5.9	1.101

In addition to these experimental results, the convergence curves of the networks have been depicted in Fig. 1. Each experimental study has been performed 10 times for all of the algorithms and the average results have been graphically shown. MaxFEs has been also taken as 10000.



a) *Dutch College* network **b)** *Highland Tribes* network

c) *Jazz Musicians* network **d)** *Physician* network

Figure 1. Convergence curves for *the* networks

For *Dutch College* network, although all of the algorithms have provided improvement in the first 100 iterations, they could not improve in subsequent iterations. Nevertheless, *IWO* has been clearly superior to other algorithms for convergence speed. For *Highland Tribes* network, although the performance of *GSA* has approached to that of *IWO*, *IWO* has again obtained better results than *GSA*. For *Jazz Musicians* network, although the performance of *GSA* has been better than that of *IWO* in first 100 iterations, *IWO* has outperformed to *GSA* in the end. For *Physician* network, although the performances of *GSA* and *BA* have been better than that of *IWO* in first 50 iterations, *IWO* has outperformed to both of *GSA* and *BA*. Besides, both of *GSA* and *BA* have approximately acquired the same results.

Conclusion

In this study, we have proposed *IWO* algorithm which is one of metaheuristic optimization algorithms to solve the *CD* problem. In order to analyze comparatively, *BA* and *GSA* have also been used in the experimental studies. For experimental studies, four different social networks have been utilized and these networks have been run under the same conditions. When the results obtained by experiments have been examined, it is cleary observed that *IWO* has been much more successful than the other methods in terms of both of solution quality and execution time. Additionally, *IWO* has achieved far superior success for the network called *Dutch College* with the largest number of edges. Therefore, it can be concluded that this algorithm can lead to much better results than the other algorithms in large networks.

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ATTITUDES OF THE SLOVAK UNIVERSITY OF TECHNOLOGY STUDENTS TO THE CREATION AND PROTECTION OF THE ENVIRONMENT

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Abstract: The paper addresses the level of environmental and ecological literacy of the students of Slovak University of Technology in Bratislava. The authors deal with literacy in stated area in three synergetic dimensions: cognitive, emotional and conative. In the cognitive level are mapped the general knowledge of students regardless of the technical field of their studies. They analyze students' views on teaching at the Technical University from the viewpoint of the need for clarity and acceptability of the effect of technology on the environment not only "here and now", but with a time lag of several years or decades. By the Semantic differential method, they try to find the answer to the question about the quality of students' attitudes to the issue of development and environmental protection. They identify explicit and implicit factors (family, society, training and education process or teacher-student interaction, issues of pattern) which are dominant in the formation of positive and negative attitudes of students of university of technology to the creation and protection of the environment. Conative dimension corresponds to measure of subjective activities of students in this area and refers to the relationship between power factor, evaluation factor and the activity factor in the semantic differential.

***Keywords*:** Environmental education, ecological literacy, cognitive dimension, emotional dimension

Introduction

Any meaningful human effort is determined by close link between past and future. This bond has distinct contours in many, if not in all, aspects of human action. The close link between past and future gives the clear sense to the life of man. The sense of being in the process of realization, which is always transformed externally into a consistent effort delivering the intended results. The life is no longer only finding of ready or fitting items? but in the sense of this continuity it is especially creating of desirable and needed items? In no area of human effort and endeavour, it has no desirable or necessary such clear and bright contours as in the field of environmental creation and protection.

The state of the environment nowadays is no longer allowing the possibility of choice or conscious postponing of problem solving to later. Needed becomes necessary, it is *modus vivendi* of human existence. While the past was giving the wide range of possibilities and procedures to man and society, nowadays the only alternative of human behaviour is the model of "homo ecologicus".

F. Fukuyama, in seeking the roots of human nature, and in the process of finding the answers to the question of the re-establishment of social order, states that one of the most important sources of social capital in present societies is the educational system. Educational system should not only provide students with knowledge and skills. It is intended to develop specific behavioural patterns and models of such existence of each individual that are the result of the so called instrumental and terminal values. Instrumental values are related to professional and ethical dimension of a man and to the suitability of his actions (be honest or be logical).

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Terminal values determine current and future goals of personality, there are the ideals determined by the status of social acceptance reflected to the individual goals, conditioned by personal hierarchy. If we have previously stated, the necessity of "homo ecologicus": it is up to schools to reflect this requirement to the maximum extent. Abstracted from geographical or historical conditionality, the dominant efforts of each school system should be to incorporate young people into society so as to be able to understand "their" time and focus their individual professional efforts not only on the subjective benefit but also on the benefit of the society and especially to the benefit of the Earth.

Methods

In the article we present the results of the research carried out at the Department of Supplementary Pedagogical Education at the Institute of Management of the Slovak University of technology in Bratislava. The main objective of the research was to find out how future graduates of University of Technology perceive the state of the environment, how they identify themselves with environmental load or with possible technological threats. We have tried to find the answers to the question of how the knowledge about the environmental burden are elaborated by students and how are they reflected into their attitudes and reasoned actions in terms of persuasive action.

For research purposes, we used the questionnaire method and the masked semantic differential method to measure the connotative meaning of concepts, the valence of the cognitive and emotional component of attitude. Authors analyze students' views on teaching at the Technical University from the viewpoint of the need for clarity and acceptability of the effect of technology on the environment not only "here and now", but with a time lag of several years or decades. By the Semantic differential method, they try to find the answer to the question about the quality of students' attitudes to the issue of development and environmental protection. They identify explicit and implicit factors (family, society, training and education process or teacher-student interaction, issues of pattern) which are dominant in the formation of positive and negative attitudes of students of university of technology to the creation and protection of the environment. Conative dimension corresponds to measure of subjective activities of students in this area and refers to the relationship between power factor, evaluation factor and the activity factor in the semantic differential.

Respondents were students of all faculties of the Slovak University of Technology – Faculty of Mechanical Engineering, Faculty of Materials Science and technology, Faculty of Electrical Engineering, Faculty of Architecture, Faculty of Civil Engineering, Faculty of Informatics and Information Technologies and Faculty of Chemical and Food Technology.

Results And Findings

Krech understands the attitudes as "knowledge, emotional and tendentious action in relation to the various subjects that are organized into the systems during the individual's development". Attitudes are open, dynamic complexes of feelings, knowledge and tendencies to act; they form the psychic reality of individuals. They are the source and regulator of an individual's social activity and they influence the social interaction.
As can be seen from the above, the attitudes have these three components:

- the cognitive component expresses the views of the individual on the subject; its core is the assessment of the opinions, assessing the favourable or unfavourable characteristics of the subject;
- the emotional component contains emotions that bind to the subject;
- the tendency to act component represents the behavioural readiness or tendency in the direction of attitude.

The attitude as such may develop in a very heterogeneous form in each component due to valence, versatility and intensity of attitude. In the socio-pedagogical-psychological literature the issue of attitudes is a topic discussed with a constant mild tension between the behavioural and mentalist concept of the interpretation of human behaviour. One group of authors emphasizes cognition; another group emphasizes rather the state of readiness to act in a certain way. Behaviourist-oriented authors consider as the base of attitudes the affective and constitutive elements of attitude and emphasize the role of activation and motivation factors, while the mentalist approaches emphasize at the formation of attitudes, the exploration of information and ways in which the information received are modified, i.e. the cognitive components of attitude.

The issue of ecologisation or environmentalisation lies in the dynamic context of qualitative changes at one of the leading places of education process at the STU. At all faculties, environmental education has been introduced, the objectives of which are clearly aimed at the qualitative shift of the environmental consciousness of (MSc-engineers-technicians) graduates of University of technology (MSc-technicians).
Students evaluated seven notions, typical for the issue of creation and protection of the environment. The notions were judged by eighteen pairs of bipolar adjectives, confirmed by factor analysis as relevant for the appropriate assessment factor, force factor and activity factor, with a seven-point evaluation period (-3 ... 0 ... +3). Considered concepts or statements were: harmony, mother, environmental protection, pollution of the environment, ozone hole, environmentalism (as a teaching subject), technique or technology, human in the environment.

The following adjectives were used in the rating factor, which is the attitude of the person and describes the focus on the object: cold - hot, unhappy - happy, lifeless - lively, dark - light, unpleasant - pleasant, brutal-kind. The force factor is consistent with the feelings of severity, hardness, generalized as tension or release. Adjectives: Rare - frequent, blurry - clear, shallow - deep, weak - strong, small - big, powerless - powerful. The activity factor shows the dynamics and variability in the time which is required in the interaction with the object. Adjectives: quiet - noisy, jerky - fluent, pale - fresh, blunt - sharp, peaceful - excited, balanced - passionate.
If we proceed from the premise that the positive attitude of human is determined by his inner harmony and love, and at the same time the goal of being is harmony and love, then the notions of harmony and mother were understood as a standard against which we compare the degree of quality of attitudes to other notions. Judging from the polarization profile, the attitudes of respondents to these notions are highly positive - these notions characterize the adjectives alive, happy, pleasant, loving, strong, quiet, and balanced. From gender polarization profiles, women's emotionality is more readable.

The adjectives - unhappy, brutal, unpleasant, but also frequent, big, strong – express the negative attitudes of respondents to ozone hole. The subject of environmental education induces positive attitudes in respondents, characterized in particular by adjectives alive, pleasant, loving. The force factor has the minimum in the dimension of helpless - which is a warning, but in the present situation unfortunately the true signal.
The quality of attitude to pollution of environment is negative. It may be characterized by adjectives -unpleasant, unfortunate, in the factor of force adjectives- frequent, deep, helpless, in the factor of activity - excited. Similarly, negative are the attitudes to the statement - man in the environment while we state the high degree of similarity of polarization profiles.

We examined the quality of attitudes in relation to three pairs of bipolar adjectives: blurred - clear, powerless - powerful, peaceful - excited. Protection of the environmental may be characterized as "poorly" visible, the dimensions helpless-powerful, peaceful-excited are the reflection of more or less neutral attitude, with a minimal shift in the positive direction. Attitudes to the protection of environment are highly positive.

Conclusion

It is shown that in creating the environmental consciousness of technicians, its integrity and complexity guarantee not only rational arguments and facts but the enforcement of a qualitatively new system of values. This system takes care of moral redevelopment of students with well-developed eco-ethics and self-reflection. It is precisely the aspect of homogeneity that we consider to be positive in terms of the perspective of solving the environmental problems of technicians. The homogeneity of the polarization profiles encourages us to believe that the connotative meaning of terms is an absolute degree of agreement among students. On the part of us, the teachers, this is a homogeneous field of attitudes and the development of such targeted activities, which will be reflected in the current behaviour of technicians in the future. It is about developing effective programs, while we understand efficiency in particular as a high degree of acceptability and clarity with the aim of qualitative changes in consciousness of students, with subsequent modification of everyday, not just professional, behaviour and action.
Part of the core curriculum of engineer-technician must be a quality-defined ecological or environmental profile. The dynamics of environmental phenomena cannot be mastered without adequate knowledge, skills and desirable attitudes. The professional preparedness is not enough just as enthusiasm and sacrifice is not enough. The common denominator for success is to link professional preparedness and personal involvement with a feeling of responsibility. Responsibility towards our self and our surroundings, responsibility towards the profession, responsibility towards future generations, and, last but not least, responsibility towards the Earth as the bearer of life.

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MODEL OF SUPPLEMENTARY PEDAGOGICAL EDUCATION OF SECONDARY SCHOOL TEACHERS AT THE SLOVAK UNIVERSITY OF TECHNOLOGY

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Abstract: Paper analyses the model of training of technical subjects' secondary school teachers, graduates from technical universities, from the viewpoint of content focus and proportionality of individual subjects in the supplementary pedagogical study. The Slovak University of Technology by providing supplementary pedagogical study satisfies the requirements of secondary schools to obtain highly qualified specialists- teachers of technical subjects. Candidates for supplementary pedagogical study have a deep knowledge of the main disciplines content of their branch. Candidates are therefore full- valued graduates of technical universities (having the title Master of Science-MSc), who have completed the second degree of university technical education. They are graduates of the following faculties: Faculty of Architecture, Faculty of Civil Engineering, Faculty of Mechanical Engineering, Faculty of Chemical and Food technology, Faculty of Materials Science and Technology, Faculty of Electrical Engineering and Information technology, Faculty of Informatics and Information technologies. In the accredited model of supplementary pedagogical education are dominant those studying subjects which are not part of study programs of graduates of technical universities and which are necessary for pedagogical-psychological and didactic erudition of teachers in teaching practice. Graduate acquires the adequate teaching competencies – the ability to design, implement, manage and organize the work in class and to create a positive climate, to diagnose students' abilities. Graduate gains the possibility to self-reflection, can participate in the elaboration of educational materials for teaching practice, is familiar with educational technology and ICT development in the didactics in the relevant field. Graduate of supplementary pedagogical education is completely prepared and qualified to perform the teaching profession of technical subjects at secondary schools –ISCED 3 and 4.

***Keywords*:** Supplementary pedagogical education, pedagogy, psychology, didactic

Introduction

The current model of the arrangement of the world, characterized by the shift from classical traditional commodities to the knowledge and commodities dependent from the knowledge, demands a new philosophy of education and training. The philosophy in which human creativity becomes a key factor the core value of society. The quality of technical education in Slovakia is naturally determined by reflection not only of this philosophy, but also of rich historical background.

Technical Education in the Slovak Republic

Technical education in the Slovak Republic is unique in the world – in Banská Štiavnica, was founded the first college of technical orientation in the world. The location of the school in the territory of Slovakia – in that time it was Hungary – was not accidental. As early as 1737, a vocational school (today we would say a secondary school) of mining was founded here, under the direction of Samuel Mikovíni, a cartographer and a mining expert

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of European format. Queen Maria Terézia, in that time Austrian monarchy, ordered to set up technical college by the decree from the 13 December 1762, this university became the centre of technology and mining science of development not only in Europe but also in the world.

At the Technical University in Banská Štiavnica as the first was founded Department of Chemistry and Mineralogy on 13 June 1763. Its first professor was Nicholas Jacquin, a native of Dutch Leyden. He started giving lectures at the beginning of September 1764. The second department was founded in 1765. The department provided teaching in mechanics and hydraulics. The first professor of this department was Mikuláš Poda, a professor from Graz in Austria. In 1770 the third Department, Mining Art and Mining Law was founded. The first professor of this department was Christoph Traugott Delius, a German mining professor from Walhausen in Thuringia.

The developed mining industry in Banská Štiavnica and the surrounding area gave the new university a unique opportunity for the perfect interconnection of theoretical training and its practical outcome. It is symbolic that this year we celebrate the 255th anniversary of the founding of this technical university. Although our Alma mater – Slovak University of Technology is not explicitly a successor of it because the continuity was interrupted by the political and economic conditions at the beginning of the 20th century, we proudly and with respect, report to this tradition in our 80 year of history. Individual faculties of the Slovak University of Technology in Bratislava provide graduates training in a wide range of technical disciplines.

There are the following seven faculties of the Slovak University of technology – Faculty of Mechanical Engineering, Faculty of Materials Science and Technology, Faculty of Civil Engineering, Faculty of Architecture, Faculty of Electrical Engineering and Informatics, Faculty of Information Technology, and the Faculty of Chemical and Food Technologies.

The Profile of Graduate of Supplementary Pedagogical Education

For more than 50 years (since 1963), our university has a department that provides the Supplementary pedagogical education for graduates-engineers. The aim of this department is to provide adequate propaedeutic of technical education in education levels of the ISCED 3, ISCED 4 by training qualified teachers of technology. The students of supplementary pedagogical education are either graduated engineers who returned to school after work in practice and complement their education in the field of pedagogy, psychology and didactic or undergraduates of STU who in addition to engineering studies attend supplementary pedagogical education during the last two years of study at university. The study takes four-semester and ends with final examinations and defence of the final thesis. Graduates obtain a certificate of teaching competence for vocational subjects at relevant technical schools (ISCED 3, 4).
Graduate of a supplementary pedagogical study represents a model of mutually complementary competencies:
Professional competencies oriented to the student
Professional competencies oriented to the education process
Professional competencies oriented towards the professional growth and the self-development of the teacher

Professional competencies oriented to student

Professional competencies of the graduate of the supplementary pedagogical study oriented to the student:

- to orientate in the current theoretical models of professional socialization and education with an emphasis on models of cognitive development and cognitive socialization and models of personal and social development of youth
- to be able to identify the developmental and individual characteristics of the secondary school student
- to be able to identify the psychological and social factors of student learning
- to lead the student to creation of a system of active and purposeful actions to acquire the value knowledge of the technic in relation to economic, ecological, social and ethical aspects

Objectives in the field of knowledge

- to explain the patterns (regularities) of psychological development and individual peculiarities of the secondary school student
- to describe the methods and tools for identifying student's developmental and individual characteristics
- to describe the learning styles and other characteristics of students influencing learning process

- to describe methods and tools for identifying learning factors
- to describe methods and tools for identifying student's characteristics influenced by the socio-cultural environment

Objectives in the field of capabilities

- to determine development characteristics of student by using the appropriate methods and tools, to interpret them and choose the adequate approach of pedagogical interaction
- to identify the individual characteristics of students in learning
- differentially choose the optimal strategies for working with students with special needs and students from different socio-cultural backgrounds

Professional competencies oriented to educational process

Professional competencies of a graduate of a supplementary pedagogical study oriented to the educational process:

- to master the subject matter, methodology and structure of the taught subjects and their didactics
- to know how to plan and design teaching with regard to the learning context
- to know how to how to teach
- to know how to evaluate the progress and results of teaching and learning students and to diagnose the internal conditions of teaching.

Objectives in the field of knowledge:

- to know the theoretical and practical relationships of branch didactics in its specialization with regard to designing of teaching
- to know the subject matter of the subjects and their didactics
- to explain the basic curricular documents and the methodology of their creation
- to describe the teaching planning process
- to define and classify material and non-material means of teaching
- to introduce criteria for the didactic efficiency of teaching
- to explain the theory of learning as the basis for an adequate choice of the teaching model
- to describe the strategies for personal and social development of students and students with special needs
- to describe methods of detecting student's diagnostic data, diagnostics principles, stages of diagnostic procedure
- to describe the diagnosis of internal teaching conditions
- to describe the types and methods of evaluating the process and outcomes of teaching

Objectives in the field of capabilities

- to adapt national education programs to specific conditions of school, class and students
- to participate in the creation and updating of the school educational program
- to assess and select the subject matter of taught subject, relevant to the objectives and performance standards, with regard to the specific needs of professional practice, region and innovations in the field
- to identify the cross-curricular relationships
- to identify the structural elements of the taught subject and their relationship
- independently design the curriculum of the taught subjects and the lesson
- didactically transform, interpret and effectively communicate the basic content, methodology and epistemology of the disciplines of own technical specialization
- to assess the universality, durability and relevance of innovation in the field for vocational education training
- to practically implement new knowledge into the curriculum of the specialist subject
- to select and use relevant methods, forms and material resources with regard to the educational context (goal, character of subject matter, student)
- to respond flexibly to unexpected situation in the classroom
- to motivate and communicate effectively with students

- to ensure a smooth course and pace of learning, to promote and develop activity of students in teaching process
- to create a positive climate and prevent problem behaviour of students
- to manage and monitor learning of students
- to use diagnostic methods aimed at the knowledge students, their attitudes, interests, value orientations, relations to teaching subject, school work as well as the' relations among students
- to identify the level of students' knowledge and skills by various diagnostic methods
- to interpret and evaluate identified diagnostic data, to suggest pedagogical measures

Professional competencies oriented to the professional growth and self-development of a teacher

Professional competencies of the graduate of a supplementary pedagogical study oriented to the professional growth and self-development of a teacher:

- to be capable of self-reflection and self-evaluation of own pedagogical activities
- to plan and implement own professional growth and self-development in the context of mobility.

Objectives in the field of knowledge

- to describe the tasks, types and phases of self-reflection, the goal of self-reflection and self-assessment
- to describe methods of self-reflection and self-evaluation
- to describe current trends in own field, in information technologies and in education and training

Objectives in the field of capabilities

- to define areas of reflection and assessment in own pedagogical activities
- to identify the strengths and weaknesses of own pedagogical work
- to set objectives and methods of own professional growth in accordance with prospective trends of education and training, the intentions of the school and the professional role
- constantly increase the level of own personal and professional qualities.

Conclusion

At the beginning of this paper we stated that the shift of the economy to knowledge requires a new philosophy of education and training. However, the need of new philosophy is not just conditioned by knowledge-based society. We think that the key determinant of the need for change in education and learning is the spirit of the time we live in. The civilized world has lost sight of what in antique period Plato called as a Good represented by the symbiosis of truth, modesty and beauty. Comenius in the 17th century as wisdom as a virtue. Kant at the beginning of the 19th century as a moral imperative. In the 21st century, neurobiological research confirms that the process of rational choice is penetrated by emotions (Damasio, 1996). It turns out that the changes in human action result from the need to adapt their actions to feelings of other people, while the rationality need not always be dominant. And so the graduates of the supplementary pedagogical education should be not only excellent technicians and excellent experts in didactic transfer. The necessary base of teacher-technician is his or her altruistic and moral equipment. The teachers have the chances of entering the value-ladder of students with their examples in the process so that their moral principles are goals for themselves. And we consider this to be the most important pillar of complementary pedagogical education.

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OBSERVATIONS OF INDUSTRY SUPERVISION OF VET AND UNIVERSITY STUDENT PRACTICUMS IN FITNESS, EXERCISE SCIENCE AND SPORT SCIENCE: PRACTICAL RECOMMENDATIONS RELEVANT TO THOSE PROVIDING STUDENT MENTORSHIP

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Abstract: More than 30 of the 43 universities in Australia offer an exercise science and/or sport science programs. In the Vocational Education and Training (VET) sector, more than 160 Registered Training Organisations offer Australian Government approved fitness training courses. The paper is a self-reflective exercise based upon mentoring placement students from multiple registered course providers from the VET sector fitness strand. Combined with reflection on general population hours for placement students from six Sydney city and one regional New South Wales based universities this represented evaluation of more than 200 students and more than 20,000 placement supervision hours. This observation was based upon student placements conducted over the previous seven years, though a significant proportion of the students surveilled were from the previous 36 months. A number of recommendations were developed that may be relevant not just for health, fitness and exercise and sport science courses, but also may be relevant to industry mentorship across a range of fields.

***Keywords*:** Student supervision, practical placement, vocational education and training, workplace learning

Introduction

The paper is based upon the researchers' experiences and critical self-reflections in conducting workplace learning practicums. This draws upon experience gained mentoring industry placement/work experience students in fitness courses, including exercise and sports science courses over a number of years. Such students included those from Vocational Education and Training (VET) based courses, as well as those from the university sector. It is hoped that evaluation of the discussion experience gained from providing such a service, together with a combination of practical recommendations for supervisors considering offering such a service or continuing to do so, may be of interest to the mentors both within the fields of health and fitness, as well as to practitioners in other disciplines that can relate to similar practical issues. As well as approaching topics relevant to multiple disciplines engaging in mentoring across education and science, this report also includes specific comments to VET and university sector education providers. These comments may be of broader interest other

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international organizations and associations offering mentoring services in terms of their position in relation to such education providers and the perception as well as recognition of the service that they offer.

Different universities require a varying number of placement hours from their students, which are typically split hours across multiple placement facilities. The hours required in a placement program at a particular facility may range from 60hours to more than 150hours. There are also guidelines for practical placement hours in order to meet professional body accreditation, outside of the university sector. For VET sector courses, this is also highly variable and can range from 30 hours to in excess of 100 hours per course. Often students might be enrolled in a number of courses and assigned only one block of hours (e.g. certificates III and IV in Fitness requiring 100hours total).

Similar to the VET sector, Universities have financial considerations and running a placement unit is a cost-effective way of teaching, with students still paying course fees, but only requiring a practicum coordinator, usually on a part-time basis, or shared between courses/given multiple responsibilities outside of directing placements and possibly with limited qualifications in Exercise and Sports Science. These costs are saved as paying clinical professionals conducting the placements is generally more economical and general population supervision by mentors is often gratis. Health Workforce Australia reported an average of clinical hours (not including general population hours) of 368 per exercise physiology student (Health Workforce Division, Department of Health, 2014) in 2013 and that the demand for provision of supervision hours was growing (Health Workforce Division, Department of Health, 2014). Often the large quantity of practical hours are in fact also used as a selling point by the university. For example, one course advertised that it included 500hours of supervised clinical practicum placement (reference not supplied to allow some level of anonymity).

Some universities have a reduced focus on practical instruction of exercise techniques in their sport/exercise science courses. This may be for a number of reasons, such as the focus is elsewhere (e.g. multiple theoretical biomechanics, marketing or sports management units), accreditation requirements for professional exercise physiology organisations may require a certain number of units in a certain field requiring removal of other units and practical exercise technique units may be the casualty (they may just seek to meet the minimal requirements for practical exercise instruction outside of placement units as dictated by the accreditation process), or changing a degree structure to include more profitable common, generic skills units may also result in such a reduction in practical exercise instruction units.

More than 30 of the 43 universities in Australia offer an exercise science and/or sport science programs, whilst the majority of these courses are accredited under a professional association, 26 universities have sort additional accreditation via a privately owned professional body. In the VET sector, more than 160 Registered Training Organisations (RTO) offer Australian Government approved fitness training courses. As well as supervision of VET students for RTOs, industry professionals may find themselves supervising university students as part of their “apparently healthy” practicum hours. There are numerous conditions for qualification as a supervisor such as degree, or postgraduate university qualifications, being a state sport coach or holding a Certificate IV in Fitness with a minimum of 10 years of industry experience also holding a strength and conditioning qualification from a privately owned organisation is specifically mentioned as one of the appropriate criteria for supervision of apparently healthy population practicum hours for many of these university courses. Research has demonstrated that practicum placements help engineer a smooth transition to effective professional practice (Billett, 2009).

Method

This self-reflective, descriptive exercise concerning mentoring industry placement students was based upon observations relevant to VET course students (Certificate III, Certificate IV and Diploma in Fitness), as well as university students completing their general population placement hours. Observations on students placed for specialist population/clinical hours was excluded from this report, as it was deemed that whilst some health and fitness professionals might be recognised as appropriate to supervise such hours, this would not universally be the case. Additionally, it was believed that observations on general population hours practicum students was of more direct relevance, thus of more interest to the exercise, health and fitness profession as a whole, than specialist/clinical population hours. Similarly for VET sector student supervision, hours of supervision for VET courses outside the three fitness courses mentioned above were excluded (e.g. Diploma of Massage, Diploma of Sports Coaching, Certificates in Allied Health Assistance or other VET courses).

To further inform the views and cogent outcomes of this report, observations were compiled from a team of authors, representing views of those with extensive experience teaching courses in VET and/or university sectors relevant to exercise, health and fitness, supported by those with minimal to no such experience. Observation was

also made by university staff not involved in supervising practicum students. Such a selection was made in order to develop a more rounded view.

Results

Reflection was based upon placement students from multiple registered course providers from the VET sector fitness strand. Combined with reflection on general population hours placement students from six Sydney and one regional NSW based universities this represented evaluation of more than 200 students and more than 20,000 placement supervision hours. This observation was based upon student placements conducted over the previous seven years, though a significant proportion of the students surveilled were from the previous 36 months.

The evaluation of the experience of mentoring brought attention to a number of concerns. The delivery of an educational and supportive environment to assist with the appropriate development of such students was viewed to be exceedingly time consuming.

Key findings relevant to practicum students from the university sector

1. There was a high variability between students in terms of desire to learn and interest in practical exercise instruction principles, knowledge, experience of working in a commercial environment (with many never having held a job of any kind before), co-cooperativeness, and work ethic. The high variability between students, echoed in the different courses at different universities, was reported to make planning harder, due to reduced ability to predict student capabilities.
2. Many students seemed to believe that the facility was being paid for hours of practical experience provided, however there were in fact in a purely voluntary capacity. Students were thus not as aware of the good faith put in to providing practicum supervision.
3. It was a general consensus that most universities for which a placement environment was provided, did not recognise the time and workload required by placement facility staff.
4. Some universities assigned placement students a mark based upon a report at the end of a student's industry placement. This may have helped to promote more attentive behaviour patterns for some students if they were aware of an assessment based upon performance. Unfortunately, cases were identified where students demonstrated little interest in developing practical skills, focusing entirely upon what mark they might receive and how they might attain those marks, as opposed to developing a level of generic work skills that were sorely lacked, together with specific practical experience of the general principles of exercise and sport science.
5. Some students were dramatically underprepared on presentation to the facility and had minimal knowledge of basic concepts such as exercise instruction and program design. It was necessary to teach them such fundamental skills.
6. In some cases students presented with minimal or incorrect knowledge of the basic principles of exercise science such as exercise instruction and programming, however believing they possessed a high degree of knowledge in this area. The re-education required was in some cases a tedious task.
7. It was found that for supervising coaches without extensive prior experience of working with interns, teaching at the relevant level, or being aware of the relevant course and the associated level of knowledge and expertise of the students, at times found it particularly burdensome to supervise students. Sometimes this could be extremely stressful and these coaches in particular expressed preference for stopping the provision of this free service.
8. For those universities with shorter placement allocations it could be difficult to gain any benefits for the placement facility as 60 hours was often not adequate to train a practicum student with adequate skills and abilities that in return they could make a contribution to the facility hosting the student. On the contrary however 150 hours is a significant investment of time and if the student was not passionate about learning and developing, then this could be frustrating.
9. Mentoring university placement students can be an exceedingly rewarding experience. Whilst some students might have no interest in their practicum placements for the purpose of developing vital industry skills and knowledge, for those that were interested and passionate about exercise/sport science, the positive emotional reward of assisting and helping develop such a future coach on their path mitigated all negative factors associated with placement supervision.

Differences Reported for the Scenario of Practicum Students from the VET Sector (fitness courses only)

1. As per the university sector, providing practicum placements for students from the VET sector could be a highly rewarding experience, with some VET sector students keeping in touch after graduating through their own businesses or joining the health, exercise and sport science team in some capacity.
2. In general, it was observed that VET sector students had more interest in the practical skills required for the health and fitness industry. For some this was attributed to the students having completed exercise training activities themselves, prior to study, though often it was also because they wished to work in the fitness industry as a career choice, so they were enthusiastic and passionate to learn.
3. Many VET sector students lacked knowledge in certain areas compared to university students, though university students were more variable in their knowledge base. As a generalization, it was observed that the knowledge of basic exercises, basic program design and ability to interact with clients was much higher in VET sector than university practicum students. University students on average however had far higher knowledge in areas such as anatomy, psychology, motor learning, biomechanics and physiology.
4. Some of the best performing practicum students were in fact those who had previously studied VET courses, had work experience in the industry and were now completing their practicum hours as part of their university course. This re-iterates the value of such an articulation into the university system.
5. A number of strength training coaches who had worked with large RTOs found that they could coerce involvement with larger franchises over boutique gyms. The claim was made that placement hours could turn into a recruitment process, rather than an opportunity to learn principles and develop skills without an alternative agenda.
6. Another observation was that some RTOs were undergoing a similar issue to the lack of practical exercise instruction skills being taught at some universities. Some RTOs appeared to be very concerned with current fads such as one example of dropping Olympic lifting from the syllabus, in order to create time to discuss a circuit training exercise trend called Crossfit. Rather than teaching basic principles which would assist students to evaluate the next fad for themselves they were more concerned about what was considered the current fad.
7. It was reported that in some large RTOs if they were partnered with another company they would suppress mention of competitors and even exclude coaches from participating in their courses. An attitude that would perhaps not be replicated in the university system.
8. Many RTOs had more focus on (more units/teaching time allocated) working with special populations than performance, with multiple modules on special populations and group exercise vastly outweighing athletic focused programming and exercise instruction.
9. Placement students had reported to supervisors that much of what they had learnt in their courses appeared to not be relevant in a practical environment. One interesting comment was “I would have preferred more emphasis on things like periodisation which you actually need to be proficient in rather than topics such as the correct way to hand someone a water bottle and towel”.

Discussion

From the involvement of the practicum supervisor in the workplace there appears to be variations in the knowledge and skills in students from different universities and courses. One limitation of this from the field report is that it is based upon observations from Sydney, Australia and findings may not be wholly extrapolated to other states or rural settings even within Australia. It is hoped that observations and suggestions may be of interest to those health and exercise practitioners considering or currently taking industry placement students in order to provide information that might allow better informed decisions in their own practices. It may also be of interest to those providing mentorship in other fields in research and education. Some of the basic principles discussed may be able to be translated into other settings and perhaps the findings from the many thousands of supervised hours discussed in this report may assist those conducting mentorship in other areas. Most importantly, it should be remembered that the negative and positive issues raised above apply to some, but certainly not all practicum students.

Though it was observed that the attitude of the placement student was a more important factor than their knowledge on commencement, it might be suggested that education providers in the university sector, should be aware of quality control issues, enforcing a minimal level of skills and abilities prior to being able to initiate placement. It should be noted however that with the significant emphasis on practical exercise instruction skills in the workplace and competency based approach to assessment in VET fitness courses, differences in practical competency performance would be expected as were observed.

Whilst it is observed that the universities have differing course structures, they have become more homogenous in recent years primarily due to private organization driven professional body accreditation requirements. Whilst

it does make it more challenging at times to deal with students at very different levels of knowledge, having a variety of students can at times be helpful and make practicum more interesting. In terms of homogenising the content of courses (such as for accreditation requirements), whilst it might make practicum supervision easier, it is viewed as a negative outcome in terms of prescriptiveness (McAllister & Nagarajan, 2015) and collective student knowledge and is not a recommendation of this report.

Those (rare) university practicum students believing that they are experts in the field, but often demonstrating incorrect knowledge, might be attributed to a number of factors. One concern is that this may be related to less experienced or sessional (part time) staff in exercise instruction related units losing some consistency across the degree. It is also a concern that due to strict guidelines to attain professional accreditations in the field of exercise physiology, at least one of the Sydney based universities significantly reduced its number of practical exercise based units. These courses have also been known to suffer in order to accommodate generic skills based common units that can be run across multiple different subject fields for economical purposes.

Conclusion

Whilst a series of concerns have been raised about practicum students, the reward is great when the right student is supervised properly. It was a general consensus that VET students were preferred over university placement students. Though there was great variation between students, there was also great variability between different universities. It was generally believe that universities and some of their students, were under appreciative of the service provided. It should be considered whether this would change if a financial contribution for general population placement supervision was required as per specialist clinical hours. The recommendations below may well prove relevant not just for health, fitness and exercise and sport science courses, but also may be relevant to industry mentorship across a range of fields.

Recommendations

1. A supervisor can expect practicum students to present with very different knowledge levels, experience and passion.
2. Many students are underprepared for practical work in the industry and the work done to prepare them can be underappreciated
3. The time costs and work needed to adequately provide a placement environment imply it may be appropriate to request funding, particularly from the university sector, for mentoring students on general population practical placement, as per clinical population students.
4. It should be considered that even experienced staff, should they not be experienced at teaching or supervision may find this activity particularly time consuming and demanding. Thus mentorship or assistance may be required.
5. It would be prudent to accept practical students in a trial capacity, particularly for those requiring more than 100hours of practicum, this could be combined by filtering, such as interviewing potential candidates.
6. Feedback for the university would be to indicate to students where placements are provided on a voluntary basis and this might increase awareness students.
7. For university students complementing an exercise/sport science degree with some VET study, or seeking a mentor may be indicated on/prior to graduation for increased preparedness prior to working in this sector.

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INTERRELATIONS BETWEEN HIGH SCHOOL STUDENTS' ACADEMIC MOTIVATION AND CHEMISTRY PERCEPTIONS

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Abstract: Motivation is described as a process in which an activity is initiated and continued for a purpose. It is a state that determines the level of one's willingness to participate in an activity. Motivation contains belief, internal forces, and reactive behavior against stimuli. Perception is to reveal individuals' beliefs and ideas in a certain way. It is important to have basic chemistry knowledge in our day, so the determination of the chemistry perceptions of students has gained importance. In literature, the relationship of academic motivation with various variables such as school performance, problem solving and metacognitive awareness have been examined. Different from the previous examples in literature, however, in this study, the aim is to examine high school students' academic motivations in terms of their chemistry perception levels. Study group consists of 1047 high school students who are enrolled at high schools in Ankara. At the end of the study, it was determined that there is a statistically meaningful relationship between high school students' academic motivations and their chemistry perception levels. This result can be interpreted as high school students with high academic motivations also having high chemistry perception.

Keywords: Academic motivation, chemistry perception, high school students.

LİSE ÖĞRENCİLERİNİN AKADEMİK MOTİVASYONLARI VE KİMYA ALGILARI ARASINDAKİ İLİŞKİNİN İNCELENMESİ

Özet: Motivasyon bir amaca yönelik aktivitenin başlatılıp sürdürüldüğü bir süreç olarak tanımlanmaktadır. Bireyin bir aktiviteye katılmaya (girişmeye) olan istekliliğinin derecesini belirleyen bir durumdur. Motivasyonun; inancı, içsel güçleri, uyarıya karşı tepkisel davranışları kapsayan bir yapısı vardır. Algı ise bireylerin bir konudaki inanç ve fikirlerini ortaya çıkarmaktadır. Temel kimya bilgisine sahip olmanın ihtiyaç olduğu günümüzde öğrencilerin kimya algılarının belirlenmesi büyük önem kazanmıştır. Akademik motivasyonun okul performansı, problem çözme, bilişötesi farkındalık gibi birçok değişken ile ilişkisi incelenmiştir. Bu araştırmada öğrencilerin akademik motivasyonları ile kimya algıları arasındaki ilişkinin incelenmesi amaçlanmıştır. Araştırmanın çalışma grubunu Ankara'daki liselerde öğrenim gören 1047 öğrenci oluşturmuştur. Araştırmada veri toplama aracı olarak akademik motivasyon ölçeği ve kimya algı ölçeği kullanılmıştır. Araştırma sonucunda akademik motivasyon ile kimya algı arasında istatistiksel olarak anlamlı bir ilişki olduğu belirlenmiştir. Bu sonuç yüksek akademik motivasyona sahip olan bireylerin kimya algılarının da yüksek olduğu şeklinde yorumlanabilir.

Anahtar Sözcükler: Akademik motivasyon, kimya algı, lise öğrencileri.

Giriş

Motivasyon, davranışı ortaya çıkaran, yönlendiren ve kalıcı olmasını sağlayan içsel bir durumdur (Woolfolk, 2004). İçsel ya da dışsal motivasyon bir bireyin bulunduğu ortamdaki öğrenme aktivitelerine katılımında önemli bir faktördür. Ayrıca motivasyon, harekete geçiren, yönlendiren ve davranışın sürekliliğini sağlayan bir içsel güç olarak ta tanımlanmaktadır (Thorkildsen, Nicholls, Bates, Brankis & DeBolt, 2002). Motivasyonun; içsel güçleri, kalıcı özellikleri, uyarıya karşı tepkisel davranışları, inanç ve etkileri kapsayan bir yapısı vardır. Motivasyon, bireyin bir aktiviteye katılmaya olan istekliliğinin derecesini belirler. Kendi bilişsel süreçlerinin farkında olan, bilişsel süreçleri öğrenmede nasıl kullanacağını bilen, kendi kendini yönlendiren bireyler, yeni motivasyon stratejileri geliştirebilir ve sonuç olarak akademik başarı düzeylerini artırabilirler. Motivasyon bir amaca yönelik aktivitenin başlatılıp sürdürüldüğü bir süreç olarak tanımlanmaktadır (Pintrich & Schunk, 2002). Bu süreçte öğrencilerin kendi kendilerini yönlendirdikleri, yeni motivasyon stratejileri geliştirdikleri ve bunun sonucu olarak ta akademik başarının etkilendiği belirlenmiştir (Matuga, 2009). Akademik motivasyon; bireyin ders ve ders dışı konuları öğrenme, ödev hazırlama, kendini geliştirme, bilgiyi kullanma, öğrendiklerini okulda ve okul dışında uygulama gibi istekler ile de ilgilidir (Bozanoğlu, 2004).

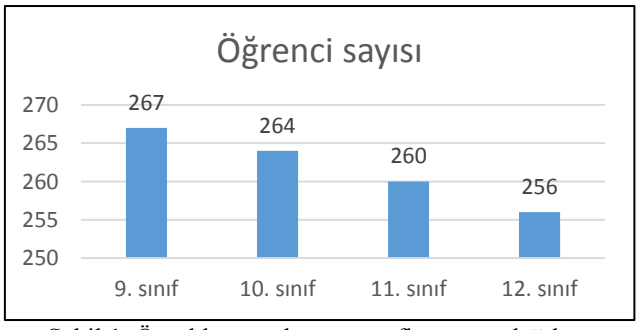
Fen bilimlerinin önemli alanlarından biri olan kimya öğrenciler tarafından geçmek zorunda olunan bir ders olarak algılanmakta ve bunun sonucu olarak kimyaya ilgi daha düşük seviyededir (Becker, 1978). Bireylerin algılarının düşük olması onların bu bilim alanında eksiklerinin olduğu ifade etmektedir. Toplum için bu denli önemli olan kimyanın lise öğrencileri tarafından nasıl algılandığının belirlenmesi ve ortaya çıkacak sonuca göre önlemlerin alınması gerekmektedir. Bu araştırmada lise öğrencilerinin akademik motivasyon ve kimya algı düzeylerinin belirlenmesi, farklı değişkenlerin etkisi ve aralarındaki ilişkinin incelenmesi amaçlanmıştır.

Yöntem

Araştırmada ilişkisel tarama model kullanılmıştır. Bu araştırma modeli iki veya daha fazla değişkenin birbiriyle olan ilişkisini incelemeyi mümkün kılmaktadır (Fraenkel, Wallen ve Hyun, 2012). Bu çalışmada akademik motivasyon ile kimya algının öğrenim görülen sınıf ve cinsiyet değişkenlerine göre değişimi ve motivasyon ve algı arasındaki ilişki incelenmiştir.

Örneklem

Araştırmanın örneklem grubunu Ankara'daki liselerde öğrenim gören 1047 lise öğrencisi oluşturmaktadır. Örneklem grubunun %52.8'i kadın, %47.2'si erkek lise öğrencisidir.



Şekil 1. Örneklem grubunun sınıflara göre dağılımı

Veri Toplama Araçları

Araştırmada veri toplama araçları olarak akademik motivasyon ölçeği ve kimya algı ölçeği kullanılmıştır.

Akademik Motivasyon Ölçeği

Akademik motivasyon ölçeği Bozanoğlu (2004) tarafından geliştirilmiştir. Ölçek 5'li Likert tipinde 20 maddeden oluşmaktadır. Ölçek kendini aşma, bilgiyi kullanma ve keşif olmak üzere üç alt boyuta sahiptir. Ölçeğin Cronbach alpha güvenirlik katsayısı .85'dir. Örneklem verilerinden elde edilen Cronbach alpha güvenirlik katsayısı ise .89'dur.

Kimya Algı Ölçeği

Kimya algı ölçeği Wells (2003) tarafından geliştirilmiş olan bir ölçektir. Bu ölçeğin Türkçeye uyarlanması Tosun (2013) tarafından gerçekleştirilmiştir. Ölçek 5'li Likert tipinde 20 maddeden oluşmaktadır. Ölçek cinsiyet, değer, tedirginlik, kimyanın kapsamı ve eğilim olmak üzere beş faktörlü bir yapıya sahiptir. Ölçeğin Cronbach alpha güvenirlik katsayısı .745'dir. Örneklem verilerinden elde edilen Cronbach alpha güvenirlik katsayısı .814'dir.

Verilerin Analizi

Araştırmadan elde edilen verilerin analizi SPSS 15 paket programı ile gerçekleştirilmiştir. Ölçeklerden elde edilen verilerin analizi gerçekleştirilirken öncelikli olarak betimsel istatistik yapılmıştır. Böylece örneklem grubunun akademik motivasyon ve kimya algı düzeyleri belirlenmiştir. Akademik motivasyon ve kimya algı puanlarının cinsiyet değişkenine göre değişip değişmediği bağımsız değişken t-testi ile incelenmiştir.

Öğrencilerin akademik motivasyon ve kimya algıya ilişkin görüşlerinin ölçeklerin alt boyutları açısından cinsiyet ve öğrenim görülen sınıfa göre farklılık gösterip göstermediği ise "Çok Değişkenli Varyans Analizi" (two-way Multivariate Analysis of Variance, MANOVA) ile incelenmiştir. MANOVA, grupların birden fazla bağımlı değişken bakımından anlamlı farklılık gösterip göstermediğini inceleyen bir tekniktir. Farklılığın hangi bağımlı değişkenler arasında olduğu MANOVA ile hesaplanan Gruplar Arası Etkileşim Testi tablosundaki anlamlılık değerlerine bakılarak yorumlanmıştır. Ayrıca MANOVA analizleri sonucu bağımlı değişkenlerde ortaya çıkan farklılıkların bağımsız değişken tarafından açıklanma oranını yorumlarken Cohen (1988)'in belirlediği eta kare değeri ölçütleri dikkate alınmıştır. Cohen (1988), .01'i küçük, .06'yı orta, .14 ve üzerini büyük eta kare değerleri olarak belirlemiştir.

Bulgular

Lise öğrencilerinin akademik motivasyon ve kimya algıları arasındaki bağlantılar araştırması kapsamında uygulanan ölçeklerin ortalamalarına ilişkin tanımlayıcı istatistikler Tablo 1'de özetlenmiştir.

Tablo 1. Akademik motivasyon ve kimya algı ölçeklerine ait betimsel istatistikler

Ölçek	**X**	**SS**
Akademik Motivasyon	**2.91**	**.68**
Kendini Aşma	2.84	.84
Bilgiyi Kullanma	3.04	.76
Keşif	2.87	.70
Kimya Algı	**3.33**	**.47**
Cinsiyet	3.83	.92
Değer	3.17	.68
Tedirginlik	3.60	.87
Kimyanın Kapsamı	2.94	.74
Eğilim	3.10	.79

Tablo incelendiğinde lise öğrencilerinin akademik motivasyonlarının orta düzeyde ve kimya algı düzeylerinin ise yüksek ve olumlu düzeyde olduğu görülmektedir. Akademik motivasyon ölçeğinin alt boyutları incelendiğinde öğrencilerin bilgiyi kullanma boyutunda en yüksek ortalamaya sahip oldukları dikkati çekmektedir. Kimya algı ölçeğinin alt boyutlarında ise öğrencilerin kimya başarısında/kimya öğrenebilme yeteneğinde cinsiyetin önemli bir etken olduğunu düşünmektedirler.

Lise öğrencilerinin öğrenim gördükleri sınıf düzeyi ve cinsiyet değişkeninin akademik motivasyon ve kimya algıları üzerine etkisini değerlendirmek için iki yönlü Çok Değişkenli Varyans Analizi (two-way Multivariate Analysis of Variance, MANOVA) yapılmıştır. İlk olarak verilerin MANOVA'nın sayıltılarını karşılayıp karşılamadığı incelenmiştir. Verilerin dağılımının normal dağılıma uygun olması ve grup varyanslarının homojen olması test edilmiştir. Akademik motivasyon ve kimya algı ölçeklerinden elde edilen verilerin basıklık (skewness) ve çarpıklık (kurtosis) değerleri +2 ile -2 arasında olduğu için normal dağılım sayıltısını sağlanmıştır. Fakat Box's M testinin [Box's M:131.442; $F_{(2,\ 1042)}$: 14.554, $p<0.05$; Box's M:270.987; $F_{(5,\ 1035)}$: 2.54, $p<0.05$] anlamlı bir değere sahip olmasından dolayı grup varyansların homojen olması sayıltısı sağlanamamıştır. Bu nedenle MANOVA analizi yorumlanırken Pillai's trace değerine bakılmıştır (Tabachnick ve Fidell, 1989).

Akademik motivasyona ilişkin bulgular;
Öğrencilerin akademik motivasyon ortalamalarının cinsiyet değişkenine göre değişim gösterip göstermediği bağımsız değişken t-testi ile incelenirken, ölçeğin kendini aşma, bilgiyi kullanma ve keşif boyutlarındaki değişim ise MANOVA ile incelenmiştir.
Akademik motivasyonun cinsiyete göre değişimi bağımsız değişken t-testi sonuçları Tablo 2'de özetlenmiştir.

Tablo 2. Akademik motivasyonun cinsiyete göre t-testi sonuçları

Akademik Motivasyon	**N**	**X**	**SS**	**sd**	**t**	**p**
Kadın	553	2.92	.69	1045	.630	.528
Erkek	494	2.90	.67			

Tablo incelendiğinde kadınların akademik motivasyon ortalama puanlarının erkeklere göre daha yüksek olduğu görülmektedir. Ancak akademik motivasyon ortalama puanları arasındaki fark istatistiksel olarak anlamlı değildir (t=.630, p>0.05).

Akademik motivasyon ölçeğinin kendini aşma, bilgiyi kullanma ve keşif alt boyutlarından alınan puanlara cinsiyetin etkisi MANOVA analizi yapılarak incelenmiştir. Tablo 3'te görüldüğü gibi cinsiyetin öğrencilerin akademik motivasyonlarında anlamlı bir etkisinin olduğu belirlenmiştir (Pillai's trace=.011, $F_{(3.1043)}$=3.756 η^2=.011, p<.001).

Tablo 3. Kadın ve erkek öğrencilerin akademik motivasyon puanlarının MANOVA değerleri

Etkileşim		Değer	F	Hipotez Sd	Hata Sd	η^2
Gruplar	**Pillai's trace**	.011	3.756	3	1043	.011

Analiz sonuçlarına göre bağımlı değişkenlerden bilgiyi kullanma alt boyutunda kadın ve erkek öğrenciler arasında anlamlı bir farklılık vardır (p<0.05). Akademik motivasyonun bilgiyi kullanma değişkeninin cinsiyet bağımsız değişkeni ile açıklanma yüzdesi %.4'tür. Cohen (1988)'e göre bu eta kare (η^2) oranı düşük değerdir (Tablo 4).

Tablo 4. Kadın ve erkeklerin akademik motivasyon puanları arasındaki etkileşim

Kaynak	Bağımlı Değişken	Kareler Toplamı	Sd	Ortalamalar Karesi	F	η^2
Gruplar	**Kendini aşma**	.145	1	.145	.208	.000
	Bilgiyi kullanma	2.299	1	2.299	4.006	.004
	Keşif	.209	1	.209	.425	.000

Ortalama puanlarına bakıldığında kadınların akademik motivasyonu açıklayan kendini aşma, bilgiyi kullanma ve keşif boyutlarında ortalamaları (X_1=2.85; X_2=3.09; X_3=2.86) erkeklerin ortalamaları ise (X_1=2.83; X_2=3.00; X_3=2.88)'dir. Tablo 4 incelendiğinde bilgiyi kullanma boyutunda cinsiyetin anlamlı bir etkisinin olduğu görülmektedir.

Lise öğrencilerinin öğrenim gördükleri sınıflara göre akademik motivasyon ortalamaları tabloda özetlenmiştir.

Tablo 5. Lise öğrencilerinin sınıflara göre akademik motivasyon ortalamaları

Akademik Motivasyon	N	X	SS
9. sınıf	267	2.92	.69
10. sınıf	264	2.98	.59
11. sınıf	260	2.94	.80
12. sınıf	256	2.80	.60

Tablo 5 incelendiğinde en yüksek akademik motivasyon ortalaması 10. sınıf öğrencilerine aitken, en düşük ortalama ise 12. sınıf öğrencilerine aittir. Öğrencilerin öğrenim gördükleri sınıfın akademik motivasyon üzerine etkisi ANOVA ile incelenmiştir. Analiz sonucunda öğrenim görülen sınıf bakımından öğrencilerin akademik motivasyonları arasında anlamlı bir fark olduğu belirlenmiştir [$F_{(3-1043)}$=3.427, p<.05]. Öğrencilerin akademik motivasyonu öğrenim gördükleri sınıfa bağlı olarak anlamlı bir şekilde değişmektedir. Sınıflar arası farkların hangi gruplar arasında olduğunu bulmak amacıyla yapılan Scheffe testi sonuçlarına göre, 10. sınıfta öğrenim gören öğrencilerin akademik motivasyonlarının 12. sınıfta öğrenim gören öğrencilerinkinden daha olumlu olduğu belirlenmiştir.

Üç alt boyuttan oluşan akademik motivasyon ölçeğinin kendini aşma, bilgiyi kullanma ve keşif alt boyutlarından alınan puanlarına sınıfın etkisi MANOVA analizi yapılarak incelenmiştir. Analiz sonucunda öğrenim görülen sınıfın öğrencilerin akademik motivasyonlarında anlamlı bir etkisinin olduğu belirlenmiştir (Pillai's trace=.029, $F_{(3.1041)}$=3.395 η^2=.010, p<.001).

Tablo 3. Sınıf değişkenine göre öğrencilerin akademik motivasyon puanlarının MANOVA değerleri

Etkileşim		Değer	F	Hipotez Sd	Hata Sd	η^2
Gruplar	**Pillai's trace**	.029	3.395	3	1041	.010

Analiz sonuçlarına göre bağımlı değişkenlerden bilgiyi kullanma ve keşif alt boyutlarında sınıf düzeyine göre anlamlı farklılık vardır ($p<0.05$; $p<0.001$). Akademik motivasyonun bilgiyi kullanma ve keşif değişkelerinin sınıf bağımsız değişkeni ile açıklanma yüzdeleri sırasıyla %.7 ve %1.7'dir. Cohen (1988)'e göre bu eta kare (η^2) oranı düşük değerdir.

Tablo 4. Sınıf düzeylerine göre öğrencilerin akademik motivasyon puanları arasındaki etkileşim

Kaynak	Bağımlı Değişken	Kareler Toplamı	Sd	Ortalamalar Karesi	F	η^2
Gruplar	**Kendini aşma**	4.221	1	1.407	2.025	.006
	Bilgiyi kullanma	4.482	1	1.494	2.608	.007
	Keşif	8.585	1	2.862	5.895	.017

Öğrencilerin akademik motivasyonun kendini aşma, bilgiyi kullanma ve keşif alt boyutlarındaki puanları arasındaki farklılıkların hangi sınıf düzeyleri arasında olduğunu belirlemek amacıyla Tukey ve Tamhane testleri yapılmıştır. Elde edilen sonuçlara göre bilgiyi kullanma boyutunda 10. ve 12. sınıflar arasında anlamlı farklılık olduğu belirlenmiştir. Akademik motivasyonun keşif boyutunda anlamlı farklılık 9. ve 12. sınıflar ve 10. ve 12. sınıflar arasında gözlenmiştir.

Kimya algıya ilişkin bulgular;
Öğrencilerin kimya algı ortalamaları incelendiğinde, kadınların kimya algılarının erkeklere göre daha yüksek ve olumlu olduğu belirlenmiştir ($X_{kadın}$:3.40; X_{erkek}: 3.25). Öğrencilerin kimya algılarının cinsiyete göre değişim gösterip göstermediği bağımsız değişken t-testi ile incelenmiştir. Analiz sonucunda cinsiyet değişkenine göre kimya algı ortalama puanları arasında istatistiksel olarak kadınlar lehine anlamlı bir fark olduğu belirlenmiştir ($t=5.247$, $p<0.001$).

Kimya algı ölçeği cinsiyet, değer, tedirginlik, kimyanın kapsamı ve eğilim olmak üzere beş alt boyuttan oluşmaktadır. Bu alt boyutlardan alınan puanlara cinsiyetin etkisi MANOVA analizi yapılarak incelenmiştir. MANOVA analizi sonucunda cinsiyetin öğrencilerin kimya algıları üzerinde anlamlı bir etkisinin olduğu belirlenmiştir (Pillai's trace=.067, $F_{(5.1041)}=14.925$, $p<.001$ $\eta^2=.067$,). Anlamlı farkın hangi alt boyutta ortaya çıktığını belirlemek için yapılan analiz sonucuna göre cinsiyet, değer ve eğilim boyutlarında olduğu saptanmıştır. Kimya algı ölçeğinin cinsiyet boyutu kimya öğrenebilme becerisinde ve kimya kariyerinde başarılı olunup olunmayacağının belirlenmesinde, değer boyutu kimyanın toplum için öneminin algılanmasında ve eğilim boyutu ise kimya yeteneği ve kimya ilgisinin düzeyinin belirlenmesinde cinsiyetin önemli olduğunu ifade etmektedir. Araştırmanın yürütüldüğü örneklem grubundaki kadın ve erkek öğrenciler üzerinde bu alt boyutların anlamlı etkisinin olduğu belirlenmiştir. Kimya algısının cinsiyet, değer ve eğilim alt boyutlarının cinsiyet bağımsız değişkeni ile açıklanma yüzdeleri sırasıyla %.41, %.07 ve %.08'dir.

Lise öğrencilerinin öğrenim gördükleri sınıflara göre kimya algı ortalamaları tabloda özetlenmiştir.

Tablo 5. Lise öğrencilerinin sınıflara göre kimya algı ortalamaları

Kimya Algı	N	X	SS
9. sınıf	267	3.25	.44
10. sınıf	264	3.30	.42
11. sınıf	260	3.34	.54
12. sınıf	256	3.44	.47

Tablo 5 incelendiğinde en yüksek kimya algı ortalaması 12. sınıf öğrencilerine aitken, en düşük ortalama ise 9. sınıf öğrencilerine aittir. Öğrencilerin öğrenim gördükleri sınıfın kimya algı üzerine etkisi ANOVA ile incelenmiştir. Analiz sonucunda öğrenim görülen sınıf bakımından öğrencilerin kimya algıları arasında anlamlı bir fark olduğunu göstermektedir [$F_{(3-1043)}=7.843$, $p<.001$]. Lise öğrencilerinin kimya algıları öğrenim gördükleri sınıfa bağlı olarak anlamlı bir şekilde değişmektedir. Sınıflar arası farkların hangi gruplar arasında olduğunu bulmak amacıyla yapılan Tukey testi sonuçlarına göre, anlamlı farklılık 9. ve 12. sınıflar ve 10. ve 12. sınıflar arasında gözlenmiştir.

Kimya algı ölçeğinin cinsiyet, değer, tedirginlik, kimyanın kapsamı ve eğilim alt boyutlarından alınan puanlara öğrenim görülen sınıf değişkeninin etkisi MANOVA analizi yapılarak incelenmiştir.

Tablo 5. Sınıf değişkenine göre öğrencilerin kimya algı puanlarının MANOVA değerleri

Etkileşim		Değer	F	Hipotez Sd	Hata Sd	η^2
Gruplar	**Pillai's trace**	.075	3.395	3	1039	.025

Tablo 5 incelendiğinde öğrenim görülen sınıfın öğrencilerin kimya algılarında anlamlı bir etkisinin olduğu belirlenmiştir (Pillai's trace=.075, $F_{(3.1039)}$=3.395 η^2=.025, p<.001). Anlamlı farklılığın hangi boyutlarda olduğunu belirlenmek için yapılan analiz sonucuna göre ölçeğin tüm alt boyutlarda farklılık gözlenmiştir (p<0.001; p<0.05; p<0.05; p<0.05; p<0.001).

Tablo 6. Sınıf düzeylerine göre öğrencilerin kimya algı puanları arasındaki etkileşim

Kaynak	Bağımlı Değişken	Kareler Toplamı	Sd	Ortalamalar Karesi	F	η^2
Gruplar	**Cinsiyet**	19.483	1	6.494	7.862	.022
	Değer	4.698	1	1.566	3.460	.010
	Tedirginlik	7.657	1	2.552	3.381	.010
	Kimyanın kapsamı	5.401	1	1.800	3.337	.010
	Eğilim	21.604	1	7.201	11.932	.033

Kimya algının cinsiyet, değer, tedirginlik, kimyanın kapsamı ve eğilim değişkelerinin sınıf bağımsız değişkeni ile açıklanma yüzdeleri sırasıyla %2.2, %1, %1, %1 ve %3.3'tür. Öğrencilerin kimya algılarının cinsiyet, değer, tedirginlik, kimyanın kapsamı ve eğilim alt boyutlarındaki puanları arasındaki farklılıkların hangi sınıf düzeyleri arasında olduğunu belirlemek amacıyla Tukey ve Tamhane testleri yapılmıştır. Elde edilen sonuçlara göre cinsiyet boyutunda 9. ve 12. sınıflar ile 10. ve 12. sınıflar arasında anlamlı farklılık olduğu belirlenmiştir. Değer boyutunda anlamlı farklılık 9. ve 12. sınıflar arasında gözlenmiştir. Tedirginlik boyutunda 10. ve 12. sınıflar arasında, kimyanın kapsamı boyutunda 9. ve 11. sınıflar arasında anlamlı farklılık olduğu gözlenmiştir. Eğilim boyutunda anlamlı farklılık 9. ve 11. sınıflar ile 9. ve 12. sınıflar ve 10. ve 11. sınıflar arasındadır.

Akademik Motivasyon ve Kimya Algı Arasındaki İlişki

Öğrencilerin akademik motivasyon ve kimya algı düzeyleri arasındaki ilişkinin incelenmesi amacıyla yapılan korelasyon analizi sonuçları Tablo 7'de verilmektedir.

Tablo 7. Akademik motivasyon ve kimya algı arasındaki ilişki

		Kimya Algı	Cinsiyet	Değer	Tedirginlik	Kimyanın kapsamı	Eğilim
Akademik Motivasyon	Korelasyon katsayısı	.295**	.149**	.254**	.258**	.153**	.244**
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000
	N	1047	1047	1047	1047	1047	1047

** Correlation is significant at the 0.01 level (2-tailed).

Tablo incelendiğinde öğrencilerin akademik motivasyonları ile kimya algı puanları arasında pozitif yönde zayıf düzeyde istatistiksel olarak anlamlı bir ilişki olduğu görülmektedir.

Sonuç

Bireylerin bulundukları ortamda yeni öğrenme stratejilerine etkin olarak katılımları ve bilgiyi kavrama, anlama, hatırlama, uygulama ve değerlendirme etkinliklerini yerine getirmeleri için motive olmaları gerekir. Motivasyonun; içsel güçleri, kalıcı özellikleri, uyarıya karşı tepkisel davranışları, inanç ve etkileri kapsayan bir yapısı vardır (Evans, 2000 akt. Ünal Karagüven, 2012). Motivasyonun sahip olduğu bu özellikler, bireyin bir aktiviteye katılmaya olan istekliliğinin derecesini belirler. Ancak öğrencilerin tüm derslere aynı istekle katılmadıkları bilinmektedir. Örneğin öğrencilerin bilimin doğasını anlamalarını sağlayan, bilimsel yöntemin uygulamalarının sınıf ortamında gerçekleştirilebildiği derslerden biri olan kimya öğrenciler tarafından yüksek motivasyona sahip oldukları bir ders olarak algılanmamaktadır (Becker, 1978). Bu araştırmada ülkemizde liselerde öğrenim gören öğrencilerin bilimsel bir çalışmanın gerçekleştirilebilmesi için gerekli olan akademik motivasyon ve bilimsel yöntemin uygulama alanlarından biri olan kimya algı düzeyleri incelenmiş, bu değişkenlere cinsiyet ve öğrenim görülen sınıfın etkileri değerlendirilmiş ve iki değişken arasındaki bağlantılar araştırılmıştır. Araştırma sonucunda liselerde öğrenim gören öğrencilerin yüksek düzeyde akademik motivasyona ve kimya algısına sahip oldukları belirlenmiştir. Lise öğrencilerinin akademik motivasyonu cinsiyet

değişkenine göre anlamlı farklılık göstermezken, kimya algı düzeyi anlamlı bir şekilde farklılaşmaktadır. Akademik motivasyon bulguları diğer araştırma bulgularını destekler niteliktedir (Seyis, 2011; Gömleksiz ve Serhatlıoğlu, 2013; Şahin ve Çakar, 2011; Demir ve Arı, 2013). Kimya algısında kadınlar lehine fark belirlenmiştir. Bu bulgu kimyada erkeklerin kadınlara göre daha iyi olmadığı, kadınların kimya alanında başarılı olmalarının beklendiği, cinsiyetin kimya başarısında önemli bir faktör olmadığını ifade etmektedir.

Akademik motivasyon sınıf düzeyine göre anlamlı bir değişim göstermektedir. Araştırmanın bu sonucu Nartgün ve Çakır (2014), Alemdağ, Öncü ve Yılmaz (2014), Eymur ve Geban (2011)'in bulguları ile örtüşmektedir. Öğrenim görülen sınıfın akademik motivasyon ve kimya algı ölçeklerinin alt boyutlarında etkili olduğu belirlenmiştir. Araştırmada ayrıca akademik motivasyon ile kimya algı arasında pozitif anlamlı bir ilişki olduğu belirlenmiştir. Araştırma sonucunun en dikkat çeken bulgusu akademik motivasyon ortalamaları arasındaki anlamlı fark 10. sınıfta öğrenim gören öğrenciler ile 12. sınıfta öğrenim gören öğrenciler arasında gözlenmesidir. 10. sınıf öğrencilerinin akademik motivasyon düzeyi, 12. sınıf öğrencilerininkinden yüksek olduğu belirlenmiştir. Bu bulgunun ülkemizde uygulanan üniversiteye yerleşme sınavının bir sonucu olduğu düşünülmektedir. Sınava girecek olan 12. sınıf öğrencilerinin motivasyon düzeyinin düşük olması beklenen bir sonuçtur. Çünkü öğrenciler ilk olarak yükseköğretime geçiş sınavına hazırlanmakta daha sonra ise minimum iki aşamadan oluşan lisans yerleştirme sınavlarına katılmaktadırlar. Bu kadar fazla sınava giren ve kaygı yaşayan son sınıf lise öğrenciler kendilerini motive edemeyeceklerdir. 10. sınıf öğrencilerinin motivasyon düzeyinin yüksek olması ise Matematik-Fen Bilimleri, Türkçe-Matematik, Türkçe-Sosyal Bilimler alanlarından birini seçerek alan seçimini gerçekleştirmiş olmaları ve ileriye yönelik yani üniversiteye yerleşme sürecinde çalışmaya odaklandıkları ile açıklanmaktadır. Bireyin bir amaca yönelik etkinlik başlatabilmesi, sürdürebilmesi, kendi kendini yönlendirebilmesi, karşılaştığı olumsuzluklar karşısında yeni motivasyon stratejileri geliştirebilmesi için ilgi gösterdiği bilim alanını doğru algılamalı ve yüksek düzeyde motivasyona sahip olmalıdır. Öğrencilerin akademik motivasyonlarının ölçülmesi ve değerlendirilmesi, öğrenme performanslarının artırılması için neler yapılması gerektiği konusunda fikirler vereceği için önemlidir (Aydın, Yerdelen, Yalmancı ve Göksu, 2014). Buradan hareketle 12. sınıf öğrencilerinin akademik motivasyonları hem derslerdeki hem de üniversite sınavındaki başarılarını artıracak şekilde düzenlenecek etkinlikler ile geliştirilmelidir.

Kimya algı değişkeninde en düşük ortalama 9. sınıf öğrencilerine aitken en yüksek ortalama ise son sınıf lise öğrencilere aittir. Bu bulgu olması gereken bir sonuçtur. Ortaokuldan liseye yeni geçen bir öğrencinin fizik, kimya, biyoloji bilimlerinin kapsamı, uygulama alanlarının ne olduğu hakkında fikir sahibi olmadan onu olumlu düzeyde algılaması beklenmemelidir. Buna karşın 4 yıl boyunca kimyayı öğrenmiş son sınıf lise öğrencisinin ise kimyayı olumlu ve yüksek düzeyde algılamalıdır. Kimyaya ilgi, kimya biliminin doğası, kimya ve kimyasallarla ilgili korku veya kaygı, kimyanın kişisel ve toplumsal olarak önemi kimyayı öğrendikçe gelişecek ve diğer bilimlerle ilişkisi kavranacaktır.

Öneriler

Lise öğrencilerinin akademik motivasyonları ile kimya algıları arasındaki bağlantıların incelenmesi amacıyla yürütülen bu araştırma sonucunda pozitif ve anlamlı bir ilişki olduğu belirlenmiştir. Bu araştırma sadece lise öğrencilerinden oluşan bir çalışma grubu üzerinde yürütülmüştür. Lise öğrencilerinden oluşan örneklem grubu ile ortaya çıkan yapının meslek lisesi öğrencileri ya da üniversite öğrencileri gibi daha farklı gruplarda doğrulanıp doğrulanmadığı incelenebilir. Farklı değişkenlerin akademik motivasyon ve kimya algısı üzerindeki etkileri incelenebilir ve öğrencilerin akademik motivasyon ve kimya algılarını etkileyen nedenler ortaya çıkarılabilir.

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THE STUDY OF SOCIAL GENDER PERCEPTIONS OF PRESCHOOL CHILDREN RELATED TO PROFESSIONS

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Abstract: Social gender is defined as the duties, responsibilities and behaviours that the society expects from men and women in accordance with their gender (Vatandaş, 2007). The cultural and social values, the expectations and conventional gender specific roles determined by the society make it possible to distinguish women and men. The gender perception also shows itself on the professions. Female and male professions are discriminated depending on the perceptions related to professions and the roles according to gender. This study was carried out in order to study the social gender perceptions of children in the pre-school period, which is the most appropriate period for acquiring the concept of social gender created by social values and judgements. The study was carried out in Buca district, in İzmir and with 30 children in kindergartens aged between 48 months and over during the educational year from 2016 to 2017. In this study, the gender perceptions of pre-school children related to the professions were revealed through the analysis of the gender perception determination form for the professions and the child information form. Qualitative research method was used in this study. The data obtained were analyzed according to the rules of content analysis, and the social gender perceptions of preschool children related to professions were interpreted.

***Keywords*:** Social perception of gender, professions, preschool children

OKUL ÖNCESİ DÖNEM ÇOCUKLARININ MESLEKLERE YÖNELİK TOPLUMSAL CİNSİYET ALGILARININ İNCELENMESİ

Özet: Toplumsal cinsiyet, toplumun kadın ve erkekten cinsiyetine uygun olarak beklediği görev, sorumluluk ve davranışlar olarak tanımlanır (Vatandaş, 2007). Toplumun belirlediği kültürel ve sosyal değerler, beklentiler ve cinsiyete özgü kalıplaşmış roller kadın ve erkeğin ayırt edilmesini sağlar. Toplumsal cinsiyet algısı kendisini meslekler üzerinde de göstermektedir. Mesleklere yönelik algılar ve cinsiyete uygun rollere dayalı olarak kadın mesleği ve erkek mesleği şeklinde ayrıma gidilmektedir. Bu çalışma, toplumsal değer ve yargıların oluşturduğu toplumsal cinsiyet kavramının kazanılmasında en uygun dönem olan okul öncesi dönemde çocukların mesleklere yönelik toplumsal cinsiyet algılarının incelenmesi amacıyla yapılmıştır. Çalışma 2016-2017 eğitim öğretim yılında İzmir ili Buca ilçesinde öğrenim gören 48 ay ve üstü toplam 30 çocuk ile gerçekleştirilmiştir. Çalışmada, okul öncesi dönem çocuklarının mesleklere yönelik toplumsal cinsiyet algıları, mesleklere yönelik cinsiyet algısı belirleme formu ve çocuk bilgi formunun çözümlenmesi yoluyla ortaya çıkarılmaya çalışılmıştır. Çalışmada nitel araştırma yöntemi kullanılmıştır. Elde edilen veriler, içerik analizi kurallarına göre çözümlenerek okul öncesi dönem çocuklarının mesleklere yönelik toplumsal cinsiyet algıları yorumlanmıştır.

Anahtar Sözcükler: Toplumsal cinsiyet algısı, meslekler, okul öncesi dönem

Giriş

Toplumsal yaşamın sınıflandırılmasına yönelik önemli değişkenlerden birisi cinsiyettir. Cinsiyet üzerine geçmişten bugüne gerek ülkemizde gerek farklı ülkelerde biyolojik, toplumsal, psikolojik ve eğitim alanında birçok araştırma yapılmıştır. Kadınlar ve erkekler arasındaki cinsiyet farklılığının yalnızca biyolojik yapılarından

kaynaklanmadığı günümüzde bilinen bir gerçektir. Toplumsal cinsiyet algısını geliştiren kadın ve erkek arasındaki bu farklılıklar davranış, düşünce, duygu, tercih, tutum yönlerinden de karşımıza çıkmaktadır (Aydilek, 2011).

Vatandaş (2007)'a göre her birey, doğduğu cinsiyete uygun olarak toplumsal cinsiyete sahip olmaktadır. Toplumsal düzene göre kadın ve erkek birbirinden tamamıyla farklı davranış, düşünce ve algı özellikleri gösterir. Anne baba tarafından çocuğun biyolojik cinsiyetinin bilinmesiyle birlikte toplumsal cinsiyete uygun özellikler de çocuk için belirlenmiş olur.

Sosyalleşme süreci içerisinde ortaya konulan ve öncelikle aile içinde verilmeye başlanan toplumsal cinsiyet rolleri, erkeklerin ve kadınların nasıl davranmaları gerektiği ve onlardan gerçekleştirmeleri beklenen farklı görevler, bireye erken çocukluk döneminde verilmeye başlanır. Yaşamın ilk yıllarından itibaren kız ve erkek çocukların davranışları, oyunları ve oyuncakları farklılık göstermektedir. Kız çocuklarının oyunları, anne ve aileyi örnek alan evcilik gibi oyunlardan oluşmaktadır. Erkek çocuklarında ise soyut düşünme ve mekanik yeteneklerin gelişmesine yönelik oyun ve oyuncaklar sunulmaktadır. Bu durumda kız ve erkek çocuklarına bazı mesajlar verilmektedir. Kadının yeri ve statüsünün ev içi alanla sınırlı olduğu mesajı kız çocuklarına verilirken, dış dünyayla daha çok iletişim halinde olabileceği, güç ve otorite kullanımında bulunabileceği, toplumla bütünleşmede daha fazla olanaklar açabileceği mesajları da erkek çocuklarına verilmektedir (Gönenç ve diğerleri, 2002; Akt: Aktaş, 2011).

Cunningham (2001)'ın yaptığı bir araştırmada annelerin toplumsal cinsiyet kalıpları ile yetişkin çocuklarının toplumsal cinsiyet davranışları arasında bir ilişki olduğu görülmüştür. Ailelerin var olan cinsiyet rolü algılarını çocuklarına doğrudan ya da dolaylı olarak aktardıkları belirtilmektedir. Çocukların toplumsal cinsiyet algılarını oluşturmada anne babaya önemli rol düşmekle birlikte aile, akranlar, medya, okul, kitaplar, şarkılar, filmler, televizyon kanalları da söz konusu beklentileri ve modelleri pekiştirerek çocuğa kuralları ve davranışları içselleştirmesini sağlayacak ortamlar hazırlamaktadır (Connell, 1998; Driscoll ve Nagel, 2008; Meece ve Daniels, 2008).

Çocukların fikirlerinin ve inançlarının çoğunun, arkadaş ve okul dünyaları genişledikçe çevrelerindeki kişiler tarafından etkilendiği görülmektedir. Çocukların uygun davranışlarının pekiştirilmesinde medyanın özellikle de televizyonun etkisi büyüktür. Çocuklar cinsiyete yönelik kalıplaşmış davranışlarını bütün bu sosyalleşme araçlarıyla öğrenmiş olurlar. Bu cinsiyet kalıpları çocuklar büyüdükçe sıkıca yerleşmiş inanç haline gelir ve bunun sonucunda da çocuğun benlik algısının bir parçası olur (Witt, 1997).

Toplumsal cinsiyet algısı yönünden baktığımızda cinsiyete farklı anlamlar yüklenmektedir. Bununla birlikte toplumun yüklediği cinsiyet kalıpları ve ayrımlarına göre de meslekler şekillenmektedir. Bu yönde yapılmış araştırmalar incelendiğinde kadınların cinsiyete ilişkin mesleki ayrımcılık konusunda daha dezavantajlı durumda olduğu gözlenmektedir. Kadının işgücü piyasasındaki yerini ve diğer sosyal değişkenlerini de olumsuz etkileyen bu durum, olumsuz etkileriyle gelecek nesillere aktarılarak mesleklere yönelik cinsiyet ayrımcılığına neden oluşturmaktadır (Parlaktuna, 2010).

Araştırmanın Amacı

Bu çalışmanın amacı, okul öncesi dönemdeki çocukların mesleklere yönelik toplumsal cinsiyet algılarını incelemektir. Çocukların cinsiyet ve toplumsal kodları öncelikli olarak kendi ailesinden edindiği gerçeğinden yola çıkarak mesleklere yönelik toplumsal cinsiyet algılarının ne yönde olduğu ortaya çıkarılmaya çalışılmış ve çeşitli öneriler geliştirilmiştir.

Araştırmanın Problemi

Araştırmanın problem cümlesi "Okul öncesi dönem çocuklarının mesleklere yönelik toplumsal cinsiyet algıları nedir?" şeklindedir. Bununla birlikte aşağıdaki alt problemlere yanıt aranacaktır:
1. Çocukların mesleklere yönelik algısı nasıldır?
2. Çocukların mesleklere yönelik geliştirdikleri cinsiyet algıları nasıldır?

Yöntem

Bu çalışmada farklı sosyoekonomik düzeyde aile yapılarından gelen, anne ve baba eğitim durumu ile anne çalışma durumu farklılıklar gösteren 30 okul öncesi dönemdeki çocuğun mesleklere yönelik toplumsal cinsiyet

algıları belirlenmeye çalışılmıştır. Çalışmada nitel araştırma yöntemi kullanılmıştır. Nitel araştırma, gözlem, görüşme ve doküman analizi gibi nitel veri toplama yöntemlerinin kullanıldığı, algıların ve olayların doğal ortamda gerçekçi ve bütüncül bir biçimde ortaya konmasına yönelik nitel bir sürecin izlendiği çalışma olarak tanımlanmaktadır (Yıldırım ve Şimşek, 2008). Çocukların mesleklere yönelik cinsiyet algılarını belirleyebilmek için araştırmacılar tarafından oluşturulmuş yarı yapılandırılmış görüşme formları kullanılmıştır.

Çalışma Grubu

Araştırma 2016-2017 eğitim öğretim yılında İzmir ili Buca ilçesinde öğrenim gören 48 ay ve üstü toplam 16 kız (%53,3), 14 erkek (%46,7) toplam 30 çocuk ile gerçekleştirilmiştir. Bu çocuklardan annesi lise mezunu olan 11 (%36.7) ve annesi lisans ve üstü mezunu olan 19 (%63.3) ; babası lise mezunu olan 15 (%50), babası lisans ve üstü mezunu olan 15 (%50) çocuk bulunmaktadır. 30 çocuğun babası çalışırken, 16 (%53.3) çocuğun annesi çalışmakta, 14 (%46.7) çocuğun annesi ise çalışmamaktadır.

Veri Toplama Araçları

Araştırmanın verileri araştırmacılar tarafından geliştirilen 'Bilgi Formu' ve 'Mesleklere Yönelik Resimli Cinsiyet Algısı Belirleme Formu' ile toplanmıştır. Çocuklara ait sosyo-demografik bilgilerin yer aldığı bilgi formunda çocukların cinsiyet, anne öğrenim durumu, baba öğrenim durumu, anne çalışma durumu vb. sorular yer almaktadır. Mesleklere Yönelik Resimli Cinsiyet Algısı Belirleme Formu'nda çocuklara kadın ve erkek cinsiyetlerinde çeşitli meslek gruplarından resimler gösterildikten sonra "Bu hangi meslek?", "Sence bu resimdeki mesleği kadınlar mı yapabilir erkekler mi yapabilir yoksa ikisi de yapabilir mi? ve "Neden?" soruları sorularak konu ile ilgili görüşleri belirlenmeye çalışılmıştır.

Veri Analizi

Elde edilen nitel veriler içerik analizi kurallarına göre çözümlenerek okul öncesi dönem çocuklarının mesleklere yönelik toplumsal cinsiyet algıları yorumlanmıştır. İçerik analizinde toplanan verileri açıklayabilecek kavramlara ve ilişkilere ulaşmak temel amaçtır. Verileri tanımlama ve verilerin içinde saklı olabilecek gerçekleri ortaya çıkarmak için içerik analizinden yararlanılır. Araştırmacı bu sayede birbirine benzeyen verileri belirli kavramlar ve temalar içerisinde birleştirip okuyucunun anlayacağı bir şekilde düzenleyerek yorumlamaktadır (Yıldırım & Şimşek, 2008).

Bulgular

Çocukların meslek tanımına ilişkin görüşleri, çocukların mesleklere yönelik toplumsal cinsiyet algılarına ilişkin bulgular ve çocukların mesleklere yönelik toplumsal cinsiyet algılarında aile yapısının (anne öğrenim durumu, baba öğrenim durumu, anne çalışma durumu) rolüne ilişkin bulgular, alt başlıklar halinde sunulmuştur.

Çocukların Meslek Tanımına İlişkin Görüşleri

Çocukların "Meslek nedir?" sorusuna verdikleri yanıtlar incelendiğinde meslek kavramını, çalışma ve iş, para kazanma, anne ve babalarının meslekleri, büyüdüklerinde yapacakları iş ile ilişkilendirdikleri görülmüştür. Çocukların meslek kavramına ilişkin bazı açıklamaları şu şekildedir:

Meslek kavramını çalışma ve iş yönünden açıklayan E8, K14, K17 ve K21 kodlu çocukların görüşlerine aşağıda yer verilmektedir.

E8: *"Çalışmak demektir."*

K14: *"Bir kişinin yaptığı iş türüdür."*

K17: *"Servis yapmak, okula gitmek, müdür olmak, iş yapmaktır."*

K21: *"İnsanların kullandığı işleri demektir."*

Para kazanma yönünden açıklayan K3, K5 ve E24 kodlu çocukların görüşlerine aşağıda yer verilmektedir.

K3: *" İnsanların para kazanmaları için bir karakterdir."*

K5: *"Aklıma kelebek geliyor. İsmi benziyor çünkü. Bir dönerci oluyorsun, döner veriyorsun, para kazanıyorsun."*

E24: *"Para kazandığımız iş demektir."*

Anne ve babalarının meslekleri yönünden açıklayan K7, E6 ve E13 kodlu çocukların görüşlerine aşağıda yer verilmektedir.

K7: *"Babamın, annemin mesleği aklıma geliyor. Bir iştir."*

E6: *"Annelerimizin, babalarımızın çalıştığı bir şey."*

E13: *"Babamın çalıştığı iş."*

Büyüdüklerinde yapacakları iş yönünden açıklayan K10, E4, E11 ve E16 kodlu çocukların görüşlerine aşağıda yer verilmektedir.

K10: *"Olmak istediğimiz şeylere bağlıdır meslek."*

E4: "Büyüyünce itfaiyeci olacağım. Meslek iş demek oluyor yani bir şeyi çalışarak yapmak demek."

E11: *"Büyüyünce doktor olacağım. Bir işi sahiplenen adam ya da kadına denir."*

E16: *"Bir şey olmak istediğin şeye meslek denir."*

Çocukların Mesleklere Yönelik Toplumsal Cinsiyet Algılarına İlişkin Bulgular

Bu bölümde çocukların mesleklere yönelik resimli cinsiyet algısı belirleme formuna ilişkin görüşlerine ait bulgulara değinilmiştir. Çocukların formda yer alan öğretmen, pilot, hekim, şoför, terzi, garson, sekreter, polis, tesisatçı, manav ve bilim insanı meslekleri hakkında görüşleri ve çıkan sonuçlar dikkat çekici nitelik taşıdığından yorumlarda bu mesleklere yer verilmiştir.

Tablo 1. Mesleklere Yönelik Resimli Cinsiyet Algısı Dağılımı

Meslekler	***Kadın Mesleği***						***Erkek Mesleği***						***Kadın ve Erkek Mesleği***					
	K N	K %	E N	E %	T N	T %	K N	K %	E N	E %	T N	T %	K N	K %	E N	E %	T N	T %
Öğretmen	1	6,3	1	7,1	2	6,7	0	0	0	0	0	0	15	93,8	13	92,9	28	93,3
Pilot	0	0	0	0	0	0	6	38	12	86	18	60	10	62,5	2	14,3	12	40
İnşaat Müh.	0	0	1	7,1	1	3,3	4	25	6	43	10	33,3	12	75,0	7	50,0	19	63,3
Hekim	1	6,3	0	0	1	3,3	3	19	2	14	5	16,7	12	75,0	12	85,7	24	80
Şoför	0	0	0	0	0	0	8	50	9	64	17	57	8	50,0	5	35,7	13	43
Çiftçi	2	13	0	0	2	6,7	2	13	5	36	7	23,3	12	75,0	9	64,3	21	70
İtfaiyeci	1	6,3	0	0	1	3,3	5	31	10	71	15	50	10	62,5	4	28,6	14	46,7
Aşçı	3	19	1	7,1	4	13	4	25	4	29	8	27	9	56,3	9	64,3	18	60
Terzi	12	75	11	79	23	76,7	0	0	0	0	0	0	4	25,0	3	21,4	7	23,3
Boyacı	1	6,3	0	0	1	3,3	6	38	10	71	16	53	9	56,3	4	28,6	13	43,4
Kuaför	6	38	4	29	10	33,3	1	6,3	1	7,1	2	6,7	9	56,3	9	64,3	18	60
Garson	1	6,3	1	7,1	2	6,6	2	13	3	21	5	16,6	13	81,3	10	71,4	23	76,8
Sekreter	1	6,3	1	7,1	2	6,7	1	6,3	3	21	4	13,3	14	87,5	10	71,4	24	80
Bahçıvan	1	6,3	1	7,1	2	6,7	6	38	4	29	10	33,3	9	56,3	9	64,3	18	60
Polis	0	0	0	0	0	0	3	19	5	36	8	26,7	13	81,3	9	64,3	22	73,3
Tesisatçı	1	6,3	0	0	1	3,3	8	50	11	79	19	63,3	7	43,8	3	21,4	10	33,3

Postacı	1	6,3	0	0	1	3,3	7	44	7	50	14	46,7	8	50,0	7	50,0	15	50
Manav	0	0	0	0	0	0	3	19	4	29	7	23,3	13	81,3	10	71,4	23	76,7
Bilim İnsanı	1	6,3	0	0	1	3,3	6	38	9	64	15	50	9	56,3	5	35,7	14	46,7
Diş Hekimi	3	19	0	0	3	10	2	13	4	29	6	20	11	68,8	10	71,4	21	70

K: Kız E: Erkek T: Toplam

Mesleklere yönelik resimli cinsiyet algısı belirleme formundan elde edilen sonuçlar Tablo1'de sunulmuştur.
Tablo 1 incelendiğinde öğretmenlik mesleğini hem kadınların hem de erkeklerin yapabileceği meslek olarak seçen çocukların sayısı 15'i kız ve 13'ü erkek olmak üzere toplam 28 (%93.3) dir. Öğretmenlik mesleğini sadece kadınların yapabileceği meslek olarak belirten 1'i kız 1'i erkek toplam 2 (%6.7) çocuk olmakla birlikte sadece kadınların yapabileceği meslek olarak belirten çocuk bulunmamaktadır.

K5, K9, K14, K21 ve E22 kodlu çocukların öğretmenlik mesleğini hem kadınların hem de erkeklerin yapabileceği meslek olarak belirttikleri görüşlerinden bazıları şu şekildedir:

K5: *"Abimin öğretmenleri geldi aklıma, hem kız hem erkek. Çünkü ikisi de eğitimini almışlardır. Mesela benim annem öğretmen. Özel eğitimde çalışıyor. Bir yerde eğitim almışlardır."*

K9: *"Kız öğretmen hasta olduğunda erkek öğretmen gelir. İkisi de olur."*

K14: *"Kız da erkek de istemiştir. Her insanın farklı istekleri vardır. İkisi de olur."*

K21: *"Çünkü Dünya'da hem kız hem de erkek öğretmenler var."*

E22: *"Bizim sınıfta bir tane Burak abi var stajyer. O öğrendikten sonra öğretmen olacak. Kız öğretmen de var."*

Sadece kadınların yapabileceği meslek olduğunu belirten K3 ve E15 kodlu çocukların görüşleri ise şu şekildedir:

K3: *"Genellikle kızlar öğretmen oluyor. Çünkü çocukları korkutmamak için kızlar öğretmen oluyor ve çocukları daha çok anlıyor. Erkekler stajyer oluyor. Sonra onlarda öğretmen oluyor ama çocuklara iyi bakamıyorlar, çocukları anlamıyorlar."*

E15: *"Çünkü öğretmenlik işi kızlara göre olabilir."*

12'si erkek ve 6'sı kız olmak üzere 18 (%60) çocuk pilotluk mesleğini sadece erkeklerin yapabileceği meslek olarak seçmiştir. Bununla birlikte 10'u kız 2'si erkek toplam 12 (%40) çocuk pilotluk mesleğini hem kadınların hem de erkeklerin yapabileceği meslek olarak belirtmiştir. Pilotluk mesleğini sadece kadınlar yapabilir diyen çocuk bulunmamaktadır.

Pilotluk mesleğini sadece erkeklerin yapabileceğini belirten çocuklardan K3, K9, K12, E22 ve E28 kodlu çocukların görüşleri şu şekildedir:

K3: *"Çünkü erkekler kullanmalı şeyleri daha çok yapabiliyor."*

K9: *"Ben bir kez uçağa bindim ama görmedim erkek pilotu ama mikrofondan sesini duydum. Kız pilot duymadım."*

K12: *"Erkekler yapar çünkü çok çok iyi uçurabilirler. Kızlar birazcık yüksekten korkuyorlar ama babam korkmuyor."*

E22: *"Erkekler ayarlarını bilir ve kullanabilir. Kızlar yemekleri dağıtır, hostes olur."*

E28: *"Kızlar uçak sürmeyi bilmez. Erkekler bilir."*

Hem kadın hem de erkeklerin yapabileceği meslek olarak belirten çocuklardan K5, K14, E6 ve E16 kodlu çocukların görüşleri şu şekildedir:

K5: *"Sadece erkek pilot gördüm ama kızlar da olabilir. Belki uçurmayı öğrenmişlerdir. Uçurma yeri var orda öğrenmişlerdir."*

K14: *"İkisi de olmak isterse yapabilir. Kızlarla alay edilmemeli. Onlar da yapabilir."*

E6: *"İkisi de yapabilir. Televizyonda görmüştüm."*

E16: *"İkisi de pilotluğu kazanabilirse olabilirler."*

Hekimlik mesleğini 12'si kız ve 12'si erkek olmak üzere toplam 24 (%80) çocuk hem kadınların hem de erkeklerin yapabileceği meslek olarak seçmiştir. Bununla birlikte 3'ü kız 2'si erkek toplam 5 (%16.7) çocuk sadece erkeklerin yapabileceği meslek olarak belirtirken 1 (%3.3) kız çocuğu sadece kadın mesleği olarak belirtmiştir.

Hekimlik mesleğini hem kadın hem de erkeklerin yapabileceğini belirten çocuklardan K7, K9, K21, E11 ve E13 kodlu çocukların görüşleri şu şekildedir:

K7: *"Bu babamın mesleği. İkisi de yapar. Çünkü ikisi de ciddi çalışıyor."*

K9: *"Onlar insanların kanını temizliyor. İkisi de çok becerikli. Anneannemle doktora gittik yanında kız doktor vardı."*

K21: *"Doktorluk mesleği kolay olduğu için ikisi de yapabilir. Hastaları muayene edip iyileştirirler."*

E11: *"İkisi de insanları seviyor. O yüzden ikisi de yapabilir."*

E13: *"İkisi de olur. Ben erkek doktora gitmiştim. Erkek olur. Kız görmedim ama kızlar da çalışkan olduğu için yapar."*

Sadece erkeklerin yapabileceği meslek olduğunu belirten çocuklardan K12, K26 ve E18 kodlu çocukların görüşleri şu şekildedir:

K12: *"Erkekler yapabilir. Kızlar hemşire olur."*

K26: *"Erkekler bu mesleği daha iyi biliyor."*

E18: *"Kızlar hemşire olur. Doktorun sağ kolu olur. Erkekler genelde güzel muayene ederler. Kızlar pek doktorluk işinden anlamaz."*

Sadece kadınların yapabileceği meslek olduğunu belirten K10 kodlu çocuğun görüşü şu şekildedir:

K10: *"Kızlar yapabilir çünkü kızlar çok iyi yapabiliyor. Ben televizyonda izledim kızlar çok iyi yapıyordu. Kızları daha çok sevdiğim için kızları seçtim. Erkekler yorulduğunda hastaları muayene etmek istemez ama kızlar azıcık muayene eder."*

9'u erkek 8'i kız toplam 17 (%57) çocuk şoförlük mesleğini sadece erkeklerin yapabileceğini, 8'i kız 5'i erkek toplam 13 (%43) çocuk hem kadınların hem de erkeklerin yapabileceğini belirtmiştir. Şoförlük mesleğini sadece kadınlar yapabilir diyen çocuk bulunmamaktadır.

Şoförlük mesleğini sadece erkeklerin yapabileceğini belirten çocuklardan K3, K9, E11, E15 ve E18 kodlu çocukların görüşleri şu şekildedir:

K3: *"Erkekler birilerinin gideceği yerleri daha çok tanıyorlardır. Kadınların evde işleri vardır. Her yeri bilemezler. Temizlik, yemekle uğraşıyorlar. Erkekler her gün işe gittiği için, işleri değiştiği, uzak işlere gittiği için her yeri biliyor."*

K9: *"Kızlar pek becerikli değildir. Ben bir taksiye bindim hep erkek gördüm. O yüzden erkek yapar."*

E11: *"Erkekler yapabilir. Benim annem bile zorlanıyor. Zor bir meslek."*

E15: *"Bazı kızların ehliyeti olmadığı için yanlış yönlere gidebilirler yani ehliyeti olabilir ama adamlar nereye gideceğini söylediğinde aklı karışabilir. Erkekler yanlış yere gitmez."*

E18: *"Ben hiç kız kullanan bir taksiye binmemiştim. Erkekler yapabilir bu mesleği. Kızlar erkekler gibi araba kullanabilir ama şoför olamaz. Erkekler müşterinin bindiğini daha iyi bilir."*

Hem kadın hem de erkeklerin yapabileceği meslek olarak belirten çocuklardan K5, K14, K21 ve E13 kodlu çocukların görüşleri şu şekildedir:

K5: *"Ben hiç kız görmedim ama erkek birçok gördüm ama kızlar da olabilir. Bence bebek oyuncağı, annem bile sürüyor. Annem şoförlük yapamaz ama diğer kızlar yapabilir. Eğitim aldılar."*

K14: *"Kız taksici hiç görmedim ama bir gün göreceğime inanıyorum. İkisi de olur."*

K21: *"Benim annem araba sürebiliyor. İkisi de yapabilir."*

E13: *"Benim babam halama araba kullanmayı öğretmiş. O yüzden ikisi de yapabilir."*

Terzilik mesleğini 12'si kız 11'i erkek toplam 23 (%76.7) çocuk sadece kadınların yapabileceği meslek olarak belirtmiştir. 4'ü kız 3'ü erkek toplam 7 (%23.3) çocuk hem kadınların hem de erkeklerin yapabileceği meslek olarak belirtirken sadece erkeklerin yapabileceği meslek olarak seçen çocuk bulunmamaktadır.

Terzilik mesleğini sadece kadınların yapabileceğini belirten çocuklardan E11, K12, K19, K23 ve K30 kodlu çocukların görüşleri şu şekildedir:

E11: *"Kızlar daha kolay yapar. Bir kere babam denemişti parmağı uf olmuştu. Benim babaannem yapıyor gözleri görmese bile."*

K12: *"Kızlar el işi yapar, bilir çünkü erkekler yapamaz, maç izler."*

K19: *"Kızlar yapabilir çünkü kızlar için kıyafet dikmek kolay iştir. Erkekler öyle tasarım filan yapamaz."*

K23: *" Kızlar yapar çünkü erkekler dikiş yapmayı bilemez çünkü iğneyi sokup çıkarmayı sadece kızlar yapabilir onlara özgü bir meslek."*

K30: *"Kızlar daha iyi dikiyor. Erkekler dikemiyor. Bana babaannem hep bir şeyler örüyor. Dedemle babam hiç başaramıyor."*

Hem kadınların hem de erkeklerin yapabileceği meslek olduğunu belirten çocuklardan K14, E15 ve E28 kodlu çocukların görüşleri şu şekildedir:

K14: *"Kızlar da dikebilir erkekler de dikebilir ama önce dikkatlerini toplamaları lazım. Sessiz bir yerde çalışmaları lazım."*

E15: *"Ben bizim oradan geçerken hem kız terzi görüyorum hem de erkek terzi görüyorum. Erkek terziyi Kemeraltı'nda görüyorum."*

E28: *"İkisi de kumaş dikebilir. Teyzemin yanında erkek kumaşçı çalışıyor."*

13'ü kız 10'u erkek toplam 23 (%76.8) çocuk garsonluk mesleğini hem kadınların hem de erkeklerin yapabileceği meslek olarak belirtmiştir. 3'ü erkek 2'si kız toplam 5 (%16.6) çocuk sadece erkeklerin yapabileceği meslek olarak belirtirken 1'i kız 1'i erkek toplam 2 (%6.6) çocuk sadece kadınların yapabileceği meslek olarak belirtmiştir.

Garsonluk mesleğini hem kadınların hem de erkeklerin yapabileceği meslek olarak belirten çocuklardan K5, K7, K12 ve E11 kodlu çocukların görüşleri şu şekildedir:

K7: *"Kızlar aşçılıktaki gibi beceriklidir. Erkekler de dikkatlidir. İkisi de yapabilir."*

K5: *"Sadece erkek gördüm ama kızlar da yapabilir çünkü bence çok kolay. Bir şey döküyorlar alıyor onu, kıyafet giyiyorlar o kadar."*

E11: *"İkisi de dengeli. İkisi de durabilir düşürmeden bir şeyi taşırken."*

K12: *"İkisi de yapar çünkü çok seviyorlar. Bu meslekte hanımefendi olmak gerek beyefendi olmak gerek. İkisi de yapabilir."*

Sadece erkeklerin yapabileceğini belirten çocuklardan E16, E18 ve K19 kodlu çocukların görüşleri şu şekildedir:

E16: *"Ben gittiğimde lokantaya hep erkekler yapıyordu."*

E18: *"Erkekler daha güzel yapar çünkü erkekler hoş geldiniz, sefalar getirdiniz gibi şeyler der."*

K19: *"Çünkü ben hayatımda hiç kız garson görmedim."*

Sadece kadınların yapabileceği meslek olduğunu belirten K10 ve E27 kodlu çocukların görüşleri şu şekildedir:

K10: *"Kızlar çok iyi yapıyor. Erkekler sadece ne istersiniz? diye soruyor. Kızlar götürüyor."*

E27: *"Pideci de isterlerse çay getiriyorlar. Onu getiren kız."*

14'ü kız 10'u erkek toplam 24 (%80) çocuk sekreterlik mesleğini hem kadınların hem de erkeklerin yapabileceği meslek olarak belirtirken 3'ü erkek 1'i kız toplam 4 (%13.3) çocuk sadece erkeklerin yapabileceği meslek olarak belirtmiştir. Sadece kadınların yapabileceği meslek olarak belirten 1'i kız 1'i erkek toplam 2 (%6.7) çocuk bulunmaktadır.

Sekreterlik mesleğini hem kadınların hem de erkeklerin yapabileceği meslek olarak nitelendiren çocuklardan K5, E18, E24 ve E29 kodlu çocukların görüşleri şu şekildedir:

K5: *"Burası ofis. İkisi de yapabilir çünkü çok kolay. Konuşuyorsun, yazıyorsun bu kadar."*

E18: *"Kızlar da telefon görüşmelerinde güzel şeyler söyleyebilir, erkekler de."*

E24: *"İkisi de telefonla görüşüp notları yazabilirler. Yetişkin oldukları için okuma yazmayı biliyorlar. Çocuklar bilmediği için yapamaz."*

E29: *"İşi kontrol ederler. Kızda kontrol eder erkek de."*

Sadece erkeklerin yapabileceği meslek olduğunu belirten çocuklardan K9, E15 ve E16 kodlu çocukların görüşleri şu şekildedir:

K9: *"Erkekler fazla konuştuğu için olur. Kızları çok konuşurken görmedim."*

E15: *"Ben sadece erkek sekreter görüyorum. Bir amcanın iş yerinde gördüm. Kız sekreter görmedim."*

E16: *"Bir dizide görmüştüm, erkekler yapıyordu."*

Sadece kadınların yapabileceği meslek olduğunu belirten K7 ve E27 kodlu çocukların görüşleri ise şu şekildedir:

K7: *"Kızlar yapabilir. Kızlar not alabilir. Hızlıca not alabilir."*

E27: *"Erkek sekreter görmedim."*

Polislik mesleğini 13'ü kız 9'u erkek toplam 22 (%73.3) çocuk hem kadınların hem de erkeklerin yapabileceği meslek olarak belirtmiştir. 5'i erkek 3'ü kız toplam 8 (%26.7) çocuk sadece erkelerin yapabileceği meslek olarak belirtirken sadece kadınların yapabileceği meslek olarak belirten çocuk bulunmamaktadır.

Polislik mesleğini hem kadınların hem de erkeklerin yapabileceğini belirten çocuklardan K7, K17, K23, K25, E11 ve E15 kodlu çocukların görüşleri şu şekildedir:

K7: *"Bir arkadaşımın babası da annesi de polis. O yüzden ikisi de yapabilir."*

K17: *"Zor bir meslek ama ikisi de yapabilir."*

K23: *"İkisi de yapabilir. Mesela geçen sene de bu okuldaydım. Bizim okula polis haftasında polis gelmişti, bir kız bir erkek. Biz polisi tanıyalım diye geldiler."*

K25: *"Kızlar trafik polisi olabilir. Erkekler normal silah çeken polis olabilir."*

E11: *"Polis, Rıza komiser. Dizide gördüm. İkisi de vatanseverse yapabilir."*

E15: *"İkisini de düşünüyorum. İkisinin de yapabileceği kolay bir şey. Kelepçe takıp şokluyorlar. Ben büyük insan olsaydım bana göre kolay olurdu. Kızlara göre de kolay. Onlar da şoklayabilir."*

Sadece erkeklerin yapabileceğini belirten çocuklardan K9, E24 ve E29 kodlu çocukların görüşleri şu şekildedir:

K9: *"Bir kere polis gördüm. Babam arabayı yavaş kullanıyordu. Erkek polisler abicim geçemezsin bu yoldan diyorlar. Babam hızlı geçerse polis yakalar. Kızlar utanıp erkekler gibi konuşamadığı için çok şef değillerdir. O yüzden olmaz."*

E24: *"Erkekler hırsızları yakalayabilir."*

E29: *"Çünkü hırsızlar erkek, polis de erkek oluyor ve onları yakalıyor."*

Tesisatçılık mesleğini 11'i erkek 8'i kız toplam 19 (%63.3) çocuk sadece erkeklerin yapabileceği meslek olarak belirtirken 7'si kız 3'ü erkek toplam 10 (%33.3) çocuk hem kadınların hem de erkeklerin yapabileceği meslek olarak belirtmiştir. 1 (%3.3) kız çocuğu bu mesleği sadece kadınların yapabileceğini belirtmiştir.

Tesisatçılık mesleğini sadece erkeklerin yapabileceğini belirten çocuklardan E8, E11, E22, K17 ve K23 kodlu çocukların görüşleri şu şekildedir:

E8: *"Ben erkek gördüm. Hiç kız tesisatçı görmedim çünkü kızlar tamir işlerinden anlamaz çünkü onlar ev hanımı birazcık. Erkekler dışarıda çalışır, aletleri iyi kullanır."*

E11: *"Kızların kafasına bir şey düştüğünde hani kızlar hassastır ya erkekler böyle serttir, dayanır ondan erkekler yapar."*

E22: *"Erkekler daha güçlü ve hızlı olduğu için yaparlar. Kızlar güçsüzdür ve yavaştır."*

K17: *"Erkekler biliyor ama kızlar bilmiyor. Bizim musluk bozulmuştu, annem bir şey yapamadı babamı aradı, geldi, o yaptı."*

K23: *"Erkekler yapar. Aynı dikişi kızların becerebildiği gibi bunu da erkekler becerebilir çünkü tamir yapmayı, vida sıkmayı erkekler becerebilir. Yani onlar daha güçlüdür, sıkabilir."*

Hem kadınların hem de erkeklerin yapabileceği meslek olarak nitelendiren çocuklardan K14, K21 ve E24 kodlu çocukların görüşleri şu şekildedir:

K14: *"İkisi de yapabilir çünkü insanlar akıllı, bilgili insan olabilir. Kızlar da erkekler de."*

K21: *"Kızlar yapmaya alıştıysa yapabilir. Erkekler de yapabilir."*

E24: *"İkisi de becerebilir."*

Sadece kadınların yapabileceği meslek olarak belirten K1 kodlu çocuğun görüşü ise şu şekildedir:

K1: *"Erkek istemez. Kızın canı istediği için yapar."*

Manavlık mesleğini 13'ü kız 10'u erkek toplam 23 (%76.7) çocuk hem kadınların hem de erkeklerin yapabileceği meslek olarak belirtirken 4'ü erkek 3'ü kız toplam 7 (%23.3) çocuk sadece erkeklerin yapabileceği meslek olarak belirtmiştir. Bu mesleği sadece kadınların yapabileceği meslek olarak belirten çocuk bulunmamaktadır.

Manavlık mesleğini hem kadınların hem de erkeklerin yapabileceği meslek olarak belirten çocuklardan K14, K23, E18, E22 ve E28 kodlu çocukların görüşleri şu şekildedir:

K14: *"İkisi de yapar çünkü biz manavda pek çok kız pek çok erkek görüyoruz."*

K23: *"Sadece bir şeyler satıyorlar. Bir şeyler satmak zor değildir. Ayrı ayrı kasalara koyup satıyorlar."*

E18: *"İkisi de gel müşteri gel diye satabilir."*

E22: *"Ben pazarda ikisini de görüyorum."*

E28: *"Meyve satmak kolaydır. İkisi de yapabilir."*

Sadece erkeklerin yapabileceği meslek olarak nitelendiren çocuklardan E8, E15, K19 ve K20 kodlu çocukların görüşleri şu şekildedir:

E8: *"Ben erkek manavcı gördüm. Erkekler dışarıda daha çok geziyor. Kızlar evde uyuyor, evi topluyor, süpürüyorlar. Kızlar da belki manavlık yapıyordur ama ben erkek gördüm."*

E15: *"Ben hep erkek manavcı görüyorum."*

K19: *"Ben pazarda hep erkek görüyorum."*

K20: *"Kızlar zor bir iş olduğunu düşünüyor. Sabah erken kalkıp meyveleri dizmek onlar için zor. Erkekler yapabilir."*

Bilim insanı mesleğini 9'u erkek 6'sı kız toplam 15 (%50) çocuk sadece erkeklerin yapabileceği meslek olarak belirtmiştir. 9'u kız 5'i erkek toplam 14 (%46.7) çocuk hem kadınların hem de erkeklerin yapabileceği meslek olarak belirtirken 1 (%3.3) kız çocuğu sadece kadınların yapabileceği meslek olarak belirtmiştir.

Bilim insanı mesleğini sadece erkeklerin yapabileceğini belirten çocuklardan K3, K9, K12, E6, E18 ve E24 kodlu çocukların görüşleri şu şekildedir:

K3: *"Erkekler deney ve tehlikeli işleri yapabiliyorlar. Kızlar zor ve basit şeyleri yapabilir ama çok zor olan şeyleri yapamazlar. Bu çok zor. Belki patlama olabilir, erkek bunu anlayabilir, odadan kaçabilirler ama kızlar anlayamayacağı için kızlar durursa patlayabilir. Erkekler dikkatlice baktıkları için kızlar da dikkatli bakar ama erkekler bunlardan daha iyi anladıkları için yapabiliyor."*

K9: *"Erkekler fazla iş yapar. Çok iyi bir koleksiyon yaparlar. Erkekler gece olduğunda bile deney yapar. Gece olduğunda kızlar ütü, çamaşır yapar o yüzden kızların çok zamanı olmuyor, erkeklerin çok zamanı oluyor."*

K12: *"Erkekler yapar çünkü karışımları yapıyor. Kızlar yapamaz çünkü onlar kaç miktar olacağını bilemezler, hızlı yaparlar o yüzden yanlış olur."*

E6: *"Kızların çok zekâsı olmayabilir erkeklerden. Babamınki gibi zekâsı olabilir ama annem yapamayabilir."*

E18: *"Çünkü erkekler karışımları pekiyi bilirler. Kızlar ise iyi bilmezler. Bütün karışımları doldurup bilim yerini patlatabilirler."*

E24: *"Kızlar karışımları döküp yüzünü simsiyah yapabilir. Erkekler daha dikkatli olduğu için yapabilir."*

Hem kadınların hem de erkeklerin yapabileceği meslek olarak belirten çocuklardan K5, K14, K21, K23, K26 ve E22 kodlu çocukların görüşleri şu şekildedir:

K5: *"Ben büyüyünce deneyci mi olayım acaba. Ben mesela şimdi olmak istedim. Olur yani kız ama kız birazcık korkunç şeyler yapabilir. Erkekse doğru düzgün bir şeyler yapabilir."*

K14: *"İkisi de yapabilir çünkü böyle kimyalar yapıyorlar. Kızlar da kimya yapabilir erkekler de ama bir kitap okumaları gerekir. O kitabı okuduğu sürece yapmaları lazım."*

K21: *"İkisi de bir şeyler icat edip insanlara sunabilir ama birazcık zor bir meslek."*

K23: *"İkisi de yapabilir çünkü bir şeyler kontrol etmeyi herkes yapabilir. Yani mesela kontrol dediğim şey mesela insanların hastalıklarını araştırıyorlar, bir şeyleri karıştırıyorlar o yüzden de deney yapmak hem kızlara hem erkeklere göredir."*

K26: *"Daha önce görmedim ama bu mesleği ikisinin de yaptığına eminim. Belki duman çıkar, öksürürüz ama kolay bir meslek."*

E22: *"İkisi de yapar. Aybüke diye bir arkadaşım var, o bana anlattı. Bilim kadınları böcekleri yakalayıp içindeki zehire bakarlarmış. Bilim erkekleri de iksir yaparmış."*

Sadece kadınların yapabileceği meslek olduğunu belirten K10 kodlu çocuğun görüşü şu şekildedir:

K10: *"Kızlar yapabilir çünkü kızlar daha iyi yapıyor kimsenin ölmeyeceği şekilde. Bir keresinde tabletimde izlemiştim bir iksir yapıyordu erkek, kıza içirip bayılıyordu."*

Tartışma

Çocukların mesleklere yönelik toplumsal cinsiyet algılarına ilişkin bulgular incelendiğinde erkekler için tesisatçılık ve pilotluk, kadınlar için terzilik mesleğini uygun buldukları görülmektedir. Bununla birlikte çocuklar öğretmenlik, hekimlik ve sekreterlik mesleklerini hem kadın hem de erkeklerin yapabileceği meslekler olarak belirtmiştir. Bulgular ışığında çocukların görüşleri dikkate alındığında fiziksel açıdan güç gerektiren meslekler çocuklar tarafından zor olarak algılanmakta ve erkeklere uygun olduğu düşünülmektedir. Çocukların bu algılarını belirleyen pek çok etmen bulunmaktadır. Ders kitapları, hikâye kitapları, televizyon programları, reklamlar, hatta çocuklar için üretilen giysiler bile cinsiyet algısını oluşturmada belirleyici rol üstlenmektedir.

Yorgancı'nın (2008) çalışmasında ilköğretim 1-5. sınıflarda okutulan ders kitaplarını incelediğinde, ders kitaplarında erkek resimlerinin kız resimlerine oranla daha fazla yer kapladığı belirlenmiştir. Kız çocukları daha çok evde gösterilirken, erkek çocukları kamusal alanda ve okulda daha çok gösterilmişlerdir. Erkek çocuklar daha çok tek başına ve yalnız gösterilirken, kız çocukları okulda ve kamusal alanda genellikle bir yetişkinle veya diğer çocuklarla birlikte gösterilmişlerdir. Kız çocuklarına resimlerde "anne" olmak dayatılırken, erkek çocuklarına "baba" rolü ile dışarıda çalışma, ekonomik özgürlük gibi konular dayatılmıştır. Mutfak, temizlik, çocuk bakım işleri kadınlara özgü işler olarak gösterilmiştir. Kadınlar için ev hanımlığı, öğretmenlik, doktorluk gibi meslekler daha uygun görülürken, erkekler için daha çok mekanik ve güç gerektiren işler uygun görülmüştür. Bu araştırmada da çocukların ifadelerinden, erkeklerin daha fazla dışarıda bulunmaları, kadınların daha çok ev içinde temizlik yapma, yemek ve ütü yapma gibi ev sorumluluklarını üstlenmeleri, bilimle uğraşma etkinliklerinin daha çok erkeklere atfedildiği, kızların bu konuda becerikli olmadıkları görüşleri toplumsal cinsiyet rollerinde geleneksel bir bakışa sahip olduklarını ortaya koymaktadır.

Ayrıca Özkan (2009) yaptığı çalışmada, okul öncesi dönem 5-6 yaş çocuklarının cinsiyet özelliklerine ilişkin kalıp yargılarını anne babalarının cinsiyet rolü algısı, yaşadığı il, anne babanın eğitim düzeyi gibi bazı değişkenler açısından incelemiştir. Araştırmanın bulgularına göre, çocuğun annesinin cinsiyet rolü ve yaşadığı ile göre cinsiyet özelliklerine ilişkin kalıp yargılarında anlamlı fark olduğu görülmüştür. Ayrıca, çocuğun yaşının, cinsiyetinin, aile yapısının, kardeş sayısının, anne çalışma durumunun ve baba cinsiyet rolünün cinsiyet özelliklerine ilişkin kalıp yargılarını etkilemediği sonucuna ulaşılmıştır.

Yapılan diğer çalışmalara bakıldığında, Ünlü (2012) çalışmasında okul öncesi dönem çocuklarının cinsiyet, yaş, anne eğitim düzeyi, baba eğitim düzeyi, annenin çalışma durumu, okul öncesi eğitim kurumunda bulundukları süre ile çocukların cinsiyet rolü davranışlarını karşılaştırmıştır. Araştırmanın sonuçlarına göre, anne eğitim düzeyi, baba eğitim düzeyi, kurumda bulundukları süre değişkenlerine bakıldığında hem kız hem de erkek çocuklarının cinsiyet rolü davranışlarında anlamlı bir fark görülmemiştir. Bununla birlikte yaş değişkeni kızlar için anlamlı bir farklılık oluştururken erkek çocukları için anlamlı bir farklılık göstermemiştir. Ayrıca anne çalışma durumu hem kız hem de erkek çocukları için anlamlı bir fark oluşturmuştur.

Trepanier-Street ve Romatowski (1999) yaptıkları çalışmada çocukların mesleki rollere ilişkin düşünce ve tutumları yeniden ele alınmış ve seçilmiş öykü kitaplarıyla bağlantılı yapılan etkinliklerin çocukların mesleki rollere yönelik tutum ve düşüncelerinde bir etki yaratıp yaratmayacağı incelenmiştir. Çalışmanın sonucunda çocukların genel olarak halen kalıp yargısal olan mesleki rollere ilişkin tutumlarının oldukça esnek olduğu gözlenmiştir. Dikkatlice seçilmiş kitaplarla yapılan etkinliklerin çocukların cinsiyet tutumlarına olumlu yönde katkı sağladığı belirlenmiştir.

Özkan (2013) yaptığı "İlköğretim ders kitaplarında kadın figürü" başlıklı çalışmasında ilköğretim ders kitaplarında yer alan resimlerde kadın figürlerinin yer alma sayısını ve biçimini incelemiştir. Çalışma sonucunda, 1. sınıf hayat bilgisi, 2. sınıf matematik ve 5. sınıf fen ve teknoloji ders kitapları dışındaki bütün kitaplarda erkek figürlerinin oranının kadın figürlerine oranla fazla olduğu dikkati çekmektedir. Kitaplarda bulunan görsel öğelerde cinsiyet ayrımcılığı gözlenmektedir. Bununla birlikte meslekler için kadın-erkek figürlerinin kullanımında ayrımcılığın olduğu söylenebilir. Ders kitaplarında yer alan kadın figürlerinin konu içerikleriyle tutarlı olup olmamasına çok fazla dikkat edilmediği görülmektedir. Görsel figürlerin çoğunlukla rastgele seçildiği izlenimi oluşmaktadır. Yapılan incelemede hemen hemen bütün kitaplarda sporla ilgili konularda ayrımcılığın daha fazla olduğu gözlenmektedir.

Sonuç

1.Çocukların Meslek Tanımındaki Görüşlerine İlişkin Sonuçlar
"Meslek nedir?" sorusuna verilen yanıtlardan elde edilen bulgular incelendiğinde çocukların meslek kavramına ilişkin fikirlerinin olduğu ve bu kavramı çalışma, para kazanma, anne ve babalarının meslekleri, büyüdüklerinde yapacakları iş olarak betimledikleri sonucuna ulaşılmıştır. Çocuklar meslek kavramının ne anlama geldiğini bilmekte ve farklı açılardan yaklaşarak açıklayabilmektedir.

2.Çocukların Mesleklere Yönelik Toplumsal Cinsiyet Algılarına İlişkin Sonuçlar:
Mesleklere yönelik resimli cinsiyet algısı belirleme formundan elde edilen bulgular incelendiğinde kız çocukları tarafından erkeklere en uygun bulunan meslek şoförlük (%50) ve tesisatçılıktır (%50). Postacı, bilim insanı, boyacı, pilot ve bahçıvan meslekleri de kız çocuklarının, erkekler için en uygun buldukları diğer mesleklerdir. Erkek çocuklarının, erkekler için en uygun bulduğu meslek pilotluk (%86) mesleğidir. Bununla birlikte tesisatçılık (%79), itfaiyecilik (%71) ve boyacılık (%71) mesleklerinin, erkek çocuklarının erkekler için uygun bulduğu diğer meslekler olduğu sonucuna ulaşılmaktadır. Toplamda baktığımızda erkekler için en uygun mesleğin tesisatçılık (%63.3) mesleği olduğu sonucuna ulaşılmaktadır.

Erkek çocuklarının kadınlar için en uygun bulduğu meslek terzilik (%79) mesleğidir. Aynı şekilde kız çocuklarının da kadınlar için en uygun bulduğu meslek terzilik (%75) mesleğidir. Toplamda baktığımızda kadınlar için en uygun bulunan mesleğin yine terzilik (%76.7) mesleği olduğu sonucuna ulaşılmaktadır.

Kız çocuklarının öğretmenlik (%93.8) ve sekreterlik (%87.5) mesleklerini hem kadınların hem de erkeklerin yapabileceği meslek olarak belirtmesi bu meslekleri toplumsal cinsiyet dahilinde değerlendirmedikleri yani cinsiyetsiz olarak ifade ettikleri sonucuna ulaşılmıştır. Erkek çocukları da öğretmenlik (%92.9) ve hekimlik (%85.7) mesleklerini hem kadın hem de erkek mesleği olarak değerlendirmiştir. Toplamda baktığımızda öğretmenlik (%93.3), hekimlik (%80) ve sekreterlik (%80) meslekleri hem kadın hem de erkeklerin yapabileceği meslek olarak belirtildiğinden bu mesleklerin cinsiyetsiz olarak belirtildiği sonucuna ulaşabiliriz.

Bulgular ışığında çocukların görüşleri dikkate alındığında fiziksel açıdan güç gerektiren meslekler çocuklar tarafından zor olarak algılanmakta ve erkeklere uygun olduğu düşünülmektedir Ayrıca çocukların bilim insanı mesleği ile ilgili görüşlerinde daha çok bilimle ilgili laboratuvar çalışmalarını ve kimya ile ilgili deneyleri betimledikleri, bunların da dikkat ve beceri gerektiren işler olarak algılandıkları görülmektedir. Kadınların bu meslekte dikkat ve beceri konusunda çocuklar tarafından zayıf bulundukları gözlenmektedir. Bu durum ülkemizdeki bilim insanı algısı için düşündürücü bulunmaktadır.

Genel olarak çocukların görüşleri değerlendirildiğinde mesleklere yönelik çoğunlukla geleneksel bir anlayışa sahip oldukları gözlenmektedir. Çocukların bu algılarının kendi deneyimleriyle sınırlı olduğu düşünülmektedir.

Öneriler

Araştırmanın amacına ve sonuçlarına ilişkin aşağıdaki öneriler geliştirilmiştir:
1. Bu çalışmanın sonuçlarından yararlanılarak okullarda çocukların toplumsal cinsiyet algısında olumlu yönde değişimler oluşturabilecek projelere ve eğitimlere yer verilebilir. Okul öncesi eğitimde, meslekler hakkında çocukların önyargılarını ve yanlış bilgilerini düzenleme adına eğitici ve bilgilendirici etkinlikler uygulanabilir.
2. Okullarda okul öncesi eğitim döneminden itibaren cinsiyete yönelik ayrımcı ifadeler içeren konuların ve materyallerin kullanılmamasına ilişkin gerekli çalışmalar yapılmalı ve çocukların sosyal öğrenmesinde etkili olan çevreden yola çıkılarak toplumdaki her bireyin bu konuda bilgilendirilmesi ve eğitilmesine yönelik programlar hazırlanmalı ve uygulanmalıdır.
3. Öğretmenlere, çocuklara cinsiyetçi davranış göstermekten kaçınan dil ve üslup kullanarak hassas yaklaşmaları önerilebilir.
4. Öğretmenlik eğitimi alınan lisans programlarında toplumsal cinsiyete ilişkin dersler açılarak öğrenciler bu konuda eğitim almaya teşvik edilmelidir.
5. Toplumsal anlamda bilinçlenme sağlanarak toplumsal cinsiyet algısında cinsiyet eşitliğine yönelik duyarlılık sağlanabilir. Bu da kitle iletişim araçlarının kullanılması ve cinsiyet eşitliğini vurgulayacak çalışmaların yapılması ile mümkün olabilir. Kamu spotu, reklamlar, televizyon programları, gazete ve dergilerde bu konuyla ilgili yazılar, aile eğitim programları gibi çalışmalar yapılabilir.

6. Ebeveynlere, çocuklarına olumlu toplumsal cinsiyet algısı geliştirmelerini sağlayacak ortamlar hazırlamaları ve uygun model olma ile birlikte cinsiyetçi ayrıma gitmeyen davranışlar göstermeleri konularında eğitimler verilebilir.

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THE EFFECTS OF PROBLEM SOLVING SKILLS OF SECONDARY SCHOOL STUDENTS ON THEIR ATTITUDES TOWARDS THE CHEMISTRY COURSE

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Abstract: The purpose of this study is to determine the attitudes towards chemistry and problem solving skills of high school students and analyze the correlation between their attitudes towards chemistry and problem solving skills with regard to multiple variables. The study group consisted of overall 323 high school students. The results confirmed high problem solving skills among high school students. A significant correlation ($p<.05$) was seen in favor of girl students between the students' gender and their problem solving skills and total score values in terms of approach and avoidance, self confidence in solving problems. No significant correlation ($p>.05$) was found between the students' problem solving skills and independent variables including the time spent studying and their age. A significant difference ($p<.05$) was observed between the students' total score values of the attitudes towards chemistry and their gender.

Keywords: Attitudes towards chemistry, problem solving skills, secondary school students.

LİSE ÖĞRENCİLERİNİN PROBLEM ÇÖZME BECERİLERİNİN KİMYA DERSİNE YÖNELİK TUTUMLARINA ETKİSİ

Özet: Bu araştırmada, lise öğrencilerinin kimya dersine yönelik tutumlarının ve problem çözme becerilerinin belirlenmesi ve lise öğrencilerinin kimya dersine yönelik tutumları ile problem çözme becerileri arasındaki ilişkinin çeşitli değişkenler açısından incelenmesi amaçlanmıştır. Araştırmanın çalışma grubunu öğrenim gören toplam 323 lise öğrencisi oluşturmaktadır. Lise öğrencilerinin problem çözme becerilerinin yüksek olduğu belirlenmiştir. Öğrencilerin cinsiyetleri ile problem çözme becerisine güven, yaklaşma kaçınma alt boyutu ve toplam puan değerleri arasında kız öğrencilerin lehine anlamlı bir ilişki belirlenmiştir ($p<.05$). Öğrencilerin problem çözme becerileri ile ders çalışma süreleri ve yaş bağımsız değişkenleri arasında anlamlı bir ilişki bulunmamıştır ($p>.05$). Öğrencilerin kimya dersine yönelik tutumları ile cinsiyet değişkeni arasında anlamlı bir ilişki bulunmuştur ($p<.05$).

Anahtar Sözcükler: Kimya dersine yönelik tutum, problem çözme becerisi, lise öğrencileri

Giriş

Fen bilimleri, bilim insanları ve fen bilgisini öğrenmeye karşı olumlu tutumlar geliştirmek; geleceğin bilim insanlarının gelişimini desteklemek ya da bilinçli bireyler yetiştirmek adına oldukça önemlidir. Bilim okuryazarı olabilmek için, eğitimsel çabalara yeterince ilgi gösteren bilinçli bireyler, yaşam boyu toplumdaki profilerini yükseltebileceklerdir (Zhang and Campbell, 2010). Yükselen profilleriyle dikkat çekmeyi başaran diğer bir grup ise problem çözme yeteneğine sahip bireylerdir. Çünkü problem çözme yeteneğiyle donanmış ve problem çözmenin önemini kavrayabilmiş bireylere duyulan ihtiyaç gün geçtikçe daha çok artmaktadır. Bireylerin sahip olduğu problem çözme yetisinin geliştirilmesi ve yaşanan yüzyılın standartlarını karşılar seviyede olması problem çözme yeterliğini etkileyen değişkenleri araştırmakla sağlanabilir. Gagne ve Skinner gibi araştırmacılar problem çözme sürecinde en önemli değişken olarak bireyin geçmişini incelemenin gerekliliğine dikkat çekerken bazı araştırmacılar, problemlerin çözümünde en önemli unsurun bireyin karşı karşıya kaldığı durumu algılama biçimi olduğunu savunmuşlardır (Heppner, 1978; Ünsal & Ergin, 2011). Uzmanların görüşleri problem ve çözüm üzerine yapılan tanımlarından daha net anlaşılabilmektedir. Ramsey (1989) problem kavramının tanımlarını yaparken, "herhangi bir hazır, anlık çözüm tepkilerinin olmadığı bir durum" ifadesini kullanır. Çözümü de, farklı fikirler ya da olası çözümler arasında seçim yapmak eylemi olarak betimler (Korkut, 2002).

Problem çözme, bir sorunu çözmek için önceki yaşantılar aracılığı ile öğrenilen kuralların basit biçimde uygulanmasının ötesine giderek yeni çözüm yolları bulabilme veya olması gereken durumla mevcut durum arasındaki fark olarak düşünülebilir (Kneeland, 2001). Ellis ve Siegler (1994) problem çözme sürecini, bilişsel, duyuşsal ve psikomotor beceriler gerektiren karmaşık bir süreç olarak yorumlar. Bu öyle bir süreçtir ki birey; problem çözme ile bir amaca ulaşma, o amaca ulaşmak için araçlar geliştirme ve karşılaşılan engelleri aşma işlemlerini aynı zamanda gerçekleştirir (Çam & Tümkaya, 2008).

Frey, Hirscgstein ve Guzzo (2000) problem çözmeyi sosyal-duygusal yeterliklerden biri olarak ele almaktadırlar. Bu ve benzeri birçok tanım bağlamında düşünüldüğünde problem çözme, kişinin duygusal yeterliklerini etkileyen tutumları ile bağlantılı olacaktır düşüncesini akıllara getirmektedir. Anderson (1988)'a göre, tutum, bilişsel, duyuşsal ve davranışsal boyutlarıyla birey davranışlarının önemli ve kritik bir yordayıcısı olarak görülen psikolojik bir yapıdır. Tutumlar insan davranışlarını önemli ölçüde etkilediği için tutumların ölçülmesi, belirlenmesi nesne ya da duruma ilişkin insanların sahip oldukları tutum derecesinin bilinmesi birçok alanda istenen bir durumdur (Kan & Akbaş, 2005). Özellikle öğrencinin bir derse karşı tutumu, problem çözme becerisini kullanmaya istekliliği için oldukça önemlidir. Bu ve benzeri görüşlerden hareketle, öğrencilerin kimya dersine yönelik tutumlarının nasıl olduğu yapılan araştırmalarla incelenmiştir. Kimya öğretimi literatüründe, öğrencilerin kimya dersine olan reddedici tutumlarının başlıca nedenleri, kimya dersinin kötü bir imaja sahip olması, öğrencilerin günlük hayatlarıyla bağlantılı olmaması ve dersin zor olması olarak belirlenmiştir (Barke, 1987; Gräber, 1992; Todt, 1985). Yapılan bu çalışmada literatürden farklı olarak öğrencilerin kimya dersine yönelik tutumları ve problem çözme becerileri bir arada incelenmiştir. Bu bağlamda çalışmanın amacı, lise öğrencilerinin kimya dersine yönelik tutumlarının ve problem çözme becerilerinin çeşitli değişkenler açısından incelenmesi olarak belirlenmiştir.

Yöntem

Betimleme modelinde gerçekleştirilen çalışma, çeşitli liselerde öğrenim gören toplam 323 lise öğrencisinin katılımıyla gerçekleştirilmiştir. Araştırmada kullanılan veri toplama araçları, Kan & Akbas (2005) tarafından geliştirilen Kimya Dersine Yönelik Tutum Ölçeği ile Heppner ve Petersen (1982) tarafından geliştirilen ve Şahin, Şahin ile Heppner (1993) tarafından Türkçe'ye uyarlanan Problem Çözme Envanteri'dir (Cronbach Alpha güvenirlik katsayısı .82) olarak bulunmuştur.

Bulgular

Öğrencilerinin Problem Çözme Becerilerine İlişkin Bulgular

Problem çözme envanterinden alınabilecek puan 32–192 arasında değişmektedir. Ölçekten alınan düşük puan, problem çözmedeki etkililiği; yüksek puan ise problem karşısında etkili çözümler üretememeyi ifade etmektedir.

Tablo 1. Lise öğrencilerinin problem çözme envanterinden (PÇE) aldıkları alt boyut puanlarının yaş gruplarına göre t-testi sonuçları

PÇE Alt Boyutu	Yaş Grubu	n	X	S	Sd	t	p
Problem Çözme Yeteneğine Güven	14-16	166	41.933	6.996	.5430	-.566	.572
	17 ve üzeri	157	42.356	6.397	.5105		
Yaklaşma Kaçınma	14-16	166	59.674	7.543	.5855	-.480	.631
	17 ve üzeri	157	60.076	7.476	.5966		
Kişisel Kontrol	14-16	166	37.421	3.630	.2817	-1.22	.221
	17 ve üzeri	157	37.936	3.9054	.3116		
TOPLAM	14-16	166	130.548	15.070	1.1696	-.687	.493
	17 ve üzeri	157	131.636	13.312	1.0624		

Çalışmaya katılan öğrencilerinin problem çözme puanlarının yaş gruplarına göre yapılan t-testi sonuçları Tablo 1.'de görülmektedir. Bulgular incelendiğinde, yapılan analiz sonucunda lise öğrencilerinin problem çözme becerileri algılarında yaş gruplarına göre anlamlı farklılaşmalar olmadığı belirlenmiştir [t(321)= -.687, p>.05].

Tablo 2. Lise öğrencilerinin problem çözme envanterinden (PÇE) aldıkları alt boyut puanlarının cinsiyete göre t-testi sonuçları

PÇE Alt Boyutu	Gruplar	n	X	S	Sd	t	p
Problem Çözme Yeteneğine Güven	Kadın	205	42.25	7.173	.50105	.403	.687
	Erkek	118	41.94	5.824	.53615		

Yaklaşma Kaçınma	Kadın	205	60.52	8.161	.57004	2.06	.039
	Erkek	118	58.73	6.058	.55775		
Kişisel Kontrol	Kadın	205	37.88	3.777	.26384	1.32	.185
	Erkek	118	37.30	3.742	.34455		
TOPLAM	Kadın	205	131.80	15.827	1.1054	1.20	.230
	Erkek	118	129.82	10.867	1.0004		

Yapılan t testi sonucunda, öğrencilerin problem çözme yeteneğine güven, kişisel kontrol ve problem çözme envanteri toplam puanlarının cinsiyet değişkenine göre istatistiksel olarak anlamlı farklılaşmalar oluşturmadığı belirlenmiştir [t(321)= .403, .185, .230 p>.05]. Ancak envanterin Yaklaşma Kaçınma alt boyutunda erkek öğrenciler lehine istatistiksel olarak anlamlı bir farklılaşma olduğu ortaya çıkmıştır [t(321)= 2.06, p<.05].

Tablo 3. Lise öğrencilerinin problem çözme envanterinden (PÇE) aldıkları alt boyut puanlarının ders çalışma süresine göre ANOVA sonuçları

	Betimsel İstatistik Değerleri				**ANOVA Sonuçları**					
PÇE	**Grup**	**n**	**X**	**S**	**Var. K.**	**KT**	**Sd**	**KO**	**F**	**p**
Problem Çözme Yeteneğine Güven	1 Saat	100	42.10	6.78	G.Arası	65.53	3	21.84	.484	.694
	2 Saat	82	41.91	6.42	G.İçi	14409.19	319	45.17		
	3 Saat	74	41.68	6.26	Toplam	14474.73	322			
	4-üzeri Saat	67	42.97	7.43						
	Toplam	323	42.13	6.70						
Yaklaşma Kaçınma	1 Saat	100	59.32	6.33	G.Arası	307.96	3	102.6	1.83	.140
	2 Saat	82	59.13	7.86	G.İçi	17814.57	319	55.84		
	3 Saat	74	59.74	7.25	Toplam	18122.53	322			
	4-üzeri Saat	67	61.73	8.69						
	Toplam	323	59.87	7.50						
Kişisel Kontrol	1 Saat	100	17.30	3.69	G.Arası	25.424	3	8.475	.594	.619
	2 Saat	82	17.75	3.77	G.İçi	4549.789	319	14.26		
	3 Saat	74	17.71	3.50	Toplam	4575.214	322			
	4-üzeri Saat	67	18.07	4.16						
	Toplam	323	17.67	3.76						
TOPLAM	1 Saat	100	129.9	12.6	G.Arası	1092.890	3	364.2	1.81	.145
	2 Saat	82	130.2	13.8	G.İçi	64122.1	319	201.0		
	3 Saat	74	130.3	13.2	Toplam	65215.0	322			
	4-üzeri Saat	67	134.6	17.4						
	Toplam	323	131.0	14.2						

Tablo 3'te görüldüğü üzere, Problem Çözme Envanteri puanlarının öğrencilerin günlük ders çalışma süresi değişkenine göre anlamlı bir farklılık gösterip göstermediğini belirlemek amacıyla yapılan tek yönlü varyans analizi (ANOVA) sonucunda puanlar arasındaki fark istatistiksel olarak anlamlı bulunmamıştır (F=.484, 1.83, .594, 1.81; p>.05).

Öğrencilerinin Kimya Dersine Yönelik Tutum Verilerine İlişkin Bulgular

Tablo 4. Lise öğrencilerinin kimya dersine yönelik tutum ölçeği alt boyut puanlarının yaş gruplarına göre t-testi sonuçları

Kimya Dersine Yönelik Tutum	**Yaş Grubu**	**n**	**X**	**S**	**Sd**	**t**	**p**
Kimya Dersine Dönük Olumlu Tutum	14-16	166	3.144	.992	.077	2.24	.026
	17 ve üzeri	157	2.888	1.05	.084		
Kimya Dersine Dönük Olumsuz Tutum	14-16	166	2.590	.949	.073	-2.06	.039
	17 ve üzeri	157	2.822	1.066	.085		
Kimya Dersine Dönük Faaliyetler	14-16	166	2.826	1.030	.080	-1.72	.085
	17 ve üzeri	157	3.028	1.068	.085		
TOPLAM	14-16	166	2.895	.4104	.031	-.053	.950
	17 ve üzeri	157	2.910	.6758	.053		

Tablo 4'te lise öğrencilerinin kimya dersine yönelik tutum puanlarının yaş değişkenine göre yapılan t-testi analizi sonuçları görülmektedir. Yapılan t testi sonrasında Kimya Dersine Dönük Olumlu Tutum ile Kimya Dersine Dönük Olumsuz Tutum puanları, yaş grupları değişkenine göre istatistiksel olarak anlamlı şekilde farklılaşmıştır [t(321)= 2.24, -2.06; p<.05]. Ancak Kimya Dersine Dönük Faaliyet ile Kimya Dersine Dönük

Genel Tutum puanları arasında yaş değişkenine göre anlamlı farklılaşma yaşanmamıştır [t(321)= -1.75, -.053 p>.05].

Tablo 5. Lise öğrencilerinin kimya dersine yönelik tutum aldıkları alt boyut puanlarının cinsiyete göre t-testi sonuçları

Kimya Dersine Yönelik Tutum	Gruplar	n	X	S	Sd	t	p
Kimya Dersine Dönük Olumlu Tutum	Kadın	205	2.63	1.0551	.07369	-1.53	.125
	Erkek	118	2.81	.92918	.08554		
Kimya Dersine Dönük Olumsuz Tutum	Kadın	205	2.97	1.0700	.07473	-.943	.346
	Erkek	118	3.09	.96304	.08866		
Kimya Dersine Dönük Faaliyetler	Kadın	205	2.89	1.0907	.07618	-.649	.517
	Erkek	118	2.97	.98451	.09063		
TOPLAM	Kadın	205	2.85	.59057	.04125	-1.97	.049
	Erkek	118	2.97	.47776	.04398		

Tablo 5 incelendiğinde t testi sonrasında sadece Kimya Dersine Dönük Genel Tutum puanları, cinsiyet değişkenine göre istatistiksel olarak anlamlı şekilde farklılaşmıştır [t(321)= -1.97; p<.05]. Ancak alt boyut puanları arasında cinsiyet değişkenine göre anlamlı farklılaşma yaşanmamıştır [t(321)= -1.75, -.053 p>.05].

Tablo 6. Lise öğrencilerinin kimya dersine yönelik tutum ölçeği alt boyut puanlarının ders çalışma süresine göre ANOVA sonuçları

Kimya Tutum	Betimsel İstatistik Değerleri				ANOVA Sonuçları					
	Grup	n	X	S	Var. K.	KT	Sd	KO	F	p
Kimya Dersine Dönük Olumlu Tutum	1 Saat	100	2.65	1.01	G.Arası	.394	3	.131	.127	.944
	2 Saat	82	2.70	1.00	G.İçi	330.158	319	1.035		
	3 Saat	74	2.72	1.00	Toplam	330.552	322			
	4-üzeri Saat	67	2.75	1.05						
	Toplam	323	2.70	1.01						
Kimya Dersine Dönük Olumsuz Tutum	1 Saat	100	3.12	1.06	G.Arası	7.357	3	2.452	2.33	.074
	2 Saat	82	3.17	.984	G.İçi	335.662	319	1.052		
	3 Saat	74	2.90	.970	Toplam	343.019	322			
	4-üzeri Saat	67	2.80	1.07						
	Toplam	323	3.02	1.03						
Kimya Dersine Dönük Faaliyetler	1 Saat	100	2.84	1.07	G.Arası	1.368	3	.456	.410	.746
	2 Saat	82	2.91	1.07	G.İçi	355.189	319	1.113		
	3 Saat	74	2.96	1.02	Toplam	356.557	322			
	4-üzeri Saat	67	3.01	1.03						
	Toplam	323	2.92	1.05						
TOPLAM	1 Saat	100	2.91	.510	G.Arası	.794	3	.265	.859	.463
	2 Saat	82	2.96	.648	G.İçi	98.254	319	.308		
	3 Saat	74	2.86	.523	Toplam	99.048	322			
	4-üzeri Saat	67	2.83	.527						
	Toplam	323	2.89	.554						

Tablo 6'da görüldüğü üzere, Kimya Dersine Yönelik Tutum puanlarının öğrencilerin günlük ders çalışma süresi değişkenine göre anlamlı bir farklılık gösterip göstermediğini belirlemek amacıyla yapılan tek yönlü varyans analizi (ANOVA) sonucunda puanlar arasındaki fark istatistiksel olarak anlamlı bulunmamıştır (F=.127, 2.33, .410, .859; p>.05).

Sonuç

Çalışmada lise öğrencilerinin yaşları arttıkça problem çözme envanterinden aldıkları puanların arttığı başka bir ifadeyle problem çözme becerilerinin azaldığı ortaya çıkmıştır. Ancak yapılan analizde problem çözme becerilerinin yaş gruplarına göre anlamlı farklılaşmadığı belirlenmiştir. Bu durumun nedeni yaş grupları arasında (14-16 ile 17 ve üzeri) problem çözme becerileri açısından anlamlı fark yaratacak kadar ayırımın olmaması olabilir. Çalışmada yaş değişkenine ait elde edilen bu bulgu, D'Zurilla, Maydeu ve Kant'ın (1998) yaş ilerledikçe problem çözme becerilerinin arttığı biçimindeki bulguları ile çelişse de, Pakaslahti ve arkadaşlarınca (2002) yapılan bir araştırmadaki 14 yaşındakilerin 17 yaşındakilere göre bazı problem çözme becerilerini daha etkili kullandıkları bulgusu ile paralellik göstermektedir. Literatürde benzer şekilde problem çözme becerilerini algılamalarının yaşa bağlı olarak farklılaşmadığı yapılan birçok çalışmada ortaya çıkmıştır (Bilgin, 2010;

Gökbüzoğlu, 2008; Sezen & Paliç, 2011; Karabulut & Pulur, 2001). Çalışmanın genelinde erkek öğrencilerin problem çözme becerisi algılarının daha yüksek olduğu dikkat çekmiştir. Ancak yapılan analizler sonucunda problem çözme envanteri toplam puanlarının öğrencilerin cinsiyetlerine göre farklılık göstermediği sadece envanterin Yaklaşma Kaçınma alt boyutunda erkek öğrenciler lehine istatistiksel olarak anlamlı bir farklılaşma oluşturduğu belirlenmiştir. Korkut (2002) tarafından yapılan çalışmada kız öğrencilerin problem çözme becerileri ile erkek öğrencilerin problem çözme becerileri arasında görülen farkın erkeklerin lehine olduğu belirlenirken, Açık (2013) tarafından yapılan çalışmada ise yaklaşma kaçınma alt boyutu toplam puan değerleri arasında kız öğrencilerin lehine anlamlı bir sonuç ortaya çıkmıştır. Ayrıca çalışmada öğrencilerin problem çözme becerilerinin günlük ders çalışma süreleri ile bağlantı olmadığı belirlenmiştir. Bu çalışmada ortaya çıkan ve literatürde yer alan aksi sonuçlar, öğrencilerin problem çözme yetilerinin cinsiyetleri ve ders çalışma süreleri ile ilgisinin olmadığı, onların günlük hayatta karşılaştıkları problem sayısıyla ve problemi çözme becerilerinin gelişimiyle ilgili olabileceği düşüncesini akıllara getirmektedir.

Araştırmada öğrencilerin yaşları arttıkça kimya dersine yönelik olumlu tutumlarının azalttığı ortaya çıkmıştır. Özellikle Kimya Dersine Dönük Olumlu Tutum ile Kimya Dersine Dönük Olumsuz Tutum puanları, yaş grupları değişkenine göre istatistiksel olarak anlamlı şekilde farklılaşmıştır. Ayrıca Kimya Dersine Dönük Genel Tutum puanları, cinsiyet değişkenine göre erkekler lehine istatistiksel olarak anlamlı şekilde farklılaşmıştır. Kıngır ve arkadaşlarının (2006) yaptığı çalışmada öğrencilerin kimya dersine karşı olumlu bir tutum geliştirdiği, ancak ölçeğin bütünü değerlendirildiğinde kız öğrenciler ile erkek öğrenciler arasında anlamlı bir fark olmadığı bulunmuştur. Çalışmamızda bazı değişkenler açısından inceleme yapıldığında anlamlı farklılaşmalar bulunamamıştır. Fakat öğrencilerin öğrenim gördüğü okul türlerine, başarı seviyeleri ve sosyoekonomik özellikleri göre farklılaşmalar olması muhtemeldir. Dolayısıyla farklı öğrenci grupları üzerinde benzer çalışmalar yapılarak literatüre kazandırılabilir.

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DEVELOPMENT OF VOCATIONAL EDUCATION MODULE BASED AUGMENTED REALITY FOR PLC TRAINING

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Abstract: The aim of this study is to investigate the effect of rapid learning on associate degree level students of PLC using modules created with augmented reality. To achieve this goal, the development of the PLC Visual System was assisted by augmented reality employıng Unity and Vuforia softwares whıch are based upon C# coding language; and education has been rendered feasible via a tablet or mobile phone runnıng an Android operating system. For PLC training based on the S7-1200 hardware, the electrical connection with PLC input / output connections is visualized with 3D animation. In this study, PLC training was applied to two separate groups: traditional theoretical and augmented reality theoretical. The model has been made web-accessible with a student management system and made available to students. 80 students studying in the second year of the associate degree, using the 5-minute module, were then subjected to information and evaluation through tests and classical exams. With the evaluation of the training made, positive improvement in education was observed by 85%. As a result of the research, it has been determined that the students with PLC education based on the augmented reality were more successful.

Keywords: Plc, augmented reality, vocational education

PLC EĞİTİMİ İÇİN ARTTIRILMIŞ GERÇEKLİĞE DAYALI MESLEKİ EĞİTİM MODÜLÜ GELİŞTİRİLMESİ

Özet: Bu çalışma artırılmış gerçeklik ile oluşturulmuş PLC kullanma modülünün ön lisans seviyesindeki öğrenciler üzerindeki hızlı öğrenme etkisini araştırmayı amaçlamaktadır. Bu amaca ulaşmak için Unity ve Vuforia yazılımları ile C# kodlama dilinden yararlanılarak arttırılmış gerçeklik destekli PLC görsel sistemi geliştirilmiş ve Android işletim sistemine sahip bir tablet veya cep telefonu üzerinden eğitim yapılabilir hale getirilmiştir. PLC eğitimi için bir adet S7-1200 donanımı esas alınmış, PLC giriş çıkış bağlantıları ile elektriksel bağlantısının yapılış şekli 3B animasyon ile görselleştirilmiştir. Bu çalışmada PLC eğitimi iki ayrı grup üzerinde geleneksel teorik ve arttırılmış gerçekliğe dayalı teorik olarak uygulanmıştır. Model bir öğrenci yönetim sistemi ile web tabanlı erişilebilir hale getirilmiş ve öğrencilerin kullanımına sunulmuştur. 5 dakikalık modülü kullanan ön lisans 2. Sınıf 80 öğrenci daha sonra test ve klasik sınavlar ile bilgi değerlendirmesine tabi tutulmuştur. Yapılan eğitimin değerlendirmesi ile %85 kadar eğitimde olumlu iyileşme görülmüştür. Araştırmanın sonucunda arttırılmış gerçekliğe dayalı PLC eğitimi alan öğrencilerin daha başarılı oldukları tespit edilmiştir.

Anahtar Sözcükler: PLC, arttırılmış gerçeklik, mesleki eğitim

Giriş

Mesleki ve teknik eğitim derslerinde teorik bilginin aktarımı, uygulama olmaksızın oldukça zordur. Bu nedenle, gelişen teknolojiler sayesinde teorik ders notlarının üç boyutlu modeller ile desteklenerek aktarılması yöntemi ile eğitimlerin olumlu yönde etkileneceği düşünülmektedir. Yapılan bu çalışmada amacımız, PLC eğitiminin temellerini ön lisans seviyesindeki öğrencilere hızlı ve daha anlaşılır bir şekilde aktarmaktır. Bu amaçla bir ders içeriği oluşturulmuş ve bu ders içeriğine uygun senaryoda bir artırılmış gerçeklik uygulaması geliştirilmiştir.

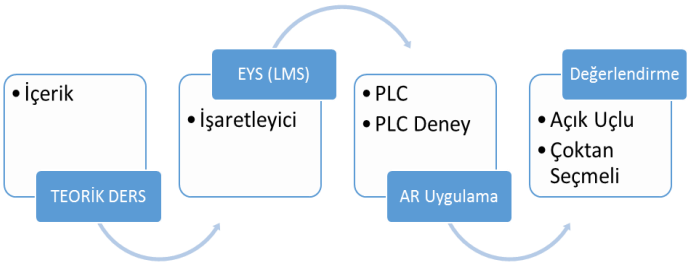
Azuma (1997)'ye göre artırılmış gerçeklik, normal koşullarda insanların duyuları ve bilişsel süreçleri tarafından belirlenemeyen bilgileri sağlayarak, gerçekliğin güçlendirilmesini ve desteklenmesini kapsayan çalışma alanı olarak görülmektedir (Azuma, 1997). Artırılmış gerçeklik için öncelikli olarak sanal ile gerçek ortamı bir arada yorumlayacak bir ara yüzey gerekmektedir. Bu ara yüzey yazılımlar, artırılmış gerçeklik uygulamalarında kolaylıklar sağlayan araçlar ile beraber tasarlanmaktadır. Yazılımlar genelde modelleme aracı, marker üretim aracı, performans artırıcı motor aracı, mobil uygulama aracı ve web ara yüzey aracı çeşitleriyle gelmektedir (Çakal & Eymirli, 2012).

PLC eğitimi konusunda yapılan çalışmalar incelendiğinde; Çolak ve diğ., laboratuvar boyutlarında geliştirilmiş olan üç katlı asansör sisteminin PLC ile kontrolü üzerine yaptıkları çalışma (Çolak, Bayındır, & Kuruşçu, 2007), Aydoğmuş ve diğ., PLC kontrollü bir SCADA sisteminin uzaktan izlenmesi ve kontrolü ile deneyler yapılması üzerine çalışıldığı görülmektedir(Aydogmus & Aydogmus, 2009). Güllü ve diğ., çalışmalarında, PLC'nin ileri seviye eğitimleri hedeflenmektedir (GÜLLÜ, Sur, & Kaplanoğlu, 2009). Haba, PLC simülatör yazılımı kullanarak kullanıcı ara yüzü ile donanım parçalarını değiştirebilen bir çalışma yapmıştır (Haba, 2010). Segundo ve Losada, 3 Boyutlu basit bir kontrol sistemini görselleştirerek öğrencilerin ilgilerini çekmektedirler (San Segundo & Rodríguez-Losada, 2010). Shyr, Mekatronik eğitimi için PLC programlamayı nasıl öğretebileceklerini tasarladıkları sanal laboratuvar çalışmasında anlamlı pozitif bir etki elde etmiştir (Shyr, 2010). Yılmaz ve Katrancıoğlu, PLC eğitimi için bir deney seti geliştirmişlerdir (Yilmaz & Katrancioglu, 2011). (Engin Ufuk & Cenk, 2013) Proses simülasyon yazılımıyla bir prosesin tasarımının ve kontrolünün nasıl yapılacağı incelenmektedir. Ayaz ve diğ., Animasyon tabanlı PLC ve operatör panel eğitim seti başlıklı çalışmalarında uygulamalı eğitimde kullanılan deney sistemlerinin düşük maliyetli, güvenlik şartlarını sağlayan ve güncel gelişmelere uyum sağlayabilecek yapıda olmasına değinmişlerdir (Ayaz et al., 2014). Narayanan ve Deshpande, sanal laboratuvarlar ile otomasyon eğitiminin kolaylaştırılması alanında çalışmaktadırlar (Narayanan & Deshpande, 2016).

İncelenen makaleler ve çalışmalar değerlendirildiğinde hemen hemen bütün çalışmaların PLC eğitiminin uygulamaya dayalı kısmı üzerine yoğunlaştığı gözlemlenmektedir. Teorik eğitimin aktarılması sürecinde bir çalışmaya rastlanmamıştır. Bu çalışmayı diğer çalışmalardan ayıran en önemli noktalardan birisi teorik eğitim sırasında arttırılmış gerçeklik destekli bir uygulama yardımı ile ön lisans seviyesindeki öğrenciler üzerindeki PLC eğitiminin verilmeye çalışılmış olmasıdır. Yapılan eğitimin değerlendirmesi ile %85 kadar eğitimde olumlu iyileşme görülmüştür. Araştırmanın sonucunda arttırılmış gerçekliğe dayalı PLC eğitimi alan öğrencilerin daha başarılı oldukları tespit edilmiştir.

Yöntem

Bu araştırma, mesleki ve teknik eğitim alanında PLC eğitiminin artırılmış gerçeklik uygulaması destekli bir modül geliştirilerek ön lisans seviyesindeki öğrencilere verilmesi amaçlamaktadır. Bu çalışmada deney yönteminden kullanılmıştır. Çalışmanın örnek kütlesi tesadüfi olarak seçilen 80 mesleki ve teknik eğitim veren meslek yüksekokulu 2. Sınıf öğrencilerinden oluşmaktadır. Bu öğrenciler, eşit ve tesadüfi olarak ikiye ayrılmış ve 40 kişi deney grubunu, diğer 40 kişi ise kontrol grubunu oluşturacak şekilde tasarlanmıştır. Araştırmada PLC eğitimi teorik ders notu üzerinde çalışan artırılmış gerçeklik uygulaması hazırlanmış olup, bu uygulama seçilen örnek kütle üzerinde araştırılmıştır. Deney grubunda bulunan öğrenciler, bu ders materyaline mobil cihazlarını (akıllı telefon, tablet bilgisayar vb.) kullanarak eğitim uygulamasına bir öğrenci yönetim sistemi ile web tabanlı olarak erişmişlerdir. Eğitimin ardından bu eğitimle ilgili sınav soruları ile değerlendirmeleri yapılmıştır. Değerlendirme sonuçları istatistiki teknikler ile analiz edilerek, uygulamanın değerlendirme sonuçları ortaya koyulmaya çalışılmaktadır.



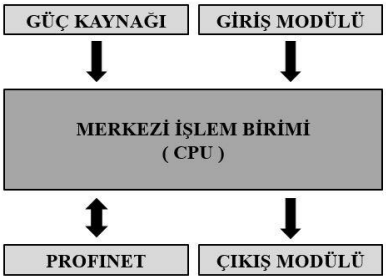
Şekil 1. Yöntem blok diyagramı

Uygulama

Bu çalışmada, PLC eğitimi için arttırılmış gerçeklik destekli uygulama modülü geliştirilmiştir. Modülün geliştirme aşamaları Şekil 2 de gösterilmektedir.

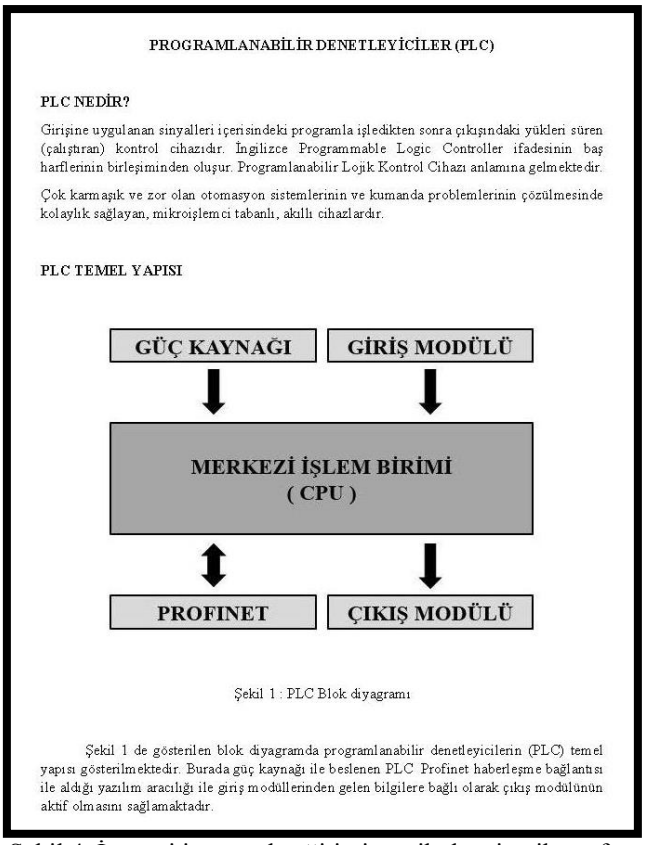
Şekil 2. Uygulama geliştirme aşamaları

Şekil 2'de gösterilen uygulama geliştirme aşamaları bir artırılmış gerçeklik uygulamasının gelişimini göstermektedir. Burada öncelikle artırılmış gerçeklik uygulaması tarafından tanımlanacak bir işaretleyici tasarımına ihtiyaç duyulmaktadır. İşaretleyici tasarımı, arttırılmış gerçeklik kamerasının algılayabileceği bir şekilde olmalı ve boyutu istenilen ölçülere göre ayarlanmalıdır.



Şekil 3. PLC eğitimi için artırılmış gerçeklik işaretleyici tasarımı

PLC eğitimi için kullanılacak olan işaretleyici tasarımı Şekil 3 'te gösterilmektedir. Bu işaretleyici bir PLC donanımının temel elemanlarının nelerden oluştuğunu basit bir şekilde göstermektedir.



PROGRAMLANABİLİR DENETLEYİCİLER (PLC)

PLC NEDİR?

Girişine uygulanan sinyalleri içerisindeki programla işledikten sonra çıkışındaki yükleri süren (çalıştıran) kontrol cihazıdır. İngilizce Programmable Logic Controller ifadesinin baş harflerinin birleşiminden oluşur. Programlanabilir Lojik Kontrol Cihazı anlamına gelmektedir.

Çok karmaşık ve zor olan otomasyon sistemlerinin ve kumanda problemlerinin çözülmesinde kolaylık sağlayan, mikroişlemci tabanlı, akıllı cihazlardır.

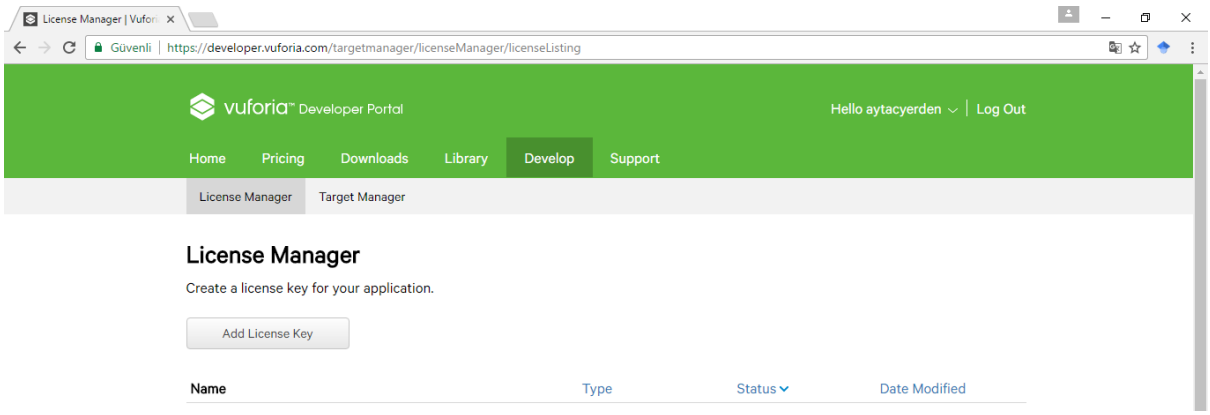
PLC TEMEL YAPISI

Şekil 1 : PLC Blok diyagramı

Şekil 1 de gösterilen blok diyagramda programlanabilir denetleyicilerin (PLC) temel yapısı gösterilmektedir. Burada güç kaynağı ile beslenen PLC Profinet haberleşme bağlantısı ile aldığı yazılım aracılığı ile giriş modüllerinden gelen bilgilere bağlı olarak çıkış modülünün aktif olmasını sağlamaktadır.

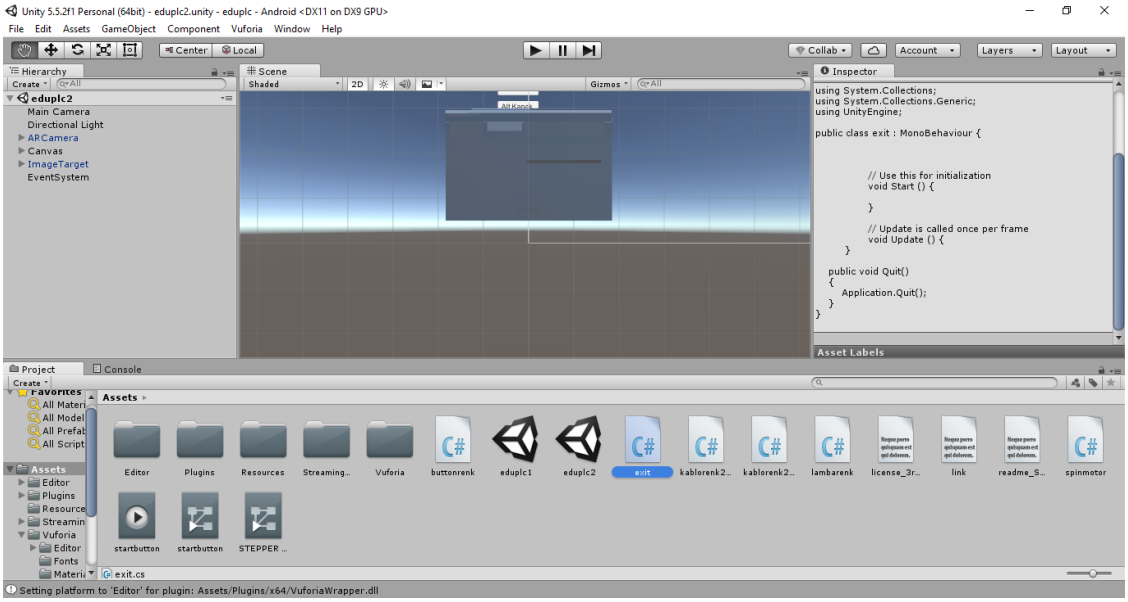
Şekil 4. İşaretçi içeren plc eğitimi teorik ders içerik sayfası

PLC Eğitimi için hazırlanan ders notları arasında arttırılmış gerçeklik uygulaması için işaretçi içeren eğitim sayfası Şekil 4'te gösterilmektedir.



Şekil 5. Vuforia geliştirici web sitesi (Vuforia, 2016)

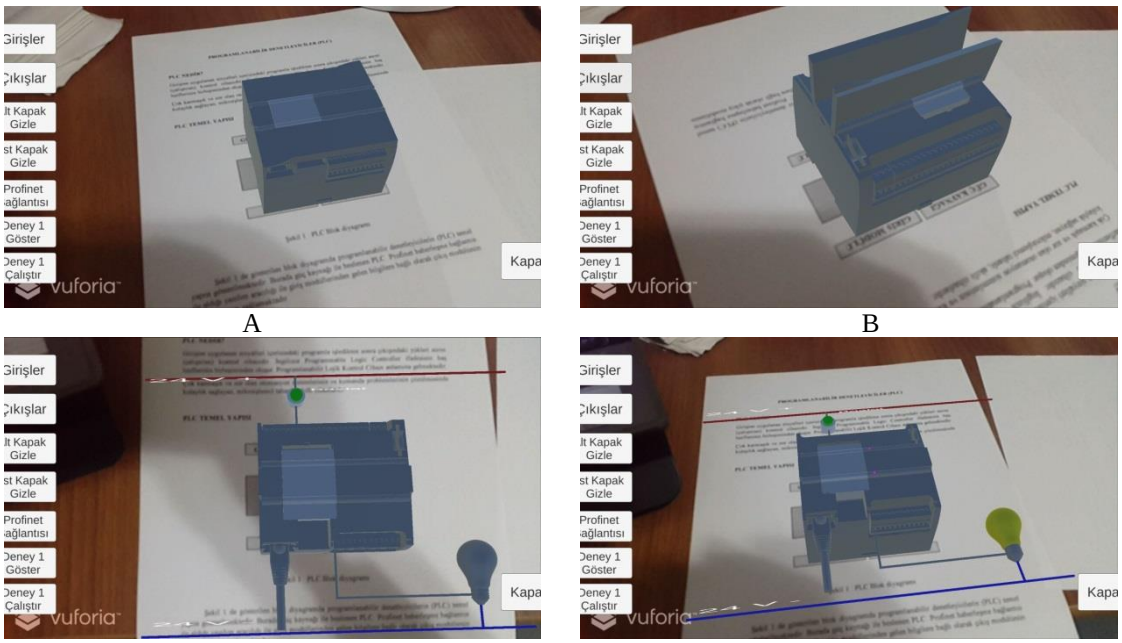
İşaretleyici tasarımı sonrası Şekil 5'te görülen Vuforia yazılımının geliştirici web sitesine kayıt olunarak yeni bir uygulama için lisans oluşturulur. Bu lisans altında hedef işaretleyici tanımlanarak Unity yazılımı içerisine aktarılacak paket program indirilir. Bu sayede Unity yazılımı artırılmış gerçeklik destekli bir kamera ve işaretçi veya işaretçilere sahip özellikte olacaktır.



Şekil 6. Unity 3D ekran görüntüsü

Unity 3D yazılımı bir oyun geliştirme platformu olarak piyasaya çıkmış olsa da günümüzde bir çok alanda kullanılmaktadır. Şekil 6'da Unity 3D yazılımının arayüzü görülmektedir. Unity 3D yazılımı ilk kurulumu sırasında Vuforia, Android ek paketleride seçilerek kurulmuştur. Unity3D ve Vuforia yazılımları eğitim ve geliştirme aşamalarında lisansları tamamen ücretsiz olarak sunulmaktadırlar.

Arttırılmış gerçeklik uygulaması içerisinde kullanmak istediğimiz 3 boyutlu (3B) modeller tasarlandı. Burada, PLC eğitimi amaçlandığı için S7-1200 PLC 3B modeli, lamba 3B modeli ve anahtar 3B modeli tasarlanarak Unity 3D yazılımı kütüphanesi içerisine eklendi.. Modellerin animatif çalışmaları amacı ile C# programlama dilinden faydalanarak oluşturulan kodlamalar Unity 3D yazılımı kütüphanesi içerisine eklendi. Kütüphane içerisine eklenen tüm materyaller bir sahne içerisinde konumlandırıldı, boyutlandırıldı ve gereken parçaların betimlenmesi sağlandı. Tüm bu işlemlerin sonuçlandırılması ardından PLC eğitimi için arttırılmış gerçeklik uygulaması android uygulama dosyası olarak kaydedildi ve öğrenci yönetim sistemi içerisine yüklendi.

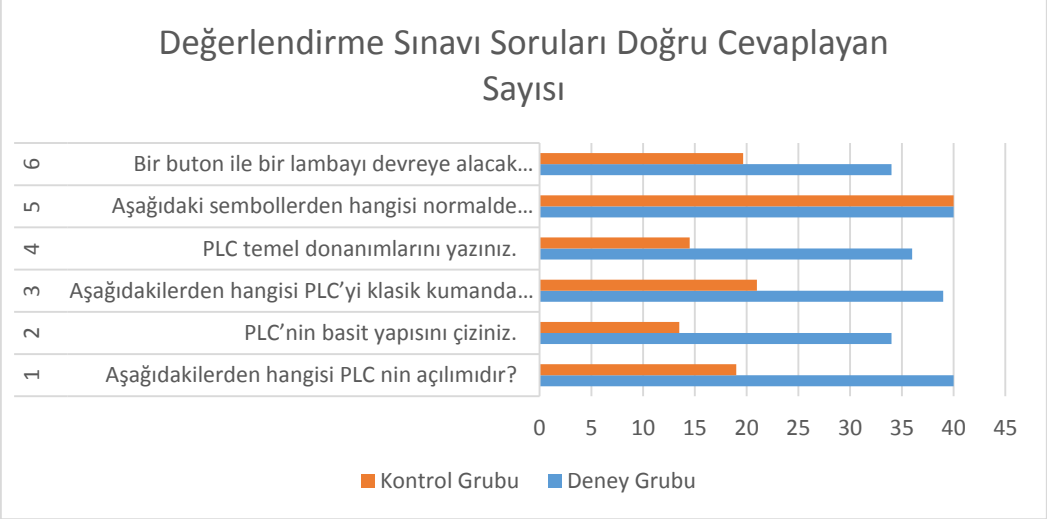


Şekil 7. PLC eğitim modülü uygulama görüntüleri

Teorik ders notları üzerine çalışan öğrenciler, mobil cihazları ile öğrenci yönetim sistemine girdiler. Buraya yüklenmiş olan uygulamayı cihazlarına yükleyerek Şekil 7'de görülmekte olan uygulama ekran görüntülerine sahip yazılımı çalıştırdılar. Burada A ile belirtilen görüntüde yazılım ilk açıldığı anda işaretleyici üzerinde oluşan 3B S7-1200 model görülmektedir. Mobil cihazın işaretleyiciye yakınlaşması, uzaklaşması veya sayfanın çevresinde döndürülmesi ile model üzerindeki tüm detaylar incelenebilmektedir. Ekranın sol tarafına atanan komut butonları aracılığı ile animasyonlarında devreye girmesi ile S7-1200 PLC ile giriş, çıkış ve endüstriyel haberleşme portu bağlantılarının nasıl yapıldığı gösterilmektedir.

Bulgular

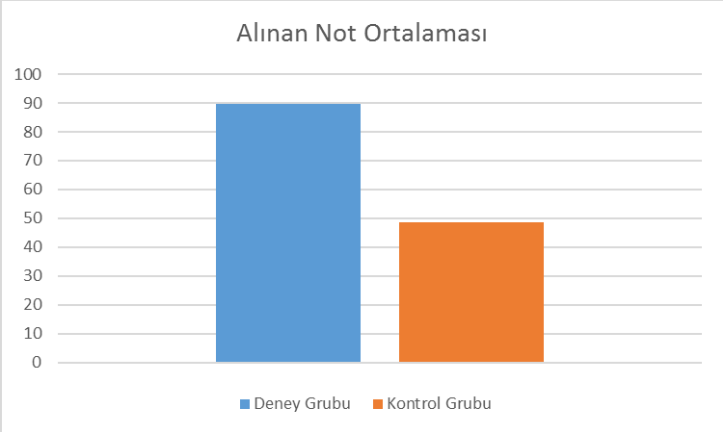
Bu çalışmada araştırmaya katılan öğrencilerin mobil cihazları (akıllı telefon, tablet bilgisayar vb.) kullanılarak verilen PLC konulu eğitim sonucunda dersin öğrenme çıktıları ve AR uygulamasının değerlendirilmesine yönelik bulgular elde edilmiştir. Elde edilen bulgular, AR uygulamasının öğrenme üzerindeki rolünü ortaya koymaya çalışmaktadır.



Şekil 8. Kontrol ve deney grupları değerlendirme sınavı soruları ve doğru cevaplanma sayıları

Şekil 8'de gösterilen grafikte deney grubu ve kontrol grubu öğrencilerinin değerlendirme sorularına doğru cevap veren öğrenci sayılarını göstermektedir. Burada PLC eğitimini arttırılmış gerçeklik destekli uygulama ile alan

öğrencilerin kontrol grubu öğrencilerinden daha pozitif etkilendikleri gözlemlenmektedir. Şekil 9'daki iki grubun toplam alınan not ortalaması da bunu destekleyici düzeydedir.



Şekil 9. Alınan not ortalaması

Bu çalışmada iki ayrı grup üzerinde fark olup olmamasına bakılması sebebi ile t testi kullanılarak, farklılık test edilmektedir. T testi, iki farklı örnek kütle ortalamaları arasında farklılığı ölçen bir istatistiki tekniktir. Yapılan t testi sonucu aşağıda Tablo 1'de görülmektedir. Bu sonuca göre anlamlılık değerinin 0,05 değerinden küçük olması sebebi ile deney ve kontrol grubu arasında anlamlı bir fark olduğu istatistiksel olarak ortaya koyulmaktadır. (0,00 <0,05) Bir başka deyiş ile AR uygulaması kullanılarak, eğitim verilen öğrencilerin, AR uygulaması kullanılmadan eğitim verilen öğrencilere göre başarı açısından farklı olduğu görülmektedir. Bu sonucu öğrenci sınav başarılarının da desteklediği görülmektedir.

Tablo 1. Kontrol ve deney grupları arasındaki t testi sonucu

Eşleştirilmiş Numuneler Testi

		Eşleştirilmiş Farklar					t	df	Sig. (2-uçlu)
		Ortalama	Std. Sapma	Std. Hata Ortalaması	Fark % 95 güven aralığı Alt	Üst			
Çift 1	Kontrol - Deney	-6,87775	5,24363	,82909	-8,55474	-5,20076	-8,296	39	,000

Sonuç

Bu çalışma, mesleki ve teknik eğitimde artırılmış gerçeklik destekli eğitimin değerlendirilmesi amacı ile gerçekleştirilmektedir. Çalışmada tesadüfi olarak seçilen mesleki ve teknik eğitim veren meslek yüksekokulu öğrencilerinin PLC ders materyalleri AR ile geliştirilmiş olup, AR uygulamasına dayanan eğitim modülü, öğrencilerin başarı kriterine göre değerlendirilmektedir. Deney yöntemi kullanılan bu çalışmada, örnek kütle tesadüfi olarak 40 kişilik gruplar olarak ikiye bölünmüş olup, deney ve kontrol grubu olmak üzere iki ayrı grup elde edilmiştir. AR uygulaması, deney grubunda bulunan öğrenciler üzerinde uygulanmış olup, kontrol grubu üzerinde uygulanmamıştır. Her iki grupta bulunan öğrenciler üzerinde sınav tekniği kullanılarak sonuçlar değerlendirilmiştir. Sınav sonuçlarına göre deney grubunun, kontrol grubuna göre %85 oranında daha başarılı olduğu ortaya çıkmaktadır. Bu sonuç, AR uygulamasına dayalı ders materyallerinin, araştırmaya katılan öğrencilerin başarısı üzerinde daha etkili olduğunu göstermektedir. Öğrencilerin bu uygulanan AR teknik ile uygulamaya dayalı mesleki eğitim derslerinde kolay öğrenme ve daha kalıcılık sağlanacağı sonucuna varılmıştır.

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PLAY ACTIVITIES IMPLEMENTED IN KINDERGARDEN CLASSROOMS

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Abstract: This study was aimed to determine pre-school teachers' implementation of play activities in their classrooms. The sample of the research consisted of 50 pre-school teachers working in state-funded and private kindergartens in the north-western region of Turkey. A questionnaire with two parts was developed by researchers to collect the data. The first part included items targeting the demographic characteristics of the teachers. The second part included questions about the play activities implemented in the kindergartens. Of the 10 items, three of them were "yes-no" questions, four of them were multiple-choice questions, and three of them were open-ended questions. The data were gathered via face to face interview with the teachers. The results demonstrated that all teachers implemented various play activities with children both inside and outside of the classroom. The vast majority of the teachers implemented play activities based on the competition in the classroom and had difficulties during the play in the kindergarten environment. Most of these difficulties were physical space limitation and insufficient materials. Early learning environments should be designed to address the space and material related limitations to provide children learning environments where they can run and play comfortably.

Keywords: Early childhood education, play, educational play

OKUL ÖNCESİ ÖĞRETMENLERİNİN SINIFTA UYGULADIKLARI OYUNLARIN ÇEŞİTLİ DEĞİŞKENLER AÇISINDAN İNCELENMESİ

Özet: Yapılmış olan bu çalışma, okul öncesi öğretmenlerinin sınıflarında uyguladıkları oyun yönteminin çeşitli değişkenlere göre nasıl değişiklik gösterdiğini belirlemek amacıyla planlanmıştır. Araştırmanın örneklemini Türkiye'nin kuzey batı bölgesinde resmi ve özel anaokullarında görev yapan 50 okul öncesi öğretmeni oluşturmaktadır. Çalışmanın verilerinin toplanabilmesi amacıyla araştırmacılar tarafından anket geliştirilmiştir. Geliştirilen anket iki kısımdan oluşmaktadır. 1. kısımda öğretmenlerin demografik özellikleri yer almaktadır. İkinci kısımda sınıf içinde uygulanan oyunlara yönelik sorular yer almaktadır Toplam 10 sorunun 3 tanesi "evet-hayır" sorusu, 4 tanesi çoktan seçmeli ve 3 tanesi de açık uçlu sorulardır. Veriler öğretmenler ile yüz yüze görüşülerek toplanmıştır. Buna göre tüm öğretmenlerin çocuklarla birlikte oyun oynadığı, çocuklara sınıf içinde ve dışında çeşitli oyunlar oynattığı saptanmıştır. Yine öğretmenlerin büyük çoğunluğunun sınıfında rekabete dayalı oyun oynattığı, anaokul ortamında oyun sırasında güçlük yaşadığı saptanmıştır. Bu güçlüklerin başında fiziksel alan ve materyal yetersizliği gelmektedir. Okul öncesi eğitim ortamlarında fiziksel mekan darlığı sorunu ve dış mekan yetersizliği çözülmeli, çocukların rahatça koşup oynayabilecekleri öğrenme ortamları oluşturulmalıdır.

Anahtar Sözcükler: Okul öncesi eğitim, oyun, oyun türü

Giriş

Oyun, okul öncesi dönemdeki çocukların hayatlarının ayrılmaz bir parçasıdır. Çocukların bu dönemde oyun ile öğrendikleri kabul edilmektedir. Clements (2004) yaptığı çalışmasında hem öğretmenlerin hem de ebeveynlerin oyunu çocukları yaşamlarının bir parçası olarak gördüklerini bulmuştur.

Oyunun çocuk gelişimine sayısız faydası bulunmaktadır. Çocuklar oyun oynarken düşünmekte, uzlaşım kurmakta, yenilik yapmaktadır. Hayali durumlar yaratarak fiziksel, sosyal ve bilişsel becerileri ile ilgili gerçek yaşam deneyimleri kazanmaktadırlar (Jones, 2015). Yine Sevinç (2004) oyun alanlarında oynanan oyunlar

çocukların yaratıcılığını ve bağımsızlığını desteklediğini, sosyalleşmelerine çocukların saldırganlık duygusunun olumlu yönde kanalize edilmesini sağlamakta, olumlu benlik gelişimini desteklemektedir.
Ulusal Küçük Çocukların Eğitimi Örgütü (NAEYC -The National Association for the Education of Young Children), oyunu gelişime uygun etkinlikler olarak merkeze koymuştur. Buna göre oyun erken çocukluk eğitim programı içerisinde yer almamakta, programın uygulanmasını sağlayan en iyi yol olmaktadır (Early Childhood Funders, 2007). Böylelikle pek çok kurum ve araştırmacı çocukların yetenekleri ve okul başarıları için oyunu merkeze alarak çalışma yapmaktadır. Oyun, yüksek nitelikteki erken çocukluk eğitimi programlarının en önemli bileşenidir (Alliance for Childhood, 2007; NAEYC & NAECSSDE, 2003). Yine Senemoğlu (1994)' nun belirttiğine göre okul öncesi dönemde çocuklara beceriler kazandırabilmek için çocukların ihtiyaçlarına göre düzenlenecek, genellikle oyun yoluyla öğretimi vurgulayan, öğretme-öğrenme ortamlarına ihtiyaç bulunmaktadır.

Pekçok erken çocukluk eğitim programı oyunu merkeze almaktadır. Ülkemizde uygulanan okul öncesi eğitim programları da oyunu merkeze almaktadır. MEB 2013 okul öncesi eğitim programında oyun okul öncesi eğitimin temel ilkelerinden biri olarak yer almış ve oyunun önemi vurgulanmıştır. "*Oyun bu yaş grubundaki çocuklar için en uygun öğrenme yöntemidir. Bütün etkinlikler oyun temelli düzenlenmelidir, s.11".* Yine okul öncesi eğitim programının tanıtımı bölümünde programın oyun temelli olduğu belirtilmiş, "*Çocuk oyun aracılığıyla öğrenir, kendini ve içinde yaşadığı dünyayı oyunla tanır ve kendini en iyi oyun sırasında ifade eder, kritik düşünme becerilerini oyun içinde kazanır. Çocuğun dili oyundur; diğer bir deyişle oyun, çocuğun işidir. Programda kazanım ve göstergeler ele alınırken oyunun bir yöntem ve/veya etkinlik olarak kullanılması özellikle önerilmektedir. Oyun aracılığıyla öğrenme bu programın ve okul öncesi eğitiminin ayrılmaz parçası olarak görülmektedir, s.15.* Oyun ayrıca etkinlik türlerinden biri olarak belirtilmiş ve *"Çocukların oyun oynama gereksinimini karşılayabilmek için, günlük eğitim programı kapsamında farklı türlerde, farklı kazanımlara hizmet edecek çeşitli oyun oynama fırsatları sunmak önemlidir, s.47".* Programda öğretmenlerin farklı oyun türlerine yer vermeleri gerektiği vurgulanmıştır (MEB, 2013).

Öğretmenler oyun ile çocuklara pek çok kavramı öğretmektedirler. Bunun için öncelikle çocuklara alan, yeterli zaman ve materyal sağlamalıdırlar. Öğretmen çocukların oyunlarını çok iyi gözlemleyebilmeli ve çocukların oyunlarına katılabilmelidir (Jones, 2015). Çalışandemir (2002) yaptığı çalışmasında öğretmenlerin etkinlik olarak en yüksek düzeyde oyun etkinliklerine yerine getirdiklerini bulmuştur. Koçyiğit ve Baydilek (2015) yaptıkları çalışmada okul öncesi çocuklar okulda ne zaman, nerede ve ne oynanacağına karar veren kişinin okul öncesi öğretmeni olduğunu ifade etmişlerdir. Yine çocukların oyun süresinin öğretmen tarafından belirlendiğini ama bu durumdan hoşnut olmadıklarını belirtmişlerdir. Oyun yeri olarak dış mekanları öğretmenlerin çok tercih etmedikleri belirtilmiştir.

Oyun aynı zamanda bir öğretim yöntemidir. Erken çocukluk eğitimi öğretmenleri çocuklara yeni bilgi ya da kavramı nasıl öğretecekleri konusunda doğrudan anlatımlar yerine daha eğlenceli olan oyunu kullanarak daha etkili öğrenme ortamı oluşturabilmektedirler (Brewer, 2007). Erken çocukluk eğitim ortamlarının daha nitelikli hale gelebilmesi için öğretmenlerin erken çocukluk eğitim programını iyi bilmeleri ve programı uygulayabilmeleri için gerekli becerilere sahip olmaları gerekmektedir (Early Childhood Funders, 2007).
Yukarıda sayılan sebeplerden dolayı öğretmenlerin oyun etkinliklerindeki önemli bir rolü bulunmaktadır. Yapılmış olan bu çalışma, okul öncesi öğretmenlerinin sınıflarında uyguladıkları oyun yönteminin çeşitli değişkenlere göre nasıl değişiklik gösterdiğini belirlemek amacıyla planlanmıştır.

Yöntem

Araştırmanın Evreni ve Örneklemi

Araştırma betimsel bir çalışmadır. Araştırmanın evrenini okul öncesi öğretmeni olarak görev yapan öğretmenler oluşturmaktadır.

Araştırmanın örneklemini Balıkesir İl merkezinde kolay açısından seçilen okul öncesi öğretmeni olarak görev yapan 50 öğretmen oluşturmaktadır. Araştırmaya katılan öğretmenlerin hepsi (%100.0) kadındır. Öğretmenlerin %46.0'ı 49-60 ay ile, %38.0'ı 61-72 ay ile ve %16.0'ı 37-48 ay grubundaki çocuklarla çalışmaktadır. Öğretmenlerin %44.0'ı özel anaokulunda, %30.0'ı ilkokul bünyesinde yer alan resmi anaokulunda ve ve %26.0'ı MEB'e bağlı bağımsız anaokulunda çalışmaktadır. Öğretmenlerin %70.0'ı 0-5 yıl , %16.0'ı 6-10 yıl, %4'ü 11-15 yıl, %2'si 16-20 yıl, %6'sı 21-25 yıl ve %2.0'ı 26-30 yıl arasında anaokulunda çalışmaktadır. Öğretmenlerin %52.0'ı, 4 yıllık okul öncesi öğretmenliği, %22.0'ı 2 yıllık çocuk gelişimi, %10'u 4 yıllık çocuk gelişimi, %10'u kız meslek lisesi, %4'ü açıköğretim ve %2'si farklı alan mezunudur. Öğretmenlerin %76'sı 20-30 yaş aralığında, %16'sı 31-40 yaş aralığında, %6'sı 41-50 yaş aralığında ve %2'si 50 yaş ve üzeridir.

Veri Toplama Aracı

Çalışmada araştırmacılar tarafından geliştirilen "Oyun etkinliği uygulamaya yönelik öğretmen görüşme formu" kullanılmıştır. Bu formda yer alan oyun sınıflamaları alan yazın taraması yapılarak konu ile ilgili kaynaklardan yararlanılarak oluşturulmuştur (Pehlivan, 2005; Tüfekçioğlu, 2004; MEB, 2009; Durualp, & Aral, 2014). Bu formda birinci kısımda çalışılan yaş grubu, çalışılan okul türü, çalışma süresi, mezun olunan okul türü, yaş ve cinsiyet ile ilgili demografik bilgiler kısmı bulunmaktadır. Aracın ikinci kısmında öğretmenlerin oyun etkinliği uygulamalarına yönelik olarak 10 soru bulunmaktadır. Formdaki sorulardan 3 tanesi "evet-hayır" sorusu, 4 tanesi çoktan seçmeli ve 3 tanesi de açık uçlu sorulardır. Forma göre oyun türleri şu şekilde sınıflandırılmıştır:

Koşmaca Oyunları: Açık havada koşarak oynanan oyunlardır. Bu tür oyunlarda çocuklar koşar, kovalar, kaçar, yakalamaya çalışır saklambaç, köşe kapmaca vb

Taklit/Dramatizasyon Oyunları: İnsan, bitki, hayvan, doğa olayları ya da taşıta öykünerek yapılan oyunlardır. Evcilik, hayvan taklitleri vb

Halka Oyunları: Çocukların otururken ya da ayaktayken halka şeklinde durarak oynadıkları oyunlardır. Kutu kutu pense, mendil kapmaca vb

***Hareketli/Fiziksel Oyun*:** Tırmanma, sallanma, dengede durma, atlama gibi motor etkinlikleri kapsamaktadır.

Yapı-İnşa Oyunları: Nesneleri ve dili kullanarak, yeni ürünler oluşturma ve yapılandırmayı içeren oyunlar. Çocuklar kil, blok, atık nesne, kâğıt ve lego gibi oyun materyallerini farklı şekillerde kullanarak ürün oluşturma

Veri Toplama İşlemi

Araştırmada öğretmenler ile yüz yüze görüşülerek görüşmeyi kabul eden öğretmenler ile görüşme formu doldurulmuştur.

Verilerin Analizi ve Değerlendirilmesi
Toplanan veriler istatistik yazılım programına girilerek sonuçlarla ilgili betimsel tablolar oluşturulmuştur.

Bulgular

Tablo 1. Öğretmenlerin "sınıfınızda çocuklarla birlikte oyun oynuyor musunuz?" sorusuna verdikleri cevapların dağılımı

Yaş grubu	n	%
Evet	49	98.0
Hayır	1	2.0
TOPLAM	50	100.0

Tablo 1'de öğretmenlerin "sınıfınızda çocuklarla birlikte oyun oynuyor musunuz?" sorusuna verdikleri cevapların dağılımına bakıldığında % 98'i çocuklarla birlikte oyun oynadığını, %2'si oyun oynamadığını belirtmiştir.

Tablo 2. Öğretmenlerin "sınıfınızda ne tür oyunlar oynatıyorsunuz?" sorusuna verdikleri cevapların dağılımı

Oyun türü	Koşmaca oyunları		Taklit-dramatizasyon		Halka oyunları		Hareketli-fiziksel oyun		Yapı-inşa oyunları	
Oyun yeri	n	%	n	%	n	%	n	%	n	%
Sınıf dışında	26	52.0	1	2.0	6	12.0	13	26.0	5	10.0
Sınıf içinde	14	28.0	40	80.0	24	48.0	21	42.0	34	68.0
Hem sınıf içi hem sınıf dışı	9	18.0	9	18.0	17	34.0	15	30.0	8	16.0
Oynatmıyorum	1	2.0	0	0.0	3	6.0	1	2.0	3	6.0
TOPLAM	50	100.0	50	100.0	50	100.0	50	100.0	50	100.0

Öğretmenlerin koşmaca oyunlarını %52.0'nın sınıf dışında, %28.0'ının sınıf içinde ve %18.0'ının hem sınıf içinde hem de sınıf dışında oynattıkları görülmektedir. Taklit-dramatizasyon oyunlarını %80.0 'inin sınıf içinde, %18.0'ının hem sınıf içi hem de sınıf dışında ve %2.0'ının sınıf dışında oynattığı, halka oyunlarını %48.0 'inin sınıf içinde, %34.0'ının hem sınıf içi hem de sınıf dışında ve %12.0'ının sınıf dışında oynattığı saptanmıştır. Hareketli-fiziksel oyunları öğretmenlerin %42.0 'inin sınıf içinde, %30.0'ının hem sınıf içi hem de sınıf dışında ve %26.0'ının sınıf dışında oynattığı ve yapı inşa oyunlarını ise %68.0 'inin sınıf içinde, %16.0'ının hem sınıf içi hem de sınıf dışında ve %10.0'ının sınıf dışında oynattığı görülmektedir.

Tablo 3. Öğretmenlerin "sınıfınızda ne sıklıkla oyun oynatıyorsunuz?" sorusuna verdikleri cevapların dağılımı

Oyun türü	Koşmaca oyunları		Taklit-dramatizasyon		Halka oyunları		Hareketli-fiziksel oyun		Yapı-inşa oyunları	
Sıklık	n	%	n	%	n	%	n	%	n	%
Oynatmıyorum	2	4.0	1	2.0	1	2.0	1	2.0	3	6.0
Günde birkaç kez	5	10.0	5	10.0	1	2.0	8	16.0	7	14.0
Her gün 1 kez	24	48.0	12	24.0	17	34.0	21	42.0	22	44.0
Haftada 2-3 kez	13	26.0	25	50.0	29	58.0	15	30.0	10	20.0
Haftada bir kez	6	12.0	7	14.0	2	4.0	5	10.0	8	16.0
TOPLAM	50	100.0	50	100.0	50	100.0	50	100.0	50	100.0

Öğretmenlerin koşmaca oyunlarını oynatma sıklığı şu şekildedir: Her gün günde bir kez oynatan öğretmenlerin %48.0, haftada 2-3 kez oynatanların %26.0, haftada bir kez oynatanların %12, günde birkaç kez oynatanların %10.0 ve oynatmayanların oranının %4.0 olduğu görülmektedir. Taklit-dramatizasyon oyunlarını ise %50.0'ı haftada 2-3 kez oynattığı, %24.0'ı her gün bir kez oynattığı, %14.0'ı haftada bir kez oynattığı, %10.0'ı günde birkaç kez oynattığı ve oynatmayanların oranının %2.0 olduğu görülmektedir. Öğretmenlerin halka oyunlarını oynatma sıklıklarına bakıldığında %58.0'ının haftada 2-3 kez oynattığı, %34.0'ının her gün 1 kez oynattığı, %4.0'ının haftada 1 kez oynattığı, %2.0'ının günde birkaç kez oynattığı ve oynatmayanların oranının %2.0 olduğu görülmektedir. Hareketli-fiziksel oyunları oynatma sıklıkları ise; %42.0'ı her gün 1 kez, %30.0'ı haftada 2-3 kez, %16.0'ı günde birkaç kez, %10.0' ı haftada bir kez ve oynatmayanların oranının %2.0 olduğu görülmektedir. Son olarak yapı-inşa oyunlarını %44.0'ı her gün 1 kez, %20.0'ı haftada 2-3 kez, %16.0'ı haftada bir kez, %14.0'ı günde bir kez ve oynatmayanların oranının %6.0 olduğu görülmektedir.

Tablo 4. Öğretmenlerin "sınıfınızda oynan oyunların ortalama süresi (dakika) ne kadar?" sorusuna verdikleri cevapların dağılımı

Oyun türü	Koşmaca oyunları		Taklit-dramatizasyon		Halka oyunları		Hareketli-fiziksel oyun		Yapı-inşa oyunları	
süre	n	%	n	%	n	%	n	%	n	%
oynatmıyorum	1	2.0	0	0.0	1	2.0	2	4.0	4	8.0
0-5 dk	7	14.0	4	8.0	1	2.0	3	6.0	1	2.0
6-10 dk	13	26.0	18	36.0	6	12.0	6	12.0	10	20.0
11-15 dk	21	42.0	14	28.0	23	46.0	15	30.0	12	24.0
16-20 dk	4	8.0	8	16.0	15	30.0	17	34.0	9	18.0
21-25 dk	1	2.0	3	6.0	1	2.0	3	6.0	7	14.0
26-30 dk	2	4.0	2	4.0	2	4.0	2	4.0	6	12.0
30 dk ve üzeri	1	2.0	1	2.0	1	2.0	2	4.0	1	2.0
TOPLAM	50	100.0	50	100.0	50	100.0	50	100.0	50	100.0

Öğretmenlerin koşmaca oyunlarını en fazla sırasıyla 11-15 dk (%42.0), sonra 6-10 dk (26.0), ve 0-5 dk (%14.0) oynattıkları, taklit-dramatizasyon oyunlarını %36.0'ının 6-10 dk, %28.0'ının 11-15 dk, %16.0'ının 16-20 dk

oynattığı, halka oyunlarını %46.0'ı 11-15 dk, %30.0'ı 16-20 dk, %12.0'ı 6-10 dk oynattığı, yine hareketli-fiziksel oyunları %34.0'ının 16-20 dk, %30.0'ının 11-15 dk ve %12.0'ının 6-10 dk oynattığı, son olarak yapı-inşa oyunlarını %24.0'ı 11-15 dk, %20.0'ının 6-10 dk ve %18.0'ının 16-20 dk oynattığı görülmektedir.

Tablo 5. Öğretmenlerin "oyun etkinliği hazırlarken nelere dikkat ediyorsunuz?" sorusuna verdikleri cevapların dağılımı

Konular	Dikkate alma		Toplam	
	n	%	n	%
Oyun oynanacak alan	22	44.0	50	100.0
Çocukların yaşı	25	50.0	50	100.0
Çocukların ilgisi	36	72.0	50	100.0
Çocukların gelişim düzeyi	34	68.0	50	100.0
Çocukların dikkat süreleri	15	30.0	50	100.0
Aylık plan/kazanımlar	12	24.0	50	100.0
Güvenlik unsurları	8	16.0	50	100.0
Rekabet olmaması	2	4.0	50	100.0
Eğlenceli olması	11	22.0	50	100.0
Yarışma/rekabet olması	1	2.0	50	100.0

**Öğretmenlerden birden fazla madde söylemişlerdir.*

Öğretmenlerin oyun etkinliği hazırlarken dikkat ettikleri konular sırasıyla şu şekildedir: %72.0'ı çocukların ilgisine, %68.0'ı çocukların gelişim düzeyine, %50.0'ı çocukların yaşına, %44.0'ı oyun oynanacak alana, %30.0'ı çocukların dikkat sürelerine, %24.0'ı aylık plan/kazanımlara, %22.0'ı eğlenceli olmasına, %16.0'ı güvenlik unsurlarına ve %4.0' rekabet olmamasına dikkat ettiklerini belirtmişlerdir.

Tablo 6. Öğretmenlerin "oyun etkinliği planlarken özel araç/materyal hazırlıyor musunuz?" sorusuna verdikleri cevapların dağılımı

Cevap	n	%
evet	43	86.0
hayır	7	14.0
TOPLAM	50	100.0

Öğretmenlerin %86.0'ının oyun etkinliği planlarken özel araç/materyal hazırladığı, %14.0'ının hazırlamadığı belirlenmiştir.

Tablo 7. Öğretmenlerin "oyun etkinliği planlarken ne tür özel araç/materyal hazırlıyorsunuz?" sorusuna verdikleri cevapların dağılımı

Özel araç/materyal	Hazırlayanlar		Hazırlamayanlar		Toplam	
	n	%	n	%	n	%
Sanat materyali	26	52.0	24	48.0	50	100.0
Kavram materyalleri	27	54.0	23	46.0	50	100.0
Kostüm	22	44.0	28	56.0	50	100.0

**Öğretmenlerden birden fazla madde söylemişlerdir.*

Öğretmenlerin %52.0'ı etkinlikler için sanat materyali hazırladığı, %54.0'ının kavram materyali hazırladığı ve %44.0'ının kostüm hazırladığı görülmektedir.

Tablo 8. Öğretmenlerin "oyun etkinliği uygularken karşılaştığınız güçlükler nelerdir?" sorusuna verdikleri cevapların dağılımı

Karşılaşılan güçlükler	Güçlük yaşayanlar		Güçlük yaşamayanlar		Toplam	
	n	%	n	%	n	%
Hiçbir problem yaşamıyorum	**48**	**96.0**	**2**	**4.0**	50	100.0
Oyun oynanacak alanın darlığı/olmayışı	34	68.0	16	32.0	50	100.0
Materyal eksikliği	17	34.0	33	66.0	50	100.0
Çocukların gelişim düzeylerinin farklı olması	12	24.0	38	76.0	50	100.0
Çocukların sıkılması	11	22.0	39	78.0	50	100.0
Çocukların birbirleriyle çarpışması/zarar görmesi	3	6.0	47	94.0	50	100.0
Çocuk sayısının çok olması	17	34.0	33	66.0	50	100.0
Aile müdahalesi	1	2.0	49	98.0	50	100.0

Rekabete dayalı/yarışmalı oyunlarda çocuklar arasında sorun çıkması	3	6.0	47	94.0	50	100.0

**Öğretmenlerden birden fazla madde söylemişlerdir*

Öğretmenlerin "Oyun etkinliği uygularken karşılaştığınız güçlükler nelerdir?" sorusuna verdikleri cevapların dağılımı verilmiştir. Buna göre öğretmenlerin %96.0'ı güçlük yaşadıklarını belirtmişlerdir. Yaşadıkları güçlüklere bakılacak olursa; %68.0'ı oyun oynanacak alanın darlığı/olmayışı, %34.0'ı çocuk sayısının çok olması ve materyal eksikliği, %24.0'ı çocukların gelişim düzeylerinin farklı olması, %22.0'ı çocukların sıkılması, %6.0'ı çocukların birbirleriyle çarpışması/zarar görmesi ve rekabete dayalı/yarışmalı oyunlarda çocuklar arasında sorun çıkması ve %2.0'ı aile müdahalesi olması konusunda güçlük yaşadıklarını belirtmişlerdir.

Sonuç

Yapılmış olan bu çalışma, okul öncesi öğretmenlerinin sınıflarında uyguladıkları oyun yönteminin çeşitli değişkenlere göre nasıl değişiklik gösterdiğini belirlemek amacıyla planlanmıştır.
Buna göre öğretmenlerin tamamına yakınının çocuklarla birlikte oyun oynadığı saptanmıştır. Benzer olarak Alat, Akgümüş, Cavalı (2012) okul öncesi öğretmenlerin çoğunun çocuklarla birlikte etkinliklere, oyunlara katıldıklarını bulmuşlardır. Çalışandemir (2002) okul öncesi öğretmenlerinin etkinlik olarak en yüksek düzeyde oyun etkinliklerini yerine getirdiklerini bulmuştur. Yine Gömleksiz ve Serhatlıoğlu (2013) yaptıkları çalışmada okul öncesi öğretmenlerinin öğretme öğrenme sürecine, planlamaya, öğrenme ortamlarının düzenlenmesine ve sınıf yönetimine ilişkin öz-yeterlik inançlarını yüksek düzeyde gördüklerini bulmuşlardır.

Yapılan çalışmada, öğretmenlerin yaklaşık olarak yarısının koşmaca oyunlarını sınıf dışında, büyük çoğunluğunun taklit-dramatizasyon oyunlarını sınıf içinde oynattığı, yaklaşık olarak yarısının halka oyunlarını sınıf içinde, hareketli-fiziksel oyunları öğretmenlerin yarıya yakınının sınıf içinde, üçte birinin hem sınıf içi hem de sınıf dışında geriye kalanların sınıf dışında oynattığı ve yapı inşa oyunlarını büyük çoğunluğunun ise sınıf içinde oynattığı saptanmıştır. Clements (2004) yaptığı çalışmada büyük kentlerde çocukların oyunlarını dış mekanlara göre iç mekanlarda daha fazla gerçekleştirdiğini saptamıştır. Çocukların yeterince dış mekanlarda oyun oynamasının ebeveynlerin, öğretmen ve toplumun çözmesi gereken sorunlardan biri olduğunu belirtmiştir. Alat, Akgümüş, Cavalı (2012) okul öncesi öğretmenlerin açık hava etkinliklerinin çocuklar için olumlu yönde katkıları olduğunu bildiklerini ve imkân olduğu takdirde açık hava etkinliklerine daha sık yer verebileceklerini belirtiler. Öğretmenler hava şartları, fiziksel şartlar, güvenlik gibi koşullara bağlı olarak dış mekanları tercih ettiklerini belirtmişledir. Genellikle bahar geldiğinde bu etkinliklere yer verdiklerini belirtmişledir. Alan yetersizliğinin olması, özellikle ilköğretime bağlı okullarda okul öncesine ait özel bir bahçe olmaması, olanların da çok küçük olması dış mekan etkinliklerinin uygulanamaması için bir sebep olarak ortaya çıkmaktadır. Yine dışarıda oyun için gereken materyallerin ve ekipmanların olmaması da öğretmenlerin bu etkinlikleri yapamamalarına bir engel olarak dile getirilmiştir. Fiziksel koşulların yetersizliğinden dolayı öğretmenler çoğunlukla etkinlik olarak kurallı oyunları tercih etmektedirler. Benzer olarak Kadim (2012) yaptığı çalışmada araç-gereç yetersizlikleri, hem fiziki olanakları, hem de sınıf mevcutlarını göz önünde bulundurarak anasınıfı öğretmenleri oyun etkinlikleri yerine sanat, müzik ya da okuma-yazmaya hazırlık çalışmalarına yer verdiklerini bulmuştur.

Öğretmenlerin oyunları oynatma sıklığı şu şekildedir: yaklaşık yarısı koşmaca oyunlarını her gün günde bir kez oynatmakta, taklit-dramatizasyon oyunlarını ise haftada 2-3 kez oynattığı bulunmuştur. Öğretmenlerin yarıdan fazlası halka oyunlarını haftada 2-3 kez oynattığı, yaklaşık yarısının her gün 1 kez, hareketli-fiziksel oyunları ve yapı-inşa oyunlarını oynattığı bulunmuştur. Öğretmenlerin büyük çoğunluğunun oyunların her türünü çocuklara uyguladığı belirlenmiştir. Tuğrul, Aslan, Ertürk ve Altınkaynak (2014) yaptıkları araştırmada okul öncesi öğretmenlerinin vakit sıkıntısı, öğrenci sayısının fazla olması, kitap çalışmalarının çok zaman alması, programın yoğun olması, branş derslerinin fazla olması gibi nedenlerle de çocukların oyun gereksinimlerinin karşılanmadığını belirtmişlerdir. Yine Bower ve diğerleri (2008) yaptıkları çalışmada hareketli –fiziksel etkinliklerin okul çevresiyle ve taşınabilir ve taşınmaz oyun araçlar, dinlendirici çevre ve fiziksel –hareket eğitimi ile ilişkili olduğunu bulmuşlardır.

Öğretmenlerin oyun etkinliklerini uygulama süreleri ise yarıya yakınının koşmaca oyunlarını 11-15 dk oynattıkları, üçte biri taklit-dramatizasyon oyunlarını 6-10 dk, yarıya yakını halka oyunlarını 11-15 dk, oynattığı, yine üçte biri hareketli-fiziksel oyunları 16-20 dk, oynattığı, son olarak dörtte biri yapı-inşa oyunlarını 11-15 dk oynattığı bulunmuştur. Yine Çalışandemir (2002) okul öncesi öğretmenlerinin oyun etkinlikleri uygulama yeterlik düzeylerine göre % 19' unun bazen, % 59' sının çoğu zaman, % 22' sinin her zaman etkinlikleri yerine getirdiklerini bulmuştur. Ayrıca etkinlikleri hiçbir zaman yerine getirmeyen ve nadiren yerine getiren öğretmen olmadığını saptamıştır.

Öğretmenlerin oyun etkinliği hazırlarken dikkat ettikleri konular sırasıyla şu şekildedir: büyük çoğunluğu çocukların ilgisine ve çocukların gelişim düzeyine, yarısı çocukların yaşına, yarıya yakını oyun oynanacak alana, yaklaşık üçte biri çocukların dikkat sürelerine, dörtte biri aylık plan/kazanımlara, beşte biri eğlenceli olmasına, çok azı güvenlik unsurlarına ve rekabet olmamasına dikkat ettiklerini belirtmişlerdir. Araştırma sonuçlarına göre öğretmenlerin oyun etkinliği hazırlarken aylık planı ve güvenlik unsurlarını dikkate alma oranı düşüktür. Öncü ve Özbay (2005) okul öncesi dönemdeki çocuklar için oyun planlanırken; çocukların gelişim durumları, hazır bulunuşluk düzeyleri, ilgileri, dikkat süreleri, becerileri dikkate alınmalıdır. Bu nedenle etkinlikler çok uzun süreli ve karmaşık planlanmamalı, çocukları sıkmayacak şekilde hareket ve eğlence barındırması gerektiğini belirtmişledir. Çalışandemir (2002) ise öğretmenler oyun etkinliklerinde her şeyden önce çocuklara güvenli bir ortamı sağlamak durumunda olduğunu belirtmiştir.

Öğretmenlerin büyük çoğunluğu oyun etkinliği planlarken özel araç/materyal hazırladığını belirtmiştir. Öğretmenlerin genellikle etkinlikler için sanat, kavram materyali ve kostüm hazırladığı saptanmıştır. Öğretmenlerin tamamına yakınının oyun etkinliği uygularken güçlük yaşadıklarını belirtmişlerdir. Çoğunluğunun oyun oynanacak alanın darlığı/olmayışını güçlük olarak belirtmiştir. Yaşanılan diğer güçlükler; çocuk sayısının çok olması ve materyal eksikliği, çocukların gelişim düzeylerinin farklı olması, çocukların sıkılmasıdır. Öğretmenlerin çok azı çocukların birbirleriyle çarpışması/zarar görmesi ve rekabete dayalı/yarışmalı oyunlarda çocuklar arasında sorun çıkması ve aile müdahalesi olması konusunda güçlük yaşadıklarını belirtmişlerdir. Erdoğan ve Canbeldek (2015) yaptıkları çalışmada dili anlama ile ilgili malzemelerin anaokullarında yetersiz olduğu, okullarda kum ve su alanlarının yeteri kadar bulunmadığı, grup etkinliklerinin gerektiği gibi düzenlenmediği çevre ve eğitimsel düzenlemenin yapılmadığı, motor gelişimi ile ilgili etkinlikler az yeterli, sınıfların oldukça sınırlı olduklarını bulmuşlardır. Yine Alat, Akgümüş, Cavalı (2012) yaptıkları çalışmada öğretmenlerin açık hava etkinlikleri uygulamada yetersiz kaldıkları saptanmıştır. Öğretmenlerin fiziksel şartların yetersizliği, okul bahçelerinde güvenlik tedbirlerinin alınmamış oluşu, sınıfların kalabalık oluşu, çocukların açık havada hastalanacaklarına dair kaygılar taşımaları, velilerin olumsuz tepkileri gibi nedenlerle uygulamada açık hava etkinliklerine yeteri kadar yer veremediklerini saptamışlardır.

Öneriler

Erken çocukluk eğitim programları oyun temellidir. Bu nedenle öğretmenlerin sınıflarında nasıl ve ne şekilde oyun oynattıkları önemli bir konudur. Yapılan çalışma sonunda öğretmenler fiziksel alan ve materyal sıkıntısından bahsetmiştir. Clements (2004) belirttiğine göre dış mekanların güvenlik unsurları ve ebeveylerin çocuklarla oyun oynamak için zaman ayırma gibi engeller aşılmalıdır. Özellikle büyük şehirlerde çocukların hareketli oyun oynamaları için yeterli dış mekan alanı bulunmamaktadır. Çocuklar genellikle pasif oyunlar oynamaktadır. Okul öncesi eğitim ortamlarında fiziksel mekan darlığı sorunu ve dış mekan yetersizliği çözülmeli, çocukların rahatça koşup oynayabilecekleri öğrenme ortamları oluşturulmalıdır.

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PRE-SCHOOL TEACHERS' OPINIONS ON OUTDOOR ACTIVITIES

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Abstract: Outdoor activities in pre-school teaching take part in activities that affect children's cognitive, physical, social and emotional development. They emphasize children's daily life experience and support the development of their creativity. Outdoor activities enable children to explore the surrounding areas by doing and experiencing through the senses (Alat, Akgümüş & Cavalı, 2012). It is suggested to use out-of-class places in the pre-school teaching program of the Ministry of National Education (MEB, 2013). This study was conducted to examine the opinions of pre-school teachers on outdoor activities that are important for all developmental areas of children. The study was conducted with 25 pre-school teachers working in pre-schools and kindergartens in İzmir which based on the Ministry of National Education in 2016-2017 academic year. In this study, where qualitative research method is used, semi-structured interview form developed by researchers was used as data collection tool. The data obtained from the interviews with the teachers were coded by the two researches and the intercoder reliability was provided and preschool teachers' views on outdoor education were examined. As a result of the analysis of the obtained data, views of pre-school teachers on outdoor education were revealed.

Keywords: Outdoor, pre-school teacher, pre-school teaching

OKUL ÖNCESİ ÖĞRETMENLERİN AÇIK ALAN EĞİTİMLERİNE YÖNELİK GÖRÜŞLERİNİN İNCELENMESİ

Özet: Okul öncesi eğitiminde açık alan etkinlikleri çocukların bilişsel, fiziksel, sosyal ve duygusal gelişimlerini etkileyen etkinlikler içerisinde yer alır. Çocukların günlük yaşam deneyimlerine vurgu yapar ve yaratıcılıklarının gelişmesini destekler. Açık alanlarda yapılan etkinlikler çocukların duyu organları aracılığı ile yaparak ve yaşayarak etrafındakileri keşfetme olanağı sağlar (Alat, Akgümüş & Cavalı, 2012). Milli Eğitim Bakanlığı Okul Öncesi Eğitim Programında da sınıf dışı mekânların kullanılması önerilmektedir (MEB, 2013). Bu çalışma okul öncesi öğretmenlerinin çocukların tüm gelişim alanları için önemli olan açık alan etkinliklerine yönelik görüşlerini incelemek amacıyla yapılmıştır. Çalışma 2016-2017 öğretim yılında İzmir ilinde Milli Eğitim Bakanlığına bağlı anaokulları ve anasınıflarında görev yapan 25 okul öncesi öğretmeni ile gerçekleştirilmiştir. Nitel araştırma yönteminin kullanıldığı bu çalışmada veri toplama aracı olarak araştırmacılar tarafından geliştirilen yarı yapılandırılmış görüşme formu kullanılmıştır. Öğretmenlerle gerçekleştirilen görüşmelerden elde edilen veriler iki araştırmacı tarafından kodlanarak kodlayıcı güvenirliği sağlanmış ve okul öncesi öğretmenlerin açık alan eğitimlerine yönelik görüşleri incelenmiştir. Elde edilen verilerin analizi sonucunda okul öncesi öğretmenlerinin açık alan eğitimleri konusunda görüşleri ortaya konulmuştur.

Anahtar Sözcükler: Açık alan, okul öncesi öğretmeni, okul öncesi eğitimi

Giriş

Açık alan etkinlikleri, öğretmen ve öğrencinin sınıf ortamının kısıtlamalarından uzak özgürce etkileşime girmelerini sağlayan; bireyin hem kendisine hem de sosyal, akademik ve çevreye ilişkin bilgi, beceri ve tutumlarının gelişmesi için çeşitli fırsatlar sunan öğrenme sürecidir (Ford,1981; Perry, 2001). Montessori, Piaget, Rousseau ve Frobel gibi ünlü eğitimciler hareketi davranışla birlikte ele almışlar ve erken çocuklukta açık alan

etkinliklerinin gelişime katkısını vurgulamışlardır (Bilton, 2010; Ouvry, 2003). Konu ile ilgili yapılan araştırmalar, doğal alanların çocukları zihinsel ve fiziksel aktivitelere daha çok teşvik ettiği ve onların daha cesaretli bireyler olmasını sağladığını ortaya koymaktadır (Moore, 1986). Sınıf dışı ortamlarla bütünleştirilerek gerçekleştirilen eğitimlerin özellikle erken çocukluk döneminden itibaren, çocukların bilişsel, sosyal, duygusal, fiziksel - motor gelişimlerine katkı sağladığı bilinmektedir (Adhemar, 2000; Fjorfort, 2001; Herrington & Studtmann, 1988; Kaplan, 1995; White, 2004, Civelek, 2016; Yıldırım & Özyılmaz, 2017).

Son yıllarda Kuzey Avrupa ülkelerinde açık alanda yapılan eğitimlerin oldukça yaygınlaştığı görülmektedir. Açık alanda gerçekleştirilen eğitimler çocuğa dış dünyayı görerek, yaşayarak öğrenme olanağı sunar. Özelikle büyük kentlerdeki çocuklar kapalı mekânlarda doğadan kopuk bir şekilde büyümektedirler. Merkezlerdeki çarpık ve plansız yapılaşma gibi çeşitli kentsel sorunlarla birlikte park, oyun alanı, orman gibi çeşitli alanların oldukça azalmasından dolayı çoğu çocuklar, zamanlarının büyük kısmını iç mekânlarda geçirerek toplum ve doğa ile çok az etkileşim kurabilmektedirler (Başal, 2005). İskandinavya'da 3-6 yaş çocuklarının gittikleri okulların eğitiminin büyük bir bölümü, soğuk havaya rağmen doğada gerçekleştirilmektedir. Bu okullarda eğitim gören çocukların daha yaratıcı, motor beceriler açısından daha becerikli olduğu ve okullarda hastalıklara bağlı devamsızlıklarda azalma olduğu tespit edilmiştir (Fjortoft, 2001). Ayrıca birçok çalışmada obezitenin önlenmesi açısından da küçük yaştan itibaren açık alan faaliyetlerinin önemi vurgulanmaktadır.

Okul öncesi eğitim programının bütün gelişim alanlarına hitap etmesi; okul öncesi öğretmenlerinin çocukların gelişimi ve eğitimi için etkili açık hava eğitimleri yaratmaları gerektiğini ortaya koymaktadır (White, 2004). Öğretmenler açık alanda çeşitli ortamlar yaratarak çocukların bu ortamlardan etkin bir şekilde faydalanmalarına yardımcı olabilirler (Doğan, 2007; Haktanır, 2007). Okul öncesi programında da (MEB, 2013) önerilen açık alan etkinliklerinin etkili ve verimli kullanılabilmesi öğretmen faktörüyle doğrudan ilişkilidir. Bu nedenle araştırmada okul öncesi öğretmenlerinin açık alan etkinliklerine yönelik görüşlerinin belirlenmesi önemlidir.

Bu çalışmada okul öncesi öğretmenlerin açık alan eğitimlerine yönelik görüşlerinin ortaya çıkarılması amaçlanmıştır. Araştırmada şu sorulara cevap aranmıştır:

- Açık alan etkinlikleri denilince aklınıza neler geliyor?
- Açık alan etkinliklerine öğretim sürecinizde yer veriyor musunuz?
- Açık alan etkinliklerinin avantajları size göre nelerdir?
- Açık alan etkinliklerinin dezavantajları size göre nelerdir?
- Açık alan etkinliklerinizde çoğunlukla hangi mekânları kullanıyorsunuz?
- Açık alan etkinliklerini uygulamada ne tür engellerle karşılaşıyorsunuz?
- Hangi tür etkinliklerin açık alana uygun olduğunu düşünüyorsunuz?

Yöntem

Bu çalışmada katılımcıların görüşlerini tespit etmek amacıyla nitel araştırma yöntemi kullanılmıştır. Nitel araştırma, incelenen olguya ilişkin olarak katılımcıların yaşantılarındaki gündelik ve sorunlu anların ve anlamlandırmaların daha detaylı incelenmesine imkân verir (Denzin & Lincoln, 1998). Çalışmada görüşme tekniği kullanılmış ve araştırmacılar tarafından geliştirilen yarı yapılandırılmış görüşme formu ile açık alan etkinlerine yönelik görüşler belirlenmeye çalışılmıştır.

Katılımcılar

Araştırmanın çalışma grubunu 2016-2017 yılında İzmir ili Buca İlçesinde resmi okul öncesi eğitim kurumlarında görev yapan yarı yapılandırılmış görüşme sorularını cevaplandırmaya gönüllü 25 okul öncesi öğretmeni oluşturmaktadır. Öğretmenlerin 23'ü kadın 2'si erkektir. Öğretmenlerin 12 tanesi İzmir ili Buca ilçesinde yer alan resmi bağımsız anaokulunda görev yapmaktayken 13 tanesi de temel eğitim kurumlarında bulunan anasınıflarında görev yapmaktadır.

Verilerin Analizi

Elde edilen veriler, incelenerek benzerlik ve farklılıklarına göre gruplandırılmıştır. Birbiriyle ilişkili olan kodlar bir araya getirilerek tematik kodlama yapılmıştır (Yıldırım ve Şimşek, 2006). Elde edilen kodların etkili bir şekilde oluşturulup oluşturulmadığının incelenmesi için (Creswell, 1998) oluşturulan kodlar, bir program geliştirme ve okul öncesi eğitimi konusunda iki uzmanın görüşü doğrultusunda değerlendirilerek gerekli

düzenlemeler yapılmıştır. Güvenirlik kapsamında, öğretmen görüşme metinleri araştırmacılar tarafından ayrı ayrı analiz edilmiş, kodlayıcılar arasındaki güvenirlik hesaplanarak uyuşma oranı 0.84 olarak bulunmuştur.

Bulgular

Okul öncesi öğretmenlerin yarı yapılandırılmış görüşme sorularına verdikleri cevaplar gruplandırıldıktan sonra tematik kodlama yapılmış ve veriler aşağıda tablolar halinde sunulmuştur.

Tablo 1. Öğretmelerin açık alan eğitimi denildiğinde düşündükleri etkinliklere ilişkin görüşler

Görüş	Sayı	%	Görüş
Bahçede ve parkta oynanan etkinlikler	9	%36	11 no'lu öğretmen "Okul bahçesi, oyun parkı gibi sınıf içerisinde olmayan tüm faaliyetleri kapsar."
Doğada yaşanan olayların gözlenmesi	9	%36	21 no'lu öğretmen "Doğada yaşanan olayların gözlenmesi ve etkinliklerde kullanılmasıdır".
Oyun oynama amacıyla	9	%36	4 no'lu öğretmen "Çocuklar için üst düzey güvenlik önlemlerinin ön planda olduğu tüm gelişim alanlarını daha rahat ortamlarda destekleyebildiğimiz kurallı ve kuralsız oyunların oynanabilmesine olanak sağlayan ortamlardır."
Açık hava etkinlikleri	8	%32	12 no'lu öğretmen "Açık havada yapılan ve hatta mümkünse doğayla iç içe olan, aklınıza gelebilecek neredeyse her türlü kazanım için yapılabilecek tüm etkinliklerdir."
Doğa ve alan gezileri	6	%24	16 no'lu öğretmen "Alan gezileri aklıma geliyor".
Dans, yarışma etkinlikleri	3	%12	6 no'lu öğretmen "Müzik ve dans, yarışmalardır"
Psikomotor alana yönelik etkinlikler	3	%12	9 no'lu öğretmen "Açık havada özellikle psikomotor alana yönelik oyun etkinliklerini kapsayan etkinliklerdir."
Bahçede ekim dikim işleri	1	%4	5 no'lu öğretmen "Okul bahçesinde yapılan inceleme gezileri, eko bahçenin ekimi, dikimi ve bitkilerin büyümesinin gözlenmesi gibi etkinlikler aklıma geliyor."

Tablo 1 incelendiğinde öğretmenler açık alan eğitimi denildiğinde dokuz öğretmen "Bahçede ve parkta oynanan oyunlar, doğada yaşanan olayların gözlenmesi ve oyun oynama amacıyla yapılan etkinlikleri" düşünmektedirler. Bu sıralamayı sekiz öğretmen ile "Açık havada yapılan etkinlikler ve alan gezileri" takip etmektedir. Üç öğretmen "Dans, yarışma etkinlikleri ve psiko-motor alana yönelik etkinlikler" cevabını vermiştir. Bir öğretmen ise açık alan eğitimleri denilince "Bahçede ekim dikim işlerini" düşündüğünü belirtmiştir.

Tablo 2. Öğretmenlerin açık alanda ne tür etkinliklere yer verdiklerine ilişkin görüşleri

Soru	Sayı	%	Görüş
Fen Etkinlikleri	15	%60	21 no'lu öğretmen: "Doğada yaşanan değişiklikleri etkinliklere dâhil ediyoruz. Bitki yetiştirme, ekimi çalışmaları yapıyoruz."
Oyun Etkinlikleri	15	%60	8 no'lu öğretmen: "Survivor oynuyoruz (mandal oyunu, pipetle hafif materyal üfleyerek varış yerine ulaşmak, yakan top)."
Psikomotor Etkinlikler	8	%32	7 no'lu öğretmen: "Yer veriyorum. Psikomotor açıdan destekleyici koşma, zıplama, yürümeyi barındıran hareket etkinliklerine yer veriyorum."

Tablo 2 incelendiğinde açık alanda 15 öğretmenin fen etkinlikleri, doğayı gözleme, bitki yetiştirme ve ekim dikim çalışmaları, deney etkinlikleri yaptırdıkları görülmektedir. Ayrıca 15 öğretmenin açık alanda park oyunları, kum havuzu oyunları, kurallı-kuralsız oyunlar gibi etkinlikler yaptırdıkları gözlenmektedir. Sekiz öğretmen açık alanda psikomotor etkinlikler yaptırdıklarını ifade etmişlerdir.

Tablo 3. Öğretmenlerin açık alan etkinliklerinin avantajlarına ilişkin görüşleri

Soru	Sayı	%	Görüş
Açık alanda çocukların sağlık açısından faydalı etkinlikler yapmaları	12	%48	13 no'lu öğretmen: "Açık hava ve güneşten yararlanmalarını enerjilerini atmalarını sağlıyor."
Çocuğa özgürlük sağlaması	11	%44	2 no'lu öğretmen: "Çocuklar kısıtlı bir alanda sıkılmak yerine özgürce derse katılmaktadır."
Yaparak, yaşayarak öğrenme sağlanması	8	%32	12 no'lu öğretmen: "En kaba haliyle yaparak, yaşayarak öğrenme en kalıcı öğrenmedir bence. Dolayısıyla herhangi bir kavramı masa başında oturup, kâğıt üzerinde ya da izleyerek öğrenmek yerine etkinliğin merkezinde olup, yaşayarak öğrenmek çocukları hem çok mutlu ediyor hem de öğrenme çok daha kalıcı oluyor."
Açık alanda yapılan çalışmaların çocukları daha istekli hale getirmesi	5	%25	5 no'lu öğretmen: "Çocuklar açık alanda etkinlik yaptıklarında mutlu oluyorlar. Sınıfa döndüklerinde gün içindeki etkinliklere katılımları daha aktif oluyor ve dikkatlerini daha uzun süre yoğunlaştırdıklarını gözlemliyorum."
Psikomotor becerilerin geliştirilmesi	4	%16	9 no'lu öğretmen: "Alanın daha geniş olmasından ötürü fiziksel gelişimlerine yardımcı olacak etkinliklerin daha rahat yapılmasına olanak verir."
Yaratıcılıklarının gelişmesi	3	%12	7 no'lu öğretmen: "Yaratıcılıklarının gelişmesine katkı sağlar. Merak duyguları uyanır."
Çevre bilincinin gelişmesi	3	%12	23 no'lu öğretmen: "Doğayla iç-içe olmaları çevre bilinci kazanmalarına yardım eder.

Tablo 3 incelendiğinde 12 öğretmen açık alan etkinliklerinin avantajlarına ilişkin düşüncelerinde çocukların sağlık açısından faydalı etkinlikler yapmasını avantaj olarak gördüklerini belirtmişlerdir. Öğretmenler verdikleri cevaplarda açık alanda çocukların temiz hava aldıkları ve güneşten faydalandıklarını eklemişlerdir. 11 öğretmen açık alanda çocukların kendilerini daha özgür hissettiklerini ve hareketlerinde de özgür olabildiklerini belirtmiştir. Sekiz öğretmen çocukların açık alanda daha aktif olduklarını, yaparak yaşayarak öğrenerek bu sayede öğrenmenin daha kalıcı olmasını avantaj olarak belirtmişlerdir. Beş öğretmen çocukların açık alanda daha mutlu olduklarını bu sebeple daha motive olduklarını ve sınıfa geri döndüklerinde çalışmalara daha istekli katıldıklarını belirtmişlerdir. Dört öğretmen çocukların fiziksel gelişimlerine yardımcı olacak etkinliklerin daha rahat yapılabilmesi sayesinde psikomotor becerilerin geliştirilmesini, üç öğretmen açık alanın merak duygularını uyandırması sebebiyle yaratıcılıklarının gelişmesini ve doğayla iç içe olmanın çevre bilincini geliştirmesini de açık alan etkinliklerinin avantajları arasında gördüklerini belirtmişlerdir.

Tablo 4. Öğretmenlerin açık alan etkinliklerinin dezavantajlarına ilişkin görüşleri

Soru	Sayı	%	Görüş
Olası kaza ve tehlikeler	13	%52	18 no'lu öğretmen "Çocuklar hareketli oyunlar sırasında düşüp bir yerini yaralayabiliyor."
Sınıf kontrolü güçlüğü	13	%52	6 no'lu öğretmen: "Alanın geniş olması kontrolü sağlamada güçlük çekilmesine neden olabiliyor."
Çocukların odaklanma güçlüğü	7	%28	9 no'lu öğretmen: "Çocukların dikkatini dağıtacak birçok faktör olduğundan dikkatlerini etkinlik üzerinde yoğunlaştırmakta zorlanabilirler."
Veliler ile ilgili sorunlar	3	%12	8 no'lu öğretmen: "Çocuklar hasta olduğunda veliler açık hava etkinliklerini sorumlu tutuyor."
Dezanavantajı olduğunu düşünmüyorum	2	%8	13 no'lu öğretmen: Herhangi bir dezavantajı olduğunu düşünmüyorum."

Tablo 4 incelendiğinde 13 öğretmen açık alan etkinlikleri sırasında yaşanan kazaları ve sınıfı kontrol etmenin zor olmasını açık alan etkinliklerinin dezavantajları olarak gördükleri anlaşılmaktadır. Öğretmenler çocukların açık alanda hareketli oyunlar sırasında düşüp kaza yaşayabildiklerini belirtmektedirler. Ayrıca 13 öğretmen verdikleri

cevaplarda alanın geniş olması ve yardımcı eleman olmaması nedeniyle de açık alanda sınıfı kontrol etmenin güçlüğünden yakınmaktadırlar. Yedi öğretmen açık alanda dikkat çeken uyarıcıların fazla olması nedeniyle çocukların o an yapılan etkinlik üzerine odaklanmalarının zorlaştığını belirtmiştir. Üç öğretmen ise açık alan etkinliklerini uygularken veliler ile sıkıntı yaşadığını belirtmiştir. Çocuklar hastalandığında velilerin açık alan etkinliklerini sorumlu tuttuklarını, velilerin çocuklarının terlememelerini, üşümemelerini istediklerini cevaplarına eklemişlerdir. İki öğretmen ise açık alan etkinliklerinin dezavantajı olduğunu düşünmemektedir.

Tablo 5. Öğretmenlerin açık alan etkinliklerinde kullandıkları mekânlar

Soru	Sayı	Yüzde	Görüş
Okul bahçesi	22	%88	8 no'lu öğretmen: "Okul bahçemiz çok büyük, açık alan etkinlikleri için yeterli oluyor."
Park	12	%48	11 no'lu öğretmen: "Oyun parkını ve yumuşak zemin olan yerleri kullanıyorum."
Gezi alanları	7	%28	16 no'lu öğretmen: "Uygun gezi alanları (botanik bahçesi, hayvanat bahçesi, piknik alanları vb.)
Kum havuzu	2	%8	5 no'lu öğretmen: "Okulumuzda bulunan kum havuzunu ihtiyaç doğrultusunda kullanıyorum."

Tablo 5 incelendiğinde açık alan etkinliklerini uygulamada 22 öğretmenin bahçeleri tercih ettikleri görülmektedir. 12 öğretmen de açık alan etkinlikleri sırasında oyun parklarını tercih ettiklerini belirtmişlerdir. Yedi öğretmen açık alan etkinliklerini gezi alanlarında gerçekleştirdiğini, iki öğretmen de okuldaki kum havuzunu kullandığını belirtmiştir.

Tablo 6. Öğretmenlerin açık alan etkinliklerini uygulamada ne tür zorluklarla karşılaştıklarına ilişkin görüşleri

Soru	Sayı	%	Görüş
Hava şartlarının elverişsizliği	9	%36	6 no'lu öğretmen: "En önemli engel hava şartları oluyor. Soğuk havada da çıkamıyoruz, çok sıcak havada da çıkamıyoruz."
Kalabalık sınıf mevcudu ve sınıf kontrolü zorluğu	7	%28	16 no'lu öğretmen: "Sınıf mevcudu sayısının fazla olması kontrolü zorlaştırıyor."
Uygun fiziki ortamın olmaması	7	%28	3 no'lu öğretmen: "Okul bahçesini diğer sınıflar dersteyken kullanabiliyoruz. Bu alanda oynadığımız oyunlar için gerekli malzemeleri de kendimiz temin ediyoruz.
Veli şikâyetleri	6	%24	10 no'lu öğretmen: "Velilerden gelen çocuğum terledi, üşüttü, hastalandı gibi şikâyetler."
Kazalar	3	%12	8 no'lu öğretmen: "Yaşları küçük olduğu için kendilerini korumakta güçlük çekiyorlar büyük kazalarla karşılaşabiliyoruz."
Engel ile karşılaşmıyorum	7	%28	11 no'lu öğretmen: "Hayır, karşılaşmıyorum."

Tablo 6 incelendiğinde öğretmenlerin açık alan etkinliklerini uygularken hava şartlarının elverişsizliği ile karşılaştıkları görülmektedir. Dokuz öğretmen çocukları sıcak havada da soğuk havada da dışarı çıkaramadıklarını belirtmişlerdir. Ayrıca kalabalık sınıf mevcutları sebebiyle açık alan etkinlikleri sırasında oldukça zorlandıklarını cevaplarına eklemişlerdir. Yedi öğretmen sınıf mevcutlarının kalabalık olması ile birlikte yardımcı eleman da olmadığı için uygulamada oldukça güçlük çektiklerini belirtmişlerdir. Yedi öğretmen açık alan etkinliklerini uygulamak için uygun fiziki ortamı bulamadıklarından yakınmaktadır. Bu öğretmenler okul bahçelerini ancak diğer sınıflar derste iken kullanabildiklerini, okul bahçelerinde yeterince güvenlik önlemlerinin alınmadığını, malzemeler konusunda sıkıntılar yaşadıklarını cevaplarına eklemişlerdir. Veliler ile yaşanan problemler de öğretmenlerin açık alan etkinliklerini uygulamalarında engel oluşturmaktadır. Altı öğretmen, velilerin çocuklarının hastalanması, üşümesi, terlemesi, mikrop kapması konusunda çok endişeli olduklarını bu nedenle açık alan etkinliklerini uygulama konusunda sınırlandırıldıklarını belirtmişlerdir. Üç öğretmen yaş grubunun küçük olması nedeniyle çocukların kendilerini korumakta güçlük çekmeleri ile birlikte sınıf kontrol güçlüğü kazalara sebep olduğunu bu nedenle de açık alan etkinliklerini uygulamaktan kaçındığını belirtmiştir.

Bahsedilen engelleri belirten öğretmenlerin yanında yedi öğretmen ise açık alan etkinliklerini uygulamada bir engel ile karşılaşmadığını belirtmiştir.

Tablo 7.Öğretmenlerin okul öncesi programının açık alan etkinliklerine uygunluğuna ilişkin görüşleri

Soru	Sayı	%	Görüş
Tüm alanlara uygun	7	%28	15 no'lu öğretmen: "Öğretmenin tecrübe, kontrol ve idaresine bağlı olarak tüm etkinliklerin açık alan eğitimine uygun olduğunu düşünüyorum."
Fen etkinlikleri	9	%36	21 no'lu öğretmen: "Fen ve doğa etkinliği, gözlem ve bitki yetiştirip dikme olarak."
Hareket etkinlikleri	9	%36	11 no'lu öğretmen: "Hareket etkinliklerinin açık alan eğitimine uygun olduğunu düşünüyorum."
Müzik etkinlikleri	7	%28	3 no'lu öğretmen: "Müzik etkinliklerinde ritmik becerileri hem sayı sayarak bilişsel alanla hem de her ritimde zıplayarak açık alanda hareket erkinliklerine adapte edilebilir."
Matematik etkinlikleri	6	%24	21 no'lu öğretmen: "Matematik etkinliğinde doğada toplanan materyaller kullanılabilir."
Drama etkinlikleri	5	%20	6 no'lu öğretmen: "Drama etkinliği yaparken kullanıyorum".
Oyun etkinlikleri	4	%16	2 no'lu öğretmen: "Oyun etkinliklerinin açık alan eğitimine uygun olduğunu düşünüyorum."
Türkçe etkinlikleri	3	%12	23 no'lu öğretmen: "Türkçe etkinliklerinde hikâye okuma çalışmalarında açık alanları kullanabiliriz."
Sanat etkinlikleri	2	%8	5 no'lu öğretmen: "Sanat etkinliklerinin açık alan eğitimine uygun olduğunu düşünüyorum.

Tablo 7 incelendiğinde öğretmenlerin daha çok fen ve hareket etkinliklerini açık alan etkinliklerine uygun gördükleri görülmektedir. Dokuz öğretmen fen etkinliklerini, dokuz öğretmen hareket etkinliklerini uygularken sınıf dışı mekânları kullandıklarını belirtmişlerdir. Fen etkinlikleri doğa gözlemi, bitki dikme, yetiştirme, deney etkinliklerini içermektedir. Yedi öğretmen ritmik becerileri hareket etkinlikleri ile birleştirerek müzik etkinliklerinin açık alana uygun olduğu düşüncesindedirler. Altı öğretmen matematik etkinliklerinde doğada toplanan materyallerle sayma, gruplama, sıralama çalışmaları yaptıklarını ifade etmişlerdir. Beş öğretmen drama, dört öğretmen oyun, üç öğretmen Türkçe ve iki öğretmen sanat etkinliklerinin açık alan etkinliklerine uygun olduğunu belirtmiştir.

Tartışma

Okul öncesi öğretmenlerin açık alan eğitimlerine yönelik görüşlerinin araştırıldığı bu çalışmada öğretmenlerin açık alan etkinliklerinden bahçede ve parkta oynanan oyunları, doğada yaşanan olayların gözlenmesini anladıkları sonucuna ulaşılmıştır. Öğretmenler genellikle açık alanları bir öğrenme ortamı olarak değil daha çok bedensel etkinlikleri kullanma alanı olarak algılamaktadırlar. Genellikle açık alan etkinlikleri, okulöncesi öğretmenleri tarafından psikomotor etkinliklerin yapılabildiği ve bazı fen etkinliklerinin gerçekleştirildiği ortamlar olarak düşünmektedirler.

Çalışmada öğretmenlerinin genellikle açık alan eğitimlerine ilişkin olumlu düşünceler taşıdıkları fakat uygulamada bazı engeller ile karşılaştıkları belirlenmiştir. Literatür incelendiğinde benzer sonuçların ortaya çıktığı görülmüştür. Waite (2010) ve Wilson (2008) tarafından yapılan çalışmada, öğretmenlerin açık alan etkinliklerini çocukların bilişsel ve fiziksel gelişimleri açısından faydalı bulduklarını fakat çeşitli engellerden dolayı açık alan etkinliklerini yeterince uygulayamadıklarını ortaya koymuştur. Maynard ve Waters (2007) çalışmalarında da katılımcılar açık alan etkinliklerini, hava koşulları, fiziksel şartların yetersizliği sınıf mevcudunun kalabalık olması, yardımcı elemanın olmayışı, veli ile ilgili sorunlar nedeniyle uygulamada zorluk çekildiğini belirtmektedirler. Okul öncesi kurumlarda yapılan araştırmalar, öğretim programı yetersizliği ve donanım eksikliğinin yanı sıra öğretmenlerin açık alan eğitimi ile ilgili yeterli donanıma sahip olmamaları nedeniyle bu etkinliklere yeterince yer veremedikleri ya da verseler bile bu etkinlikleri yeterince etkin bir şekilde gerçekleştiremediklerini, bu nedenle de çocuklara yeterince katkı sağlamadığını göstermiştir (Bilton, 2010; Wilson, 2008).

Alat, Akgümüş, Cavalı (2012) çalışmalarında okul öncesi öğretmenlerinin açık alan etkinliklerine yönelik genel olarak olumlu düşünceler taşıdıkları ancak bu etkinlikleri uygulamada yetersiz kaldıkları saptanmıştır. Bu çalışmada ve benzer araştırmalarda da saptandığı üzere (Clements, 2004, Maynard & Waters, 2007, Valentine & McKendrick 1997; Wilson 2008) hava şartları ve sağlık endişelerinin yanı sıra aileler ve öğretmenler güvenlik konusunda da bir takım endişelere sahiptirler.

Çalışmada öğretmenler açık alan etkinliklerinin programda pek çok etkinlikte uygulanabileceğini belirtmişlerdir. Benzer şekilde Alat vd. (2012) de açık alan etkinliklerinin öğretim programının esnekliği sayesinde planlara eklenebileceğini önermişlerdir. MEB 2013 Okul öncesi programı incelendiğinde programın açık alan etkinlikleri için çok uygun olduğu ayrıca programda öğretmenlere açık alan uygulamaların önerildiği görülmektedir.

Çalışma genel olarak değerlendirildiğinde öğretmenlerin açık alan etkinliklerine olumlu yaklaşımları olduğu halde bunu uygulamaya aktaramadıkları görülmektedir. Bunun nedeninin kalabalık sınıflarda sınıfın kontrol edilmesinin güçlüğü, birçok okulun açık alan konusunda yeterli alana sahip olmayışı ve velilerin açık alan etkinliklerine kuşku ile bakmaları olarak düşünülmektedir.

Sonuç

Çalışmada aşağıdaki sonuçlara ulaşılmıştır:

- Okul öncesi öğretmenleri açık alan etkinliklerini daha çok park ve bahçede oynanan etkinlikler, doğada yapılan gözlemler ve açık hava etkinlikleri olarak düşünmektedirler.
- Öğretmenler genellikler açık alan etkinliklerinde fen ve hareket etkinliklerine ağırlık vermektedirler.
- Öğretmenler, açık alan etkinliklerini çocuğun sağlığı açısından faydalı bulmakta ve çocuğa özgürlük sağladığını düşünmektedirler.
- Öğretmenler açık alan etkinliklerinin kazalara sebep olması ve sınıfı kontrol etmede güçlükler yaşanması gibi dezavantajları olduğunu belirtmişlerdir.
- Öğretmenler açık alan etkinliklerini uygularken en çok okul bahçesi ve park alanlarını tercih etmektedirler.
- Öğretmenler, açık alan etkinliklerini uygularken birtakım engellerle karşılaşmaktadırlar. Özellikle hava şartlarının elverişsizliği, sınıfların kalabalık olması sebebiyle sınıf kontrolü zorluğu ve veliler ile yaşanan problemler en çok karşılaşılan engellerdir.

Öneriler

Çalışma sonuçlarına göre aşağıda bazı öneriler sunulmuştur:

- Açık alan etkinlikleri hakkında uzman kişiler tarafından okul öncesi öğretmenlerine hizmet öncesi ve hizmet içi eğitimler verilebilir.
- Açık alan etkinliklerinin verimli ve güvenli bir şekilde uygulanabilmesi için okul öncesi eğitim kurumlarına fiziksel koşullar açısından uluslararası standartlar getirilmelidir.
- Öğretmenlerin kalabalık sınıf mevcudundan dolayı yaşadıkları güçlükleri aşmak için okul öncesi eğitim sınıflarına yardımcı eleman sağlanmalıdır.
- Açık alan etkinliklerinin yararları ve gerekliliği ile ilgili velilere eğitimler verilebilir. Böylece etkinlikler sırasında ailelerin de desteği alınabilir.

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COMPACT TRI-BAND FILTER USING CONTIGUOUS ELECTRICAL COUPLED RECTANGULAR OPEN LOOP RING RESONATORS

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Abstract: A compact microstrip tri-band bandpass filter is proposed. The filter consists of two contiguous electrical coupled Open Loop Rectangular Ring (OLRR) resonators structure. Tri-bands can be excited and designed using a proper arrangement between the proposed resonators structure and a parallel coupled 50-Ohm symmetric feeds structure. The filter is synthesized using substrate with 3.5 relative dielectric constant and thickness of 1.5 mm. The dimensions of the filter are optimized using the full wave Electromagnetic simulator. Three transmission bands for Worldwide Interoperability for Microwave Access (WiMAX) and Wireless Local Area Network (WLAN) applications at 3.425 GHz, 4.3 GHz, and 5.725 GHz are observed. The transmission bands are accompanied with four transmission zeros which provide skirt shapes around the transmission bands which improve the frequency selectivity of the filter. To enhance the out-of-the- band spurious rejection of the proposed filter, transmission zero at 8.85 GHz was created by adding stub in a selected location on the feed structure. The length of the loaded stub was the quarter guided wavelength of the selected frequency location. The proposed filter also has advantages as low insertion loss, simple profile and miniaturized size. The overall dimension of the proposed filter is 23.6mm x 20mm ($0.42\lambda_g \times 0.36\lambda_g$, where λ_g refers to guided wavelength at 3.425 GHz). The measured frequency response of the OLRR based tri-band filter was in good agreement with the simulated one which validates the feasible configuration of the proposed filter.

Keywords: Microstrip filter, open loop rectangular ring resonator, tri-band filter, electric coupled resonators

Introduction

The rapid development of the telecommunication industry motivates the invention and development of different types of high performance resonators. In literature, microstrip resonators have still the best known and most widely used planar transmission line resonators for RF and microwave circuits. This popularity and widespread use are due to its planar nature, ease of fabrication, easy integration with solid-state devices, good heat sinking, and good mechanical support (Mansour, 2004; Shang, Xia and Lancaster, 2014; Zhu, Ahmed and Abbosh, 2015; Wang and Wu, 2014; Olokede etal., 2014; Rohini and Devapriya, 2016; Mahmood and Beg, 2014)

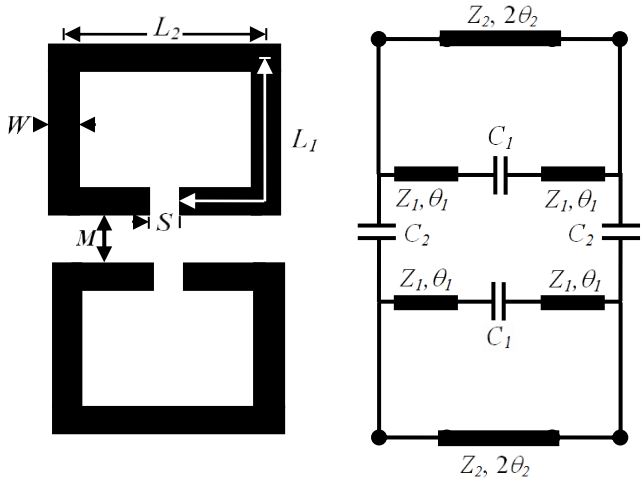
In modern communication systems, compact size and high selectivity are the most important features required for the band pass filters (BPFs). Split ring resonators (SRR) and complementary SRR are heavily used in the design of band pass filters to achieve these requirements. As the length of the ring resonator is equal to the multiplication of the mode number and the guided wavelength at resonance frequency, miniaturized structures can be realized using these resonators (Baena etal., 2005; Radkovskaya etal., 2005; Alahnomi etal., 2016; Izyani etal., 2014; Jindal and Sharma, 2012; Mancera and Baena, 2014; Chang and Hsieh, 2004).

A more compact version of the resonator is the square open-loop resonator. The square open loop resonator (SOLR) is mostly used for filter applications due to its compact size and good frequency response performance. The most common structures of square open loop resonator used for miniaturized microstrip filters design are conventional Square Open Loop Ring (SOLR), folded arms SOLR, meander line SOLR, and dual mode SOLR (Park, Caekenberghe, and Rebeiz, 2004; Hong, Shaman and Chun, 2007; Hsiao and Chiang, 2010; Chen, Yi-Ru Chen, and Chang, 2003; Tosic and Potrebic, 2012; Hong and Lancaster, 1996 ; Choi and Seo, 2011).

In this paper, a tri-band microstrip band pass filter with a contiguous electrical coupled Rectangular Open Loop Ring Resonator (ROLRR) is presented. It provides three transmission bands and four transmission zeros. The transmission zeros beside the pass band achieve a skirt shape cut-off response. The paper is organized as follow: section 1, give an introduction and literature survey. The analysis of electrical coupled ROLRR is presented in section 2. In section 3, the proposed tri-band bandpass filter design using SOLRR is provided. In section 4, the proposed resonators used in filter structure are analyzed and simulated to achieve the three pass bands with center frequencies 3.45GHz, 4.2GHz and 5.75GHz. The measured and the simulated results are also presented in this section to validate the filter design.

Analysis of Electrical Coupled Solrr

The electrical coupled square open-loop ring resonator and its equivalent circuit are shown in Figure. 1. The ring ends capacitance is represented by the capacitor C_1.The mutual capacitance between the electrically coupled rings is represented by the capacitor C_2 in the equivalent circuit. The even-odd method can be used for simplifying the analysis of the equivalent circuit as shown in Figure. 2.



(a) (b)

Figure 1. (A) SOLRR configuration (B) equivalent circuit of the resonator

The input admittance Y_{in} is given as:

$$Y_{in} = -jY_2 \frac{Y_1 - Y_2 \tan\theta_1 \tan\theta_2}{Y_2 \tan\theta_1 + Y_1 \tan\theta_2} \tag{1}$$

When Y_{ino} enforced to zero, then the odd mode analysis of Figure 2(a) gives:

$$Z_1\left(\frac{1}{2\omega C_1} - Z_1 \tan\theta_1\right) + Z_2 \tan\theta_2 (2\omega C_2 + 1)\left(Z_1 + \frac{\tan\theta_1}{2\omega C_1}\right) = 0 \tag{2}$$

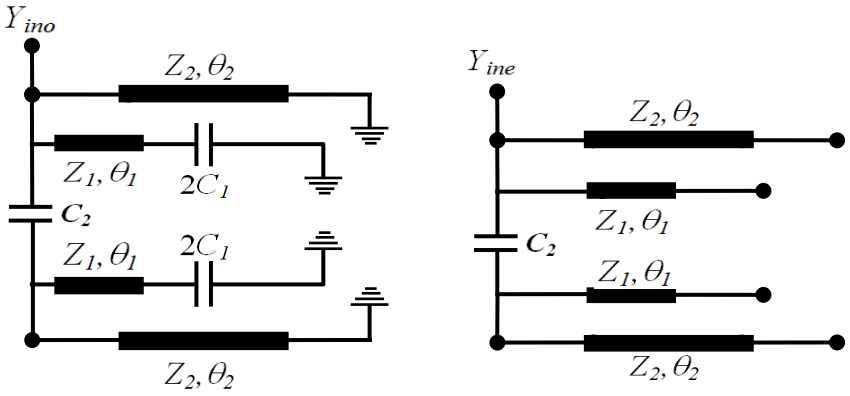
Similarly, when $Y_{ine} = 0$, the even mode analysis of Figure 2(b) leads to:

$$Z_2 \tan\theta_1 + Z_1 \tan\theta_2 - Z_1 Z_2 \omega C_2 = 0 \tag{3}$$

By equating Y_{ino} and Y_{ine} in (2) and (3), the transmission zeros of the circuit in Fig. 1(b) will be the roots of (4).

$$Z_1\left(\frac{1}{2\omega C_1} - Z_1 \tan\theta_1\right) + Z_2 \tan\theta_2 (2\omega C_2 + 1)\left(Z_1 + \frac{\tan\theta_1}{2\omega C_1}\right) - Z_2 \tan\theta_1 - Z_1 \tan\theta_2 + Z_1 Z_2 \omega C_2 = 0 \tag{4}$$

It seems clear that the locations of transmission zeros depend on the transmission line impedances ($Z_1$and Z_2), the electrical lengths (θ_1 and θ_2), the ring ends capacitance (C_1), and the mutual capacitance of the electrically coupled rings (C_2).



(a) (b)

Figure 2. Equivalent circuits for analysis (A) odd mode (B) even mode

Proposed Tri-Band Bandpass Filter Design Using Solrr

The dimension of the uncoupled open loop ring is selected according to the approximate value of the resonant frequency of the *n*th mode design equation given by (Jitha etal., 2008):

$$f_{rn} = \frac{nc}{2(P-S)\sqrt{\varepsilon_{eff}}} \qquad n = 1, 2, 3, \ldots \tag{5}$$

Where P is the average perimeter, S is the split width, and c is the speed of light in free space and ε_{eff} is the effective dielectric constant calculated for the microstrip line. A substrate with a relative dielectric constant 3.5, thickness h = 1.5mm has been used to design the filter. The effective dielectric constant is calculated by:

$$\varepsilon_{eff} = \frac{\varepsilon_r + 1}{2} + \frac{\varepsilon_r - 1}{2}[1 + \frac{12h}{W}]^{-0.5} \tag{6}$$

Using the dimensions L_1 and L_2 of 6.7mm and 4.9 mm respectively with ε_{eff} =2.474, the resonance frequency of the fundamental mode is calculated using (5) that gives f_{r1}=5.211 GHz. From the analysis given in the previous sections, it's certainly expected that other resonant modes less than f_{r1}=5.211 GHz can be achieved using electrical coupling between the SRRs. Proper selection of the geometry of the resonator and the feeding ports leads to the excitation of lower modes in the resonator. The resonant frequencies can be selected and optimized using full wave Electromagnetic Simulator that optimized the overall dimensions of the designed filter and the desired transmission zeroes can be obtained.

A new tri-band band pass filter is illustrated in Figure 3. The proposed resonator are electrically coupled and arranged contagiously to each other. A pair of 50-Ω microstrip line feeds the resonator through a pair of parallel coupled plates. The dimensions of various design parameters are: L_1 = 6.7 mm, L_2 = 4.9 mm, L_c = 7.5 mm, L_f = 5.5 mm, W = W_c =0.6 mm, M = g = 0.3mm and S = 0.3mm.

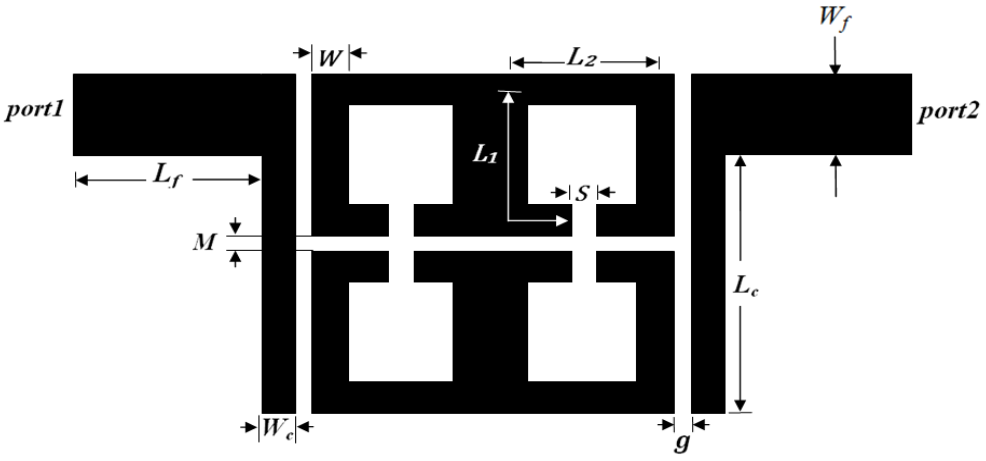


Figure 3. Proposed filter configuration

Simulation and Experimental Results

The simulated frequency response of the filter is shown in Figure 4. The response has three basic transmission bands at 3.425 GHz, 4.3 GHz, and 5.725 GHz with a return loss of -16 dB, -36.8 dB, and -23.5 dB respectively. Each of the bands is surrounded by two transmission zeroes. So four transmission zeroes are clearly located at 1 GHz, 3.625 GHz, 4.45 GHz and 6.15 GHz with insertion loss of -36.2 dB, -64.08 dB, -32.17 dB, and -75.2 dB respectively.

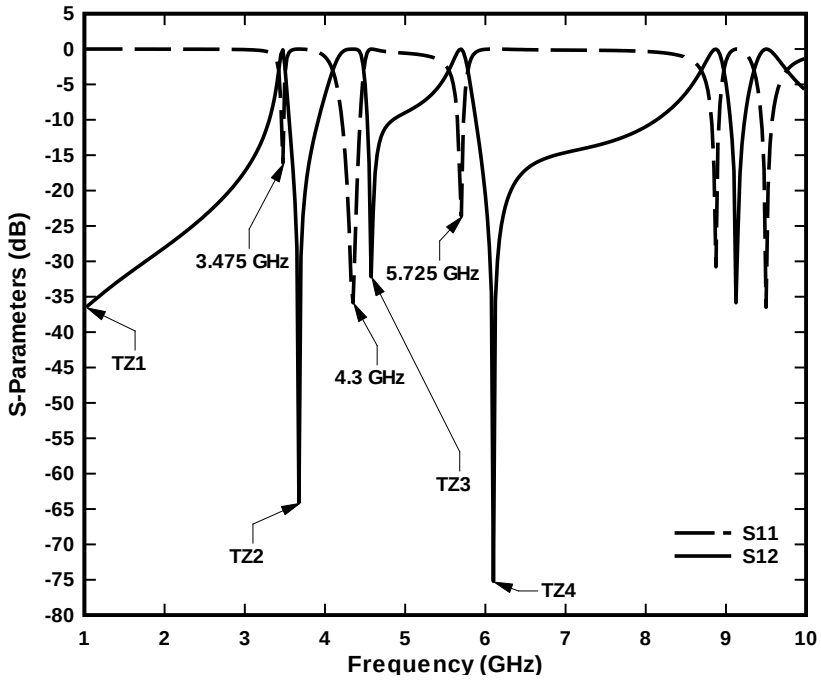


Figure 4. Frequency response of the proposed filter

Repetitions of higher mode spurs occurred beyond 8 GHz. To clarify the region beyond the last transmission zero Tz4 at 6.15 GHz, a new transmission zero Tz5 was inserted at 8.8 GHz using quarter wave stub and 10 GHz. The effect of insertion Tz5 on the frequency response of the filter is the clarification of spurs for the region between 6GHz and 10 GHz as shown in Figure 5. The parameters of the stub are: L_s=4.9 mm, W_s=1.2 mm and d_s=0.5 mm. The location and length of the quarter wave stub are shown in Figure 6.

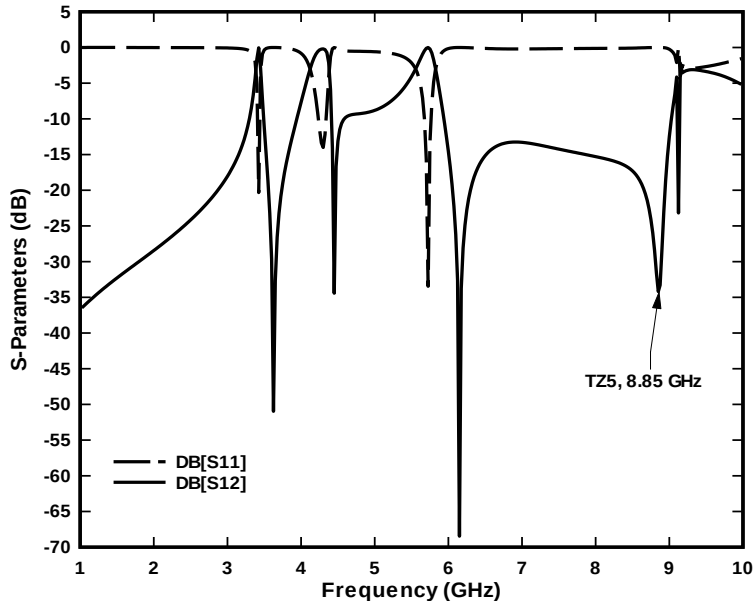


Figure 5. Frequency response with additive transmission zero TZ5.

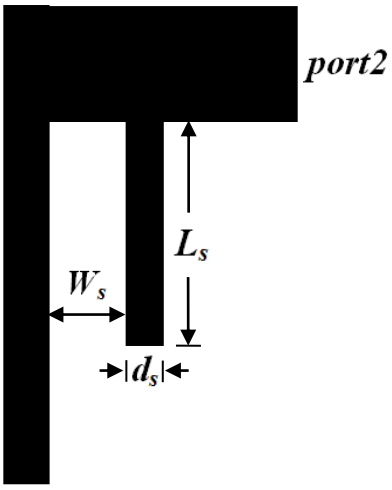


Figure 6. Dimensions and location of the added quarter wave stub

The prototype was fabricated as shown in Figure 7. The calculated performance of a prototype filter matches well the full-wave simulations. Figure 8 shows the simulated and measured results.

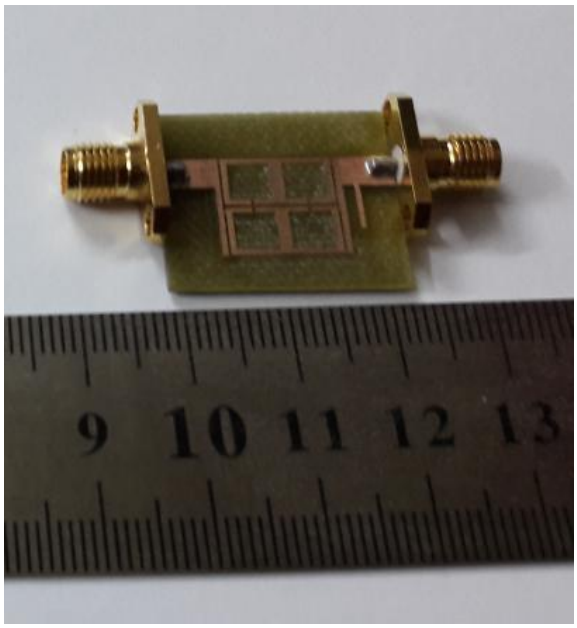


Figure 7. Photograph of fabricated prototype filter

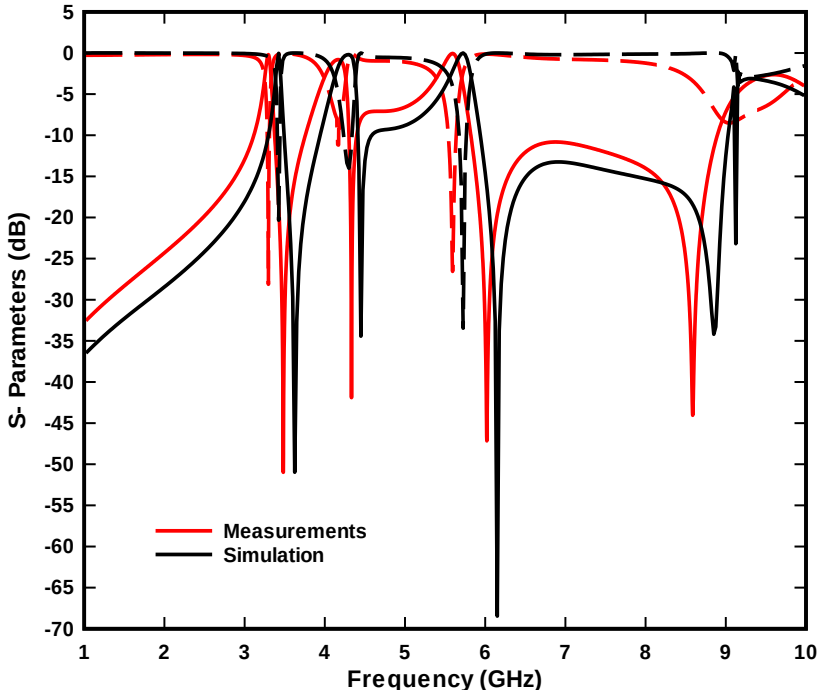


Figure 8. Measured and simulated frequency responses

Conclusion

A compact and simple microstrip Tri-band band pass filter is designed and implemented. It is demonstrated that electrically coupled and contiguous arrangements of the open loop square ring resonators can be used for the purpose of filter structure miniaturization. This can be achieved through the excitation of lower degenerate modes in the pre-selected frequency designed resonators. The fabricated prototype is very small and it's dimensions just 23.6mm x 20mm ($0.42\lambda_g \times 0.36\lambda_g$, where λ_g refers to guided wavelength at 3.425 GHz) and can be further miniaturized using a higher permittivity substrate. The multi-bands property and compactness of this design are attractive for applications in modern communication systems.

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ELECTROCHEMICAL BEHAVIOR OF PURE TITANIUM IMPLANTING IN THE TEETH IN ACIDIC ARTIFICIAL SALIVA

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University of Baghdad

Mayasah Aswad
Technical institute

Abstract: Titanium is used in dentistry for its unique combination of physical, chemical, and biological properties. The aim of present study was to evaluate the electrochemical behavior of pure titanium used for dental implants and for bridges in artificial saliva enriched with some kind of Iraqi food(acetic acid)with three pH (3, 4, 8) . Using the open circuit potential (OCP) measurements, potentiodynamic polarization, and electrochemical impedance spectroscopy (EIS). Electrochemical impedance spectroscopy(EIS) is powerful, rapid and accurate method for the evaluation of the corrosion resistance.

***Keyword**:* Corrosion, electro impedance spectroscopy, titanium and titanium alloy, dental implant

Introduction

Titanium and its alloys have proven to be technically superior in wide variety to industrial and commercial applications in such fields as aerospace, architecture, sporting equipment, desalination planes, military hard ware, eyeglass frames, watch making jewelry, medical implants and dental alloy. The physiological inertness of titanium makes it available as a replacement for bones and cartilage in a variety of surgeries. Titanium is used for heart valves, pace makers, artificial hips, and joints. (Dan etal,2003). Titanium and its alloys are used in dentistry for implants because of its unique combination of chemical, physical and biological properties (Jodhpur Colony,2009). Although titanium implants are considered as highly corrosion resistance materials for applications in body fluid, determination of their corrosion rate is of great important(Norma Terumi etal 2009). Dental implants are made of biocompatibility materials and they are surgically inserted into the jaw bone primarily as a prosthetic foundation (Jodhpur Colony,2009).

Titanium is a reactive metal with good corrosion resistance because of formation of a stable, protective and strongly adherent oxide film. If the oxide film is broken in service, only small amount of oxygen or water are necessary to renew it(R.W Cahn etal ,2003). The mouth is the portal entry of the human body. The pH. Of saliva from 5.2 to 7.8. Factors such as temperatures, quantity of saliva, pH, Protein, and the physical and chemical properties of food and liquids as well as oral health conditions may influence corrosion(Jodhpur Colony,2009).

All authors agree that the titanium corrosion resistance in these media is due to the formation of an adherent and highly protective oxide film on its surface which is mainly formed of TiO_2. Nevertheless, this oxide can also loss its chemical stability under certain conditions (R.W Cahn etal,2003). Although titanium implants are considered as highly corrosion resistant materials for applications in body fluids, the determination of their corrosion rate is of great importance. Indeed, some studies indicated that titanium release in the organism, even at low levels, can lead from local discoloration of the tissues to serious inflammatory reactions (M.Karthege and S.Tomilselvi, 2006).

The Electrochemical Impedance Spectroscopy (EIS) measurements technique is suitable for the study of electrochemical behavior of dental metal and alloy (Her-Hsiang Huang and Tzu-Hsin Lee, 2005). Measurement of ac impedance data in a powerful tool for the analysis of corroding systems, particularly (corrosion, plating, batteries, fuel cells, etc)(Nd Coggen and NJ Evans, 1999).

The major classification of the dental implants are Indosaw implants that are placed within the bone and the sub.To detect theCorrosion behavior, the physiological environment is typically modeled at 37◦C in aqueous solution, at pH 7.3, within dissolved gases (such as oxygen), electrolytes, cells,and proteins. Immersion of metals in this environment can lead to corrosion which is deterioration and removal of the metal by chemical reactions. During the electrochemical process of corrosion metallic biomaterials can release ions which may reduce the biocompatibility of materials and jeopardize the fate of implants. For examples, the type and concentration of

released corrosion products can alter the functions of cells in the vicinity of implants as well as of cells at remote locations after transportof the corrosion by products to distant sites inside the body. These circumstances becomes stronger possibilities in the bodies of sick and elderly patients, who are the largest group of recipients of prostheses(Kay etal,2002).

The aim of the present work to study the corrosion behavior of pure titanium as implants in teeth in acidic artificial saliva.

Exprimental Work

The electrochemical behavior of pure titanium was investigated using electrochemical impedance spectroscopy (EIS) measurements at the open circuit potential, and polarization techniques. The specimens examined in the present work are pure titanium (99.9% pure) were obtained on the (Fakultat Mechanic: Technich Universitat Dresden/ Germany). The specimen were grounded until 2400 grid, Textile used for polishing(OP-Chemical) which means (oxide polishing-chemical resistance) as well as using suspension polishing which contain colloidal SiO_2 (~0.1 **µ**m)+20mlH_2O_2+0.5ml HNO_3+0.3ml HF. The polishing took about 15 minutes for every sample.

The electrolyte which is used in the present work is artificial saliva (0.26gm/l Na_2HPO_3, 6.7gm/l NaCl, 0.33gm/lKSCN, 0.2gm/lKH_2PO_4, 1.5gm/l$NaHCO_3$, 1.2g/ml KCl) with different concentration of acetic acid to reach Ph. from 7.8 to 4,3.

The experiment maintained at 37 ∓1 C° using thermostat bath. The electrochemical behavior was studied in different solutions with and without acetic acid on the artificial saliva. The cell as in Fig.(1). Working electrode pure titanium, reference electrode SCE, and counter electrode (platinum). The following electrochemical measurement were conducted for each specimen;Electrochemical Impedance measurements (Model IM6 [ZAHNE ELEKTRIK]) as in Fig.(2). the duration time:

(a) (EIS) was 3hr for every specimen, the starting measure after (5miutes).
(b) (O.P.C.) Open-circuit-potential as in Fig(2), measurements were performed using (Model AUTO (PG STAT 20) in aerated medium immediately after (EIS) measuring and there after 21hr at regular intervals (20sec).
(c) The polarization scan was performed at the same instrument O.P.C... The impedance spectra of all the samples were recorded before and after polarization conditions, to evaluate the performance of the coating under equilibrium conditions and after the onset of the corrosion process respectively.

The impedance parameters jZ_j, polarization resistance *Rp* and capacitance *C* were calculated from Nyquist and Bode plots. Electrochemical impedance spectroscopy the impedance spectra were acquired in the frequency range of 10^{-2} – 10^5 Hz. The applied amplitude of the AC potential was 10 mV. Electrochemical impedance spectroscopy data was fitted with NOVA 1.7 software, resulting in equivalent electrical circuits and Nyquist and Bode plots. The impedance spectra displayed in Bode plots can give more information than Nyquist plots, by including frequency and phase angle. *2.4 Inductively coupled plasma mass.*

Figure 1.The cell of electrochemical measurement


Figure 2. EIS system

Litreture Review

As it titanium and its alloys which is used for implanting in teeth. We review a number of researches carried out by many scientist on the corrosion behavior of these alloy in mouth with artificial saliva and other biological fluids.
1-M.Karthege, S.Tomilselvi,2006 are studied the effect of PH 3.5, 5.0 and on Ti-6AL-4V in artificial saliva solution containing 1% NAF (sodium fluoride).i.e. the aim of this work is to contribute the understanding of the effect of fluoride on titanium based dental alloy.

2- Kajzer, W. Krauze, A. .Marciniak, J. vol.31 ISSUE2 on sec.2008,Journal of achievements in material and manufacturing Eng. Were studied the comparison of corrosion of AISI 316L, stainless steel in various corrosive media such artificial urine, tirade's physiological sol.,& artificial plasma.

3-Johhpur colony, Banaras Hindu university, Varanasi 221005, Vttar Pradesh, Ondiavol . 20 2009, Issue 1, page 91-98. An overview of the corrosion aspect of dental implant (titanium and its alloy). This article highlights a review of various aspect of corrosion and bio compatibility of dental titanium as well as supra structures. This knowledge will also be helpful in exploring possible research strategies for probing the biological properties of materials.

4- Norma Terumi Kadowaki, Gustavo Aristides, Santana Martine,and Alain Robin (material .Resarch Vol12 no. 3 2009) were evaluated the electrochemical behavior of three titanium dental implants purchased on Brazilian market in artificial saliva by using open circuit potential measurements, electrochemical impedance spectroscopy and potentiodynamic polarization.

5- N.figueira, T.M.Silva, M.J.Carmezim.J.C.S Fernandes" (Electro chemical Acta,Jan 2009, www.elezevier.com/locate/electacta. Were assessed the corrosion behaviors of NiTi in Hank's solution at 37◦C. pure titanium and pure nickel were included in this study in order to understand the contribution of each alloying element.

6- V. Raman, S. Tamilselvi, S. Nanjundan and N.Ranjendran ,department of chemistry,Anna university, India (Trends Bio mater. Artif. Organs, vol.18 (2) January 2005. The objective of the present investigation was acidic artificial saliva. Potentiodynamic anodic polarization and open circuit potential tests were used to evaluate the corrosion behavior of Ti-6AL-7Nb aerated artificial saliva with PH 7.4 at 37◦ C. The passive range was higher for the Nb-alloy compared to the potentiodynamic impedance spectroscopy (EIS) was carried out on specimens immersed for various time duration.

7- OLmedo DG, .Duffo G, RL. Carbrini, Guglielmotti M.B,(local effect of titanium implant corrosion: an experimental study in rats).int. J.oral maxillofac surg.2008. The aim of the study was to evaluate histological and biological effect of pitting corrosion and to contribute clinically relevant date on the permanence of titanium metal structures used in osteosynthesis in the body.

8- Fengxiang Qin, Zhenhua Dan, Xinmin Wang, Guoqiang Xie and ,Akihisa Inoue, (Trends in material science and Engineering,2011, They developed new Ti-based bulk metallic glassy (BMG) alloys in Ti-Zr-PH-Ct in system without Ni element for application as biomaterias in various forms.

9-Ngoc-change Ouach, Peter J. vggowitzer,patrik sehmutz, "corrosion behavior of an Mg-y-RE alloy used in biomedical applications studied by electrochemical techniques" science direct 2008, they investigated the corrosion behavior of an Mg-y-RE magnesium alloy in two different physiological solution (artificial plasma (AP)

and simulated body fluid (SBF) by using electrochemical impedance spectroscopy (EIS). They showed that SBF was significantly more aggressive than AP with regard to the polished surface.
10-Dr. Amany Fekry (Faculty of scieuce-Cairo University) on 29 March 2010. Their studied to investigate the stability of the titanium and Ti-6AL-4V in aqueous solutions of oxalic acid. It was found that the corrosion rate increase with either increasing oxalic acid concentration or temperature results on titanium and its alloy in 0.01 M oxalic containing either $SO4^{-2}$ or CL^{-1} was that oxide film resistance decrease with the increase of the sulphate ion concentration.

11-Majid H. Abdualmageed and Slafa I.Ibrahim (Alkhawarizmi Engineering Journal,vol 6,No.3,pp7784,2010). (Corrosion behavior of Ti-6ALv alloy in different media).
They studied the corrosion behavior of Ti-6AL-4V alloy by using galvanostatic measurements at room temperature in different media which include sodium chloride (food salt), sodium tertrate (presence in jellies , margarine and sausage casing,etc.) sodium oxalate (prensence in 7up dring,etc.), and sodium hydroxide in order to compare . They showed that the polarization resistance (RP) for NaCo3> Oxalate>CH_3cOOH> NaOH> Tartrate> NaCl.

12-Warner Geurtsen (International and American Associations for Dental research) vol.13 (1)71-84(2002) " Biocompatibility of dental casting alloys". Medical university Hannover D.30623 Hannover Germany. in this paper it has been documented that some Ni-based alloys, such as beryllium-containing Ni alloys, exhibit increased corrosion, specifically at low pH.

13- Noam Eliaz, Moshe Eliyahu ,(18 October 2006 in Wiley Inter science). They interest in electrochemical formation of hydroxyapatite has evolved. In this work, highly crystalline hydroxyapatite is electrodeposited on pure titanium Ti-6AL-4V alloy. The conclusions of this work have implications on optimization of coating on implants as well as in enhancement of the understanding of bone mineralization in vivo.

14-I.H.Liu, T.M Lee, C.Y. Chang, C.K.Institute of oral medicine , Taiwan (2007 by International and American Association for dental research), Ni Ti wires are used under bending conditions in the oral environment for a long period . The purpose of this study was to investigate the effect of bending stress on the corrosion of NiTi wires using potentiodynamic and potentiostatic tests in artificial saliva. The results indicated that bending stress induces a higher corrosion rate of NiTi wires in passive regions. It is suggested that the passive oxide film of specimen would be damaged under bending conditions. Auger electron spectroscopic analysis showed a lower thickness of passive films on stressed NiTi wires compared with unstressed specimens in the passive region. By scanning electron microscopy, localized corrosion was observed on stressed sent alloy specimens after a potentiodynamic tests at PH= 2.

15- Anelise Marlene Schmidt, Denise Schermann Azambuja, (material Res, vol.9 no.4 Carlos Oct/Dec.2006). Material research of this paper reported on an investigation of the electrochemical behavior of Ti grade 2 and Ti6Al4V alloy in aqueous citric acid solutions with PH 2.0 containing halide ions. Voltammetric studies of Ti and the alloy in citric acid, with and without chloride ions, indicate that the Ti and Ti alloypresented a passive behavior in the test solutions used. Pitting was observed at 3.0 and 2.5 V/SCE for Ti and Ti6Al4V, respectively, when bromide ions were added to the solution. In solutions containing fluoride ions, dissolutions of the film occurred at potential close to -1.0 V/SCE in both electrodes.

Results and Discussion

The immersion solutions used in the present study were artificial saliva with different values of PH corrosion, electro impedance spectroscopy, titanium and titanium alloy, dental implant, the pH of the immersion solutions used ranged from 8, 4 and 3.

The open circuit potential stabilized from -0.3v to 0.3 v for both the metal specimens during the first half hour.No visible surface changes were observed on any of the specimensafter the anodic polarization, R_P values determined as the calculated corrosion current (I_{corr}).
Fig.3 shows the potentiodynamic curves obtained in the artificial saliva at pH values 8, 4and 3 at 37◦C for the pure titanium. With the purpose of evaluating the effect of the pH on the corrosion behavior of the pure titanium, Polarization curves were performed in the artificial saliva withpH values 3, 4, and 8.

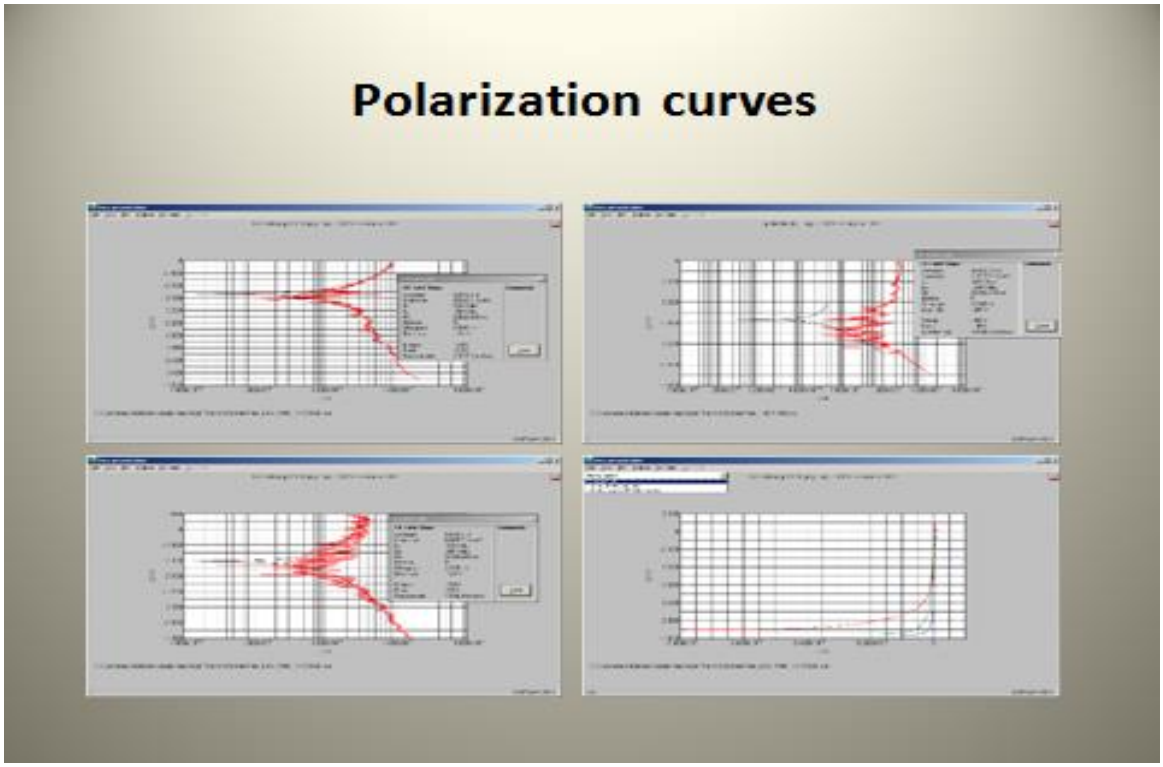

Figure 3. The potentiodynamic curves performed in the artificial saliva with pH values 3, 4, and 8.

Table 1 .Clarified the behavior of all the data for polarization curves

Time	**i_c**corrosion current(A)	**I_C** Corrosion current density(A/cm^2)	**b_c** Tafel slope cathodic (v/dec)	**b_a** Tafel slope anodic(v/dec)	**Polarization resistance R_p** (ohm)	**$E._{corr.observed}$** (v)	**$E._{corr.calculated}$** (v)
26h	-9.443E-10	-4.721E-9	0.149	0.554-	`.9.405E+7	-0.285	…….
26h	2.102E-8	1.051E-8	0.38	0.225	1.769E+6	-0.134	-0.153
24h	1.04E-8	5.201E-8	0.175	0.256	1.864E+6	-0.103	-0.117

The corrosion behavior of the pure titanium was assessed in the artificial acidic saliva by electrochemical impedance spectroscopy. Fig.4 depicts the obtained Nyquist and Bode diagrams.
It is clearly that when if the open circuit potential (OCP) is stable within time, then the oxidant insulator layer of titanium will be stable too, thus, the titanium will has a large corrosion resistance.

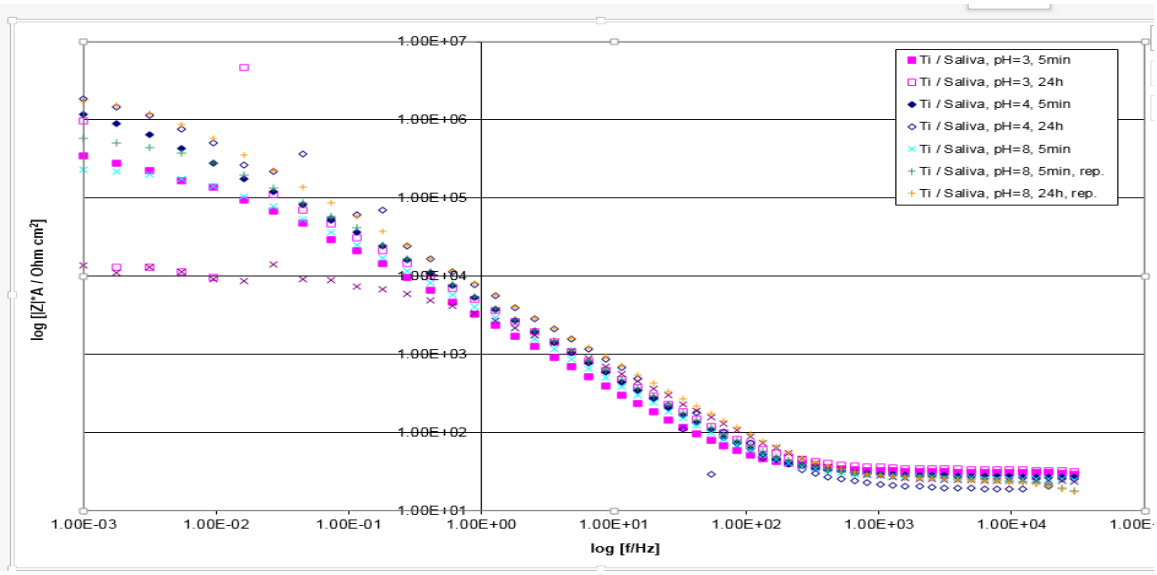

Figure 4 a. The impedance behavior versus frequency of ti in artificial saliva

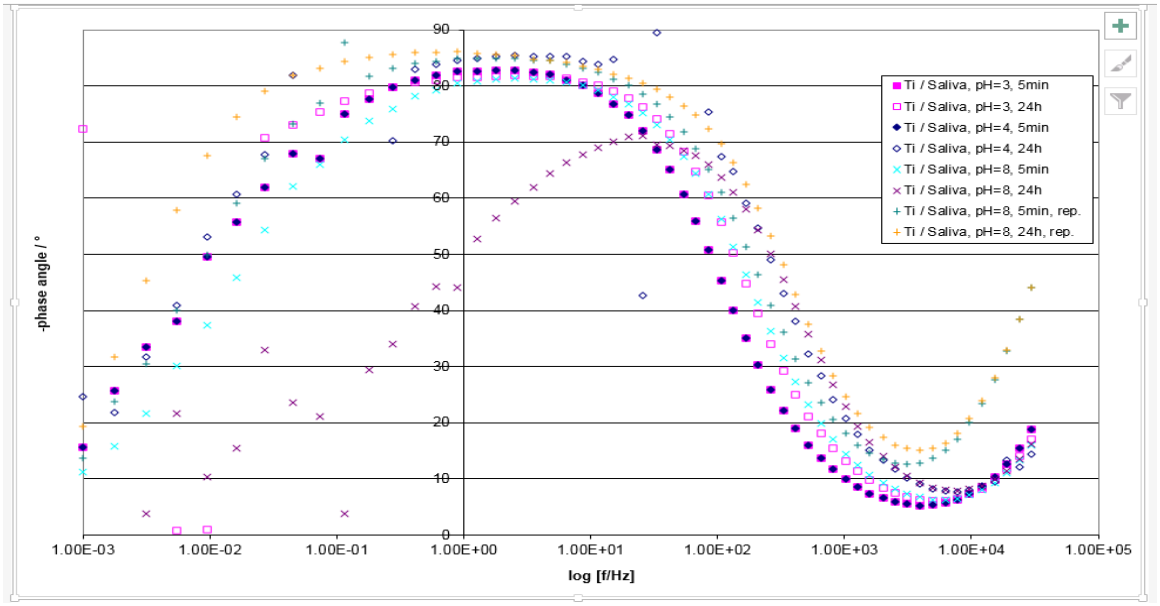

Figure 4b. Phase angle behavior versus frequency of ti in artificial saliva

The corrosion impedance of titanium is mainly depending on the OCP and the current density, so whensoever's the current density is decreasing and it is stable with respect to OCP, then the titanium corrosion impedance value will be high, this large value will make the impedance has a linearity behavior and the best gradient with respect to the frequency.

According to fig.4ait can be shown that the capacitive impedance value of Ti at (pH=8,24h) is the same impedance value of Ti at (pH=4,24h), but, the linearity behavior of Ti at (pH=8,24h) is dominant.

In fig.4b, it is clearly that the Ti phase angle at (pH=8,24h) is relatively more stable than Ti phase angle at (pH=4,24h).

According to fig.4 a,b ,it can be shown that the impedance value of Ti (at pH=4,24h) is larger than Ti impedance at (pH=4,5 min),then it is obvious that the linearity behavior of Ti impedance at (pH=4,24h) is better than Ti impedance at (pH=4,5 min),itis obvious that Ti phase angle at (pH=4,24h) is relatively more stable than Ti phase angle at (pH=4,5 min).

It is clearly that the Ti impedance value and its phase angle at (pH=4,5min) is larger than and more stable than Ti at (pH=3,24h),then the gradient behavior of Ti impedance at (pH=4,5min) is better than Ti impedance at (pH=3,24h).

It is obvious that the Ti impedance value and its phase angle at (pH=3,24h) is larger and more stable than Ti at (pH=8,5min), then, the gradient behavior of Ti impedance at (pH=3,24h) is better than Ti impedance at (pH=8,5min).
According to the same figure,it can be shown that the Ti impedance value and its phase angle at (pH=8,5min) is larger and more stable than Ti impedance at (pH=3,5min), then,the gradient behavior of Ti corrosion resistance at (pH=8,5min) is better than Ti impedance at (pH=3,5min).Table (2) shows a brief summary of all the information.

Table2. Summary results table for EIS

Marker group	pH	Time	Corrosion impedance	Linearity	Stability
+	8	24 h	3MΩ	best linearity(better than ◊ group)	**best stability(more stable than ◊ group**
◊	4	24 h	3MΩ	good linearity(better than♦ group, less than + group)	**good stability(more stable than ♦ group, less stable than + group)**
♦	4	5 min	2MΩ	Better than □ group, less than ◊ group)	**better than □ group)**
□	3	24 h	1MΩ	Better than x group, less than ♦ group)	**Better than x group**
X	8	5 min	0.2 MΩ	Better than ■ group, less than □ group	**Better than ■ group**
■	3	5 min	0.2MΩ	Better than **x** group	**Less than** x **group**
X	8	24 h.rep	0.02 MΩ	The worst	**The worst**

Conclusion

Pure Titanium exhibits good corrosion resistance at three kinds of different solution PH, polarization studies and electrochemical impedance spectroscopy support the above behavior.

The corrosion current densities calculated from polarization studies are much lower in pH 8, 4<8<3.
The EIS measurement technique is suitable for study of electrochemical behavior of dental materials. It can be seen that the EIS value of Titanium at (pH=8,24h) is relatively high (3 M ohm),then, it is obvious that the Titanium corrosion resistance has a good gradient with respect to frequency, thus, the phase angle of Titanium impedance at (pH=8,24h) is more stable with respect to frequency, also, it can be concluded that the EIS value of Titanium at (pH=8,5 min) is relatively low , then, the Titanium corrosion resistance has a relatively bad gradient behavior with respect to frequency, thus, the phase angle of titanium impedance at (pH=8, 5min) is less stable than others

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PUMICE/FATTY ACID EUTECTIC AS COMPOSITE PHASE CHANGE MATERIAL FOR THERMAL ENERGY STORAGE IN BUILDINGS

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Abstract: Phase change materials (PCMs) have been widely used in for thermal energy storage (TES) in buildings. For this aim, PCMs have been incorporated with gypsum board, plaster, concrete, porous clay minerals or other wall-covering materials. Pumice clay can be used together with cement, mortar and concrete due to its good compatibility and chemical inertness. These properties make it a potential matrix for the construction of S-SCPCMs. Moreover, pumice clay is abundantly available and can be easy handled in Turkish markets. This paper was focused on the preparation, characterization of TES properties of pumice/lauric acid-myristic acid (LA-MA) composite. The morphology, chemical structure and TES properties of the prepared pumice/LA-MA composite was studied by using SEM, FT-IR, DSC and TGA analyses. The FT-IR and SEM results showed that the pumice show well compatibility to the eutectic PCM and it was well-infiltrated into the porous structure of pumice. The DSC results indicated that the pumice/LA-MA including 24wt%LA-MA has a melting temperature of 32.78ºC and latent heat of melting of 34.18 J/g. The TG analysis showed that the produced S-SCPCM has greater thermal durability compared with pure LA-MA. All results showed that the fabricated composite PCM is suitable for heating and cooling applications in buildings envelopes.

Keywords: Composite PCM, pumice, capric acid, myristic acid, thermal energy storage.

Introduction

In thermal energy storage (TES) technique, PCM can store or release a specified amount of heat by phase change in a constant or narrow temperature range (Parameshwaran and Kalaiselvam, 2012). So, in recent years this method is attracting attention for building applications. In order to achieve thermal comfort and decreasing the fluctuations of indoor temperature in building envelopes, building material based-several composite PCMs were prepared as shape-stabilized form (Memon t al., 2013).

Fatty acids as organic PCMs have been generally preferred for heating/cooling purposes due to their desired physical, chemical and good TES properties (Li et al., 2013). However, they need storage container to avoid the outflow in melted state during heating stage. Therefore, by encapsulation of PCMs into a porous building material, it is not needed to usage of extra container. Moreover, the combination of PCM with a porous and lightweight material does not need any solvent and also is simple, environment friendly and cost-effective (Sarı et al., 2014). In this regard, some clay materials such as perlite (Jiao etal., 2011), diatomite (Li et al.,2011) and vermiculite (Karaipekli and Sarı, 2009) were used to encapsulate different organic PCMs.

Pumice is is a volcanic rock that consists of highly vesicular rough textured volcanic glass, with or without crystals. PS is widely used to make lightweight concrete or insulative low-density cinder blocks. When used as an additive in cement, a fine-grained version of pumice called pozzolan is mixed with lime to form a lightweight, smooth, plaster-like concrete (http://en.wikipedia.org/wiki/Pumice).

In addition to these properties, the integration of pumice with organic PCMs make it promising applicant for the invention of novel shape-stabilized composite PCMs (S-SCPCMs) with TES goals in buildings. However, additionally, the investigation on the functionality of pumice as supporting material to hold fatty acids or their eutectic mixtures as PCMs is limited with few studies (Fang and Zhang, 2006; Sarıer et al., 2011). In this sense, this work is aimed to a develop and determine TES properties of pumice/LA-MA composite as novel S-SCPCM, which could be used for building applications.

Experimental
Materials, methods and instrumentation
Pumice used as supporting matrix is originated in Nevşehir, Turkey). The dried pumice is mainly composed of 71.10wt% SiO_2, 15.50 wt%Al_2O_3, 1.70wt%Fe2O3, 0.3wt%CaO, 1.10%K_2O and other metal oxides [7]. The LA

and MA were obtained from Sigma-Aldrich company (Germany). The eutectic mixture was prepared by blending of melted MA with melted LA in the predetermined eutectic weight combination ratio.
The pumice/LA-MA composites were produced using vacuum impregnation way. During impregnation, the mass fraction of the LA-MA was varied from 10 to 30wt% by performing simultaneously leakage test. Based on the leakage test results, the maximum combination ratio of LA-MA into the pumice was determined to be 24wt%. This composite was called as shape-stabilized composite PCM (S-SCPCM). The morphology of the prepared S-SCPCM was investigated using SEM analysis (LEO 440 model SEM instrument). The chemical characterization of the fabricated S-SCPCM was carried out by using a FT-IR spectrophotometer (JASCO 430 model). The TES properties and thermal durability temperature limits were measured by a differential scanning calorimetry (Perkin Elmer JADE model) and a TGA instrument (Perkin–Elmer TGA7 model). The TES reliability of the prepared S-SCPCM was determined by using a thermal cycler with BIOER TC-25/H model.

Results and Discussion

Morphologic caharacterization results

The SEM images given in Fig. 1 shows the morphological of pumice before and after impregnation of PCM. As can be seen from Fig.1(a), the surface of the pumice is consisted with micro and mesopores with different geometric shape. The most of them are connected each other and thus these pores enable the holding LA-MA molecules and thus preventing the eutectic PCM seepage during the heating process from the surface of pumice surface.

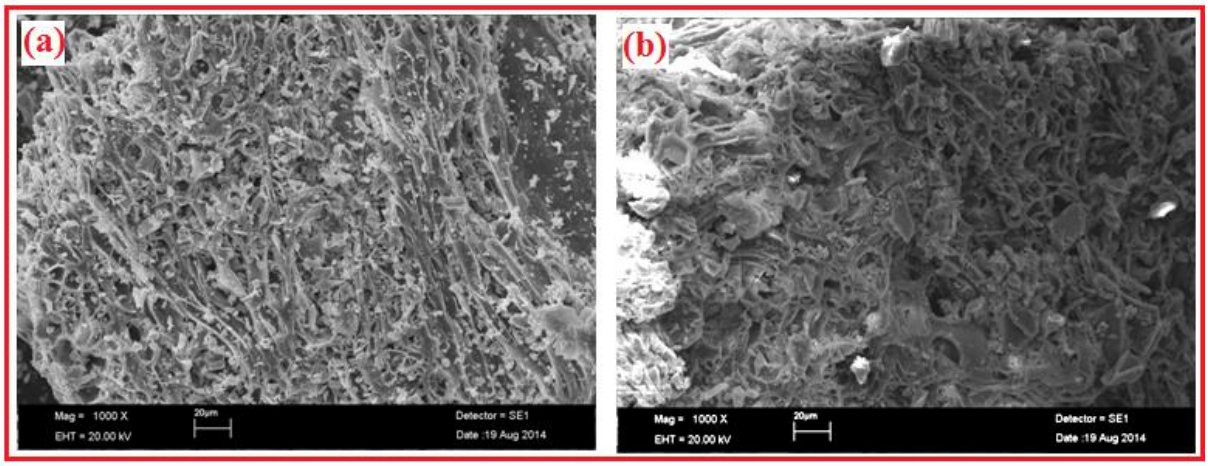

Fig. 1. (a) SEM images of unloaded pumice and (c) SEM images of pumice /LA-MA composite as S-SCPCM

On the other hand, as seen from Fig. 1(b), with impregnation the pores onto the surface of pumice were occupied partially with LA-MA used as PCM. Thus the formed structure provides structurally durable against the exudation problem of eutectic PCM above its melting temperature due to the surface tension and capillary forces between the PCM molecules and inter layers of pumice.

Chemical characterization results

As seen from the FTIR analysis results belongs to LA-MA and pumice in Fig. 2, its stretching vibration bands of $–CH_2$ groups are recorded in the close ranges of about 2850-2980 cm^{-1} for LA-MA while the peaks between 3200 cm^{-1} and 3600 cm^{-1} and around 1727 cm^{-1} are attributed to the stretching and bending vibrations of -OH and -C=O groups of the fatty acid eutectic mixture. Moreover, pumice has some characteristic bands such as symmetric, anti-symmetric vibration and bending vibrations of Si-OH, Si-O, Si-O-Si and Si-O-Al detected at 1039 cm^{-1} and 460 cm^{-1} and 1045 cm^{-1} and 463 cm^{-1}, respectively. On the other hand, in the spectrum of the fabricated S-SCPCM, it can be easily detected all of the bands belongs to LA-MA and pumice. In addition to these results only little shifts in some characteristic peaks regarded with S-SCPCM were observed after impregnation. This could be due to the physical interactions between the components of the composite. However, any new absorption peak was not observed in the spectrum of the composites. All of the results confirmed the chemical inertness of pumice against the eutectic mixture used as PCM.

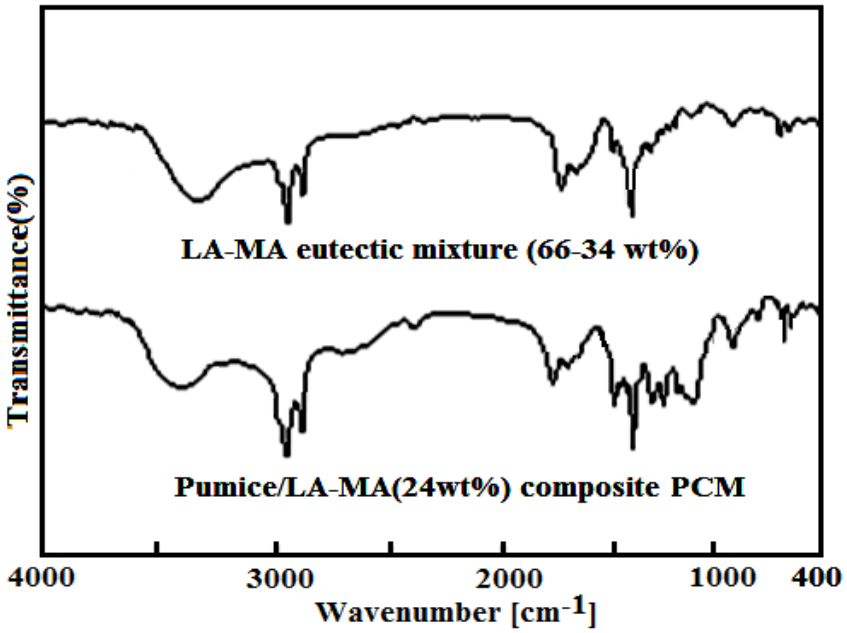

Fig. 2. FT-IR spectra of the pumice and the prepared pumice/LA-MA(24wt%) composite PCM

TES properties

In order to achieve the eutectic combination ratio and melting temperature of LA-MA mixture, the obtained DSC heating curves for seven samples prepared at different combination ratios were presented in Fig. 3. As clearly seen from thermograms, when the combination ratio was reached to 66–34%, the eutectic composition was achieved. As different from the others, the sample with eutectic ratio show only one regular peak like pure material.

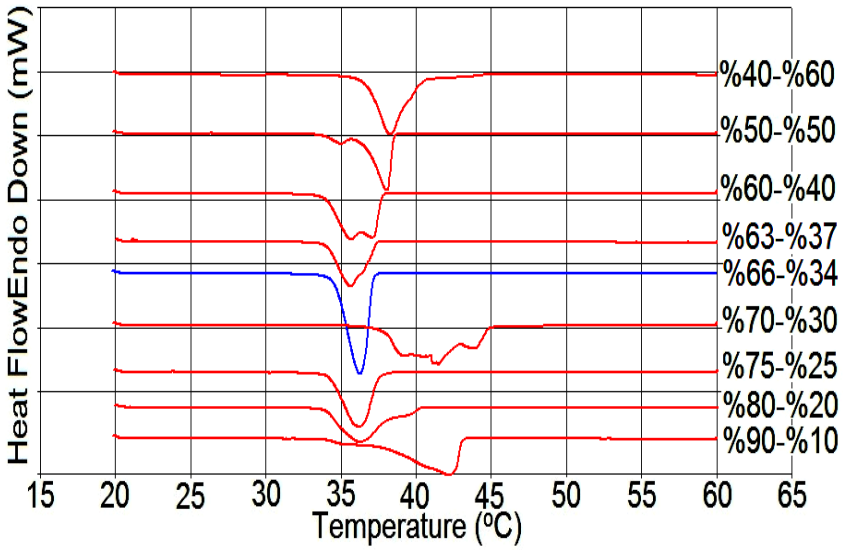

Fig. 3. DSC curves of the prepared LA-MA eutectic PCM

As seen the DSC curve given in Fig. 4, the pumice/LA-MA composite prepared in shape-stabilized form show a melting and freezing phase changes at 32.78ºC and 32.16 ºC and latent heat of melting and freezing of 34.18 J/g and 33.48 J/g, respectively. These values indicated that the prepared S-SCPCM have proper phase transition temperatures and adequately high phase transition enthalpies for heating, ventilating and air conditioning (HVAC) applications in building envelopes depending on the climatic conditions. Moreover, by comparing the phase change temperatures of the composite PCMs compared to that of pure LA-MA, it can be detected small decreases. This could be due to weakly attractive interactions among the components of the composite.

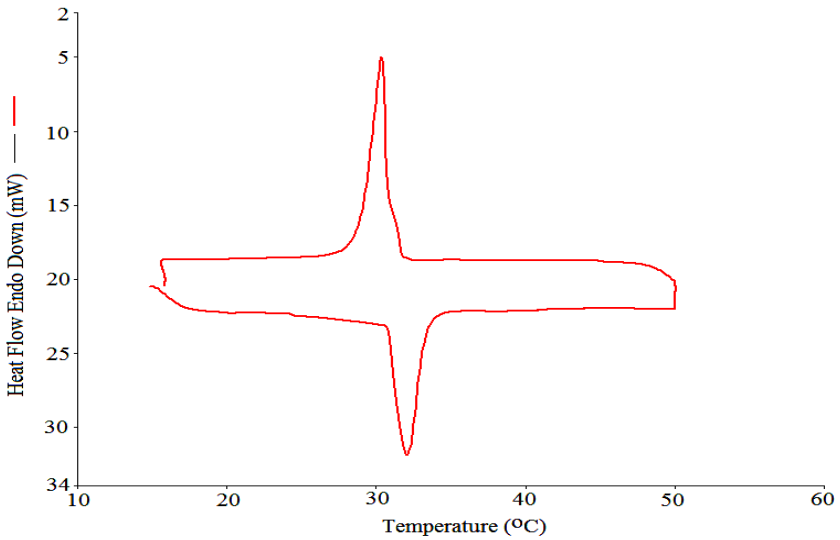

Fig. 4. DSC curves of the prepared pumice/LA-MA(24wt%) composite PCM

Additionally, the theoretical holding ratio of PCM by pumice was calculated as 24.4 wt% by dividing the measured melting enthalpy of the prepared S-SCPCM to the corresponding value of the eutectic PCM. This results is very close to real impregnation mass fractions of 24.0 wt%.

TES reliability and chemical stability results

A newly developed S-SCPCM should show high reliability in term of its TES properties after long-term utility period. With this sense, in this work, the TES reliability of the prepared S-SCPCM was determined by measuring TES properties after repeated for 1000 heating/cooling cycles. The DSC results performed after thermal cycling test, it was observed very little decrease in its melting and freezing temperatures as 0.12 and 0.09°C, respectively. Moreover, after thermal cycling, the corresponding enthalpy values of the S-SCPCM were reduced as little as 6.4% and 5.8% for freezing period, respectively. However, it can be concluded that the prepared S-SCPCM has good thermal reliability for solar passive TES applications.

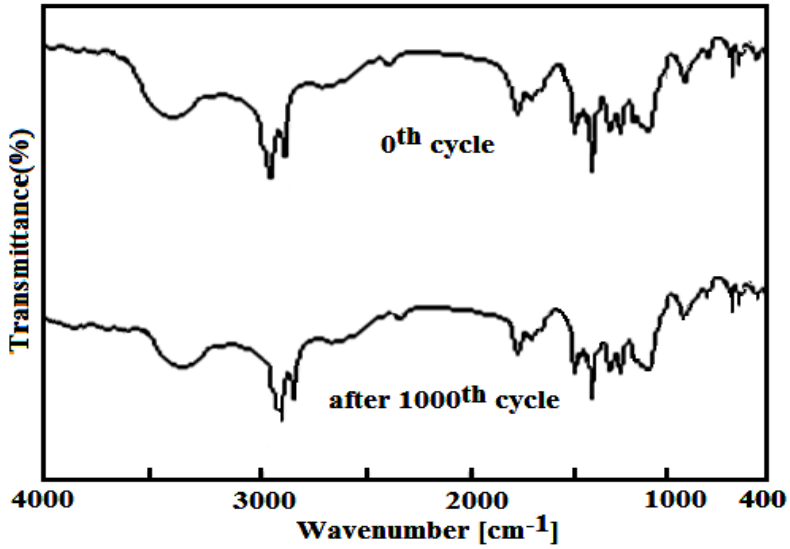

Fig. 5. FT-IR spectra of the pumice/LA-MA(24wt%) composite PCM after thermal cycling.

On the other hand, a newly prepared composite PCM should be stable chemically after thermal cycling. As clearly seen from the FT-IR spectrums in Fig. 5, the profile and wavenumbers of the characteristic absorption bands of the prepared S-SCPCM were maintained unchanged even after 1000 cycling. These mean that the prepared S-SCPCM has good chemical stability.

Thermal durability results

A developed composite PCM should show good thermal durability against high temperature. In this regard, the TG analysis of the prepared S-SCPCM were carried out in the temperature range of 40-330°C. As seen from

Fig. 6, LA-MA eutectic mixture was evaporated from the composite in the range of 125-165°C, which is corresponded to the percentages of weight loss of 25.2wt%. These results indicated that the degradation temperatures of the LA-MA hold into composite are extremely over its phase change temperatures. Thus, it can be concluded that the prepared S-SCPCM have high thermal durability and thus good thermal stability.

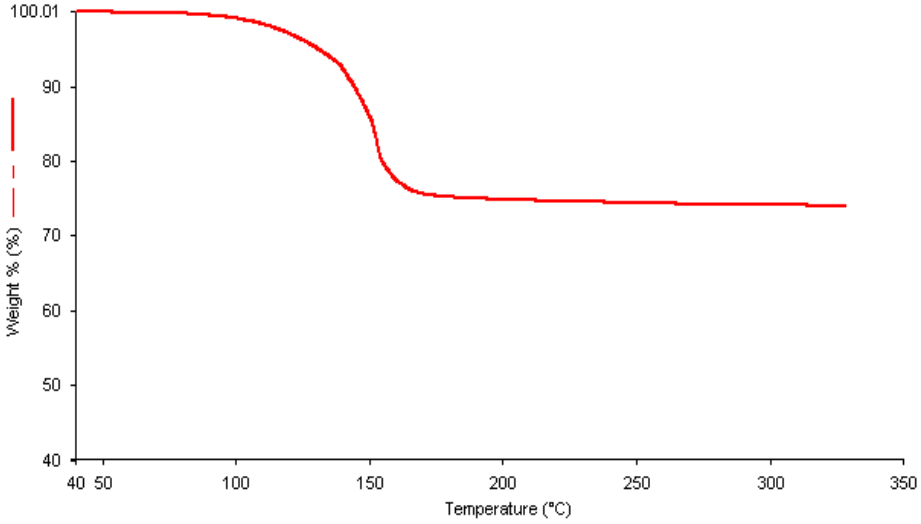

Fig. 6. TG curves of pure LA-MA and produced F-SPCMs.

Conclusions

This study is aimed to prepare, characterize and investigate the TES properties of pumice/LA-MA composite PCM. The LA-MA eutectic mixture was encapsulated maximally as 24wt% into the pores of pumice. The FT-IR and SEM results shoved the presence of good physical compatibility. The DSC results indicated that the prepared S-SCPCM has suitable phase change temperature and good latent heat capacity for solar HVAC applications for buildings depending on climatic conditions. Thermal cycling test showed that the prepared S-SCPCM has good TES reliability and chemical stability. The TG analysis exhibited that the prepared S-SCPCM had considerably high thermal durability. By taking account of all results, it can be also deduced that the pumice/LA-MA composite PCM prepared as S-SCPCM can be considered as promising TES material, which can be used in the preparation of thermal insulation/coatings of interior/exterior wall, plasterboards, and building bricks.

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PB(II) ADSORPTION FROM AQUEOUS SOLUTION ONTO MANGANESE OXIDE-MODIFIED KAOLIN

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Abstract: This study is focused on the investigation of the Pb(II) adsorption from aqueous solution onto the manganese oxide (MnO_2)-modified kaolin (Mn-mK). The chemical and morphological characterizations of Mn-mK were carried out by using Scanning Electron Microscopy (SEM) and Fourier Transform Infrared (FT-IR) analysis methods. The lead adsorption feasibility of Mn-mK was examined systemically by evaluating the effects of initial pH of solution, contact time, adsorbent concentration, and temperature of solution on the adsorption efficiency. From the Langmuir model, the adsorption capacity of modified sorbent were found to be 192.9 $mg.g^{-1}$. Moreover, based on all results the prepared Mn-mK is promising adsorbent in the removal of Pb(II) ions from waste waters because of its relatively high adsorption capacity and the advantages of ease and preparation in low-cost.

Keywords: Lead, kaolin, manganese oxide, modification, adsorption

Introduction

Heavy metals are extremely toxic and threaten the living by joining the food chain. Lead is among the most toxic heavy metal ion affecting the environment (Alloway et al., 1993). It comes into water through the combustion of fossil fuels and the smelting of sulphide ore, and into lakes and streams by acid mine drainage. Process industries, such as battery manufacturing and metal plating and finishing are also prime source of Pb pollution. The current EPA and WHO drinking water standard for lead is 0.05 mg/L and 10 µg/L, respectively. Lead accumulates mainly in bones, brain, kidney and muscles and may cause many serious disorders like anaemia, kidney diseases, nervous disorders and sickness even death (Chua et al., 1999). It is therefore, essential to remove Pb(II) from wastewater before disposal.

The elimination of Pb(II) ions from aqueous solutions has been carried out by using different kinds of adsorbents such as usage of the low-cost adsorbents such as agricultural wastes (Peternele et al., 1999), metallurgical slags (Ortiz et al., 2001), fly ashes (Panday et al., 1984), iron oxides (Wu et al., 2003), francolite mineral (Prasas et al., 2002), quartz and talk (Huang and Fuerstenau, 2001) bentonite (Naseem and Tahir 2001) and siderite (Erdem and Özverdi, 2005). On the other hand, MnO_2-modified adsorbents has attracted more notice because of the following physical and chemical properties of MnO_2: (i) ionization ability at low pH, (ii) carrying ability of more negative charge in solution compared to SiO_2, TiO_2, Al_2O_3, and FeOOH (Allen et al., 1991) (iii) the loading ability at large amounts to the silica-based surfaces (Eren et al. 2009), (iv) the noticeably increasing ability of the specific surface areas of silica-based adsorbents Therefore, in recent times, the interest in new type MnO_2-modified adsorbents is increasing with each passing day (Al-Deges et al., 2000)
The present study aims to explore the adsorption potential of Mn-mK in the removal of Pb(II) from aqueous solution and waste water samples. The effects of batch adsorption parameters were studied systemically.

Experimental Procedures

Preparation of Mn-mK and instrumentation

Kaolin was provided from Eczacıbası mineral industry. The sample was sieved form 200 mesh and dried in an oven at 105°C for 24 h. The used chemicals grade were with analytical reagent used. Kaolin (15g) was modified by using $MnCl_2$ and NaOH solutions. The Moore and Reid's method [15] was used in the modification process. After precipitation process of manganese ions as manganese hydroxide compound on the adsorbent surface, it was converted to MnO_2 via oxidation reaction at open air. The manganese content of Mn-mK and the Pb(II) ion

concentration in solution during the batch experimental runs were determined using flame atomic absorption spectrometer with deuterium background corrector (Perkin Elmer Analyst 700 model Norwalk, CT, USA). The morphology of Mn-mK was characterized using a LEO 440 model SEM instrument. A JASCO 430 model FT-IR spectrometer was used to characterization of both adsorbents.

Batch adsorption procedure

The stock Pb(II) solution (1000 mg L^{-1}) was prepared from analytical grade $PbCl_2$ (Merck, Darmstadt, Germany). The initial pH, adsorbent concentration, contact time and temperatures were optimized in the range of 1-7, 1-16 g/L, 5-60 min and 20-50°C, respectively. For each isotherm experiment, the stock Pb(II) solution was diluted to the required concentrations ranging from 10 to 400 mg/L. The Pb(II) concentration of filtrate was analyzed using flame AAS.

Results and Discussion

Characterization by SEM analyses

Fig. 1 shows the SEM photographs of Mn-mK sorbent before and after the adsorption of Pb(II). The surface of Mn-mK has relatively uniform and smooth surface due to occupying of the spaces or holes by MnO_2 particles that are formed onto surface during the modification process. The SEM analysis obtained after the adsorption indicated that the Pb(II) ions was adsorbed into the holes or pores onto the surface of Mn-mK by means of capillary forces and chemical ion exchange.

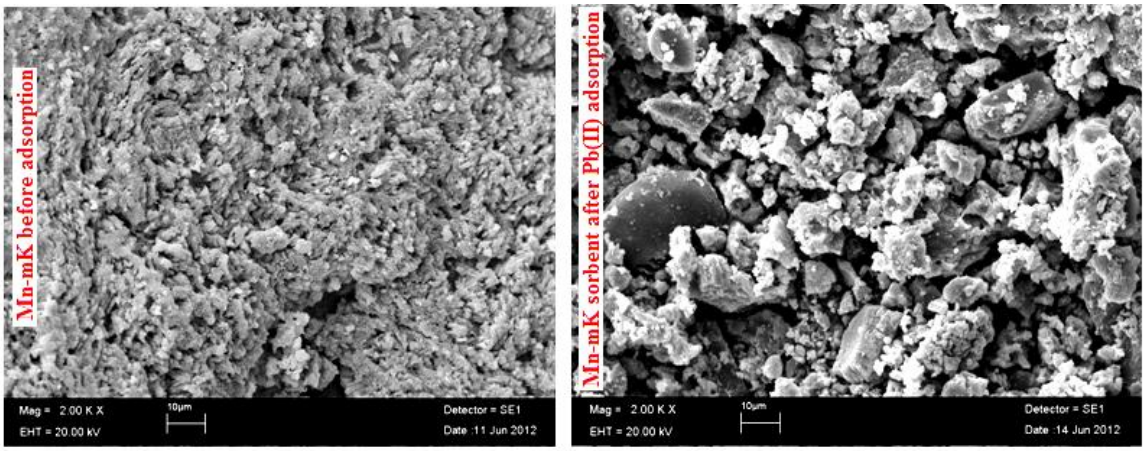

Fig. 1. SEM photographs of before and after Pb(II) adsorption

Characterization FT-IR spectroscopy

The FT-IR technique was applied to identify the functional groups onto Mn-mK surface as well as describe the probable interactions mainly involved in lead adsorption onto modified adsorbent.

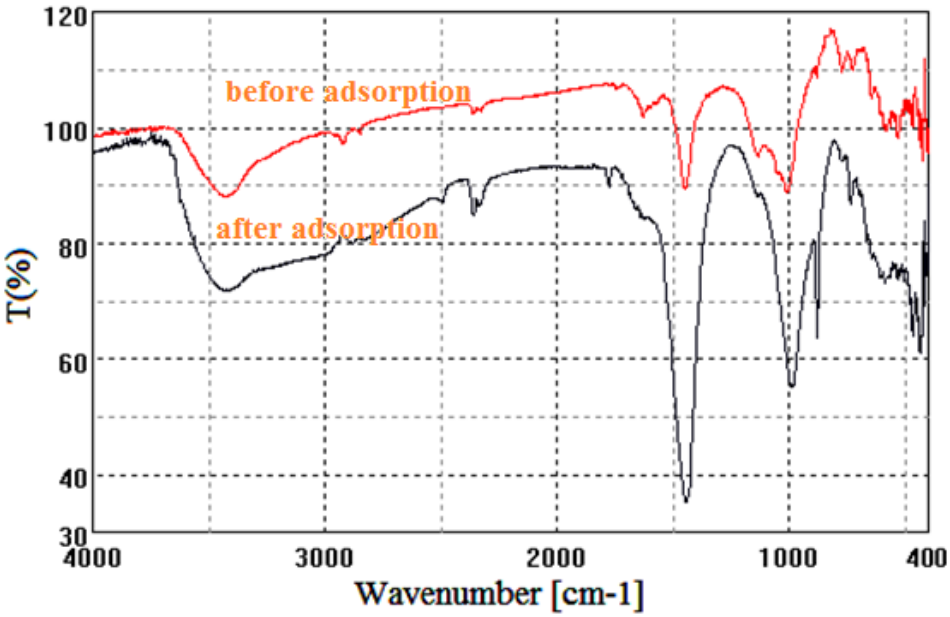

Fig. 2. FT-IR spectrum of before and after Pb(II) adsorption

As seen from Fig. 2, before adsorption, the broad bands observed at interval of 3430-3560 cm^{-1} are attributed to the O-H stretching vibrations of the H-O-H, Si-OH and Al-OH groups of Mn-mK sorbent. The spectral bands at 1642 and 1622 cm^{-1} also represent to the bending H-O-H bond of water molecules retained in the silica matrix. The bands observed at 1075, 773 and 587 cm^{-1} represent the stretching bands of Si-O-Si groups and the deformation bands of Si-O and Al-O-Si groups of Mn-mK sorbent, respectively. Moreover, the new bands at 1446 and 879 cm^{-1} are associated with the stretching bands of Mn-O and Mn-O-Mn groups onto the Mn-mK, respectively. On the other hand, as seen from Fig. 2, after Pb(II) adsorption process, the stretching bands of H-O-H, Mn-OH and Mn-OH groups onto the Mn-mK were overlapped at interval of 3278-3670 cm^{-1}, respectively. The deformation bands of Mn-O groups shifted to 662 and 433 cm^{-1}, respectively. The stretching bands of Mn-O and Mn-O-Mn groups onto the surface of Mn-mKwere seen at 1440 and 980 cm^{-1}. These results mean that the Mn-OH groups plays important role in the lead sorption mechanism that is proceed primarily via chemical ion exchange.

Effect of pH

As clearly seen from Fig. 3, the lead adsorption efficiency of Mn-mK is low (in the range of 60-70%) at strongly acidic conditions due to much more number of hydronium (H_3O^+) ions than the number of hydroxylated Pb(II) ions which result in a hardly competition.

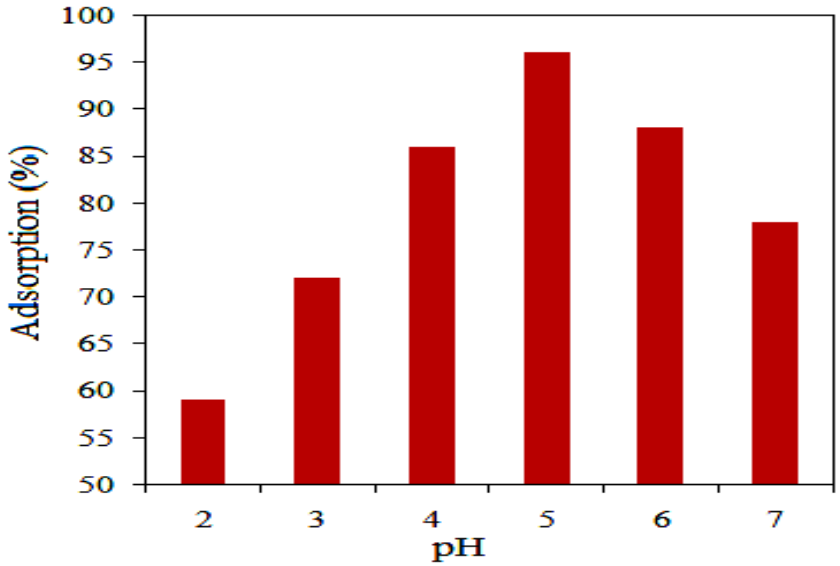

Fig. 3. Effect of pH on the adsorption of Pb(II) onto Mn-mK (initial metal concentration:10 mg L^{-1}; temperature:20°C, adsorbent concentration:8 g L^{-1}, contact time:40 min).

The complex ions with positively charged considerably prevent lead ions which resulted in low efficiency adsorption. The removal efficiency is increased with increasing pH to 5 and it arrives at maximum value. With rising pH from 5 to 7, the decrease in the lead adsorption efficiency was most likely to be due to onset of precipitation of Pb(II) ions as hydroxide compound as dominating species.

Effect of adsorbent concentration

Fig. 4 shows the influence of modified adsorbent concentration on the adsorption efficiency. As seen from Fig. 4, the adsorption efficiency is increased significantly with increasing the adsorbent concentration up to 8 g L^{-1} and at higher concentrations, remains nearly constant. These results are due to two facts: (i) The increased number of sorption sites per unit mass depending on adsorbent concentration allows comparatively high adsorption (ii) At great adsorbent concentration creates particle aggregation and decrease in the total specific surface area and, as a result, an increase in diffusion path leads to low adsorption efficiency.

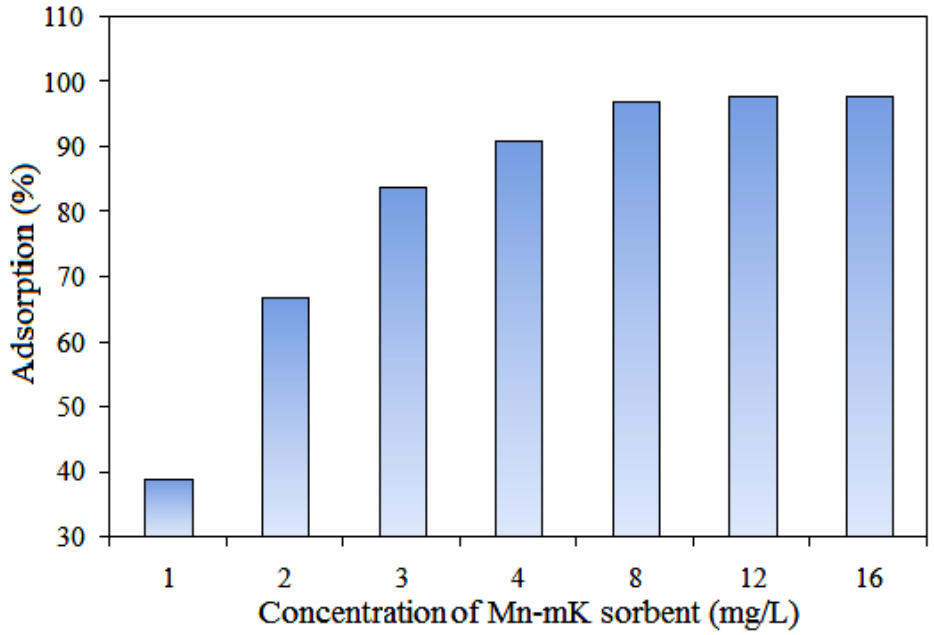

Fig. 4. Effect of adsorbent concentration on the adsorption of Pb(II) onto Mn-mK(initial metal concentration:10 mg L^{-1}; pH:5, contact time:40min; temperature:20^{o}C)

Effects of contact time and temperature

The effect of contact time on the adsorption capacity of Mn-mK was studied in the time ranges of 5-60 min under the optimal conditions. As seen from the results in Fig. 5, the initial adsorption of Pb(II) was rapid onto Mn-mK because lead ions–clay interactions reached equilibrium in less than 40 min. Thus, the contact time of 30 min was used in the following experiments. The sorption sites on the clay mineral were quickly covered by lead ions and the adsorption efficiency was dependent on the transportation rate of the metal ions from the liquid phase to the adsorption sites.

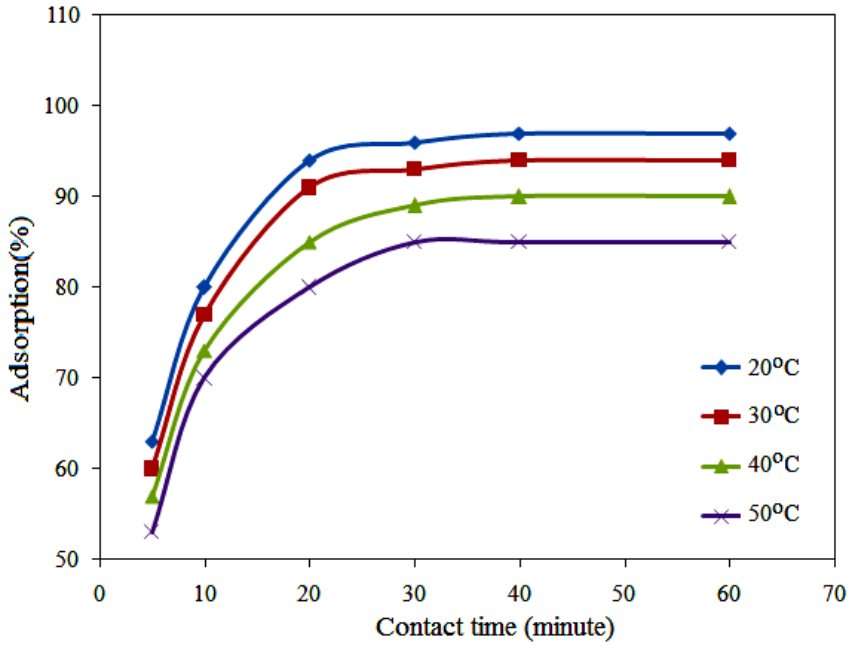

Fig. 5. Effect of contact time and temperature on the adsorption of Pb(II) onto Mn-mK (initial metal concentration:10 mg L^{-1}; pH:5; adsorbent concentration:8 g L^{-1}).

The temperature dependency of adsorption efficiency for the removal of Pb(II) onto the surface of Mn-mK was also shown in Fig. 5. As also seen from the curves, the adsorption efficiency was decreased with increasing the temperature from 20 to 50°C, indicating that the adsorption process of Pb(II) onto Mn-mK is exothermic character in nature.

Adsorption isotherm models

the Langmuir and Freundlich isotherm models were implemented to the batch equilibrium data. The Langmuir adsorption isotherm estimates the maximum monolayer adsorption capacity of the adsorbent and also decides whether the process is taken place as monolayer adsorption. This model can be written in non-linear form as below (Langmuir, 1918):

$$q_e = \frac{q_m K_L C_e}{1 + K_L C_e} \quad (1)$$

By using non-linear regression analysis, the correlation coefficients (R^2), and q_m parameters and standard errors were calculated was found as 0.992 and 192.9 $mg.g^{-1}$, respectively. These results indicated that the adsorption mechanism of Pb(II) ions onto the surface of Mn-mK is carried out via monolayer.

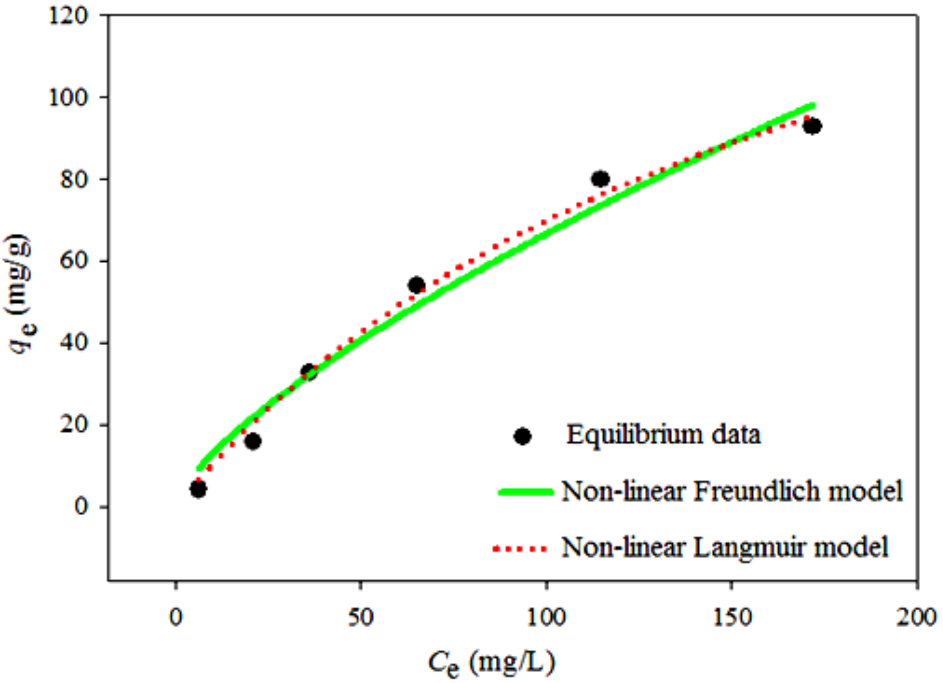

Fig. 6. Non-linear Langmuir and Freundlich isotherms for the adsorption of Pb(II) onto Mn-MK (adsorbent concentration:8 g L-1; contact time:40 min; pH:5; temperature:20°C).

The Freundlich isotherm model is known as non-ideal multilayer sorption occurred onto heterogeneous surfaces. This model can be written as follow (Freundlich, 1906):

$$q_e = K_f C_e^{1/n} \quad (2)$$

By non-linear analysis of the plot in Fig. 6, the K_f and 1/n parameters were calculated to be 2.48 and 0.72, respectively. The 1/*n* value indicate that the adsorption of Pb(II) onto modified adsorbent was favorable at studied conditions. However, the correlation coefficient (R^2) value were found as 0.979, indicating that this isotherm model did not give a better fitting than Langmuir isotherm.

Conclusions

In this study, MnO_2 modification of the kaolin was confirmed by FTIR spectroscopy and SEM techniques. The adsorption experiments regarding the removal of Pb(II) from aqueous solution and real sample have been carried out using Mn-mK under optimized batch conditions. The initial pH of solution, contact time, adsorbent concentration, initial metal ion concentration, and temperature of solution were found to be efficient in the removal of Pb(II) ions from aqueous solution using Mn-mK. From the Langmuir model, the sorption capacities of Mn-mK was found to be 192.9 mg g^{-1} at pH 5 and 20 ºC, respectively.

Acknowledgement

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TEXT MINING FOR EFFICIENT PROJECT EVALUATION

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Abstract: In this work, we propose text mining techniques for the evaluation of the progress in a project by looking for the enrichment of the vocabulary, the casual and condition relations, and the structure of the terms in the development phases of the RUFO project. In our paper, we used text mining and the structure of the vocabularies as a tool to measure the success and the progress in the project. The experimental results illustrate an overall performance of project evaluation. We used a quantitative and qualitative evaluation to measure the success in the project. By looking into the number of indexing terms, the causal relations and the positive conditional relations, and levels of hierarchical structure of the terms there is an evidence that the vocabulary enrichment had an impact on partner's evaluation ability.

Keywords: Text mining, project management, statistical evaluation, RUFO

Introduction

Project Evaluation requires reporting the achievements of the progress of the project over the lifetime of the project, typically done on a periodic basis, perhaps annually or at the end of a phase of a project (Otieno 200, and Patton 2002). The role of monitoring and evaluation is a large problem and it is important in improving the progress in the project. Evaluation deals with questions of cause and effect. It is assessing, estimating the value, worth, or impact of an intervention [wiki].

Project evaluation plays an essential role to the success of any project and therefore demands special attention [Wiki]. While project evaluation is common, it has been difficult to evaluate automatically the progress of a project based on the documents, reports and presentations generated by the participants to extract meaningful patterns and build structure of the terms from these reports. This research focus on the structure and enrichment of the terms one has to take into account when performing the evaluation.

Text Mining can be defined as a technique which is used to extract interesting information or knowledge from the text documents which are usually in the unstructured form (Jusoh, and Alfawareh, 2012, Nasa 2012 and Akilan 2015). We describe an approach of using text mining methods and glossaries as tool for evaluating and supporting project management and control of the project. Our approach using text mining methods provide an evidence that the vocabulary enrichment had an impact on attainment in project evaluation.

The contents of this paper are divided into five sections (1.Introduction, 2. Literature Survey, 3. Methods 4. Results and Findings, and 5. Conclusions). In the Methods section, we describe the methods and the methodology used to build the system and how we select the glossaries and used the text mining techniques to build the concepts hierarchy to support the indexing. In Section 4 discuss an application where we proposed a concepts hierarchy to evaluate the progress of a project and measure the level of success. The last section presents the conclusions.

An Overview of RUFO Project

RUFO is a TEMPUS-MEDA project (JEP-2153_2004), supported and financed by the General Directorate of Education and Culture of the European Commission and coordinated by Cnam (Paris). RUFO's purpose is to create an interuniversity network in Palestine for the development of individual and collective competences in the field of open and distance learning, in connection with European networks.

The development of the RUFO project implemented in 3 phases Figure 1. These phases are Defining and preparing the "pioneering projects", Developing the "pioneering projects" and Evaluating the "pioneering projects" and considering supports for replicating models

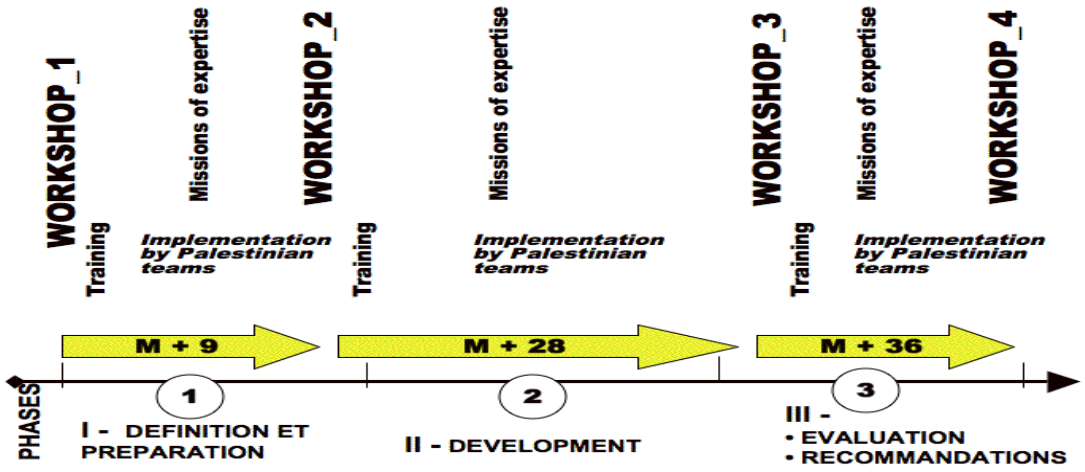

Figure 1. The 3 phases of the project

Literature Survey

Many studies discussed, addressed and examined the use of indexing and text mining in different applications. Each study focuses on a special technique as an application for text mining. In what follows, we present a brief discussion for some related work achieved in this respect.

The work of Rose (Rose et al. 2010), Ventura (Ventura et al., 2014), Van Eck Eck (Eck et al., 2010), (Abuzir 2010), (Abuzir 2014), and Matsuo (Matsuo et al., 2014) presented different automatic techniques to extract words from unstructured documents based on statistical analysis. The most common used statistical techniques are Term Frequency (TF) counts the frequency of a term in the corpus, Document Frequency (DF) counts the number of documents where a term occurs and Term Frequency/Inverse Document Frequency (TF/IDF) as a measure that yields large values for terms that appear only in very few documents of the given document collection.

D'Addio (D'Addio et al., 2014), in their approach they used semi-supervised learning and sentiment analysis to automatically identify aspects that represent the different subjects of the reviews in order to be used by recommender systems.

The work of Gwadera and Crestani (Gwadera R. and Crestani F., 2009) present a new technique for mining and ranking streams of news stories using cross-stream sequential patterns and content similarity based on event that happens at a specific time and place.
The paper of Ramakrishnan (Ramakrishnan et al. 2008), present an extraction mechanism that generates structured representations of textual content. Their results show over 62% average precision across 8 relationship types tested with over 82% average precision for compound entity identification.

Fragkou (Fragkou, 2015) in his paper he present techniques based on the combination of text segmentation and information extraction that can be beneficial for the identification of the various topics that appear in a document.

Methods

The main idea has been to use the documents collection of the RUFO project as a source for extracting the keywords as terms to represent the domain of RUFO project. We used a full text parsing technique and incorporating both statistical and lexico-syntactic methods to extract the terms and the relationships between them. The knowledge extracted by our system is more concise and contains a richer semantics.

Such groups of related concepts/terms enabled us to either, evaluate and/or update the existing terms in case those concepts are already defined in the list, or to enrich the existing list in case those concepts are not defined. This is an iterative refinement process with the newly available documents or glossaries.

We used the CRET (Abuzir, 2014) to identify important terms as well as their significant relationships. The following subsections describe the iterative approach that consists of subsequently parsing of the collection and the process of adding new keywords into the indexing terms.

Building Initial Term Categories

In the first stage for the indexing terms construction, initial concepts category containing the relevant domain concepts and the relationships among the concepts. We proposed the following terms as the main categories or concepts of the domain of the RUFO Project documents:

network,
tempus,
open distant learning,
pioneering projects,
methodology,
pedagogical
interuniversity network of competencies
project phases
diffusion

Parsing and Inserting Update Terms

As a first step to extract the terms from the documents, we parsed the project proposal. Table - 1 shows a sample of the extracted terms and their frequency. This list is used to update the indexing terms. The list is a collection of terms and statistics gathered when we parsed RUFO project proposal. We used this list pair to update the list of indexing terms and to update the main categories or concepts of the domain of the RUFO Project.

Table – 1 A sample list of update terms and their frequency

Update Term	F	Update Term	F	Update Term	F	Update Term	F	Update Term	F
assist	40	policy	10	Description workpackage	4	survey	14	policy debate	6
needs	32	ist programme	10	per participant objectives	4	non-material needs	14	ist work	6
consumption	29	work programme	9	product and service	4	contribution	13	action groups	5
programme	28	on-line	9	journal of teleworking	4	deliverable	13	workpackage number	5
workshop	24	area	9	description of work	4	activities	13	ist work programme	5
material	20	material consumption	9	b3 description	4	existing	12	evaluation milestone	5
non-material	19	groups	9	start date	4	date	12	service design	5
project	17	citizens	9	per participant	4	design	12	milestones and expected	4
number	16	particular	9	number date	4	future	12	descriptionworkpackage number	4
final	15	debate	8	number per	4	recommendations	12	expected result	4
new	15	on-line communities	7	new products	4	reporting	12	work and business	4
conference	15	information society	6	starting event	4	communities	11	workpackage number date	4

Before mining any text or terms, we perform certain pre-processing operations:
1. removal of stop words
2. changing all words into lower case
3. perform stemming removing the presuffix and post suffix
4. removal of irrelevant or generic terms

In our example, terms like number, conference, final, new, etc., would be considered as general terms. These terms would not select as an indexing terms. The first step was to eliminate these terms from the list (Table– 2) shows the new update list after removing the noisy terms.

Later, we used the filtered list of terms to update the list of concepts. In adding these terms to the list of concepts, we organized then in a structure that reflects the hierarchical structure of terms for effective indexing. As an example, the term "activities" can be added as a lower level under the main concept "societies" to reflect the hierarchical relation between these two terms.

By following, the preprocessing and the previous procedure the new list of terms were filtered by removing noisy terms. Table-2 shows the new update list after removing the noisy terms..

At the same time a lexico-sytactic model used to find a lexico-syntactic patterns (Abuzir, 2004). All keywords, concepts and new terms are directly visible. The following sentence is an example, see Figure 2:

Table - 2 A filtered list

Sample of Filtered list			
needs	groups	consumption	research
material	citizens	non-material	services
survey	on-line communities	non-material needs	contribution
activities	information society	future	recommendations
communities	ist community	policy	material consumption

*"**Material needs** like basic food, basic shelter, basic clothing etc form a quite small proportion of all **consumption**."*

Figure -2 includes some examples of the patterns

By selecting the previous sentence from the document, we identified common patterns (a lexico-syntactic patterns).
As we can see in the this sentence, the simple pattern "like"

Term like {Term, | Term,…}

shows the natural way to discover the hierarchical relation between terms in unstructured text. The terms food, shelter and clothing can be considered as narrow terms for Material needs. At the same time **material needs** can be considered as narrow term for consumption.

Using this technique some lexico-syntactic patterns were extracted. However, these patterns are too general and need manual constraints. They do not prevent the extraction of pairs of terms that are not linked by the target relation.

The previous procedure was followed to update the indexing list. Table - 3 shows the new filtered list of terms. We applied this methodology to identify important terms as well as their significant relationships.

Table – 3 New update terms

New Term	FR	Low Level Sub Topic	New Term	FR	Low Level Sub Topic
consumption	29	society	communities	11	society
material	20	needs	material consumption	9	consumption
material needs		needs	groups	9	communities
research	22	information	citizens	9	groups
non-material	19	needs	Products	7	consumption
non-material needs	14	needs	on-line communities	7	ist, community
services	14	society	information society	6	society
survey	14	information	ist community	3	ist

contribution	13	knowledge	lifestyle jump	immaterialisation
activities	13	society	backfire	immaterialisation

The previous paragraphs describe the way in which we updated the indexing terms. In the following section we used the new terms to parse, index and update the indexing list with new terms. Table-4, shows that the following keywords were used in the indexing process.

Table-4

Keywords	Ferquancy
Immaterialisation	2
Information	8
IST	51
Knowledge	5
needs	32
policy	10
Scenario	1
society	7
Substitution	8
Sustainability	22

Results and Findings

The indexing and retrieval processes we used in our research are based on the hierarchical structure of the terms. We used this hierarchy to create a mapping between documents collection and concepts.

Table-5 and figure-3 show different numbers of keywords, concepts and roots (nodes at the highest level in the hierarchy of the concepts). In table-5, keywords represent the number of keywords and main roots in our list. Indexing result shows how many keywords and concepts were used in the indexing process for each phase.

The second part of table-5, the Indexing result; shows how many keywords and concepts were used in the indexing process for each phase. For example, in phase 1 the system finds 10 keywords out of 17 in the document. In the second phase there are only 102 keywords were founded in the documents collection. In our collection, the documents in the second phase were emails. In the third phases our collection are the delivery and the power point presentation. Because of that, we have a high number of terms used in indexing.

Table 5- Statistical information about usage of indexing terms

Step number	Indexing list		Indexing Result	
	Number of keywords	Number of Roots	Number of Keywords used in indexing	Number of concepts used in indexing
Phase 1	17	4	10	0
Phase 2	102	5	97	21
Phase 3	191	8	38	5

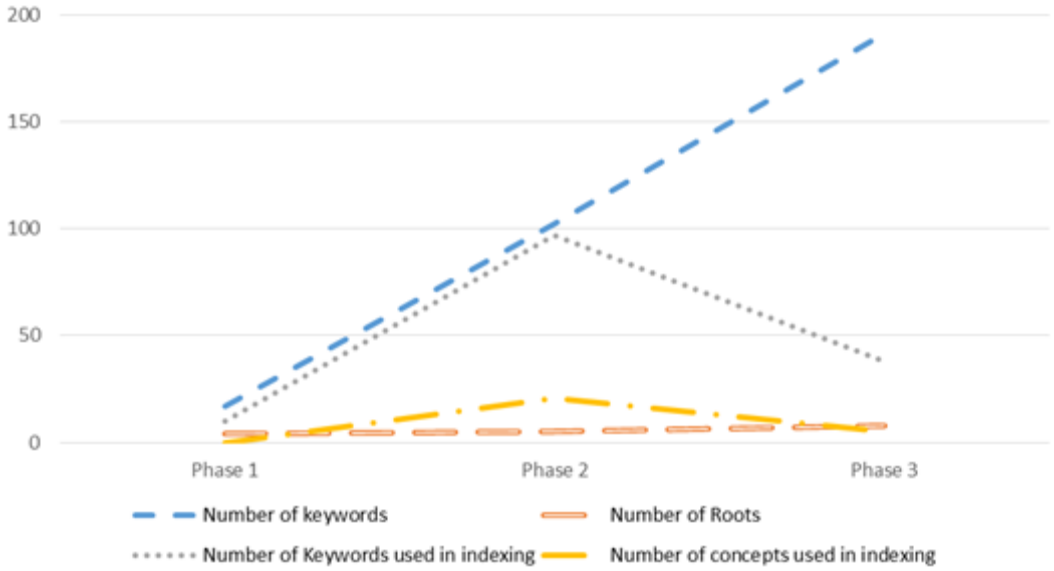

Figure 3. Statistical information about the indexing terms

Figure-3 shows that the number of keywords in the indexing is increasing. As the number of keywords used in indexing is increasing, we used more keywords and concepts to represent the content of the documents. The number of the root terms is stable.

So, next to the analysis about the number of keywords and concepts extracted from the repeated indexing in the different phases of the RUFO project, the number of relations existing between the individual terms within the list can be considered. A basic evaluation is given about the causalities and conditions that exist in the different RUFO documents.

In our approach, we gathered the necessary quantitative data related to the causal and conditional relation, statistical information will be exposed here, about what kind of relation are represented in the RUFO documents, and the frequency and evolution is reflected on this matter throughout the different phases.

From the last tables there's one important remark. Although the size and the number of the documents is increasing during the 3 phases, the number of keywords and concepts , casual relations and conditional relations that were retrieved in the indexed documents, is proportionally seen high in phase3. Figure 8 shows the degree of positive conditions (IF Condition) through the progress of the project.

We illustrated the total number of causal relations and conditions relations in figures (4 and 5) and Tables (6 and 7).

During the process of indexing the document collection of RUFO project, the number of keywords and the relationships between them increased. At the same time, the number of levels in the structure hierarchy of the terms increased from one to seven. There are seven levels in the hierarchy in phase three. As the number of keywords, relationships and the levels is increasing the more the indexing list can represent the domain.

Table 1 - Total number of Causal relation in the different phases of RUFO Project

	Phase1	Phase2	Phase3
Total number of Causal Relations	124	898	2016

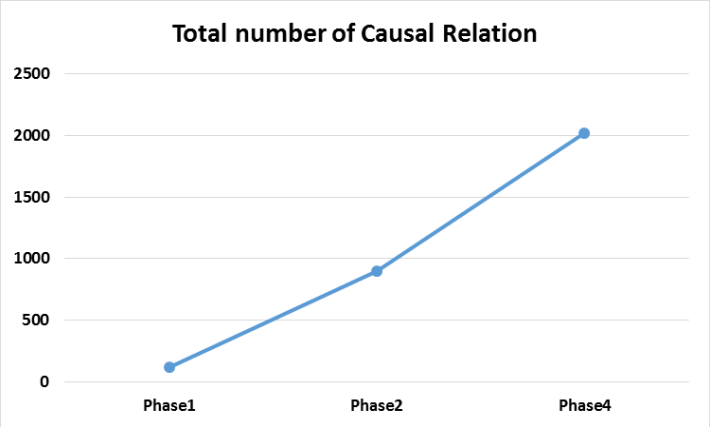

Figure 4. Total number of causal relation

Table 7 - Total number of if and if not conditions in the different phases of RUFO Project

	Phase 1	Phase 2	Phase 3
If	0	36	248
If not	0	3	7

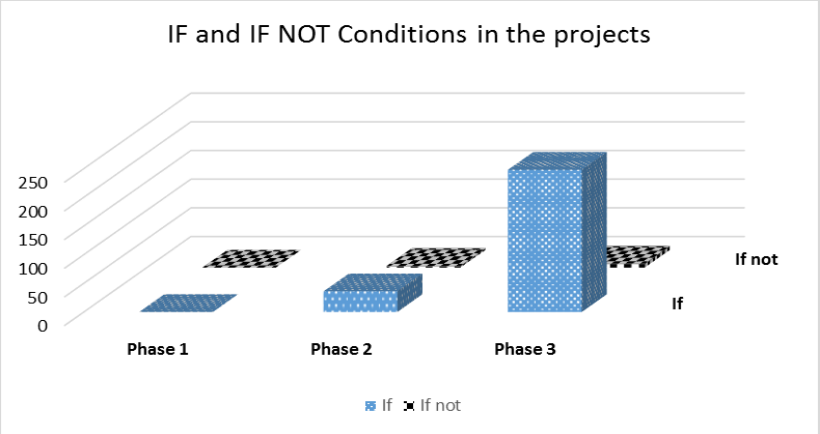

Figure 5. Total number of conditions

There is an evidence from this research that the vocabulary enrichment had an impact on partner's writing ability. The findings suggest that on average the project had a positive impact on the writing ability across all partners in the RUFO project. However, our estimates are statistically significant so we are able to conclude that the vocabulary enrichment and the complexity of term structures were caused by the project phases rather than occurring by chance.

This evaluation reported that partners gained the confidence required to engage in the different activities, and that their writing and speaking skills improved.

Conclusion

In this paper, we discuss an approach supporting project evaluation and control based on text mining, lexico syntactic and information retrieval techniques. In our approach, we used several techniques to measure the project progress based on the measurements of using terms, casual and conditions relations, and the complexity of the structure of indexing terms.

We used the frequency of terms (TF) and the complexity of the indexing list as a tool to measure the success and the progress in the RUFO project. The increased number of terms, the complexity of the hierarchical levels and the increasing number of relationships between terms and the positive conditions used in the different phases of the project are a good evidence of success for progress of the project.

These factors are good evidence of success for the progress of the project. As we can see, users or project partners start using more specific and general terms to represent their concepts or describe the project. The number of hierarchical levels increases form 1 to 7 levels in phase 3. This evaluation reported that partners gained the confidence required to engage in the different activities, and that their writing and speaking skills improved.

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EXPLORATION OF IRON ORE DEPOSIT IN ELBISTAN OF SOUTHERN TURKEY, USING MAGNETIC DATA

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Abstract: The objective of this paper is geophysical exploration of the possible iron ore deposits of an area in Elbistan district in Kahramanmaraş-Southern Anatolian region, Turkey. To achieve this, Reduction to the Pole (RTP) magnetic data has been used with horizontal gradient magnitude (HGM) and tilt angle map (TAM) techniques which are two various boundary analyzing techniques to prospect the terrains and boundaries of iron ore deposit in the area. The locations of proposed drill holes have been determined with varying depths between 25 to 40 meters.

Keywords: Iron ore, magnetic data, magnetic gradient, edge detection, depth estimation.

Introduction

Hansen et al. (1987) used the horizontal gradient magnitude (HGM) for commenting edges in gravity anomaly data. The tilt angle map (TAM) technique was first suggested by Miller and Singh (1994). Verduzco et al. (2004) enhanced this method. The application of the edge detection technique based on the Reduction to the Pole (RTP) magnetic anomaly from semi-infinite vertical contact model was described by Oruç and Selim (2011). This study aims to find possible iron ore deposits in study area. With this study, the edges and the depths of the locations that have high magnetization are determined in the area.

Methodology

Nowadays using TAM techniques, edge detection and depth estimation of the units that have high density contrast or high magnetization contrast are performed. Tilt angle formula is given as,

$$\phi = tan^{-1}\left(\frac{\partial T/\partial z}{\sqrt{(\partial T/\partial x)^2 + (\partial T/\partial y)^2}}\right) \quad (1)$$

The denominator term in Eq. (1) is generally defined as the HGM (Eq. 2).

$$HGM = \sqrt{(\partial T/\partial x)^2 + (\partial T/\partial y)^2} \quad (2)$$

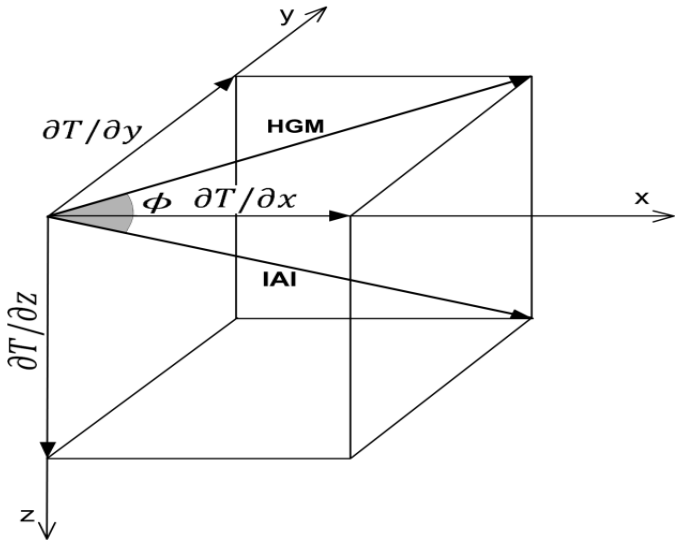

Fig. 1. Schematic diagram demonstrating the first magnetic gradients ($\partial T/\partial z$, $\partial T/\partial x$ and $\partial T/\partial y$) and ϕ and HGM (modified from Oruç and Selim, 2011)

Fig. 1 shows that the tilt angle ϕ is attained from the first vertical gradient $\partial T/\partial z$ and the HGM (Oruç and Selim, 2011). A map of ϕ can therefore be consulted an image of the tangent of the angle. Half the horizontal distance between the $\pm 45^0$ contours of the tilt angle is the depth to source.

Geological Setting and Calculations

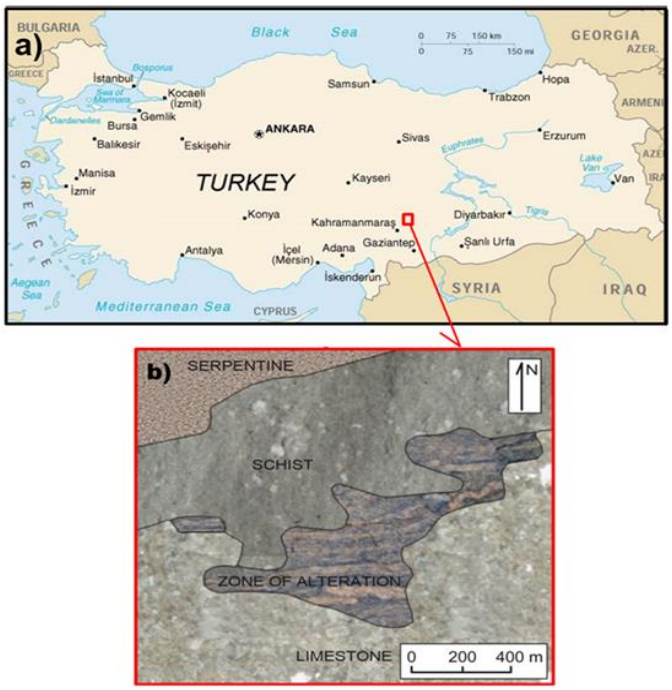

Fig. 3. The study area and geologic sketch map of the study area (modified from URL-1)

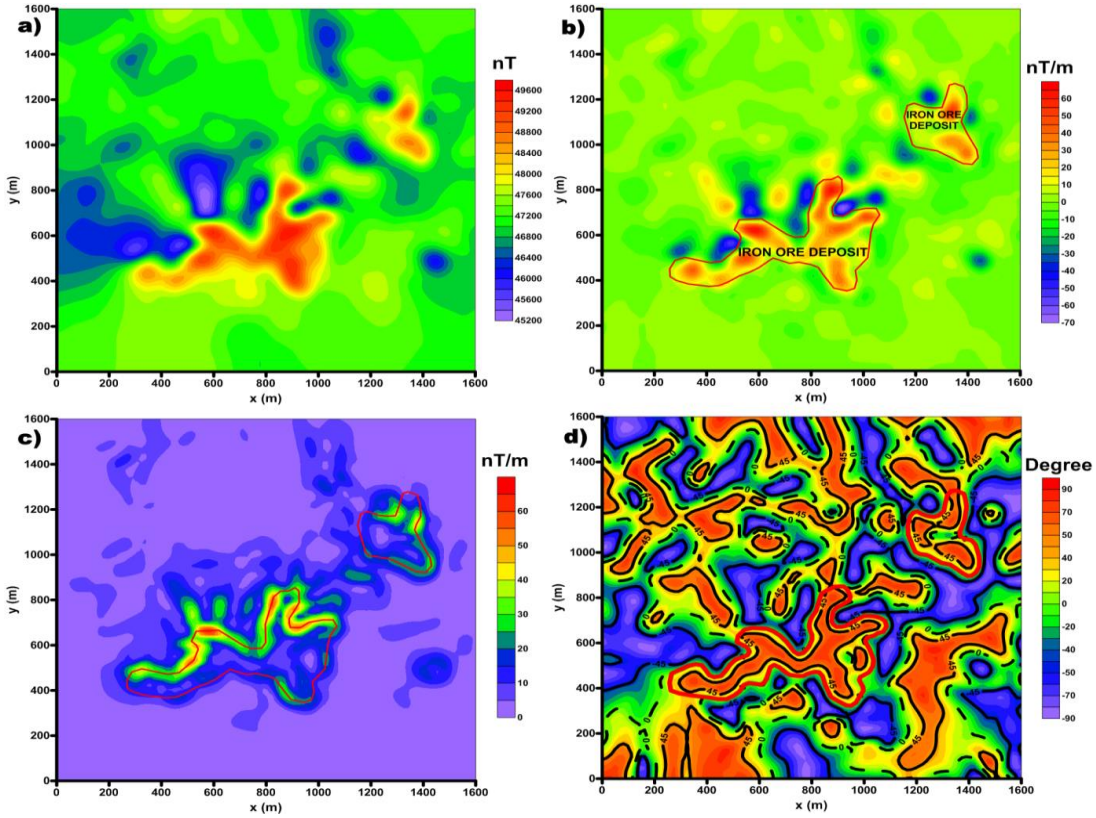

Fig. 4. (a) RTP magnetic anomaly map of the area. (b) First vertical magnetic gradient map. (c) HGM obtained from Fig. 4(a). (d) TAM obtained from Fig. 4(a).

The geological map of the study area was created (Fig. 3). Serpentine and schist structures with east-west direction were observed in the north and northwest parts of the study area. The site was divided by 33 west-east extending profiles. Each profile has an average length of 1600 meters and stations were evenly distributed with 50 meters of intervals. Before applying the HGM and TAM techniques, the total field anomaly data were converted to RTP. The middle and NE parts of the survey area are characterized by high-magnetic values. It is considered to be a relationship between maxima anomaly locations in the RTP magnetic anomaly, and first vertical gradient of RTP magnetic anomaly maps and potential iron ore deposits (alteration zones) belonging to the study field (Fig. 4 a and b). First, the first vertical gradient of the magnetic anomaly has been computed by using the FFT algorithm developed by Gunn (1975) as illustrated in Fig. 4(b). Second, an image of the HGM has been ensured to illustrate in recognizing the horizontal location of geologic contacts as shown in Fig. 4(c). Finally, an image of the TAM has been ensured to illustrate in recognizing the horizontal location and depth of geologic contacts as shown in Fig. 4(d). Fig. 4(c) shows the simple form of the HGM and Fig. 4(d) shows the simple form of the TAM only displaying the contours -45^0, 0, and $+45^0$ degrees. As specified in the method, the depth from the surface of the upper boundaries of these masses is calculated throughout the boundaries of sought mass by using the half length values of horizontal distances remaining between the $\pm 45^0$ contours of the tilt angle in the TAM image (Fig. 4d).

Conclusions

It is thought that maxima magnetic and magnetic gradient anomalies from the approximate in the middle part with southwest-northeast direction of the study area are associated with the iron ore deposits (Fig. 4 a and b). The maxima contours of HGM and the zero contour of TAM give the edges of possible iron ore deposits which are in the Fig. 4(c) and (d). Considering the results, drillings are proposed for the most appropriate three different locations that have high anomaly for the iron ore deposits. The first drilling location is proposed at the point (x=600 m and y = 610 m), the second drilling location is proposed at the point (x = 880 m and y = 800 m), and the third drilling location is proposed at the point (x = 1350 m and y = 1150 m) (Figs. 4 b). The locations of proposed drill holes were determined with varying depths between 25 to 40 meters.

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METHOD DIAGNOSTIC FOR DIFFERENTIAL PATHOLOGICAL PROCESSES OF RECTAL TISSUES

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Abstract: The different numbers of microelements in normal and pathological–neoplastic cells for their radiation with giving of negative structures and photo-electrical effect - individual for normal of rectal tissue and pathological process (chronic anal fissure, non-malignant and malignant tumors). The γ-quantum is absorbed at the expense of the characteristic irradiation of microelements in normal and pathological tissues – new speed of method for differential diagnostic of pathological processes: chronic anal fissure and rectal tumors. The studies of biopsy material after operative intervention for rectal diseases (chronic anal fissure, polyps and adenocarcinoma), through registration of coefficients of absorbed at the expense of the characteristic irradiation of microelements on entrance intensive γ-quantum 10 kHz, tissue for energy 59,6 *keV* – 5 mm, for energy 17 *keV* – 5 mm, for energy 5,9 *keV* – 1 mm, time of registration 60 sec. The different of absorbed at expense low level energy γ-irradiation of cells rectal tissues had universal of characteristic and basis for early of differential diagnostic of pathological processes.

Keywords: Diagnostic, pathological processes, rectal tissues, γ-quantum.

Introduction

Well known that considerable proportion in basic mechanisms of cell malignant transformations and it's further vital functions by violation of cell cycle, changes of its morphology and motion, absence of replicate senescence (cells' immortality), changes in regulation of apoptosis with genetic instability takes specific, so-called "malignant", physicochemical disbalance of microelements with increasing of intracellular concentration of Ca^{2+} and accumulation of Na^{+}, Li^{+}, Pb^{+} almost in ten times more in neoplastic cells than in normal.

Taking into account presence of different numbers of microelements in normal and neoplastic cells where proposed using of well-known photoelectric effect for early differential diagnostic with fixation of received results in the form of physical size. In case of light-striking of cells with it's losing of negative charge appears photoelectric effect, which is strictly individual for normal cells as well as for inflamed cells, non-malignant growth cells and malignant growth cells. Measures intensity of cells' γ-quantum absorption same as tissues' characteristic radiation of microelements.

Methods

Absorption of γ-quantum in case of energy spectrum of radiation from hundred *keV* to several *MeV* appears as a result of incoherent scattering by electrons of oxygen, carbohydrate and hydrogen atoms and characterized by low «k» absorption coefficient:

$$\mathbf{J_1 = J_0 e^{-kL}},$$

Where,

$\mathbf{J_1}$ – intensity of γ-quantum behind the object of investigation, hertz;

$\mathbf{J_0}$ – intensity of γ-quantum in front of the object of investigation, hertz;

k – absorption coefficient, 1/sm;

L – layer thickness of gamma-raying object of investigation, sm;

Mostly interesting follow long-lived almost homogeneous γ-source of radiation: americium 241, γ-quantum energy- 59,6 keV, specific activity up to 2 Ki/g; molybdenum-93, γ-quantum energy- 17 keV, specific activity up to 0,5 Ki/g; ferric, γ-quantum energy-5,9 keV, specific activity up to 1 Ki/g.

Results and Findings

In case of energy 59,6 and lower than keV γ-quantum absorbed mostly as a result of photoelectric effect: knock out electrons from one electron shell to another with further transposition of electrons in atoms with emission of characteristic radiation, which can be fixed by special spectrometer.
These investigations are bases on two laws of photoeffect:

1. In case of constant wave-length irradiation unit of luminous flux is in direct proportion to absorbed luminous energy (Stoletov's law);

2. Rate of movement of knocked out electrons is in direct proportion to oscillation frequency of light wave and independent of incident light flow unit (Einstein's law, bases on Plank's quantum theory of light).

Were investigated 138 examples of biopsy material, which extracted during operative interventions in patients with rectal pathology (histological confirmed polyps, cancer) and normal tissue, by the measurement and registration of absorption coefficients and microelement's characteristic radiation in initial intensity 10 kHz with layer thickness of investigated objects: for energy of 59,6 keV- 5 mm, for energy of 17 keV-5 mm, for energy of 5,9 keV- 1 mm, scanning time 60 sec.

Were received follow results of measuring of biopsy material and registration of absorption coefficients and microelement's characteristic radiation in initial intensity in patients with rectal pathology:

Energy, *keV*	Inflammation tissue/ absorption coefficient	Polyp/ absorption coefficient	Cancer/ absorption coefficient	Contrast range, %
59,6	up to 0,19	0,21	0,22	4,76
17	up to 1,7	1,9	2,1	10,5
5,9	up to 21,0	26,0	31,0	19,23

Thus, using energy of γ-quantum of 59,6 keV the difference of impulse for different pathological processes amount to 30% and allow us to maintain of possibility of differentiation of malignant, non-malignant and inflammatory disease of rectum using this energy and scanning time of 60 sec.

Using energy of γ-quantum of 17 keV pathological processes more reliable differentiated because of difference of impulse exceed metering error ($\pm 3 \sqrt{232000} < 142100$).

Almost same results were received during metering using ferrum and energy of 5,9 keV.
Thus, it's proved that change of intensity of absorption of low-frequency γ-radiation by the tissues' cells is universal and give us possibility for early differentiation in case of neoplasm's and inflammatory processes in rectum.

Conclusion

Conducted experimental investigation by measuring and registration of mini-γ-quantum absorption and microelements' characteristic radiation of pathological changed rectal tissues' cells in case of chronic anal fissure, polyps and cancer tumors give us possibility to substantiate new quick-acting method of differential diagnostic, which can be using in program of prevention of permanent colostomy and saving and improvement of patients' quality of life after operative interventions.

The molecular mechanisms by which oncogenes initiate and stimulate tumor growth are: (1) overproduction of the growth factors, (2) increased density of the growth factor receptors on the cell membrane, (3) mutation of the transducer mechanisms, and 4) mutation of the transcription factor.

Recommendations

The method (co-authors V. Sulyma, V. Gaponov, V. Kravchenko, L. Mesheryakov) uses the phenomenon of photoelectric effect and different numbers of microelements in normal and pathological–neoplastic cells for their radiation with giving of negative structures - individual for normal of rectal tissue and pathological process (chronic anal fissure, non-malignant and malignant tumors). The γ-quantum is absorbed at the expense of the characteristic irradiation of microelements in normal and pathological tissues – new speed of method for differential diagnostic of pathological processes: chronic anal fissure and rectal tumors. The studies of biopsy material after operative intervention for rectal diseases (chronic anal fissure, polyps and adenocarcinoma),

through registration of coefficients of absorbed at the expense of the characteristic irradiation of microelements on entrance intensive γ-quantum 10 kHz, tissue for energy 59,6 *keV* – 5 mm, for energy 17 *keV* – 5 mm, for energy 5,9 *keV* – 1 mm, time of registration 60 sec. The different of absorbed at expense low level energy γ-irradiation of cells rectal tissues had universal of characteristic and basis for early of differential diagnostic of pathological processes.

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DESIGNING INFORMATION SYSTEMS FOR MEDICAL APPLICATIONS IN CLOUD ENVIRONMENTS

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Abstract: This paper explores three decades of London Ambulance Service (LAS) Information Systems (IS) design and redesign endeavours. The literature shows that during the last three decades, implementation of efficient IS remained one of the most daunting challenges faced by the LAS, which is the busiest emergency ambulance service in the UK. The failure of the London Ambulance Service Computer Aided Dispatch (LASCAD) in 1992, which triggered government inquiries and scholarly studies into its causes, was one of the tremendous issues the organization had to overcome. Without a stable and dependable IS, the ultimate goal of delivering high-quality service within the specified response time cannot be realized. Thus, it was imperative to turn around the 'epileptic' nature of the organization's IS to meet the goal of providing the highest-quality care to patients. Consequently, the organization has been prodding and tuning the IS architecture in the exclusive anticipation of accomplishing an enhanced and stabilized IS for day-to-day emergency operations. Target response times are set by the UK government for the country's emergency ambulance services. To continuously meet those targets, IS redundancy is vital to facilitate a 24/7 service. The data show doubts about the organization's capacity to completely eliminate system failures over time given the history of system failures; however, evidence shows that after a lot of trial and error, the organization has found a smooth spot by implementing Command Point at the front end and a cloud computing solution at the back end. The organization's glitch-free operation during the London 2012 Olympics and Paralympic Games was a testimony to the resiliency and stability that LAS IS has attained. This paper used data collected from the LAS and University College London Hospital (UCLH). And data analysis was conducted using qualitative methods and NVivo software.

Keywords: Affordable care act, London ambulance service, information system, cloud computing, London 2012 Olympics

Introduction

Designing and implementing a large-scale information system (IS) project remains a challenge in practice notwithstanding the contemporary technological advancements. The failure of the London Ambulance Service Computer Aided Dispatch (LASCAD) in 1992 that triggered government inquiries and a variety of research into its causes has become a distant memory. However, the rollout failures of the Affordable Care Act (ACA) in October 2013 in the United States is yet another stark reminder of the immediate challenges associated with deploying large-scale IS. These two projects are indeed not isolated failed projects in the IS domain. In the past 30 years, according to Currie and Galliers (1999), there have been several large-scale IS failures across organizations and industries, an indication of the gravity and persistence of IS implementation risks.
Faced with unabated IS failures, the London Ambulance Service (LAS) has been relentlessly going through various stages of organizational change and technological development to enhance their service in the last several decades. Yet, the literature shows that despite all the efforts, starting with the first CAD project, which was started and abandoned in the 80s (Finkelstein, Anthony & Dowell, 1996; Greenwood, Khajeh-Hosseine & Sommerville, 2010), the second failed project in 1992 (Beynon-Davies, 1999; Finkelstein, Anthony & Dowell, 1996; Fitzgerald & Russo, 2005; McGrath, 2002) and the 'turnaround' and 'golden circle' of 1996 (Fitzgerald & Russo, 2005; McGrath, 2002), up until 2011 when a Command Point software upgrade failed, the LAS had been experiencing sporadic IS failures (Fiveash, 2011; Musick, 2006). However, after over three decades, the LAS now seems to have brought the situation under control. The LAS's glitch-free operation during the London 2012 Olympic and Paralympic Games, the biggest event the LAS has ever planned for, attests to the fact that all the efforts are finally paying off.

Since the emergence of information technology (IT), up until this time and age in which technology has become part of our everyday lives, IS project failures could not be, and have not been, eliminated. Instead, they have

become part of the human learning experience. According to Currie and Galliers (1999), "failure is an undesirable fact of life and the price of progress". And consequently, both academics and practitioners have shown growing interest in studying the success or failure of IS projects.
Be that as it may, while the literature is replete with debates about software failures, it is often easy to overlook the servers at the back end. Thus, in the discourse on IS failure, there is neither enough research in the literature that shed lights on, nor adequate articles as regards the data centres that support, the massive front-end applications.

Both among businesses and academics, discussions about server reliability and resiliency often border on business-critical applications. In other words, the applications should be available 24/7 (24 hours a day, seven days a week). Obviously, emergency management applications fall into that category owing to the mission they are tasked to achieve, which is to save human lives in emergency situations. Therefore, owing to the business-critical nature of emergency services, it deserves only the most resilient and reliable IT solution. As a result, no IT solution befits emergency services other than cloud computing, due to – among other benefits – its dynamic on-demand scaling capacity. In the event of emergency, the capacity to scale dynamically is vital, taking unanticipated high demand into account. In the absence of that capacity, the IS could potentially be overwhelmed and brought to a screeching halt.

Along those lines, it was imperative in this study to empirically investigate the LAS's historic IT solutions and examine the lessons learned over time as well as to explore the ways in which those lessons helped shape their current IS solution and their overall IT strategy.

IS Project Failure and Success Factors

The failure and success factors as regards LASCAD 1992 and 1996, respectively, have been widely explored. In terms of the causes of the LASCAD 1992 failure, several studies arrived at similar findings, citing predominant factors such as an unattainable rollout time frame; poor judgement in selecting the vendor; a lack of user involvement; an inadequate testing process; poor project management; and the role of management (Beynon-Davies, 1999; Fitzgerald & Russo, 2005; Greenwood, Khajeh-Hosseine & Sommerville, 2010; McGrath, 2002; Wastell & Newman, 1996; Charette, 2005).

Implementation of large IS projects in complex organizations often focusses on the technological aspect with emphasis on factors that make the technology meet user requirements (Southon, Sauer & Dampney, 1999). While those factors remain important in the successful deployment of IS projects, there is increasing awareness of taking more complex organizational and people-related factors into consideration in the decision-making process. Owing to the intricacy of organizational issues, IS project implementation cannot simply be addressed from the technical or informatics perspective. Many studies address the organizational and human issues according to Gray, Sauer, and Dampney (1999), for example organizational change (Morton, 1991), politics (Knights & Murray, 1994), leadership (Beath, 1991), training, resistance (Hirschheim & Newman, 1988), practice changes, commitment (Sabherwal & Elam, 1995), and communication (Larson & King, 1997).

Identification and analysis of risk factors is an important preparatory activity towards avoidance or reduced chance of IS failure. Prior to the successful LASCAD 1996 implementation, the organization identified and analysed IS deployment risk factors. Such factors are supported by various studies both in the field of IS and in organizational change management. For instance, Lyytinnen and Hirschheim (1988) argue "that the obvious first step in software project risk management is the identification of the risks to be controlled". Once the risks are identified, the principles of project success are adhered to and efforts are directed towards the mitigation of the known risks and avoidance of project failure pitfalls.

In conducting a survey of the literature on IS failure, Lyytinen and Hirschheim (1988) identify four major theoretical categories of such phenomenon:

(1) Correspondence failure

This is the most common form of IS failure discussed in the literature and typically reflects a management perspective on failure. It is based on the idea that design objectives are first specified in detail. An evaluation is conducted of the IS in terms of these objectives. If there is a lack of correspondence between objectives and evaluation, the IS is regarded as a failure.

(2) Process failure

This type of failure is characterized by unsatisfactory development performance. It usually refers to one of two types of failure: first, when the IS development process cannot produce a workable system; secondly, the development process produces an IS but the project runs over budget in terms of cost, time, etc.

(3) Interaction failure

Here, the emphasis shifts from a mismatch of requirements and system or poor development performance to a consideration of usage of a system. The argument is that if a system is heavily used it constitutes a success; if it is hardly ever used, or there are major problems involved in using a system, then it constitutes a failure.

(4) Expectation failure

This was described by Lyytinen and Hirschheim (1988) as a superset of the three other types of failure. They also describe their idea of expectation failure being a more encompassing, politically and pluralistically informed view of IS failure than the other forms. This is because they characterize correspondence, process, and interaction failure as having one major theme in common: the three notions of failure portray a highly rational image of IS development; each views an IS as mainly a neutral technical artefact. In contrast, they define expectation failure as the inability of an IS to meet a specific stakeholder group's expectations. IS failures signify a gap between an existing situation and a desired situation for members of a particular stakeholder group. Stakeholders are any group of people who share a pool of values that define what the desirable features of an IS are, and how they should be obtained.

Background of the Study

The health-care sector exhibits much cause for concern over the fact that IS are connected to patient care, thus any system downtime puts lives at risk. The NHS in general and the LAS in particular have a history of system failures resulting in government inquiries and various studies. As a result, in the last three decades, the LAS has focussed concerted efforts towards the implementation of a robust and stable IS.

This paper is a component part of the following ongoing PhD study at Loughborough University, England, UK: *EXPLORATORY RESEARCH ON THE NATIONAL HEALTH SERVICE AMBULANCE TRUSTS' INFORMATION SYSTEMS.*
The paper attempts to address the objectives of one of the subresearch questions:
Investigate the extent to which cloud computing risks and benefits are reflected in the information systems of NHS Trusts.

Overview of the Case

The LAS is one of the largest ambulance services in the world and it provides an emergency service to the London population which according to Darren (2013), stood at 8.3 million as at 2013. Their operating space covers 14 districts spread across over 600 square miles. The service has 70 ambulance stations, 250 vehicles, one helicopter, and over 5000 staff, and operates from 26 local operational areas. Traditionally, the LAS was viewed as an organization that renders an emergency service by simply transporting patients to hospitals. This view is no longer accurate. Today, according to the Health and Public Services Committee Chair Borwick (2011, pp.7–8), the LAS does much more than that:

> many of its staff have the skills to save patients' lives in that crucial 'golden hour' of medical emergency, as well as providing a range of support and advice to patients with less urgent conditions often in their own homes or over the phone.

The Main Goals of Emergency Service

The goals of an emergency service are multifaceted and particularly interesting for academic and industry research. The health-care sector exhibits much cause for concern over the fact that IS are connected to patient care, thus any system downtime puts lives at risk. Additionally, the NHS has a legal obligation to comply with

all appropriate legislation in respect of data, information, and information security. It also has a duty to comply with guidance issued by the government of the UK and the European Union.

Rapid Response to Emergency Incidents

A key goal of every emergency service remains the capacity to respond rapidly to emergency incidents, bearing in mind that every minute counts in life and death situations.
In England, the government holds ambulance services to a certain standard in order to meet that goal. For example, Category A 8-minute response time 75% of the time is an indicator that measures ambulance response time to the scene of potentially life-threatening incidents. Ambulance services are also monitored against the standard of ambulances reaching 95% of Category A calls within 19 minutes. These are the metrics used in measuring how fast patients needing emergency ambulances get them. The LAS has performed relatively well against those targets in the last three years with an average of 75.4%, which is slightly above the average for England of 74.5%.

System failure negatively impacts enormously on the ambulance response time due to the associated delays in the entire dispatch cycle from the initial call to the patient's treatment. When failure occurs – either on the application side or the server side – ambulance services are forced to default to the manual process of using pen and paper to first record incoming calls, and thereafter use radio to locate ambulances for dispatch. In addition to delays, the manual call-taking process is also cumbersome and error-prone, like most manual activities.

Brief Overview of Cloud Computing

Sosinsky (2010) defines cloud computing as "the combination of the infrastructure of a datacenter with the ability to provision hardware and software". Similarly, the National Institute of Standards and Technology (NIST) Brown (2012) defines cloud computing as:

> a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources—for example, networks, servers, storage, applications and services—that can be rapidly provisioned and released with minimal management effort or service provider interaction.

In a nutshell, cloud computing refers to the offering of computing resources as services over the Internet in a shared, scalable, and elastic manner. It enables consumers to rent IT resources as a utility (similar to electric power utility), measure, and pay for actual usage instead of permanently owning an entire IT infrastructure.
Cloud computing has different models and they differ in both services and access methods. Traditionally, software has to be purchased and installed by every user. With Software as a Service (SaaS), software application can be rented over the Internet on a pay-per-use basis. Examples of SaaS are SalesForce CRM and Google Apps. Platform as a Service (PaaS) involves rentable platforms for application development over the Internet using the application programming interface (API) and tools of the cloud service provider. Examples of PaaS include Microsoft Azure and Amazon DB/S3. And the service of leasing of servers, storage, network, computer memory, and processors over the Internet is called Infrastructure as a Service (IaaS). Examples of IaaS include Amazon EC2, Rackspace, and Cloud Storage (Bojanova & Samba, 2011; Buyya, Broberg & Goscinski, 2011; Guha & Al-Dabass, 2010).

Cloud Computing Business Case

The benefits organizations reap from moving to the cloud are numerous. The following is a non-exhaustive list of cloud computing benefits (Marinescu, 2013; Carroll, Van Der Merwe, & Kotze, 2011; Sether, 2016):

1. Operational benefits

Reduced cost: Since technology is paid incrementally, organizations save money in the long run in areas of support, administration, management, procurement, configuration, and power supply.
Increased storage: Users can store more data on the cloud than on a private network. And if users need more storage, it can be provisioned easily. Additionally, floor or space rental becomes unnecessary when the cloud solution is used.

Automation: IT staff no longer need to worry whether an application is up to date or not: in cloud environments updating servers is the job of the provider. Moreover, licensing of software is eliminated in cloud environments.

Flexibility: Users have more flexibility with a cloud solution. Applications can be tested and deployed with ease, and if it turns out that a given application is not getting the job done, organizations can switch to another cloud service provider. Furthermore, time is saved in developing and deploying platforms as economies of scale come into play in cloud environments.
Better mobility: Users can access the cloud from anywhere and at any time with an Internet connection. This is ideal for road warriors or telecommuters, or users who need to access the system after hours.
Better use of IT staff: IT staff no longer have to worry about server updates, hardware failure, and other computing issues. They can focus on duties that matter, rather than being maintenance staff.

2. Economic benefits

People: We hate to suggest that anyone should lose their job, but the honest-to-goodness truth (we're sorry) is that by moving to the cloud, fewer IT staff members are required to run the day-to-day operation than in the traditional IT environment. Doing that enables an organization to find the best people to remain on the staff and to streamline the operation of the IT department.

Hardware: With the exception of very large enterprises or governments, major cloud suppliers can purchase hardware, networking equipment, bandwidth, and so forth much more cheaply than a 'regular' business. That means that if users need more storage, it's just a matter of upping the subscription costs with the provider, rather than buying new equipment. If an organization needs more computational cycles, there will be no need to buy more servers; rather, the organization just buys computational cycles from the cloud provider.
Pay as you go: Think of cloud computing as being like leasing a car. Instead of buying the car outright, customers pay a smaller amount each month. It's the same with cloud computing: customers just pay for what they use. But, also like leasing a car, at the end of the lease customers do not own the car. That might be a good thing: the car may be a piece of junk, and in the case of a purchased server, it's sure to be obsolete.
Time to market: One of the greatest benefits of the cloud is the ability to get apps up and running in a fraction of the time customers would need in a conventional scenario. Let us take a closer look at how getting an application online faster saves money. Before the cloud, launching a start-up meant using either an underpowered or inflexible host or an overpriced self-host. The former was a bad option, because it was inflexible. The latter cost a lot of money. To do that, customers needed to find a host, configure the machine, ship the machine, and manage the machine. With a cloud, customers can spin up a new instance in seconds. Figure 1 is a presentation of cloud computing benefits.

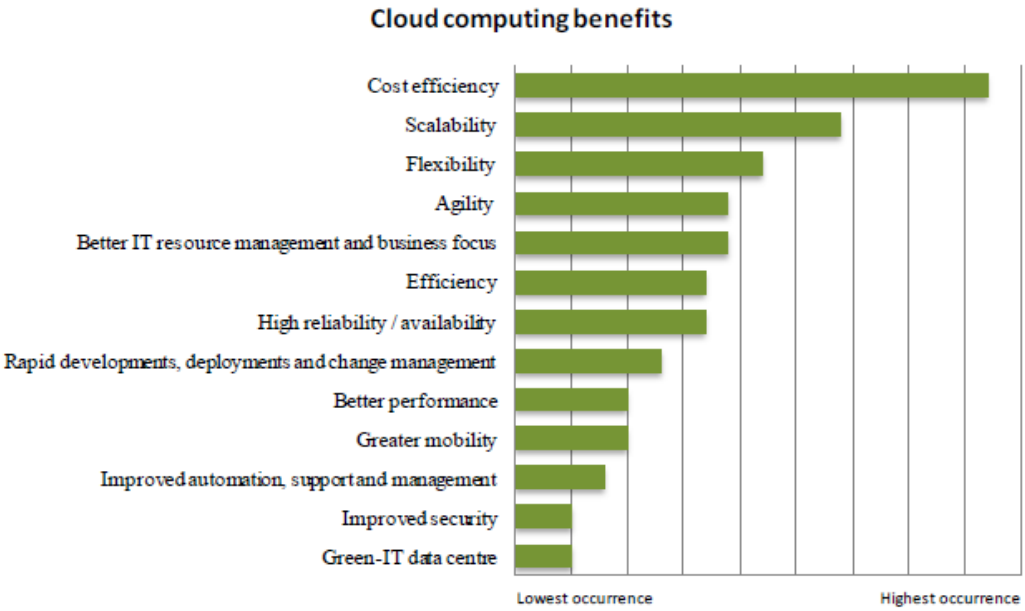

Figure 1. Cloud computing benefits. source: (Carroll, Van Der Merwe, & Kotze, 2011).

Cloud Computing Service Model

Cloud computing offers three major service models. The first of these is Software as a Service (SaaS), examples of which include Google Apps, Salesforce, Hotmail, and Yahoo Mail. The second service model is called Platform as a Service (PaaS), and examples of such services include Google App Engine, Windows Azure, and

Amazon Elastic. The third service model is called Infrastructure as a Service (IaaS), examples of which include Amazon EC2, Rackspace, and Cloud Storage. These service models are shown in Figure 2.

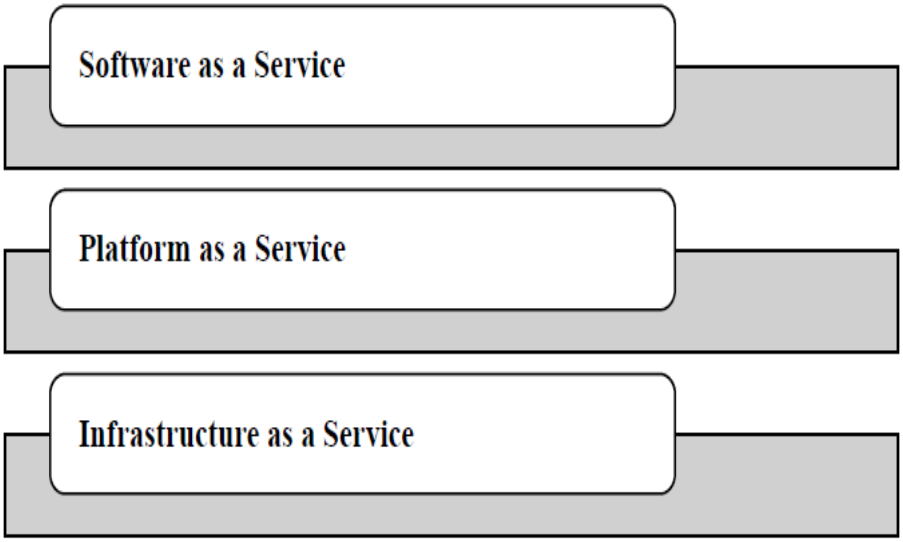

Figure 2. Cloud computing service models. source: Ajayi, Lili, & King (2107)

Cloud Computing Deployment Model

The following is an overview of the four principal cloud deployment models:

1. Public cloud. This model denotes the cloud infrastructure service made available by cloud providers (such as Google, Amazon, and Salesforce.) for the general public as well as large industries and organizations.
2. Private cloud. This is the model that services a particular organization exclusively, and it can be hosted by the organization or a third party. It can also be achieved on-site or off-site. Private clouds are often deployed for strategic, operational, regulatory compliance reasons. It provides an avenue for better control, security, and privacy.
3. Community cloud. This model, also referred to as the vertical cloud, stands for a cloud solution organized around a set of business competencies that could be jointly owned and shared by several entities to use for common concerns. The model also provides industry-specific capabilities such as governance, auditing, and security.
4. Hybrid cloud. In this model, multiple clouds such as public, private, community, and non-cloud data centres are combined as a single entity for a given organization. By combining multiple clouds, organizations can effectively manage their clouds from a single place at the same time (Bloomberg, 2013; Buyya, Broberg & Goscinski, 2011; Guha & Al-Dabass, 2010; Jamsu, 2012; Marinescu, 2013; Marks & Lozano, 2010).
   Figure 3 shows a cloud computing deployment model.

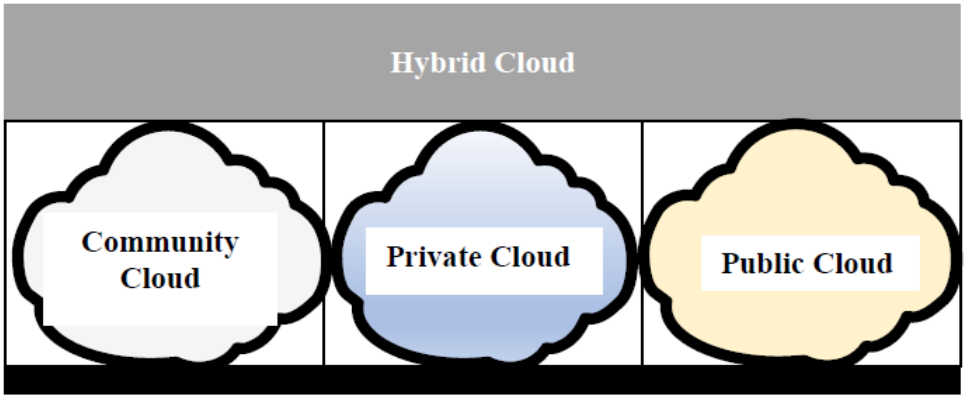

Figure 3. Cloud computing deployment model. source: Ajayi, Lili. & King (2017).

Research Methods

Grounded theory (GT) pioneered by Barney Glaser and Anselm Strauss was the approach underpinning this research. After fully evaluating alternative methods, it became clear that GT is the most appropriate. GT is not a

research technique but a method that encompasses the entire research process from the inception of the research idea to the end of the research. The GT method is most suitable for exploratory areas of study, areas in which this study falls. With a sound understanding of the research, it became obvious that only GT would enable use in new situations, in gaining a new point of view in a familiar setting, or in enhancing the possibility of a fresh perspective. Additionally, GT has both inductive and deductive elements and enables the inclusion of data from a larger range of sources beyond the qualitative data collected. Owing to the mixed elements, Glaser (1974, p. 116) argues that "in grounded theory circles, it is acknowledged to be the only true method of research". And according to Glaser and Strauss (1967), quantitative data can be used to support or further explore initial analysis, which strengthens the research (Denzin & Lincoln, 2000).

We evaluated phenomenology, discourse analysis, and GT. The goal in phenomenology is to study how people make meaning of their lived experience; discourse analysis examines how language is used to accomplish personal, social, and political projects; and grounded theory develops explanatory theories of basic social processes studied in context (Stark & Trinidad, 2007; Ajayi, Yang, & King, 2017).

Data Analysis

Qualitative data analysis was conducted using NVivo software, and it turned out that doing that became a practical process. The software allows for ease of data integration into the 'project' as it is called in NVivo. Various types of file formats, such as Word, PDF, websites, and spreadsheets, can be imported, coded, and reported as the user desires. Codes can be linked by methods of open or axial coding. Additionally, the software enables linking to non-textual data such as audio, video, websites, and pictures. And direct coding from videos and audios can be done. Furthermore, visualization of data and codes is simplified in NVivo using any contemporary charts, be they graphs or pie charts. Throughout the process, users are able to iterate the collected data at the back end while manipulation is going on at the front end. The massive amount of data collected in this research – which was not surprising given the combined methods in the study – was easily handled by the software, which can be used to manage up to 10 GB of data in a single project. NVivo software in many ways seems to be aligned with different concepts of GT, be it conceptualization – formatting and linking of nodes, memos, and other files – or iteration of the data as well as the back-and-forth elements. New data are easily integrated into the existing project. Strauss (1984, p. 14) advises that the theory generated by tight alignment with the data from which it emerged. In terms of the organization and the conduct of the work at hand, NVivo is an important and useful tool (Crowley, Harrè & Tagg, 2002).

Data analysis was done using QSR NVivo-10 due to its many easy-to-understand features. The software allows the inclusion of all qualitative data for analysis, such as documents (e.g. notes, transcribed interviews, and memos.), audio, video, and pictures (e.g. images and photographs). It enables the user to manipulate and model data in a variety of ways by means of coding, theme comparison, and linking, running and storing queries, reports, charts, and graphs for a given study. Additionally, NVivo has powerful features that allow data exchange with other applications such as Microsoft Excel and IBM SPSS (Richards, 1999, p. 5-6, 8).
Figure 4 presents theory formulation from data by means of iteration and interpretation of data.

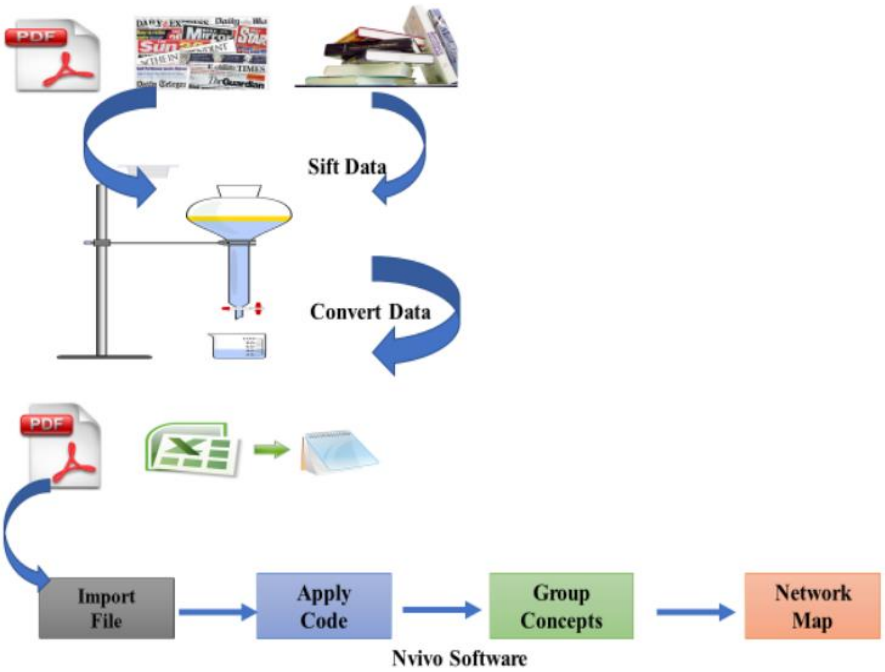

Figure 4: Theory formulation, iteration, and interpretation of data

The process of coding in this research involved back-and-forth data analysis in that each time a category was changed or a new category was added, the entire data was recoded again to allow for conformity in the whole data. This process, just like the other processes involved in qualitative data analysis, was indeed cumbersome and time-consuming, but ensuring conformity was the only way the researcher could return to the data sets and retrieve and organize the data that support that particular theme. It was challenging to analyse the large volume of data, but the researcher used the Microsoft Word program to manipulate and manage the data, and that eliminated having to print out the interviews and label them with sticky notes or similar. The researcher stopped coding at a point where all incidents could be readily classified and a sufficient number of regularities emerged. The researcher actively reflected during the entire data analysis process on the field notes, and the things observed during the interviews. Figure 5 presents Network Mapping.

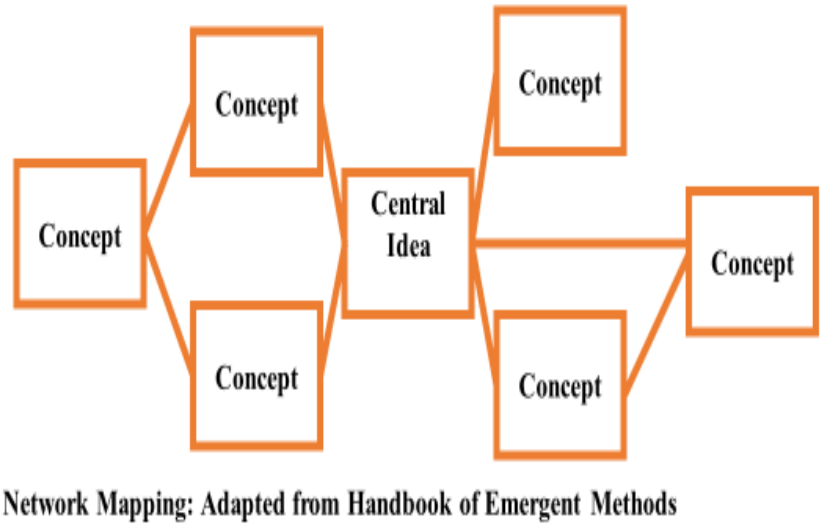

Figure 5. Network mapping source: Ajayi, Yang, & King (2017).

Results and Findings

Subsequent IS implementations at the LAS applied different development processes to ensure previous deficiencies were avoided. And that contributed to the successful implementations christened the ‘golden circle’ and the ‘turnabout’ in 1996 and other projects in later years including hybrid cloud deployment.

The Lessons Learned (1980s – 2010s)

Comparing the LASCAD 1992 and 1996 projects, David, Khajeh-Hosseini, and Sommerville (2010) used Stakeholder Impact Analysis and found that 24 stakeholder risks were associated with each project (Figure 6). Whereas the former, in which only two of the 24 risks were appropriately or partially mitigated, failed, the latter succeeded owing to the fact that 23 of the 24 known risks were appropriately or partially mitigated.

	Partially Mitigated	Unmitigated	Project outcome
LASCAD 1992	2	22	Failure
LASCAD 1996	23	1	Success

Figure 6: Mitigated vs unmitigated risks and project outcome

Cloud Solution Deployment in NHS Trusts

It would seem that the NHS has henceforth set a benchmark in the emergency domain by implementing the private cloud solution. The NHS opted for a private cloud for a variety of reasons. There were some concerns regarding data security in public clouds. They will not accommodate situations where patient data could be hacked into. Thus, the private cloud ensures that all patient data are locked down in their own cloud. To validate that perspective, a senior infrastructure manager said: "The government will certainly ask where your data is, where it is held, and how it is protected."

Before selecting the private cloud, the NHS exhausted other options as it was imperative that the cloud solution was the best way forward. Factors such as elasticity, resiliency, and minimum administrative efforts scored highly in the decision-making process. As a senior manager put it: "During the Olympics last year, the cloud was a perfect solution for us. It was the single most important event in which we could expand our services and after the event shrank back to where we were before the event." By doing that, the NHS did not have to procure additional servers for a huge event such as the 2012 London Games, and then own them thereafter even without proportionate demands.

Another overarching point was the residency of data. Citing regulatory requirements, hosting data in servers outside of UK borders is totally out of the question. They fully vetted other alternatives to a private cloud and ruled out public, community, and hybrid clouds. The view of a senior manager on that was: "No one can guarantee us that our data will remain in the UK, not Microsoft, not Google."

The historic systems failure in the LAS is still fresh in respondents' memories and they expressed their concerns and doubts about the capacity of the service to completely eliminate such failures in the future. They also fear future scenarios in which human deaths may result due to delayed response time. Those views were expressed by 12 (66%) of the respondents. However, one factor contributing to those views could be inadequate information dissemination, considering the fact that, while most respondents knew about the recurring failures, only two (11%) were aware of the application upgrade from the old call-taking system (CTAK) to Command Point in 2012, as well as the deployment of the cloud computing solution at the back end.

Although the literature does not reflect much on LAS server failures, the organization understands that the stability of their back-end servers is vital to their service. Thus, their goal to eliminate server failures entirely played a major role in the new strategy. To corroborate that point, a senior manager said: "Hardware problems resulting in server failure were always an issue, all the time, all the time. So that is why it is very important that the service that we purchase can as seamlessly as possible scale over or slide over to alternate hardware as quickly as possible." By doing so, any failure will not impact on the overall service, but it will be contained by scaling over to alternate hardware. The LAS believes that their glitch-free operation during the 2012 Games contributed immensely to the resounding success of the Games.

While IS improvement continues at the LAS, their main focus remains improved response time. In the absence of system failure, delayed response is almost non-existent because everything goes smoothly. Conversely, in the event of system failure, the entire service is thrown into chaos. To that, a senior command and control officer

said: “If everything just went blank, we have got 70 ambulance stations with about 250 vehicles on the road. We wouldn’t know where they are. We wouldn’t know what they are doing.”

The 2012 London Olympic and Paralympic Games

The London Games event was a huge task. At any point in time during the Games, it was estimated that 180,000 people would be in the Olympic Park. The overall task of the LAS was to ensure that emergency services were available for those in the Olympic Park as well as the rest of London at all times. Additionally, during that period, several other cultural events took place across London. In order to fulfil their role, the LAS [24, 25] prepared extensively for all these events by setting up a planning office to do the following:

- Establish the number of staff and vehicles required to cover the events.
- Set up a training programme for clinical staff and officers.
- Develop Games e-learning packages for staff.
- Coordinate the national ambulance service response to the Games.
- Support the London Organizing Committee of the Olympic and Paralympic Games (LOCOG) in providing staff inside the venues.

In addition, the data centre was upgraded to a private cloud to handle additional traffic.

Managing the Games

While adequate emergency care was maintained across London during the Games, below is a summary of key Games-related activities:
1) Upwards of 400 staff were deployed across 18 venues for the 30 days of the Games.
2) In excess of 165,000 hours of ambulance cover were delivered.
3) The LSA responded to nearly 1,500 Games-related incidents.
4) The LSA conveyed 800 patients to emergency departments.

Cloud Service and Deployment Models in NHS

For the NHS, cloud computing is the way to go. The organization has shown commitment and motivation towards cloud technology. While the organization focussed on private clouds in the past due to regulatory requirements and security-related issues, today the NHS has moved away from private-only clouds to hybrid public-private architecture. Obviously, regulations and security issues continue to stand in the way of purely public clouds, but the NHS cloud solution strategy remains to deploy private clouds for patient data and public clouds for non-patient and non-sensitive data. In doing that, the organization considers first what should go to the cloud and what should remain on premises, therefore the NHS is able to get the best from both private and public clouds.
The cloud strategy is not peculiar to the NHS or the health-care field; rather, it is paralleled by findings in other studies. Generally, cloud services have been accepted as a viable IT option for organizations. For example, in September 2016, Intel Security surveyed over 2,000 professionals for its annual cloud security research study, and more than 90% of the over 2,000 cloud security professionals surveyed (Samani, 2017) stated that they were using some type of cloud service in their organization. Figure 7 presents cloud computing deployment models across industries.

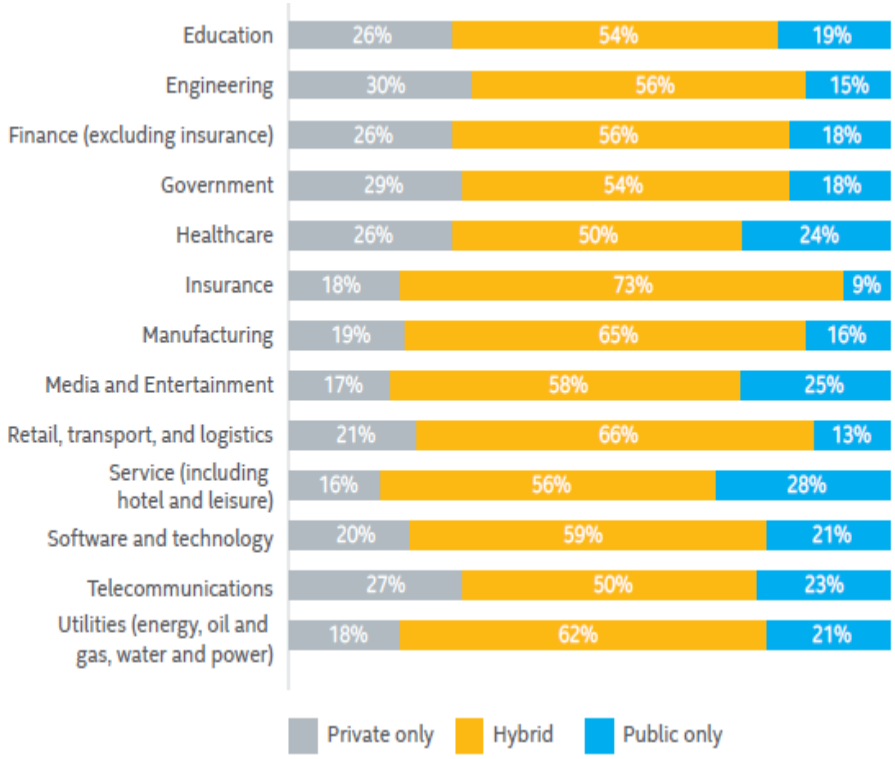

Figure 7. Cloud computing deployment models across industries. Source: Samani (2017)

Conclusion

This paper answers a subresearch question of a broader PhD study that is currently ongoing at Loughborough University, England. In answering the question *investigate the extent to which cloud computing risks and benefits are reflected in the information systems of NHS Trusts*, the paper explored three decades of unfaltering efforts by the LAS to improve its emergency service to London residents. Categorically, their service is critical in nature, therefore constant application and server availability are vital to the overall success. The continual enhancement of the LAS's IT/IS did not work so well in the 80s due to various deficiencies. The cumulative lessons drawn from the failures led to the new strategy the LAS implemented just in time for the London 2012 Games. Solution deployments take time to plan, test, and implement. For that reason, after the current solution deployment, changes are not foreseen in the near future barring pervasive system failure of any kind (hardware or software).

Both the NHS and other organizations have accepted cloud computing as a viable IT option. The NHS views cloud technology as a necessary tool for stabilizing emergency systems. The unparalleled capability to auto-scale when demands spike and again shrink back to the initial level when demands reduce is a phenomenal feature and the strongest argument in the emergency domain for cloud technology. The reason for that is simple: there is hardly any other domain where demands can unexpectedly spike to such an extremity as in the emergency domain in the event of a disaster such as a terrorist attack or earthquake. Among other important cloud computing features, the auto-scale capacity was fully tested during the 2012 Olympic and Paralympic Games. Therefore, it was clear that cloud computing would cast its wide-stretching footprint across the emergency domain sooner rather than later. However, what was not, and is still not, clear is the form that that footprint would take. This study shows that the hybrid cloud has taken hold in the NHS and improvements in NHS services are evident, but it remains to be seen whether the current NHS IS/IT strategy becomes the blueprint in the design of emergency systems going forward.

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OPTIMUM SIZING OF STANDALONE PV/WIND POWER GENERATING SYSTEM WITH STORAGE

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Abstract: To allow a real penetration of the renewable resources which are intermittent and more or less easily predictable, optimal sizing of hybrid renewable power generation systems is essential. Proper design and sizing of Hybrid RES is very important, otherwise it might lead to increased establishment cost. This paper presents a model to optimize the capacity sizes of different components of standalone, hybrid photovoltaic/wind power generation system using a battery bank.The recommended model takes into account the Deficiency of Power Supply Probability (DPSP) criteria for optimum sizing of the sources. It also considers the minimization of system cost ensuring reliable and economic, load supply for the hybrid, standalone system. A case study has been conducted to analyse one standalone system which is designed to supply a community located in Portland, Victoria, Australia.

Keywords: Hybrid renewable energy systems, standalone, optimum sizing, DPSP

Introduction

Renewable Energy Systems (RES) are being widely accepted as an alternative to standard conventional energy sources due to depletion of natural resources and their consequential environmental impact. One of the increasing use of stand-alone RES is in powering the remote areas where grid power is significantly expensive due to transportation. The drawback of these systems is that they are less reliable as the generated power depends on meteorological conditions. This can be compensated by using more than one type of RES (i.e. solar, wind, biogas), proper storage and backup. A hybrid renewable system comprising of solar and wind energy is eco-friendly, cost-effective option for powering the rural areas compared to conventional sources. Proper design and sizing of hybrid RES are very important, otherwise, it might lead to increased establishment cost. The sizing optimization can ensure minimum investment with an adequate and full use of the solar /wind sources and battery bank so that the hybrid system can work under optimum conditions in terms of investment and system power reliability requirement[1]. Different optimization techniques for hybrid PV/wind systems sizing has been suggested by researchers, such as dynamic programming, graphical construction technique, probabilistic approach, artificial intelligence methods, multi-objective design, linear programming and iterative technique [1]. This paper presents the optimum model of a standalone hybrid RES which utilizes the interactive optimization technique and follows Deficiency of Power Supply Probability (DPSP) for power reliability for power reliability.

For standalone applications, storage cost still represents the major economic restraint. Combining different types of RES (i.e., solar /wind power) can minimize the storage requirement resulting the reduced cost of the overall system. For a given load characteristic and storage capacity, an algorithm was developed to calculate the optimum number of PV module and Wind turbines that would achieve the desired Deficiency of Power Supply Probability (DPSP)[2]. Considering the seasonal variation of wind speed, average Sun hour and load, two peak seasons' (winter and summer) data has been considered ensuring that the system can reliably operate throughout the year.

Standalone Renewable Energy Systems

The standalone renewable energy system considered here is composed of three parts: wind turbines, PV panels, and battery bank. Wind turbines and PV panels generate electricity in accordance with the local wind and solar energy resources, to supply the load; the battery bank forms the energy storage system that can supply the load when there is a lack of electricity, and store the surplus power when the power generated exceeds the load.

Energy storage system is essential in standalone systems to overcome the energy shortage due to the renewable energy's unpredictable and fluctuant nature.

Hybrid Pv/ Wind System Model

1. PV generator model

The hourly output power of the PV generator with an area A_{pv}(m2) at a solar radiation on tilted plane module Gt (W/m2), as given by [3]:

$$P_{PV}=\eta_{pv} A_{pv} G_t \quad (3.1)$$

Where η_{pv} represents the PV generator efficiency and can be presented as:

$$\eta_{pv}= \eta_r \eta_{pc} [1-\beta(T_c - T_{cref})] \quad (3.2)$$

Where η_r is the reference module efficiency, η_{pc} is the power conditioning efficiency which is equal to 1 if a perfect maximum power tracker (MPPT) is used. β is the generator efficiency temperature coefficient, it is assumed to be a constant and for silicon cells the range of b is 0.004-0.006 (℃),T_{cref} is reference cell temperature (℃) and Tc is the cell temperature (℃) and can be calculated as follows:

$$T_c=T_a+[(NOCT-20)/800]G_t \quad (3.3)$$

Where T_a is the ambient temperature (°C) and NOCT is the nominal cell operating temperature (° C). η_{pc} , β, NOCT and A_{pv}, are parameters that depend upon the type of module used. The data are obtained from the PV module manufacturers.

2. Wind Turbine System Model

The wind speed distribution for selected sites as well as the power output characteristic of the chosen wind turbine are the factors that have to be considered to determine the wind energy conversion system power output. Choosing a suitable model is very important for wind turbine power output simulations [3]. The most simplified model to simulate the power output of a wind turbine can be described by [4] :

$$P_w(V) = \begin{cases} P_R\left[\left(V2 - V_C^2\right)/V_R^2 - V_C^2\right], & V_C \le V \le V_R \\ P_R, & V_R \le V \le V_F \\ 0, & Otherwise \end{cases} \quad (3.4)$$

where P_R is the rated electrical power; V_C is the cut-in wind speed; V_R the rated wind speed; and V_F is the cut-off wind speed. In this study, the adjustment of the wind profile for height is taken into account by using the power law that has been recognized as a useful tool to model the vertical profile of wind speed. The equation (3.5) is from reference [5,6]:

$$\frac{V(H)}{V\left(H_{ref}\right)} = \left(\frac{H}{H_{ref}}\right)^{\propto} \quad (3.5)$$

Where V(H) is the wind speed at hub height H, m/s; V (H_{ref}) is the wind speed measured at the reference height H_{ref} , m/s; α is the power law exponent. The determination of a becomes very important. The value of 1/7 is usually taken when there is no specific site data [6].

3. Battery Bank Model

Battery bank storage is sized to meet the load demand during the non-availability period of renewable energy source, commonly referred to as days of autonomy. Normally the number of days of autonomy is taken to be 2 or 3 days. Battery sizing depends on factors such as maximum depth of discharge, temperature correction, rated

battery capacity and battery life. The total capacity of the battery bankthat is to be employed to meet the load is determined using the equation (3.6) [3]:

$$C_B = \frac{E_L S_D}{V_B (DOD)_{\max} T_{cf} \eta_B} \quad (3.6)$$

Where E_L is the load in Wh; S_D is the battery autonomy or storage days; V_B is the battery bank voltage; DOD_{max} is the maximum battery depth of discharge; T_{cf} is the temperature correction factor and η_B is the battery efficiency. Depending on the PV and wind energy production and the load power requirements, the state of charge of battery can be calculated from equations (3.7) and (3.8) [3].

Battery charging :

$$SOC(t) = SOC(t-1)\cdot(1-\sigma) + [E_{Gen}(t) - E_L(t)/\eta_{inv}]\cdot\eta_B \quad (3.7)$$

Battery discharing :

$$SOC(t) = SOC(t-1)\cdot(1-\sigma) + [E_L(t)/\eta_{inv} - E_{Gen}(t)] \quad (3.8)$$

Where SOC(t) and SOC(t-1) are the states of charge of battery bank (Wh) at the time t and t -1, respectively; σ is hourly self-discharge rate; $E_{Gen}(t)$ is the total energy generated by PV array and wind generators after energy loss of controller; $E_L(t)$ is load demand at the time t; η_{inv} and η_B are the efficiency of inverter and charge efficiency of battery bank, respectively. At any time, t, the charged quantity of the battery bank is subject to the following two constraints:

$$SOC_{\min} \le SOC(t) \le SOC_{\max} \quad (3.9)$$

The maximum charge quantity of battery bank SOC_{max} takes the value of nominal capacity of battery bank C_B, and the minimum charge quantity of battery bank SOC_{min}, is determined by the maximum depth of discharge

(*DOD*): $SOC_{min} = (1\text{-}DOD).C_B$. (3.10)

According to the specifications from the manufacturers, the battery's lifetime can be prolonged to the maximum if DOD takes the value of 30 - 50%. In this paper, the DOD takes the value of 50%.

Optimal sizing criteria for hybrid renewable energy system

Various methods have been discussed in the present literature to evaluate the sizes of the hybrid PV/wind systems, such as energy to load ratio, battery to load ratio and non-availability of energy [3]. For stand-alone renewable energy system, in order to select the optimum combination if the renewable energy sources, an evaluation may be carried on the basis of reliability and economy of power supply [3]. The proposed mythology for optimum sizing of renewable energy sources is described in next section.

1. Reliability criteria based on DPSP technique

The study will consider deficiency of power supply probability (DPSP) technique to be the technically implemented criteria for sizing and evaluating the proposed hybrid solar/wind system employing a battery bank [3].

DPSP can be considered as a measurement of reliability which is the probability that an insufficient power supply results when the hybrid system (solar panels, wind power and energy storage) is unable to satisfy the load demand [3]. This methodology can be explained in following steps:

1. When the generated power from the PV/wind system is greater or equal to the load demand the load will be supplied accordingly and any excess power will be used to charge the battery bank first till the battery reaches its maximum State of Charge(SOC). A new SOC is calculated using Eq. 3.7. When the state of charge of the battery bank reaches a maximum value, SOCmax, the control system stops the charging process.

2. When generated power is less than load demand the battery will start discharging to assure the load demand till it reaches the minimum SOC.In this case, a new SOC will be calculated using Eq. 3.8.
3. Once the battery reaches the minimum SOC and generated power is still less than load demand, this situation is called a Deficiency Power Supply (DPS). At this stage, the control system will disconnect the load. Deficiency power supply (DPS) at hour t, can be calculated using equation (4.1)

$$DPS(t) = E_L(t) - [E_{Gen}(t) + SOC(t-1) - SOC_{\min}]\eta_{inv} \quad (4.1)$$

4. The deficiency of power supply probability (DPSP) for a specific period can be defined as the ratio of all the DPS values for that period to the sum of the load demand. That indicates that DPSP of 1 means that the load will never be satisfied and the DPSP of 0 means that the load will always be satisfied. DPSP for a given time period T is presented in equation (4.2) [7]

$$\text{DPSP} = \sum_{t=1}^{T} DPS(t) / \sum_{t=1}^{T} E_L(t) \quad (4.2)$$

From the above-described situations, a program is developed in MATLAB to size the components for each configuration, for a particular DPSP specified by the user. The flow chart is illustrated in Fig 1.

In this flowchart, $N_{pv,min}$, $N_{pv,max}$ represent the lower and higher limits of the variation interval of the PV and generator rated power and and $N_{wind.}$ represents wind generator rated power, respectively. NS_D represents the maximum number of storage days. For this study, NS_D=2 r, ΔNpv represent the variation step of the PV generator rated power.

The input data to this program are, hourly solar irradiation, on a tilted plane, hourly mean values of ambient temperature and, wind speed, a user specified value of DPSP, load demand for desired period and specifications of the system devices. The aim of this program is to determine the optimum number of PV generator for a given value of wind power generator to achieve a given DPSP value. The MATLAB program has been developed using the flowchart given in Fig 4.1.

Using this program, the different combination of wind turbine rated values and the corresponding value of PV generator rated power to satisfy the specified DPSP value, was obtained. Determination of the Optimum Number of wind turbines and PV modules from that set of configurations was done based on the Economic approach.

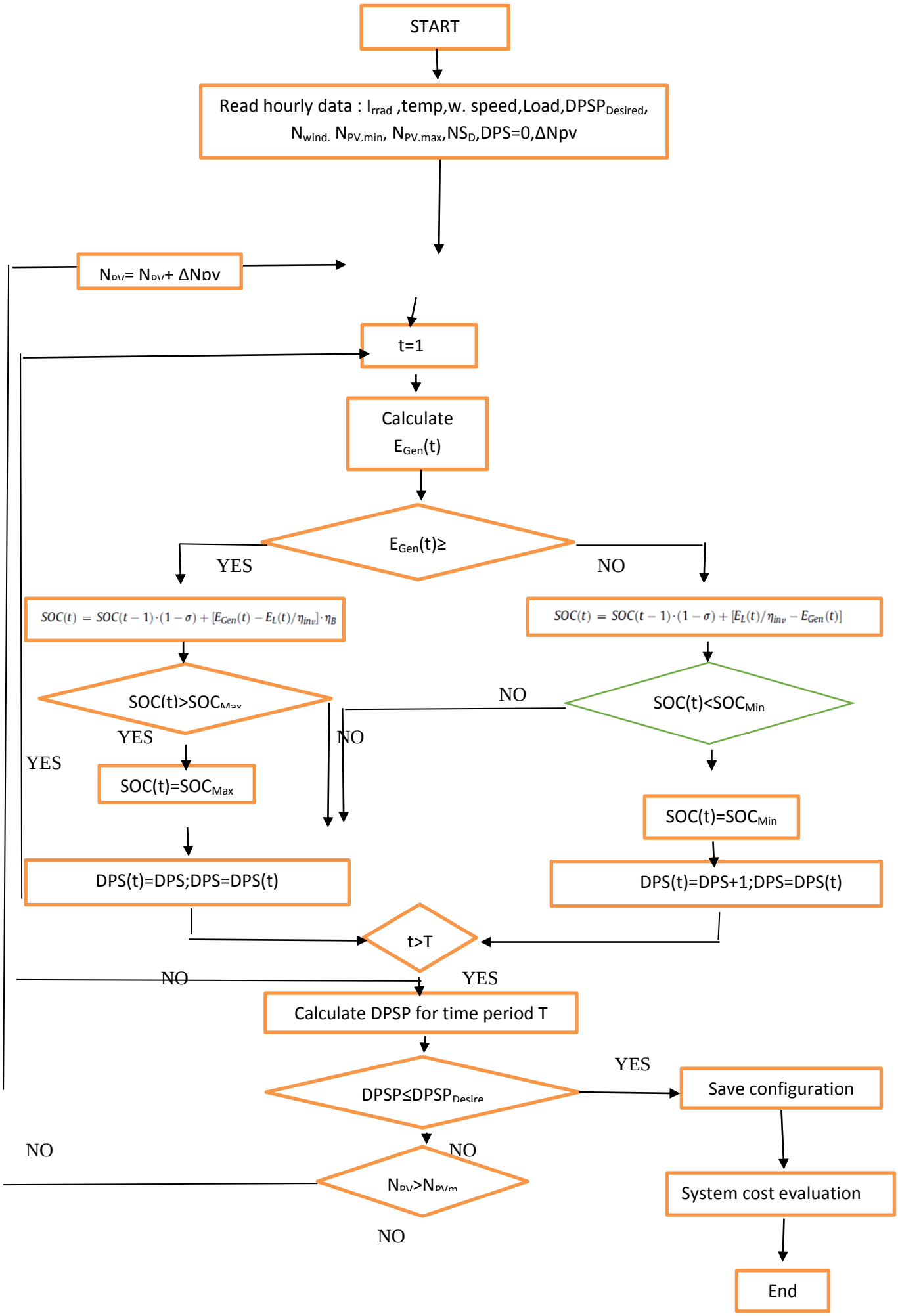
START
Read hourly data : Irrad ,temp,w. speed,Load,DPSPDesired, Nwind. NPV.min, NPV.max,NSD,DPS=0,ΔNpv
NPV= NPV+ ΔNpv
t=1
Calculate EGen(t)
EGen(t)≥
YES
NO
SOC(t) = SOC(t − 1)·(1 − σ) + [EGen(t) − EL(t)/ηinv]·ηB
SOC(t) = SOC(t − 1)·(1 − σ) + [EL(t)/ηinv − EGen(t)]
SOC(t)>SOCMax
SOC(t)<SOCMin
YES
NO
SOC(t)=SOCMax
SOC(t)=SOCMin
DPS(t)=DPS;DPS=DPS(t)
DPS(t)=DPS+1;DPS=DPS(t)
t>T
NO
YES
Calculate DPSP for time period T
DPSP≤DPSPDesire
YES
Save configuration
NO
NPV>NPVm
NO
System cost evaluation
NO
End

Fig.4.1 Flowchart for optimal sizing of RES using DPSP criteria [3]

2. Optimum Sizes of the Sources Depending Upon Economic Approach:

For a given DPSP value a number of combinations of wind turbine and PV modules can be obtained. One can plot the number of PV modules against the number of wind turbines. An example plot of the number of PV modules versus number of wind turbines is shown in Fig.4.2.

It is necessary to determine a PV/ Wind turbines combination that yields a minimum cost of the system [1]. The cost function of the system can be defined using equation (4.3):

$$C=\alpha.N_{PV}+\beta.N_{wind}+C_0 \quad (4.3)$$

Where
C - capital cost of the system,
N_{PV} =Total capacity of PV generator(KW)
N_{wind} =Total capacity of wind generator(KW)
α - Unit cost of a installed PV module ($/KW)
β – Unit cost of a wind turbine($/KW)
C_0 – the total constant costs including the cost of design, installation and battery bank.
The condition to obtain the optimum solution of (12) yields:

$$\frac{\partial Npv}{\partial Nwind}= -\frac{\beta}{\alpha}$$

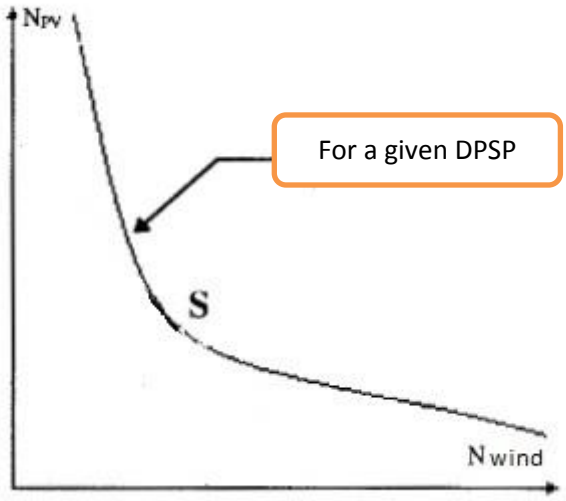

Fig. 4.2 Plot of PV module vs number of wind turbines

Results and Discussions

Case Study

The recommended methodology has been used to analyse a stand-alone hybrid PV/Wind energy system with battery back-up, which is designed to supply a community of twenty residential households located in Portland, Victoria, Australia (38° 20′ 0″ S, 141° 36′ 0″ E). The technical characteristics of the PV module, wind turbine and the battery used in the studied project are listed in Tables 5.1-5.3. Irradiance and wind speed data for Portland obtained from the Australian Bureau of Meteorology were utilized. Fig 5.1 and 5.2 shows the seasonal variations of average sunshine hours, Fig 5.3 and 5.4 shows the Portland Daily global solar exposure of the months of July and January and Fig 5.5 shows the Mean 9am and 3pm wind speed of Portland(km/h) for one year. From these figures, a significant seasonal variation of the meteorological conditions can be observed. Fig 5.6 represents the load profile for the target community for January and July. It also can be observed that the load demand also varies significantly with season. Keeping these seasonal differences in mind, a MATLAB program has been developed to size the sources of the standalone system using the load and meteorological data of January and July for a given DPSP (.03 in this study) with two days of autonomy of battery bank.

Table 5.1: Specification on wind turbine

Type	Rated power	Cut-in speed	Rated speed	Survival wind speed	Rotor height
AWS-V	5kw	2.5m/s	10m/s	55m/s	5.3m

Table 5.2: Specification of PV panels

Type	Voc (V)	Isc(A)	Max system Voltage	Opt. Operating current(A)	Pmax(W)
CS6K 295MS	39.5	9.75	1000 V(IEC)	9.14A	295W

Table 5.3: Specification of Single battery

Type	Nominal capacity(Ah)	Voltage	Round-trip efficiency	DOD(%)
Varta Solar	100	12	.85	50

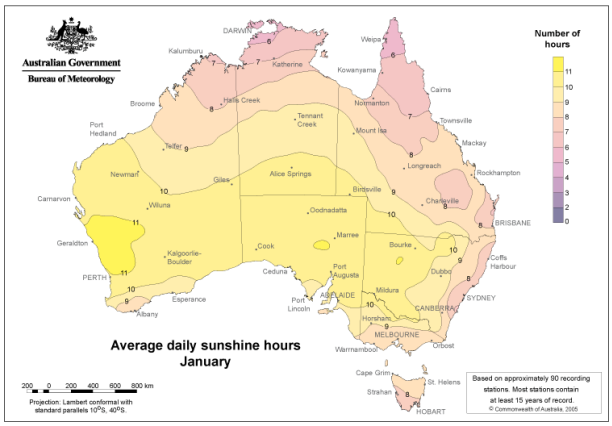

Fig 5.1 Average daily sunshine hours for january, Source: Australia Govt. Bureau of Meteorology

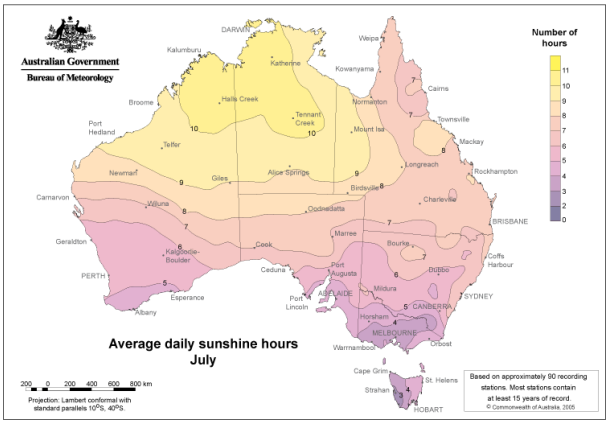

Fig 5.2 Average daily sunshine hours for july source: Australia Govt. bureau of meteorology

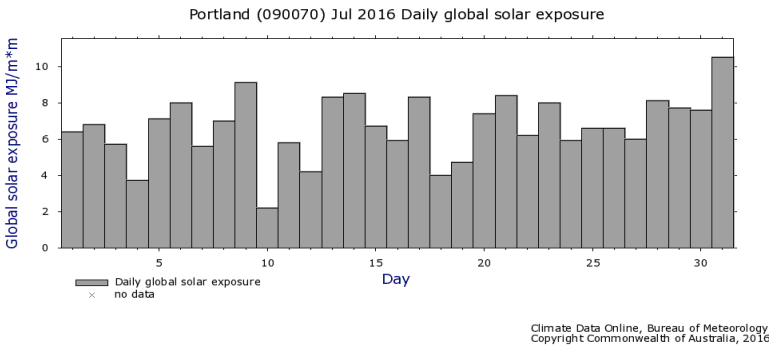

Fig 5.3 Portland daily global solar exposure july source: Australia Govt. bureau of meteorology

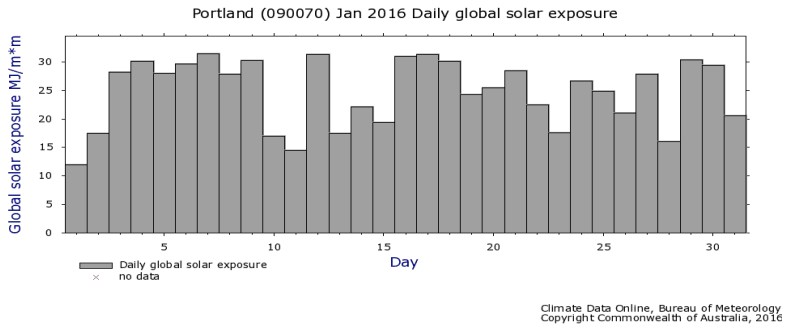

Fig 5.4 Portland daily global solar exposure july source: Australia Govt. bureau of meteorology

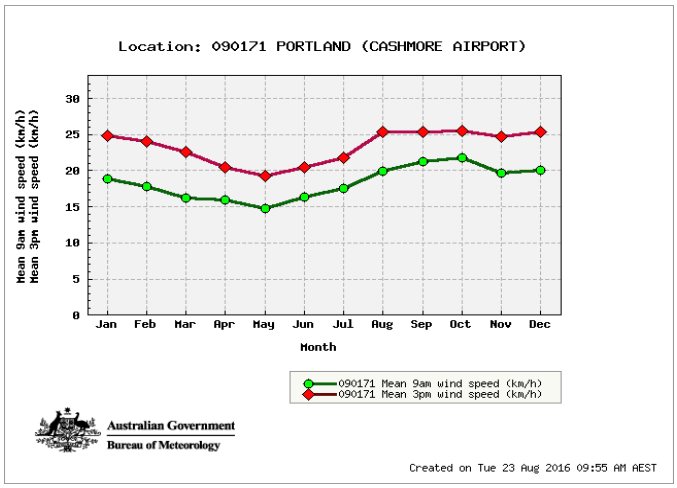

Fig 5.5 Mean 9am and 3pm wind speed of Portland(km/h), source: Australia Govt. bureau of meteorology

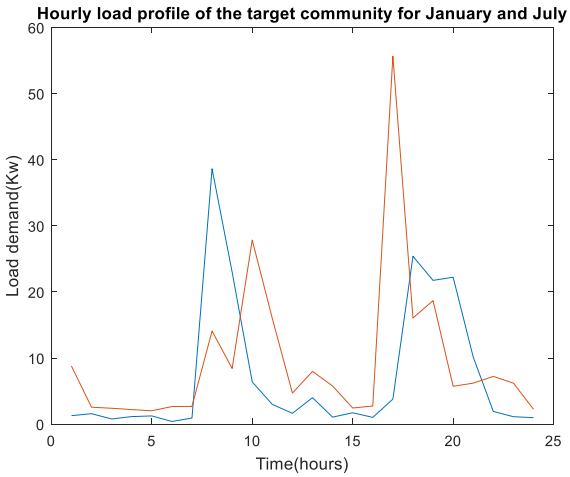

Fig 5.6 Hourly load profile of the target community for january(red) and july (blue)

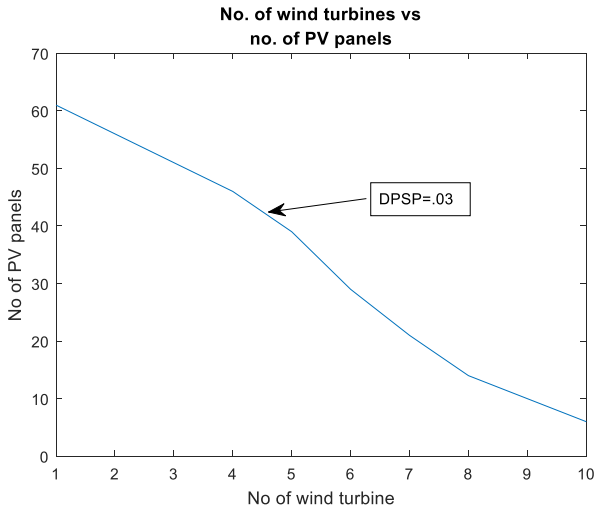

Fig.5.7 System configurations for a specified DPSP for 2 days of autonomy of the battery bank

With the use of the program described in the former section, we calculated a series of possible combinations of the of the number of PV modules and wind turbines for two days of battery bank autonomy. For a given unit price of wind turbines and PV modules, an optimum solution that minimizes the cost of the system was found. A plot of the number of PV modules versus the number of wind turbines for a given DPSP is shown in Fig.5.7. The point on the plot that satisfies the minimum cost condition is selected as the optimum system configuration. According to the proposed methodology, the optimum no of wind turbines and PV panels would be 2 and 56.

With this optimum configuration, system performance has been observed for the different seasons with satisfactory results. One example has been illustrated using Fig 5.8 and 5.9. Fig 5.8 represents the load demand of the community for two typical days of February. The same figure also shows the generated power of the system with optimum configuration for those two days. State of charge of the battery bank for those two days has been shown in Fig 5.9.

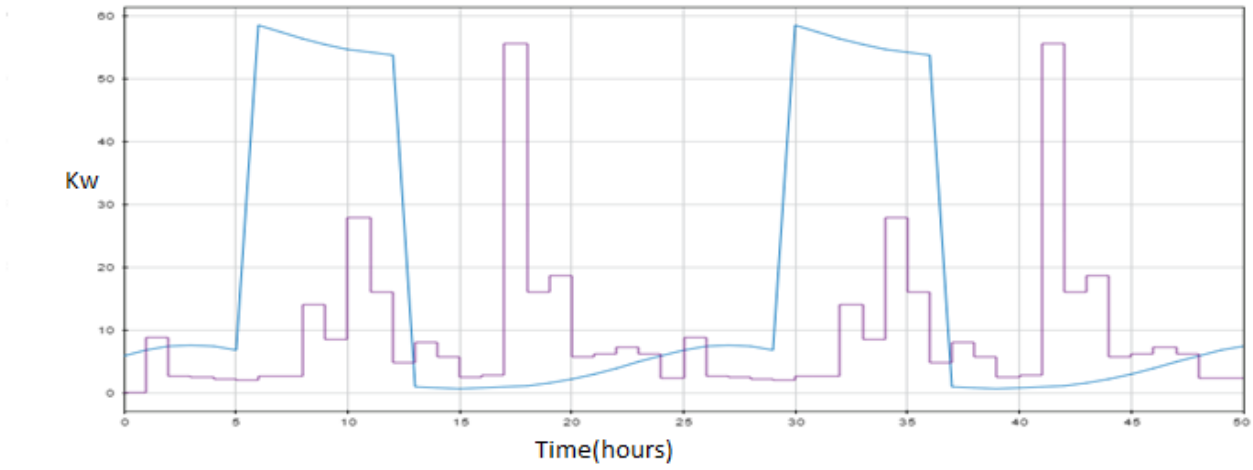

Fig.5.8 Load demand for two days of february(purple) and total generated power (blue) of the system after optimum sizing

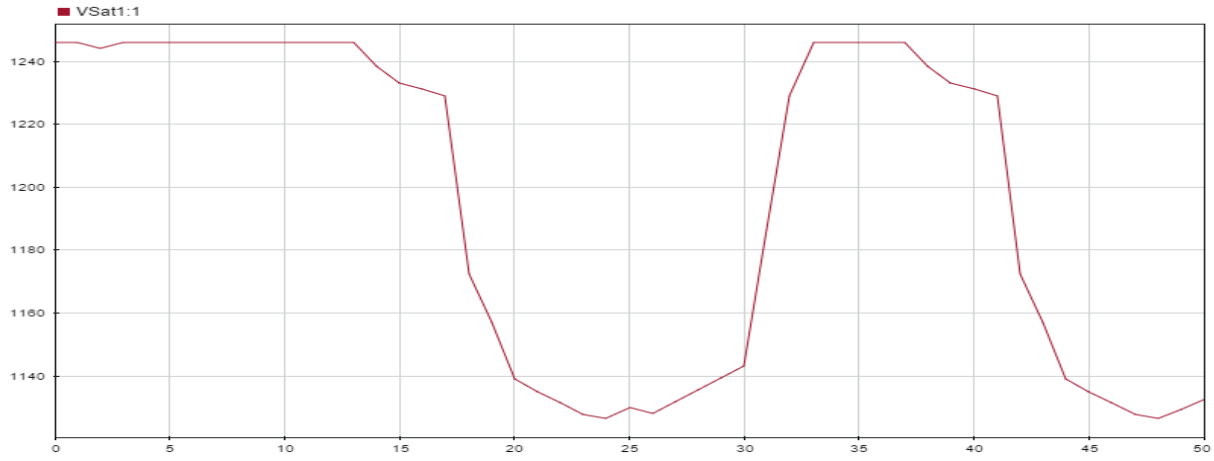

Fig. 5.9 Battery state of charge

Conclusion

The major aspects in the design of PV and wind power generation systems are (1) the reliable power supply of the consumer under varying atmospheric conditions and (2) with minimum system cost. A methodology for calculation of the optimum size of the renewable energy sources in a hybrid wind/PV system for a given load and level of reliability was demonstrated. It is based on the use of data for both wind speed and irradiance for the site and it also considers the seasonal variation of the meteorological conditions. The average power outputs of both the wind turbine and the PV module were calculated. For a given Deficiency of Power Supply Probability, different combinations of the number of PV modules and the number of wind turbines were calculated. An optimum design choice depends on the relative costs of a PV module and a wind turbine. It has been assumed that total cost of the system is linearly related to both the number of PV modules and the number of wind turbines.

The optimum mix of PV modules and wind turbine depends on the particular site, load profile, and the desired reliability of the hybrid system.

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SHORT TERM LOAD FORECASTING USING FUZZY LOGIC

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Abstract*:* For an economic generation of power, load forecasting is necessary. It is also important for economic allocation between plants (Unit commitment scheduling), maintenance scheduling and for system security such as peak load sharing by power interchange with interconnected units. In the present work, the results of a fuzzy logic model for short-term (hourly) load forecasting are presented. The present methodology uses the historical load data and the time of the day to design the Fuzzy rule base to predict the load curve of the day. The results obtained prove that the Fuzzy rule base can efficiently predict the short term load demand with minimum error.

Keywords*:* Short term load forecasting, fuzzy logic

Introduction

Load forecasting is a very important part of the power system as it is the part of energy management system for operation and planning purposes. Load forecasting is the method of predicting the electrical load demand. Load forecasting is an integral and central process in the planning and operation of electrical energy management system [7]. Load forecasting can be divided into two categories:

- Shor-term, and
- Long term.

Long term forecasting is required for preparing maintenance schedules of the generating units, planning future capacity requirements of the system, entering into agreements with neighbouring utilities which may have either surplus or deficit of energy, for energy interchange etc. For day–to–day operation, covering one day or a week, short-term load forecasting is needed in order to commit (i.e. to select) enough generating capacity for meeting the forecasted demand and for maintaining the required spinning reserve. Spinning reserve means the generating capacity in excess of actual loading of the committed units. Traditional models for load forecasting can be generally classified as time series models or regression models [2]. The previous load has been used to predict the future load demand in time series model. But this estimation method is very complex and a large amount of data is required to build the comprehensive forecasting system. The regression model is the second major modelling technique used to forecast short-term load [3]. In this methodology, the database is divided into smaller segments. For each section, a regression model may be built, such as a particular season or a day of the week. The estimated parameter values are readily interpretable but the disadvantage of this method is that they require a substantial database possibly including obsolete historical data.

Fuzzy logic methods are the alternative to the conventional methods of load forecasting. This is an appropriate method especially when it is tough to get a mathematical relationship between historical data. Fuzzy logic models may be integrated into expert systems or artificial neural network models where both user expertise and numerical data can be utilised. One of the major obstacles in implementing and using a short term load forecasting model has been the lack of user trust and confidence in the model [1]. The design method to capture the nonlinear relationships between inputs (previous day's load, peak load, day, time) and outputs (predicted load) is very complex in terms of its mathematical representation, and it does not offer the user an intuitive understanding. Using fuzzy logic, this mathematical relationship can be reduced to a logic table, such as a set of IF-THEN statements (e.g. IF Day is Weekend and Time is 1 THEN Load is Mf1) and that gives the user more confidence to use the model. A set of logic statements, or rules. These statements could be developed from expert knowledge or, from a set of historical observations with expert assistance. In this research, historical load information, day, time are converted into 'fuzzy' information. A fuzzy rule base is developed to produce 'fuzzy'

forecasts and defuzzification is performed to generate a point estimate for system load. This methodology has yielded accurate results comparable to other more complex statistical models, [2], [4].

In this paper, a method of hourly load forecasting using fuzzy logic has been presented. The load forecasting has been done using the one-year data from the large-scale power system. The proposed methodology uses fuzzy rules to incorporate historical load data with time and day. Here day means Weekend or weekdays. The aim of the work is to determine the probable load curve of a particular day observing one-year data from large-scale industry.

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Fuzzy Logic Methodology For Short Term Load Forecasting

Fuzzification

Fuzzification is the process by which the crisp numerical values are converted into the degree of membership related to the corresponding fuzzy sets. A membership function (MF) accepts a crisp value as its argument and returns the degree to which that value belongs to the fuzzy set the MF represents. This work makes an arrangement of fuzzy subsets for different inputs and outputs in a complete universe of disclosure as a membership function in order to express the fuzziness of data.

The advantage of using fuzzy logic model is that the values for the inputs and outputs may be expressed in natural language. For example, a 'Load' variable can take 'Fazzy' values, such as 'VVL' stands for 'very very low', "VL' for 'very low' etc. A fuzzy logic model maps the input values to output values using simple IF-THEN logic statement.

Fuzzy Rule-Base

Fuzzy Rule Base is the heart of a fuzzy model. In this part of the system the heuristic knowledge is stored in terms of 'IF-THEN' Rules. The rule base is used to send information to fuzzy inference system(FIS) to process through inference mechanism to numerically evaluate the information embedded in fuzzy rule base to get the output. Fuzzy inference is the process of formulating the mapping from a given input to an output using fuzzy logic. The mapping then provides a basis from which decisions can be made, or patterns discerned. An example of rule may be 'For example, 'IF day is 'Holiday' and 'Time' is '1am' THEN the 'Load' is 'Mf4'. Fig. 2.1 represents the configuration of fuzzy logic.

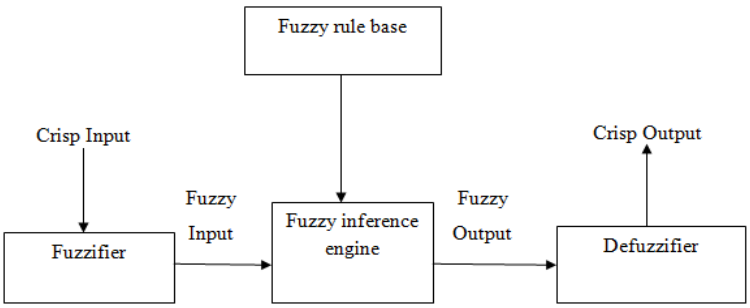

Fig 2.1. Configuration of fuzzy logic

Proposed Methodology

From the observation of the data set, it can be seen that a load of a particular time (for example 10am-11am) of a day depend upon certain factors. They are, the time load is to be forecasted, forecasted maximum load of the day, the day (whether it is Weekend or weekday), and historical load. It is observed from the data set, that in the case of weekend or holidays, the load is dependent on the previous day's load more than the forecasted maximum load of the day. But in the case of weekdays, the load is dependent on the forecasted maximum load of the day more than the previous day's load. To incorporate all the factors affecting the hourly load forecasting, fuzzy logic has been used.

This has been done by designing two fuzzy logic models and multiplying the outputs of the two fuzzy models. The schematic diagram of the fuzzy logic load forecasting model can be presented by fig 3.1.

As mentioned, two fuzzy logic models have been designed to forecast the load demand. In 1st model, 'time' and the 'day' have been used as inputs. Day means whether it is weekday or weekend (or holiday) as it is known that load demand of a weekday and weekend (or holidays) follow different patterns. The membership functions of 'time' and 'day' are shown below. It shows that the variable 'day' has 2 membership functions. One 'holid' (which represents the holidays and weekends), and the second one is 'weekday'. The variable 'time' has 12 membership functions. (1,2,3 …….12). The output 'load' has 13 membership functions (mf1, mf2…..mf13).Figs 3.2-3.8 show the membership functions of the fuzzy logic model. 24 rules have been formed observing the test data. It is based on the demonstrated success in generating forecasts, the methodology proposed by Wang, L. X. [6], and Kosko [5] is used. From this fuzzy model, we can get the forecasted load which depends on the day and the time only. But these two inputs are not sufficient as that would result in the same load profile for all weekdays throughout the year, and also the same for all weekends and holidays which is not practical. Load demand is also dependent on some other criterion.

From the observation of the test data, it can be seen that the hourly load is dependent on previous day's load of that particular time at which the load is to be forecasted, and the forecasted maximum load of the day. The peak load or maximum load of the can be forecasted from the maximum minimum temperature, previous day's peak load [3]. So, to incorporate another two variables, another fuzzy logic model has been developed and the output of that model is a factor, which depends on the previous day's load and the forecasted maximum load of the day. The inputs to this fuzzy model are 'prevdload' (which represents the previous day load demand on that time), 'maxload' (maximum forecasted load of the day) and 'day' (whether it is weekend/Holiday or weekday) and the output is 'factor'. The membership functions of the two fuzzy logic model are shown below). As stated earlier, it has been observed that the weekends load is much dependent on previous days' load other than that of a weekday and weekday's load curve depends much on the forecasted peak load of the day. So 'day' is another factor that has been taken as input in this model. 89 rules have been formed from the observation of the load profile to get more accurate performance.

In order to forecast the hourly load demand of a day, 1st it is required to select a test set of data. Then using this data, one can get the output from the two fuzzy logic models for 24 hours as represented in Fig 3.1. From the 1st fuzzy controller, the value of load can be obtained and from the second fuzzy model, one can derive the factor that needs to be multiplied with the output of the first fuzzy model. After multiplying the two outputs of the two fuzzy logic models, one can generate the value of forecasted load demand for 24 hours, means the load curve of the day. After observing the performance of the system with the test data, further modifications of the fuzzy logic model can be done to achieve better performance. One can do that by modifying the shape of the membership functions, by modifying the rules or by doing both.

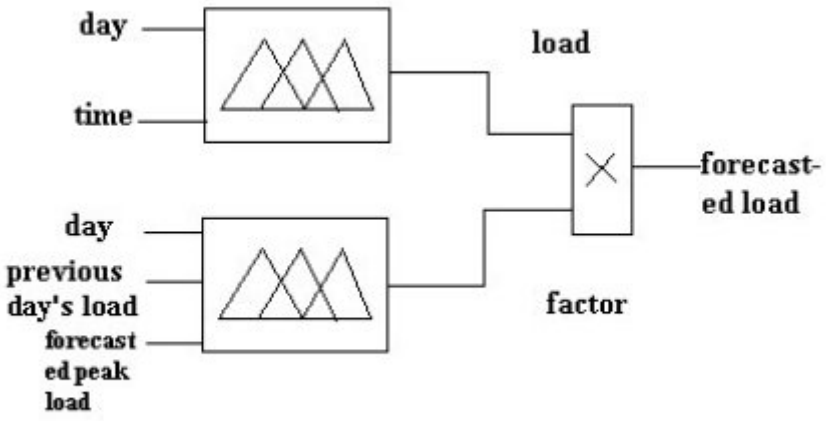

Fig. 3.1 Schematic diagram of the fuzzy logic model

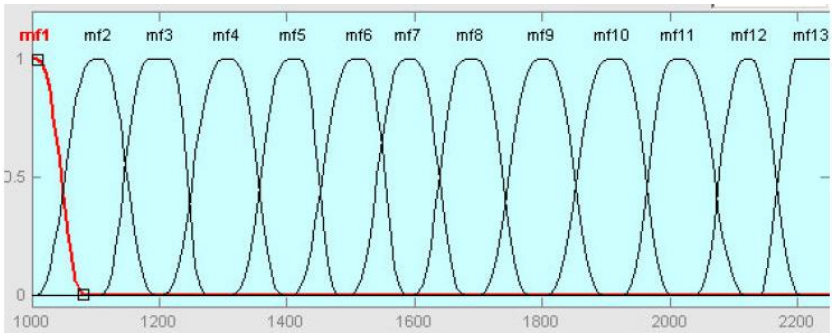

Fig 3.2 Membership function of output of fuzzy logic model 1- 'load' (forecasted)

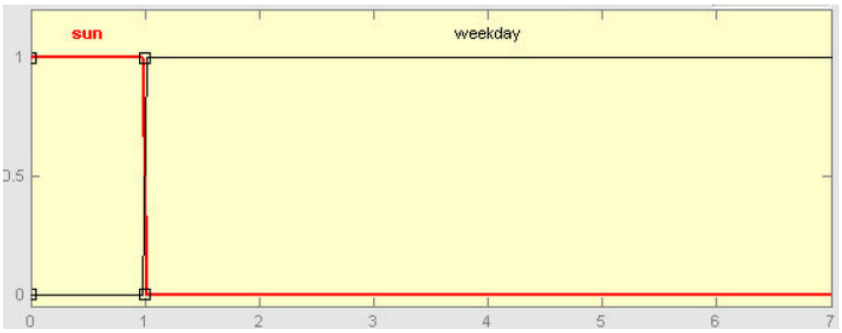

Fig 3.3 Membership function of input of fuzzy logic model 1- 'day'

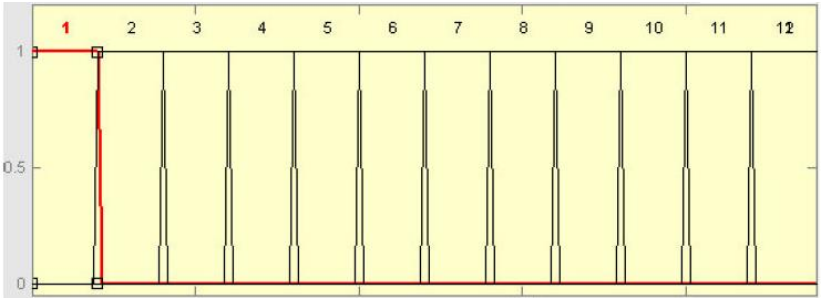

Fig 3.4 Membership function of input of fuzzy logic model1 - 'time'

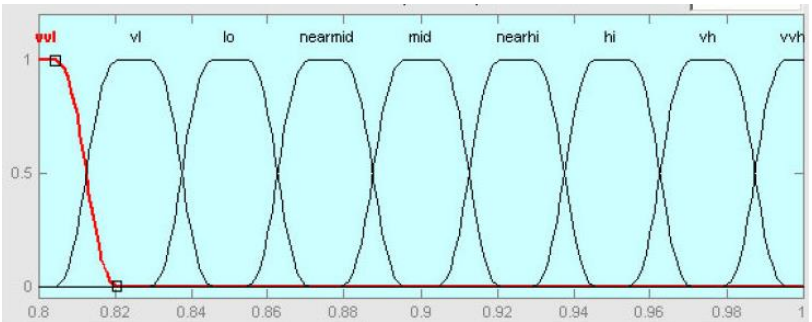

Fig 3.5 Membership function of output of fuzzy logic model2 - 'factor'

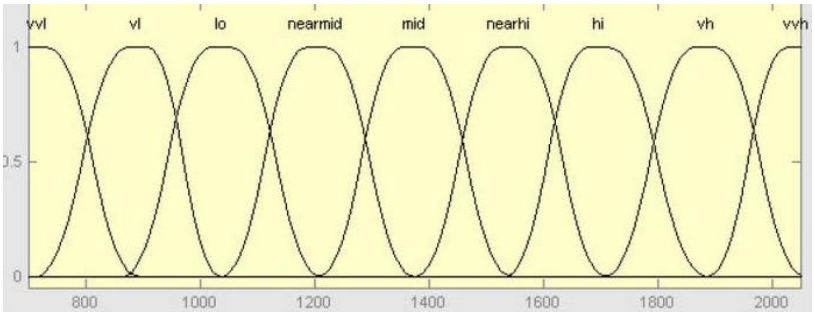

Fig 3.6 Membership function of input of fuzzy logic model2 'prevdload'

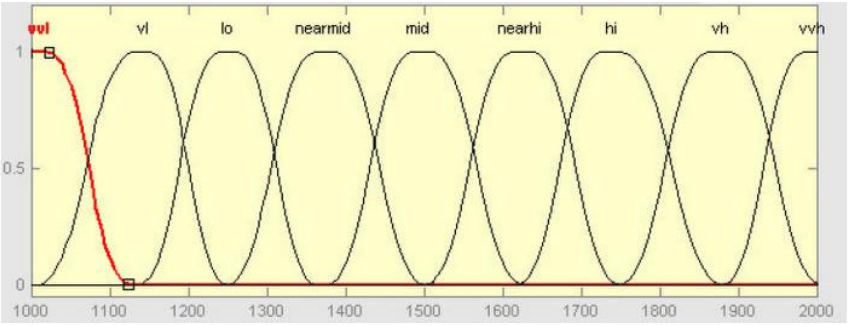

Fig 3.7 Membership function of input of fuzzy logic model 2- 'maxload'

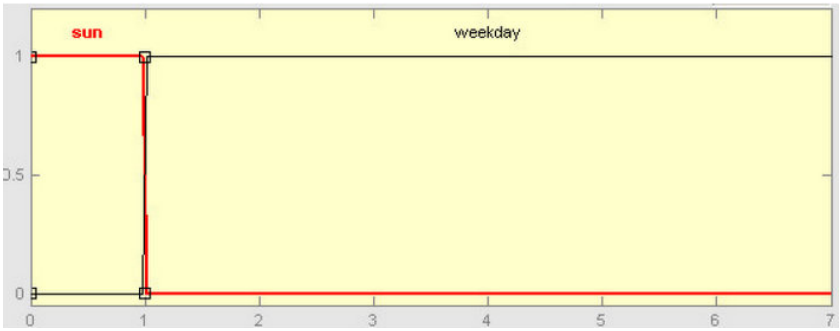

Fig 3.8 Membership function of input of fuzzy logic model2- 'day'

Simulation and Results

The simulation is done in MATLAB /SIMULINK environment. Fuzzy logic toolbox has been used to create the fuzzy logic models stated above.

Figures 4.1- 4.3 represents the actual load versus forecasted load curves for different days are shown. From these figures, it can be said that the fuzzy logic model is working satisfactorily to forecast the short term load demand. The mean absolute percentage error (MAPE) was used to study the performance of the fuzzy model. It is defined as follows

$$MAPE = \left(\frac{1}{N}\right)\sum_{i=1}^{N}\frac{|\text{forecasted load} - \text{actual load}| \times 100}{\text{actual load}}$$

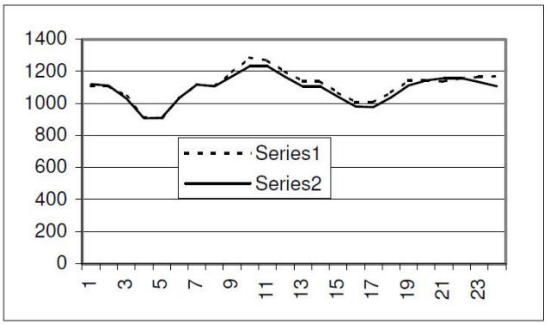

Fig 4.1 Load curve of Sunday/Weekend – series1 represents actual load, series2 represents forecasted load

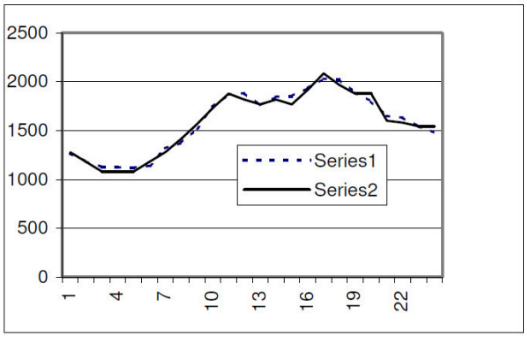

Fig 4.2 Load curve of Monday –series1 represents actual load, series2 represents forecasted load

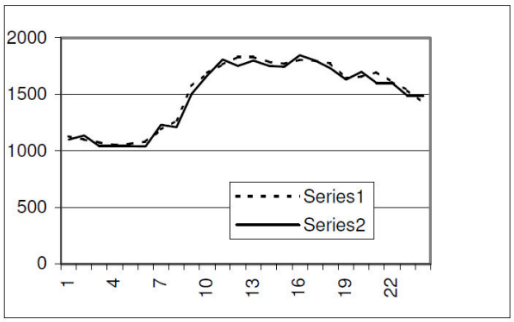

Fig 4.3 Load curve of Tuesday – series 1 represents actual load, series 2 represents forecasted load

Where N is the number of observations in the test data set. Here the table 1 shows the MAPE and maximum percentage error for seven days. For each day,

Table 4.1. MAPE for seven days

DAY	MAPE	MAXIMUM PERCENTAGE ERROR
SUN	2.37	4.49
MON	2.53	4.7
TUE	1.87	2.89
WED	1.98	3.01
THU	2.7	2.98
FRI	1.89	3.01
SAT	2.01	3.02

load has been forecasted for 24 hours. The results show that the fuzzy logic model is working satisfactorily with permissible error.

Conclusions

A methodology to design a fuzzy logic model for short term load forecasting is presented in this paper. The fuzzy logic model is able to forecast the short term load demand efficiently for different days and time. However, this model has a limitation. The suggested model is not able to consider any sudden load change. If the load requirement changes abruptly for few hours only due to any unpredictable reason, this model will not be able to follow the change, this means that it will not be able to forecast the load for that particular time with a permissible range of error. Besides this, the model works satisfactorily.

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SPECTROSCOPIC AND THERMODYNAMIC PROPERTIES OF 1-(4-METHYLPIPERAZINE-1-YL-METHYL)-3-BENZYL-4-(3-CINNAMOYLOXYBENZYLIDENEAMINO)-4,5-DIHYDRO-1*H*-1,2,4-TRIAZOL-5-ONE

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Abstract : In this study, 1-(4-methylpiperazine-1-yl-methyl)-3-benzyl-4-(3-cinnamoyloxybenzyliden-amino)-4,5-dihydro-1H-1,2,4-triazol-5-one was optimized by using B3LYP/6-31G(d) HF/6-31G(d) basis sets. ^{1}H-NMR and ^{13}C-NMR spectral data values were calculated according to the method of GIAO using the program package Gaussian G09W. Experimental and theoretical values were inserted into the graphic according to equitation of δ exp=a+b. δ calc. The standard error values were found via SigmaPlot program with regression coefficient of a and b constants. Also, calculated IR data of compound were calculated in gas phase by using of 631G(d) basis sets of B3LYP and HF methods and are multiplied with appropriate adjustment factors. Theoretical infrared spectrums are formed from the data obtained according to B3LYP and HF methods. In the identification of calculated IR data were used the veda4f program. Furthermore, molecule's theoretical angles, dipole moments, mulliken charges, HOMO-LUMO energies, total energy of the molecule, ionization potential, electron affinity, electronegativity and thermodynamic properties for both methods were calculated.

Keywords: 4,5-Dihidro-1H-1,2,4-triazol-5-one, GIAO, B3LYP, HF, 6-31G(d)

Introduction

The optimized molecular structure, vibrational frequencies, UV–Vis spectroscopic parameters, atomic charges and frontier molecule orbitals (HOMO and LUMO) of the titled compound have been calculated by using DFT/B3LYP and HF method with 6-31G(d) basis set. All quantum chemical calculations were carried out by using Gaussian 09W (Frisch et al., 2009; Wolinski, Hilton & Pulay, 1990) program package and the GaussView molecular visualization program (Frisch, Nielson & Holder, 2003). The molecular structure and vibrational calculations of the molecule were computed by using Becke-3-Lee Yang Parr (B3LYP) (Becke, 1993;Lee, Yang & Parr, 1988) density functional method with 6-31G(d) basis set in ground state. IR absorption frequencies of analyzed molecule were calculated by two methods. Then, they were compared with experimental data, which are shown to be accurate. Infrared spectrum was composed by using the data obtained from both methods. The assignments of fundamental vibrational modes of the title molecule were performed on the basis of total energy distribution (TED) analysis by using VEDA 4f program (Jamroz, 2004).

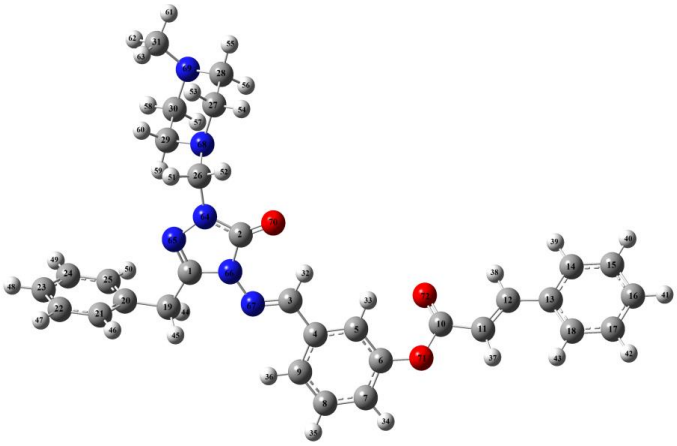

Fig. 1. The optimized molecular structure of 1-(4-methylpiperazine-1-yl-methyl)-3-benzyl-4-(3-cinnamoyloxybenzyliden-amino)-4,5-dihydro-1*H*-1,2,4-triazol-5-one (1) with DFT/HF 6–31G(d) level.

Methods

The molecular structure of the title compound in the ground state (in vacuo) is computed by performing both Hartree-Fock (HF) and the density functional theory (DFT) by a hydrid functional B3LYP functional (Becke's three parameter hybrid functional using the LYP correlation functional) methods (Becke, 1993; Lee, Yang & Parr, 1988) at 6-31G(d) level.

Results and Findings

3.1. Molecular Structure

The optimized molecular geometric parameters (bond angles) of the molecule by using B3LYP/6–311G(d) and HF/6–311G(d) levels are listed in Table **1**.

Table 1.The calculated bond angles of the molecule.

Bond lenghts		B3LYP	HF	Bond lenghts		B3LYP	HF
1	C(1)-N(65)-N(64)	105.24	105.65	61	H(60)-C(29)-N(68)	108.83	109.08
2	C(1)-N(66)-N(67)	121.27	121.18	52	C(29)-N(68)-C(27)	111.40	111.68
3	C(1)-N(66)-C(2)	108.15	107.96	63	N(65)-C(1)-C(19)	126.42	126.88
4	C(1)-C(19)-C(20)	113.65	113.68	64	C(26)-N(64)-C(2)	124.53	125.19
5	C(1)-C(19)-H(44)	108.11	107.91	65	N(65)-C(2)-N(66)	101.93	102.60
6	C(1)-C(19)-H(45)	108.22	107.93	66	N(65)-C(2)-O(70)	129.37	129.10
7	H(44)-C(19)-C(20)	110.58	110.54	67	O(70)-C(2)-N(66)	128.69	128.29
8	H(45)-C(19)-C(20)	110.59	110.60	68	C(2)-N(66)-N(67)	130.55	130.82
9	C(19)-C(20)-C(21)	120.68	120.66	69	N(66)-C(1)-C(19)	122.27	122.01
10	C(19)-C(20)-C(25)	120.58	120.56	70	N(66)-N(67)-C(3)	118.76	119.89
11	C(20)-C(21)-H(46)	119.48	119.67	71	N(67)-C(3)-H(32)	122.06	122.38
12	C(20)-C(21)-C(22)	120.73	120.70	72	N(67)-C(3)-C(4)	120.06	120.24
13	H(46)-C(21)-C(22)	119.80	119.63	73	H(32)-C(3)-C(4)	117.88	117.37
14	C(21)-C(22)-H(47)	119.78	119.79	74	C(3)-C(4)-C(5)	117.91	117.99
15	C(21)-C(22)-C(23)	120.08	120.11	75	C(3)-C(4)-C(9)	122.42	122.42
16	H(47)-C(22)-C(23)	120.14	120.10	76	C(4)-C(5)-H(33)	120.25	120.74
17	C(22)-C(23)-H(47)	120.18	120.19	77	C(4)-C(5)-C(6)	119.51	119.70
18	C(22)-C(23)-C(24)	119.64	119.61	78	H(33)-C(5)-C(6)	120.24	119.56
19	H(48)-C(23)-C(24)	120.18	120.20	79	C(5)-C(6)-O(71)	122.56	120.46
20	C(23)-C(24)-H(49)	120.13	120.12	80	C(5)-C(6)-C(7)	120.01	121.10
21	C(23)-C(24)-C(25)	120.08	120.09	81	O(71)-C(6)-C(7)	116.31	118.33
22	H(49)-C(24)-C(25)	119.79	119.79	82	C(6)-C(7)-H(34)	119.18	119.56
23	C(24)-C(25)-H(50)	119.79	119.61	83	C(6)-C(7)-C(8)	119.31	119.14
24	C(24)-C(25)-C(20)	120.72	120.60	84	H(34)-C(7)-C(8)	121.52	121.29
25	H(50)-C(25)-C(20)	119.48	119.68	85	C(7)-C(8)-H(35)	119.48	119.51
26	C(25)-C(20)-C(21)	118.75	118.78	86	C(7)-C(8)-C(9)	120.52	120.53
27	N(65)-C(1)-N(66)	111.31	111.11	88	H(35)-C(8)-C(9)	120.00	119.96
28	N(65)-N(64)-C(26)	121.82	121.98	88	C(8)-C(9)-H(36)	120.95	120.58
29	N(64)-C(26)-N(68)	112.92	113.13	89	C(8)-C(9)-C(4)	119.98	119.95
30	N(64)-C(26)-H(51)	106.30	106.69	90	H(36)-C(9)-C(4)	119.07	119.48
31	N(64)-C(26)-H(52)	106.39	106.38	91	C(9)-C(4)-C(5)	119.70	119.58
32	C(26)-N(68)-C(27)	112.89	112.68	92	C(6)-O(71)-C(10)	120.51	119.84
33	C(26)-N(68)-C(29)	113.24	113.48	93	O(71)-C(10)-O(72)	123.95	123.44
34	H(51)-C(26)-N(68)	113.44	112.94	94	O(71)-C(10)-C(11)	109.38	110.28
35	H(52)-C(26)-N(68)	108.47	108.61	95	O(72)-C(10)-C(11)	126.67	126.27
36	N(68)-C(27)-H(53)	112.02	111.79	96	C(10)-C(11)-H(37)	116.82	116.52
37	N(68)-C(27)-H(54)	108.62	108.71	97	C(10)-C(11)-C(12)	119.82	119.68
38	N(68)-C(27)-C(28)	109.32	109.62	98	H(37)-C(11)-C(12)	123.35	123.80
39	H(51)-C(27)-C(28)	110.08	110.31	99	C(11)-C(12)-H(38)	116.27	116.75

40	H(52)-C(27)-C(28)	109.38	109.06	100	C(11)-C(12)-C(13)	127.87	127.69
41	C(27)-C(28)-N(69)	113.94	113.75	101	H(38)-C(12)-C(13)	115.86	115.56
42	C(27)-C(28)-H(55)	110.08	110.04	102	C(12)-C(13)-C(14)	118.51	118.39
43	C(27)-C(28)-H(56)	107.91	108.02	103	C(12)-C(13)-C(18)	123.23	123.13
44	H(55)-C(28)-N(69)	108.98	109.18	104	C(13)-C(14)-H(39)	119.05	119.43
45	H(56)-C(28)-N(69)	107.89	108.05	105	C(13)-C(14)-C(15)	121.06	120.99
46	C(28)-N(69)-C(30)	109.78	110.13	106	H(39)-C(14)-C(15)	119.89	119.58
47	C(28)-N(69)-C(31)	114.25	114.62	107	C(14)-C(15)-H(40)	119.85	119.86
48	N(69)-C(31)-H(61)	109.01	109.20	108	C(14)-C(15)-C(16)	119.93	119.88
49	N(69)-C(31)-H(62)	109.01	109.20	109	H(40)-C(15)-C(16)	120.22	120.26
50	N(69)-C(31)-H(63)	115.68	115.09	110	C(15)-C(16)-H(41)	120.18	120.18
51	C(31)-N(69)-C(30)	114.27	114.60	111	C(15)-C(16)-C(17)	119.75	119.78
52	N(69)-C(30)-C(29)	113.90	113.67	112	H(41)-C(16)-C(17)	120.07	120.04
53	N(69)-C(30)-H(57)	107.81	107.99	113	C(16)-C(17)-H(42)	119.99	120.00
54	N(69)-C(30)-H(58)	108.93	109.13	114	C(16)-C(17)-C(18)	120.31	120.25
55	H(57)-C(30)-C(29)	108.18	108.27	115	H(42)-C(17)-C(18)	119.70	119.74
56	H(58)-C(30)-C(29)	110.06	110.03	116	C(17)-C(18)-H(43)	119.43	119.18
57	C(30)-C(29)-N(68)	109.52	109.71	117	C(17)-C(18) -C(13)	120.69	120.60
58	C(30)-C(29)-H(59)	110.45	110.52	118	H(43)-C(18)-C(13)	119.88	120.21
59	C(30)-C(29)-H(60)	110.02	109.54	119	C(18)-C(13) -C(14)	118.26	118.48
60	H(59)-C(29)-N(68)	111.08	111.02				

Vibrational Frequencies

The 1-(4-methylpiperazine-1-yl-methyl)-3-benzyl-4-(3-cinnamoyloxybenzyliden-amino)-4,5-dihydro-1H-1,2,4-triazol-5-one has 72 atoms and the number of the normal vibrations are 210. The observed and calculated vibrational frequencies, the calculated IR intensities and assignments of vibrational frequencies for title compound are summarized in Table **2**.

Table 2. The calculated frequencies values of the molecule.

	Vibration Types	scaled DFT	scaled Hf
1	τ NCCC (25), τ NCNN (22)	8	5
2	δ COC (20), τ NCCC (10)	12	6
3	τ NCCC (23), τ NCNN (17), τ CCOC (13)	14	8
4	τ COCC (26)	16	13
5	τ CCOC (16), τ COCC (18)	19	12
6	τ NCCC (28)	21	15
7	τ CCCC (16), τ COCC (18)	23	16
8	τ CNCN (45)	29	19
9	NCNN (11)	28	23
10	τ CCNN (19)	35	25
11	δ COC (13), τ CCNN (12)	37	38
12	τ CCOC (12), τ COCC (23)	40	41
13	τ CCCC (14), τ CCOC (10), τ COCC (18)	47	44
14	τ NCNN (18), τ CCNN (17)	56	57
15	δ NCC (10), δ CCC (10)	67	64
16	δ CCC (10), τ CCNC (13)	90	90
17	τ CCCO (19), τ CCOC (34)	93	97
18	τ COCC (18)	101	98
19	τ CNNC (19)	119	116
20	τ CCCO (26), τ CCOC (10)	148	133
21	τ CNNC (14), τ HCCN (54)	153	168
22	τ CCCN (18)	162	176
23	τ NCNN (13)	171	180
24	τ CNNC (24), τ NNCN (11)	178	183
25	τ CCCN (15)	189	191
26	δ CNC (19), τ CNCN (21)	198	199
27	δ CCC (11), CCO (12)	202	200

28	δ CCN (10), δ CNC (15), τ CNCN (10)	209	213
29	τ HCNC (24)	218	219
30	CC (15), δ CCC (12)	224	228
31	τ CCCC (25)	232	230
32	τ CCCC (21), τ NCNN (13)	238	233
33	τ CNNC (16)	250	252
34	τ COCC (18)	257	264
35	δ OCN (13)	276	283
36	τ CCCO (10), τ CCCC (20)	282	292
37	τ CCOC (13)	290	297
38	δ CNN (10), δ CCN (13), τ CCCN (13)	312	323
39	δ NNC (15), δ OCN (11)	322	346
40	δ COC (11), δ CCN (13), τ CNNC (16)	334	352
41	δ CNN (17), δ NNC (14)	348	357
42	δ HCN (11)	355	367
43	τ NCNN (10), τ CNNC (10), τ NNCN (11)	359	371
44	δ COC (11)	370	386
45	δ CNN (12), δ NNC (13), δ OCN (13)	387	409
46	τ HCCC (11), τ CCCO (35), τ CCCC (33)	409	430
47	δ CNC (11), τ HCCC (17)	413	437
48	δ CNC (43)	431	444
49	δ CNC (10)	440	450
50	δ HCH (44)	441	461
51	τ HCCC (16), τ CCCC (28), τ OCCC (14)	461	486
52	δ CCC (11)	470	490
53	δ CCN (16)	490	504
54	τ HCCN (139, δ CNC (30), δ HCH (44)	495	510
55	τ HCCC (15), τ CCCO (19), τ CCCC (20)	496	517
56	δ CCC (18), δ CCO (16), δ OCO (10)	558	573
57	δ CCC (11), δ NCN (12)	582	602
58	τ CCCC (16), τ OCCC (21)	594	614
59	δ CCC (28)	617	641
60	δ CNC (12)	627	647
61	δ CCC (40), ν CC (40)	628	649
62	δ CNN (14), δ CCN (11), δ OCN (14)	629	654
63	τ NNCN (14)	635	687
64	τ NNCN (14), ν NC (23), ν CC (13)	653	687
65	τ CCCO (18), τ OCOC (24)	686	721
66	τ HCCC (26), CCCC (43), ν CC (21), δ HCC (10)	691	724
67	τ HCCC (24)	700	732
68	τ ONNC (27)	701	734
69	τ HCCC (18), τ OCOC (40)	710	760
70	τ ONNC (46)	**716**	**781**
71	δ COC (10), δ OCO (28)	**751**	**799**
72	τ HCCC (12), τ OCOC (34)	769	801
73	τ HCCC (18)	773	806
74	τ HCCC (10)	776	812
75	ν NC (26)	779	822
76	δ NCC (13)	789	834
77	ν NC (24)	801	840
78	τ HCCC (31), τ CCCC (10)	808	855
79	ν NN (10), δ NCC (13)	833	874
80	τ HCNC (15), ν NC (10)	845	880
81	τ HCCC (40)	846	885
82	τ HCCC (48)	847	888
83	ν CC (10), δ CCC (11)	857	906
84	τ HCCC (32)	876	937
85	τ HCCC (25)	886	943
86	δ CNC (11), δ CCN (14)	902	960
87	τ HCCC (52)	915	981
88	δ CCC (18), ν CC (21)	921	989
89	τ HCCC (48)	926	995
90	δ CCC (11), ν CC (10), ν OC (17)	951	997

92	τ HCCC (55), ν CH (53)	961	1010
93	ν NN (13), ν NC (17), ν CC (20)	970	1029
94	τ HCCC (58), τ CCCC (10)	973	1037
95	δ CNC (10), ν CC (19)	984	1037
96	τ HCCC (35), δ CCC (18)	986	1038
97	τ HCCC (41), τ CCCC (13)	990	1039
98	ν OC (15)	993	1042
99	τ HCCN (12), ν CC (10)	995	1048
100	τ HCCN (12)	1000	1055
101	ν CC (25), δ CCC (24)	1007	1062
102	τ HCNN (39), δ CCC (13)	1009	1066
103	τ HCNN (47), δ CCC (11)	1009	1073
104	ν NC (26)	1026	1076
105	τ HCCC (49)	1030	1091
106	τ HCCN (24)	1037	1092
107	ν CC (28), δ HCC (19)	1048	1093
108	ν CC (17), δ HCN (22)	1049	1096
109	τ HCNC (12)	1061	1109
110	ν CC (14), δ HCN (10), τ HCNC (16)	1064	1112
110	δ HCC (17)	1070	1121
111	ν NC (11), δ HCC (11)	1080	1127
112	δ NNC (10), ν NC (22), δ CNN (11)	1089	1132
113	δ HCC (22)	1104	1135
114	ν CC (12), δ HCC (14)	1104	1153
115	ν NC (17)	1133	1162
116	δ NCN (13)	1151	1172
117	ν NC (12)	1154	1198
118	ν NC (12)	1163	1206
119	ν OC (15), δ HCC (50)	1175	1212
120	ν NC (16)	1178	1230
121	ν OC (18), δ HCC (27)	1182	1233
122	ν CC (10), δ HCC (41)	1184	1235
123	ν CC (14), ν OC (11), δ HCC (22)	1189	1242
124	δ HCC (21)	1204	1249
125	δ HCC (21)	1205	1251
126	τ HCNC (26)	1220	1264
127	δ HCC (37), τ HCNC (11)	1224	1268
128	ν CC (11), δ HCC (29)	1228	1271
129	δ HCC (31)	1242	1276
130	ν OC (13), δ NCN (13)	1255	1279
131	δ HCC (14)	1277	1289
132	δ HCC (25), δ CCC (18)	1283	1298
133	ν CC (11), ν NN (10), δ NCN (14)	1291	1327
134	ν CC (19), δ HCC (17), δ CCC (10)	1313	1347
135	δ HCC (47)	1315	1351
136	δ HCC (45)	1318	1367
137	δ HCN (27)	1320	1375
138	δ HCC (54)	1328	1378
139	δ HCC (32)	1339	1381
140	δ HCN (11)	1345	1383
141	ν CC (34), δ HCC (18)	1348	1387
142	ν CC (40), δ HCC (23)	1356	1404
143	ν CC (43), δ HCC (21)	1359	1421
144	δ HCC (47)	1364	1431
145	δ HCC (47)	1364	1435
146	ν NC(10), δ HCN (39)	1383	1443
147	δ HCN (41)	1384	1443
148	δ HCC (17), τ HCNC (23)	1389	1461
149	τ HCNC (12)	1398	1472
150	τ HCNC (19)	1403	1478
151	δ HCN (16)	1417	1494
152	δ HCN (14), δ HCH (44)	1427	1496
153	δ HCH (10), τ HCNC (14)	1438	1512

154	ν CC (11), ν NC (14), δ HCH (12)	1450	1515
155	δ HCH (70)	1467	1530
156	ν CC (14), δ HCN (12), δ HCC (10)	1469	1535
157	δ HCH (45)	1482	1539
158	ν CC (14), δ HCC (24)	1484	1540
159	δ HCH (17)	1485	1550
160	δ HCH (44), τ HCCN (13)	1486	1557
161	δ HCH (32)	1489	1561
162	δ HCH (36), τ HCNC (13)	1497	1558
163	δ HCH (35), τ HCCN (11)	1499	1563
164	δ HCH (53)	1504	1567
165	δ HCH (47)	1508	1570
166	δ HCC (26)	1525	1587
167	δ HCH (42)	1528	1587
168	ν CC (12), δ HCC (32), δ CCC (12)	1532	1589
169	δ HCH (60)	1534	1591
170	ν CC (40)	1618	1693
171	ν CC (14), δ CCC (11)	1621	1708
172	ν NC (14), ν CC(19), δ HCC (12)	1638	1721
173	ν CC (13)	1644	1727
174	ν NC (23)	1644	1770
175	ν NC (50)	1664	1782
176	ν CC (21), δ HCC (10)	1681	1814
177	ν OC (72), ν NC (10)	1789	1863
178	ν OC (81)	1793	1906
179	ν CH (48)	2895	2960
180	ν CH (59)	2900	2965
181	ν CH (51)	2939	3004
182	ν CH (53)	2941	3006
183	ν CH (24)	2964	3047
184	ν CH (62)	2970	3054
185	ν CH (58)	3010	3059
186	ν CH (58)	3015	3065
187	ν CH (68)	3023	1072
188	ν CH (73)	3037	3076
189	ν CH (21)	3039	3083
190	ν CH (25)	3047	3092
191	ν CH (43)	3063	3102
192	ν CH (50)	3066	3108
193	ν CH (28)	3080	3119
194	ν CH (16)	3082	3126
195	ν CH (51)	3093	3136
196	ν CH (25)	3096	3156
197	ν CH (48)	3112	3163
198	ν CH (57)	3135	3168
199	ν CH (37)	3145	3196
200	ν CH (44)	3155	3202
201	ν CH (26)	3159	3209
202	ν CH (54)	3160	3210
203	ν CH (33)	3167	3214
204	ν CH (47)	3169	3223
205	ν CH (38)	3177	3226
206	ν CH (55)	3184	3230
207	ν CH (47)	3189	3232
208	ν CH (49)	3192	3240
209	ν CH (38)	3199	3246
210	ν CH (27)	3214	3248

NMR Spectral Analysis

In nuclear magnetic resonance (NMR) spectroscopy, the isotropic chemical shift analysis allows us to identify relative ionic species and to calculate reliable magnetic properties which provide the accurate predictions of

molecular geometries (Rani et al., 2010; Subramanian, Sundaraganesan, & Jayabharathi, 2010; Wade, 2006). In this framework, the optimized molecular geometry of the molecule was obtained by using B3LYP and HF methods with 6–31G(d) basis level in DMSO solvent. By considering the optimized molecular geometry of the title compound the ^{1}H and ^{13}C NMR chemical shift values were calculated at the same level by using Gauge-Independent Atomic Orbital (GIAO) method. Theoretical and experimental (Yüksek, Beytur & Gürsoy-Kol, 2016) values were plotted according to δ exp=a. δ calc.+ b, Eq. a and b constants regression coefficients with a standard error values were found using the SigmaPlot program.

Table 3. The calculated and experimental ^{13}C and ^{1}H NMR isotropic chemical shifts of the molecule.

No	Experim.	DFT/631d/DMSO	Diff./DMSO	HF/631d/DMSO	Diff/DMSO
C1	144,82	151,60	-6,78	125,92	18,90
C2	150,16	152,80	-2,64	128,98	21,18
C3	152,81	155,73	-2,92	128,88	23,93
C4	135,62	138,88	-3,26	111,41	24,21
C5	127,76	131,31	-3,55	107,59	20,17
C6	150,97	154,93	-3,96	125,31	25,66
C7	124,94	127,81	-2,87	105,69	19,25
C8	130,23	133,83	-3,60	108,33	21,90
C9	120,35	125,14	-4,79	102,34	18,01
C10	164,78	167,61	-2,83	142,75	22,03
C11	117,00	119,28	-2,28	94,23	22,77
C12	146,74	154,07	-7,33	128,16	18,58
C13	130,96	136,85	-5,89	108,55	22,41
C14	128,69	129,95	-1,26	105,65	23,04
C15	128,47	132,72	-4,25	106,47	22,00
C16	134,98	136,04	-1,06	111,10	23,88
C17	128,47	132,88	-4,41	106,65	21,82
C18	128,69	138,41	-9,72	112,16	16,53
C19	30,95	43,73	-12,78	16,33	14,62
C20	133,83	138,05	-4,22	111,11	22,72
C21	129,01	134,20	-5,19	109,38	19,63
C22	128,72	131,97	-3,25	107,09	21,63
C23	125,73	130,80	-5,07	106,41	19,32
C24	128,72	132,00	-3,28	107,16	21,56
C25	129,01	133,98	-4,97	109,19	19,82
C26	65,91	75,88	-9,97	41,85	24,06
C27	49,44	53,46	-4,02	20,65	28,79
C28	54,51	61,82	-7,31	26,71	27,80
C29	54,51	60,87	-6,36	26,04	28,47
C30	49,44	52,48	-3,04	19,65	29,79
C31	45,73	48,03	-2,30	18,49	27,24
H32	9,69	10,15	-0,46	9,28	0,41
H33	7,23	7,78	-0,55	6,63	0,60
H34	7,64	7,51	0,13	6,63	1,01
H35	7,58	7,94	-0,36	6,96	0,62
H36	7,7	8,44	-0,74	7,68	0,02
H37	6,94	6,87	0,07	5,89	1,05
H38	7,92	8,12	-0,20	7,57	0,35
H39	7,84	8,37	-0,53	7,46	0,38
H40	7,47	7,93	-0,46	6,87	0,60
H41	7,37	7,92	-0,55	6,91	0,46
H42	7,47	7,89	-0,42	9,82	-2,35
H43	7,84	7,75	0,09	6,88	0,96
H44	4,1	4,38	-0,28	2,89	1,21
H45	4,1	4,39	-0,29	2,92	1,18
H46	7,34	7,74	-0,40	6,72	0,62
H47	7,31	7,82	-0,51	6,69	0,62
H48	7,29	7,77	-0,48	0,65	6,64
H49	7,31	7,81	-0,50	6,69	0,62
H50	7,34	7,73	-0,39	6,71	0,63

H51	4,57	4,08	0,49	2,37	2,20
H52	4,57	4,63	-0,06	3,12	1,45
H53	2,29	2,54	-0,25	0,79	1,50
H54	2,29	3,27	-0,98	0,94	1,35
H55	2,6	3,01	-0,41	1,18	1,42
H56	2,6	3,48	-0,88	1,83	0,77
H57	2,6	2,94	-0,34	1,02	1,58
H58	2,6	3,28	-0,68	1,59	1,01
H59	2,29	2,63	-0,34	0,53	1,76
H60	2,29	2,87	-0,58	0,65	1,64
H61	2,13	2,45	-0,32	1,02	1,11
H62	2,13	2,47	-0,34	1	1,13
H63	2,13	3,39	-1,26	1,35	0,78

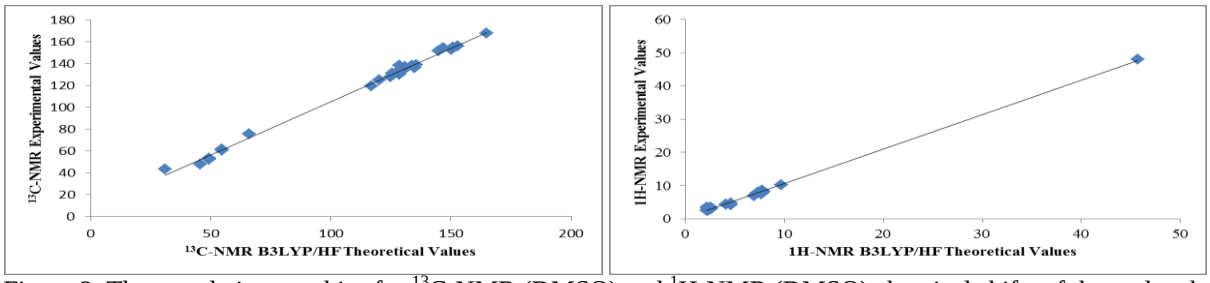

Figure 2. The correlation graphics for ^{13}C-NMR (DMSO) and ^{1}H-NMR (DMSO) chemical shifts of the molecule

Table 4. Mulliken atomic charges of the molecule

	DFT	HF		DFT	HF		DFT	HF
C1	0.554	0.629	**C25**	-0.169	-0.208	**H49**	0.130	0.202
C2	0.847	1.110	**C26**	0.010	0.107	**H50**	0.127	0.204
C3	0.038	0.090	**C27**	-0.136	-0.135	**H51**	0.147	0.180
C4	0.117	-0.034	**C28**	-0.144	-0.132	**H52**	0.172	0.209
C5	-0.197	-0.226	**C29**	-0.144	-0.143	**H53**	0.114	0.134
C6	0.350	0.394	**C30**	-0.145	-0.132	**H54**	0.149	0.178
C7	-0.158	-0.227	**C31**	-0.303	-0.286	**H55**	0.134	0.164
C8	-0.143	-0.204	**H32**	0.212	0.299	**H56**	0.152	0.184
C9	-0.154	-0.191	**H33**	0.165	0.251	**H57**	0.135	0.179
C10	0.617	0.832	**H34**	0.144	0.225	**H58**	0.448	0.164
C11	-0.214	-0.349	**H35**	0.139	0.212	**H59**	0.168	0.201
C12	-0.146	-0.112	**H36**	0.151	0.235	**H60**	0.114	0.135
C13	0.166	0.012	**H37**	0.153	0.225	**H61**	0.147	0.165
C14	-0.186	-0.211	**H38**	0.171	0.250	**H62**	0.146	0.166
C15	-0.131	-0.204	**H39**	0.143	0.218	**H63**	0.124	0.134
C16	-0.123	-0.191	**H40**	0.140	0.212	**N64**	-0.370	-0.580
C17	-0.131	-0.205	**H41**	0.139	0.212	**N65**	-0.341	-0.339
C18	-0.170	-0.198	**H42**	0.139	0.211	**N66**	-0.433	-0.645
C19	-0.437	-0.410	**H43**	0.137	0.214	**N67**	-0.313	-0.327
C20	0.184	0.051	**H44**	0.182	0.218	**N68**	-0.386	-0.587
C21	-0.168	-0.208	**H45**	0.181	0.217	**N69**	-0.367	-0.559
C22	-0.129	-0.197	**H46**	0.127	0.204	**O70**	-0.549	-0.672
C23	-0.128	-0.203	**H47**	0.130	0.202	**O71**	-0.550	-0.720
C24	-0.129	-0.198	**H48**	0.129	0.201	**O72**	-0.478	-0.586

Table 5. Electronic properties of the molecule

	DFT (kcal/mol)	HF (kcal/mol)
Ionization Potential	186.64	191.04
Electron Affinity	143.42	141.82
Electronegativity	165.03	166.43
Chemical hardness	21.61	24.61
Chemical softness	0.02314	0.02032

Energy	-11010.83	-10942.34

Table 6. The calculated dipole moment values of the molecule

Dipole Moment	B3LYP (a.u.)	HF (a.u.)
μ_x	-1.3559	-1.7535
μ_y	-1.1907	-1.7096
μ_z	-1.0108	-1.0467
μ_{Toplam}	2.0683	2.6633

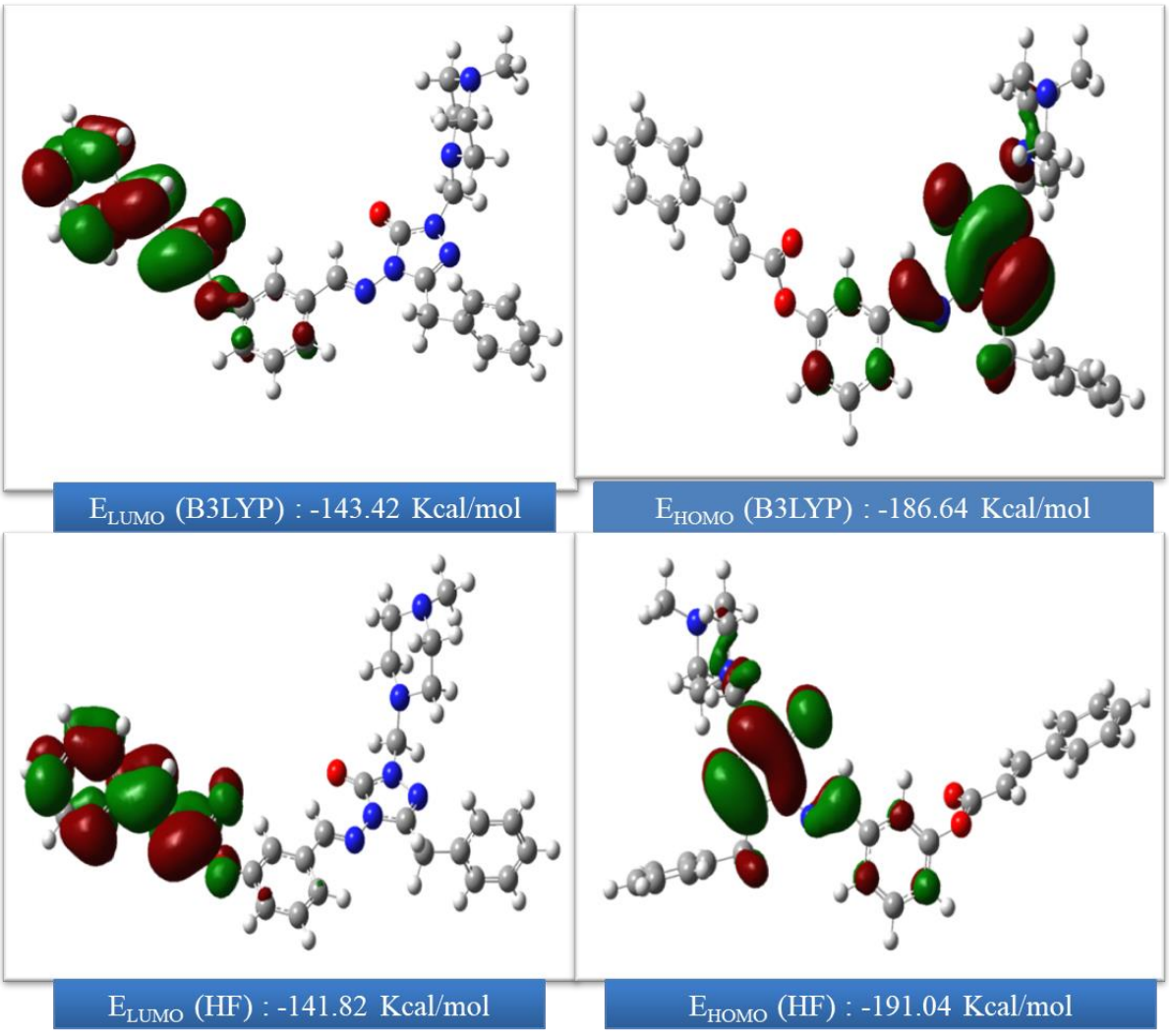

Figure 3. The calculated HOMO-LUMO energies of the molecule according to DFT/B3LYP/6–31G(d) and HF/B3LYP/6–31G(d) levels

Conclusion

The vibrational frequencies, ^{1}H and ^{13}C NMR chemicals shifts, HOMO and LUMO analyses and atomic charges of 1-(4-methylpiperazine-1-yl-methyl)-3-benzyl-4-(3-cinnamoyloxybenzyliden-amino)-4,5-dihydro-1H-1,2,4-triazol-5-one have been calculated by using DFT/B3LYP and HF methods. ^{13}C and ^{1}H NMR chemical shifts parameters were obtained theoretically are in a very good agreement with the experimental data.

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UNAUTHORIZED REMOTE ACCESS, CAPTURING INFORMATION ON THE TARGET COMPUTER AND IDENTIFICATION OF FORENSIC EVIDENCE

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Abstract: IT Technologies, facilitator our lives, becomes bad intentioned people's means of criminality on the other side. For instance, a computer kilometres away can be seized, the data/passwords can be stolen. This is done by means of some misused remote access by bad intentioned people and Dark Comet software is the one of them. In order not to experience such victimization, while users have to be careful about "Computer and information security in internet", forensic science specialists who encounter unauthorized access have to know that it can determine which computer forensics evidence in that computers.

Keywords: Unauthorized remote access, dark comet, trojan, keylogger.

Introduction

Rapidly developing IT technologies are in every sphere of our life and they have removed borders. While IT technologies make our lives easier on the one hand, they have also become a vehicle of committing crime for malevolent people on the other hand. Beside enabling one to commit some of the classical crimes more easily (fraud on the internet), IT technologies have also caused new types of crimes to emerge (having access to IT systems). In addition to that, the risk for individuals to be victimised has been increasing due to the fact that addiction to IT technologies is on the increase, that people keep their important data (such as passwords) on their computers, and that the number of users having no knowledge about "IT technologies security" is great.
Thanks to opportunities IT technologies- which we have said that they have removed borders- provide ill-intentioned people, it has become possible for such people to access to a computers which are kilometres away through "social engineering" technique- which is frequently used by those malevolent people without need to have physical contact without to be in the same location with the victim- and to seize the data (such as files, passwords, etc.) saved in those computers. This study divides remote access into two categories: "authorized access" and "unauthorized access", and it deals with the issue of "unauthorized access". Descriptions and applications through the software DarkComet enabling one to have unauthorized access will also be offered while explaining the issue of unauthorized access.

Remote Access

Turkish Language Society defines remote access as "reaching a remote source of data by means of data communication opportunities" [1].
This study considers the concept of remote access as "connecting to a remote computer through remote access software and by using internet technology, and being able to use that computer without physically touching it."

Authorized Remote Access:
It is the type of access made by using programmes such as TeamViewer and by obtaining authorization (such as IP, ID, Password) from the user of the target computer.

Unauthorized Remote Access:
It is the type of access made by malevolent people without authorization from the users of the target computers using malware created through DarkComet, Spy-Net and Turkojan by means of social engineering techniques.

Malware and Types of Malware

Malware is a general name used to refer to software with malevolent intention. Such software includes applications aiming to capture personal information such as password and user name and trying to cause a computer to collapse, slowing down a computer and opening a computer to others' control. The following are the malware which are thought to be encountered most frequently: [2], [3].

- Viruses
- Spams
- Worms
- Rootkits
- Trojans
- Keyloggers
- Backdoors
- Spywares

Malware Contamination Incidents and Turkey

Turkey in Microsoft Security Intelligence Reports: ımportant findings in relation to malware contamination incidents in Turkey were obtained in the second semi-annual security reports of the years 2013 and 2015 issued by Microsoft every six months [5], [6].

Microsoft Security Intelligence Report, Volume 15, January Through June, 2013: *Table 1* below shows the ratio of computers reporting malware perception to the total number of computers in the country and comparisons are also made with previous periods [5].

Table 1

	Country/Region	3Q12	4Q12	1Q13	2Q13	Chg. 2H–1H
1	United States	13.80%	13.36%	14.10%	11.51%	-5.72% ▼
2	Brazil	28.80%	26.28%	25.57%	26.75%	-5.00% ▼
3	Russia	26.61%	27.29%	28.61%	29.70%	8.18% ▲
4	Turkey	39.33%	38.95%	41.25%	47.35%	13.20% ▲
5	India	32.61%	29.67%	29.31%	29.44%	-5.88% ▼
6	Mexico	28.16%	26.41%	24.52%	29.18%	-1.61% ▼
7	Germany	13.97%	12.51%	13.21%	11.06%	-8.37% ▼
8	France	14.18%	14.89%	14.53%	15.57%	3.52% ▲
9	China	35.81%	31.81%	28.85%	25.88%	-19.06% ▼
10	United Kingdom	14.17%	13.47%	13.53%	12.32%	-6.48% ▼

Table 2 below shows the rates of encountering malware in ten countries where the highest rates of malware contamination were encountered in the world in the second quarter of the year 2013 [5].

Table 2

Category	Worldwide	United States	Brazil	Russia	Turkey	India	Mexico	Germany	France	China	United Kingdom
Misc. Trojans	10.3%	8.0%	15.1%	23.6%	30.2%	15.8%	14.6%	6.9%	8.9%	16.3%	8.0%
Worms	4.7%	0.7%	8.4%	5.7%	21.4%	18.0%	17.7%	1.2%	2.1%	5.8%	0.9%
Exploits	3.9%	4.0%	3.1%	3.9%	7.7%	5.4%	3.7%	4.6%	3.6%	2.7%	4.1%
Trojan Downloaders & Droppers	2.7%	1.8%	8.2%	3.9%	10.7%	2.1%	5.6%	0.9%	5.1%	3.6%	1.6%
Viruses	2.1%	0.3%	3.3%	2.2%	8.8%	8.8%	3.5%	0.5%	0.8%	6.2%	0.5%
Password Stealers & Monitoring Tools	1.3%	0.8%	3.2%	2.5%	2.5%	2.8%	1.7%	1.2%	1.3%	1.1%	1.0%
Backdoors	1.2%	0.6%	1.7%	1.2%	2.8%	2.4%	2.4%	0.5%	0.9%	3.1%	0.8%

Microsoft Security Intelligence Report, Volume 19, January Through June, 2015: Table 3 below shows the ratio of computers reporting malware perception to the total number of computers in the country and comparisons are also made with previous periods [6].

Table 3

Country/Region	3Q14	4Q14	1Q15	2Q15
United States	15.4%	11.6%	11.0%	9.8%
Brazil	32.9%	21.7%	20.5%	20.2%
Russia	27.3%	24.1%	22.8%	17.7%
India	38.2%	32.0%	34.9%	31.3%
France	22.8%	13.0%	15.8%	13.2%
Turkey	35.1%	27.9%	32.0%	28.1%
China	18.1%	15.2%	13.1%	13.7%
United Kingdom	17.2%	11.4%	12.7%	11.7%
Mexico	30.0%	21.7%	22.6%	21.2%
Canada	18.1%	12.5%	14.0%	12.5%

Table 4 below shows the rates of encountering malware in ten countries where the highest rates of malware contamination were encountered in the world in the second quarter of the year 2015 [6].

Table 4

Category	Worldwide	United States	Brazil	Russia	India	France	Turkey	China	United Kingdom	Mexico	Canada
Browser Modifiers	5.6%	9.1%	11.6%	7.0%	22.3%	14.2%	16.5%	0.6%	10.8%	13.9%	11.2%
Trojans	4.5%	4.2%	12.6%	20.6%	17.9%	5.7%	25.9%	10.2%	4.4%	9.0%	5.1%
Worms	2.9%	0.6%	8.8%	4.5%	31.2%	1.9%	17.2%	5.6%	0.8%	20.8%	0.6%
Adware	1.6%	4.5%	7.0%	5.1%	8.2%	7.7%	9.6%	0.2%	4.7%	6.3%	5.3%
Obfuscators & Injectors	1.5%	1.0%	5.3%	7.3%	8.5%	1.9%	7.7%	4.9%	1.7%	3.1%	1.6%
Software Bundlers	1.5%	1.7%	1.5%	0.5%	5.2%	2.2%	3.5%	0.2%	2.3%	2.9%	2.5%
Exploits	1.5%	3.4%	2.4%	1.3%	4.7%	2.5%	4.5%	1.7%	4.4%	2.9%	5.6%
Downloaders & Droppers	1.2%	2.3%	6.4%	6.6%	4.2%	2.7%	3.6%	3.2%	3.1%	2.0%	3.3%
Viruses	1.0%	0.4%	2.2%	1.5%	8.2%	0.4%	6.6%	7.4%	0.3%	1.2%	0.4%
Backdoors	0.6%	0.7%	1.4%	2.0%	3.5%	0.9%	3.2%	1.8%	0.9%	1.5%	0.7%
Other Malware	0.4%	0.9%	0.3%	0.3%	1.7%	0.5%	1.4%	1.3%	0.6%	0.6%	1.5%
Password Stealers & Monitoring Tools	0.2%	0.4%	1.0%	0.8%	0.8%	0.3%	1.0%	0.5%	0.4%	0.5%	0.6%
Ransomware	0.2%	0.6%	0.5%	0.6%	0.1%	0.7%	0.6%	0.0%	0.4%	0.8%	0.7%

The Legal Aspect of Remote Unauthorized Access

Turkish Criminal Law [7] Chapter Ten-Computer Crimes

Access to Information Systems:

Article-243

(1) The person who has access to the whole or a part of an information system and who keeps remaining there is sentenced to up to one-year imprisonment or to pay judicial fine.
(2) If the crime is committed for systems which may be benefitted from in return for the cost of the acts described in the above sub-article, the punishment given is reduced up to the half.
(3) If the data contained in the system disappears or changes due to the act, the person committing the crime is sentenced to six month to two year- imprisonment [7].

Blocking the system, breaking it, wiping out or changing the data:

Article-244

(1) The person who hinders the operation of a system or breaks it is sentenced to one to five year imprisonment.
(2) The person who breaks, wipes out, changes the data in an information system or makes it inaccessible is sentenced to six month to three year imprisonment.
(3) If these acts of crime are committed in relation to the information system of a bank, a credit agency or a state institution and organisation; the punishment to be given is raised up to the half.
(4) Unless a person's gaining unfair advantage or providing others with unfair advantage by committing the acts described in the above sub-articles constitutes another crime, the person is sentenced to two to six year imprisonment and to judicial fine up to five thousand days [7].

Darkcomet Software

It is a remote administration tool (RAT) developed by Jean-Pierre Lesueur, a French programmer and computer security coder. DarkComet was developed so as to use it as a remote assistance tool, but it has many aspects for abuse [8].
Malware created with DarkComet software is hidden in familiar types of files (picture files, exe files, e-mails, etc.), it is sent to the computer of remote access and it is made sure that the user opens the file, and thus the control of the target computer is taken over (as soon as the file is opened).

6.1. What can be done after the Control of the Target Computer is seized by DarkCome? [9]

- Files can be reached and they can be transferred, the files can be encoded.
- Message can be left to the user.
- The user's camera and microphone can be reached and the user can be watched or listened.
- What the user does can be seen simultaneously by having access to his/her screen.
- The person's passwords can be reached.
- The computer can be shut off, re-started or power can be cut off at that moment.
- Registry can be reached.

Applications for Sending the Trojan Created With Darkcomet to the Target Computer, Connecting to the Computer and Seizing it

The computer to reach remote is referred to as the suspected computer, and the computer to be reached is referred to as the target or victimized computer in this study.
Trojans created by malevolent people are hidden in games, programmes and so on in order not to cast doubts. Trojan in our example appeared to be a chess game and it was sent to the target computer via e-mail.

Sending the Trojan to the Target Computer

Trojan can be sent to the target computer through e-mail, chat instruments, etc. Sending it and operating the Trojan by the user of the target computer are related with social engineering ability.
In our application ,the sender was called "suphelipc", and the target computer was called "magdurpc", and the Trojan was sent through e-mail- which is shown in Picture 1 below.

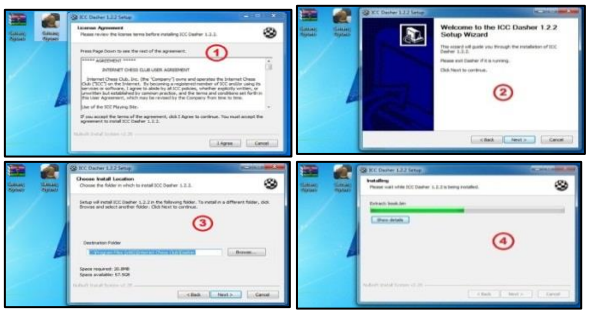
Picture 1. Sending the trojan via e-mail

The e-mail's Coming into the Target Computer and Installing the Game in the Computer

Trojan sent to the victimized computer by the suspect computer reached the target computer. The "exe" set up coming into the target computer in the attachment of the e-mail and thought to be just a game of chess was downloaded as a compressed file was installed in the computer and began to work. See Picture (2-8).

Picture 2. E-mail's coming into the computer and downloading the programme

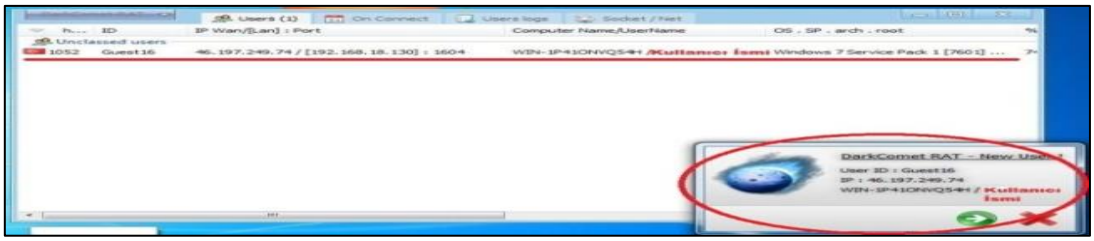
Picture 3. Taking the programme out



Pictures (4-5-6-7) Installing the game

Picture 8. Game is ready to play

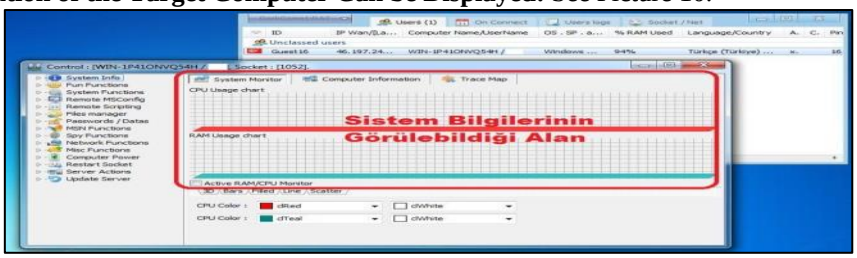
7.3. Having the Connection between the Suspect Computer and the Target Computer:
Now, the user of the target computer can play the game of chess, the message that the target computer had been accessed was conveyed to the suspect computer. The message is shown in Picture 9 below.
As soon as the user of the target computer clicks on the game programme to install it in his/her computer, Trojan begins to work, and thus connection starts between the two computers. That is to say, it is not necessary to install the game programme in the target computer or to operate it smoothly in order for connection to start. It is sufficient if the user of the target computer downloads the file attached to the e-mail, takes the set up file out of the compressed file and clicks on the set up file. Even if the user gives up installing the game, Trojan has already settled in the target computer and connection between the two computers has been established.



Picture 9. "The message of "connected"

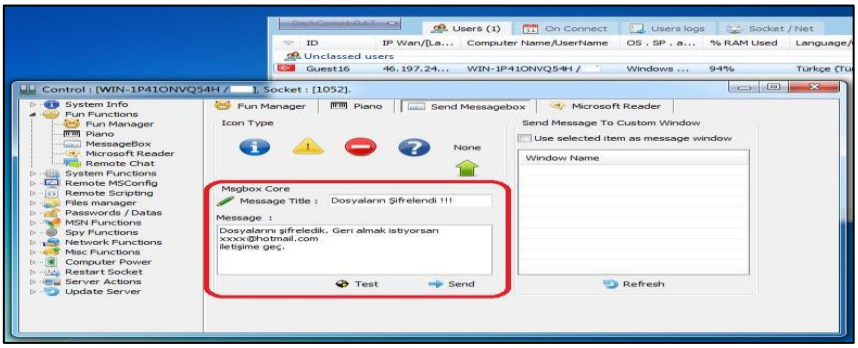
Applications for What Can be Done in the Target Computer with Darkcomet

System Information of the Target Computer Can be Displayed: See Picture 10.

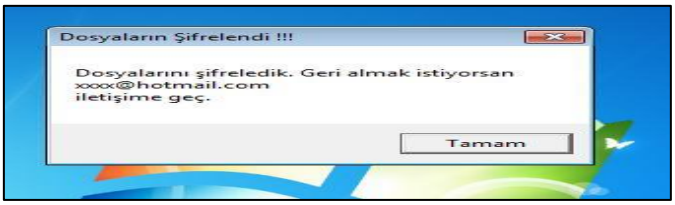


Picture 10. The page of target computer's system information

8.2. Message Can be Left to the Target Computer: Picture 11 below shows preparation of the message in the suspect computer and Picture 12 shows the message conveyed to the target computer.

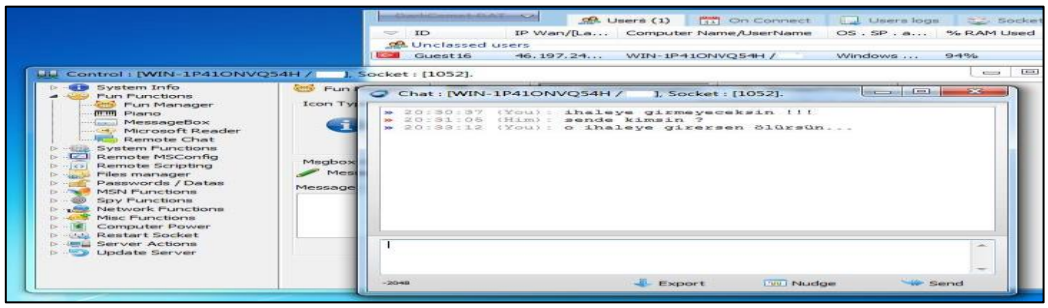


Picture 11. Preparing the message in the suspect computer

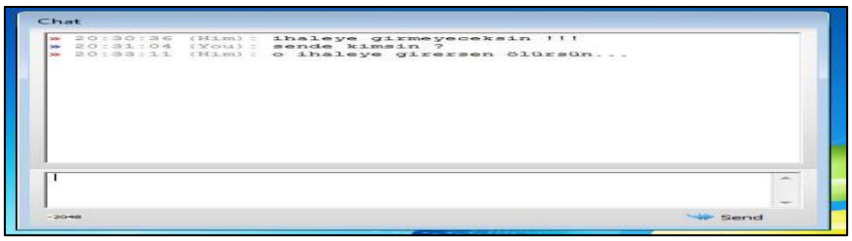


Picture 12. The message conveyed to the target computer

A Window for Chat with the Target Computer can be Opened: The window for chat can be started by the user of the suspect computer and can only be terminated by him/her. The user of the target computer cannot close the chat window. Picture 13 below shows the chat window in the suspect computer, and Picture 14 shows the chat window in the target computer.

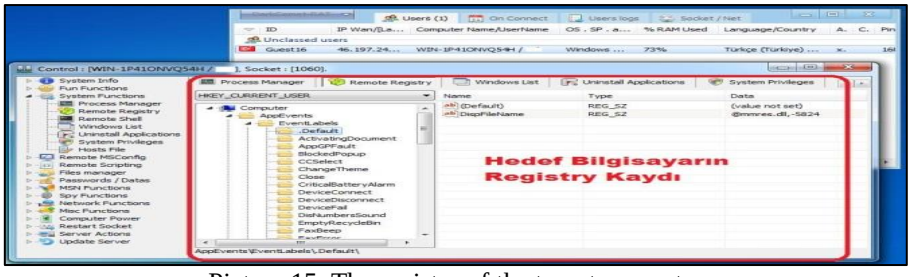


Picture 13. Chat window in the suspect computer



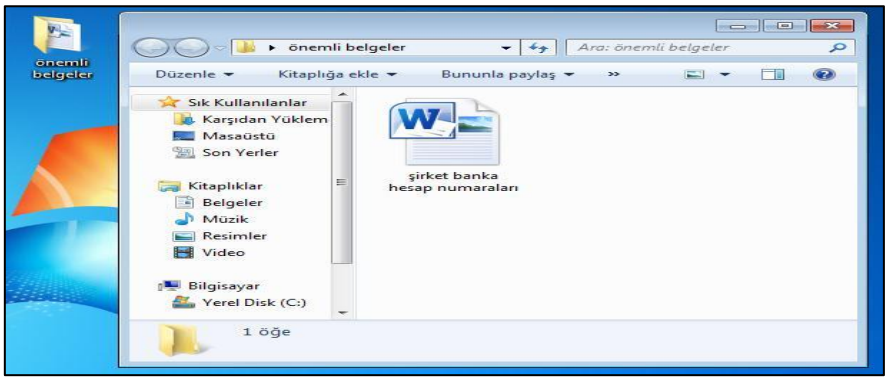
Picture 14. Chat window in the target computer

Registry of the Target Computer can be Accessed: Picture 15 below shows the registry of the target computer which has been accessed by means of DarkComet software. Having accessed to the registry, any types of modifications can be made to the keys in the registry.

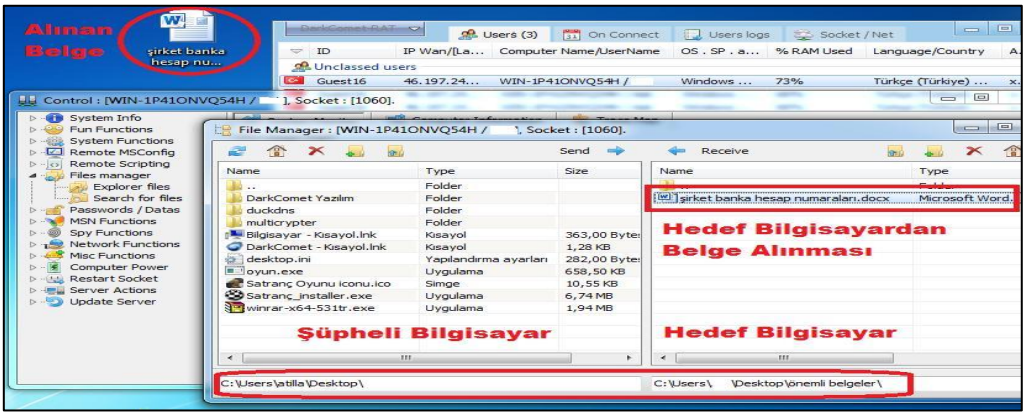


Picture 15. The registry of the target computer

Files can be Transferred from the Target Computer or Files can be Created in the Target Computer: Word document entitled "Company's Bank Account Numbers" in the file called "important Documents" in the desktop shown in Picture 16 was transferred to the suspect computer as is seen in Picture 17.



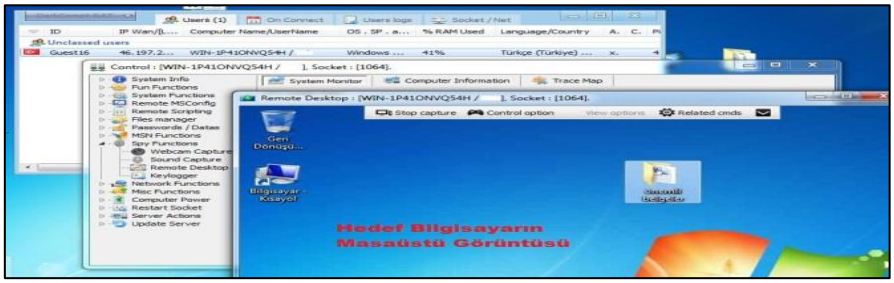
Picture 16. Word document saved in the target computer



Picture 17. The word document transferred into the suspect computer

Desktop of the Target Computer can be Accessed: Picture 18 below shows the desktop of the target computer, and picture 19 shows the desktop which has been accessed by the suspect computer. As is clear from the picture, any transaction can be made as if we were next to the target computer.

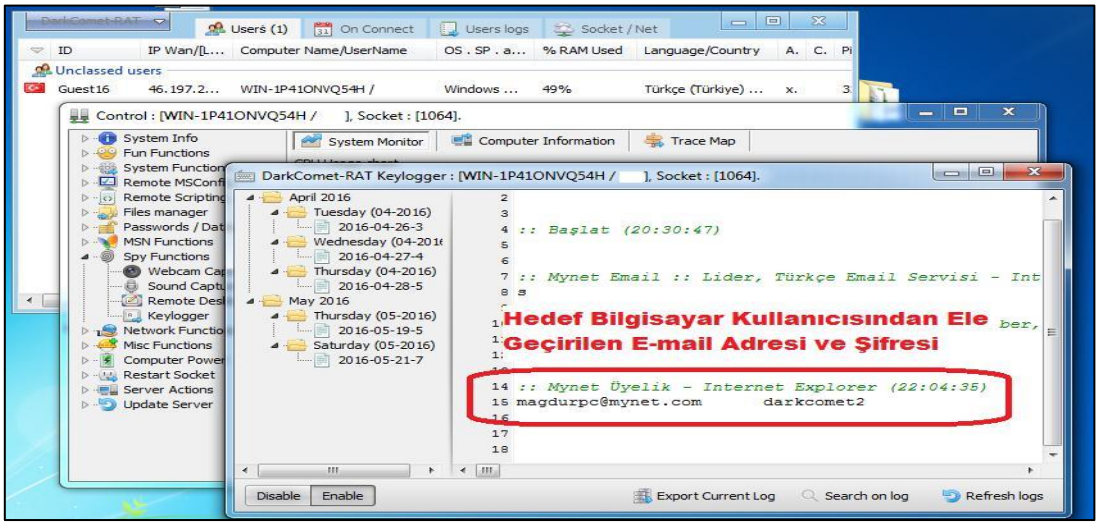
Picture 18. Desktop of the target computer



Picture 19. Desktop of the target computer which has been accessed by the suspect computer

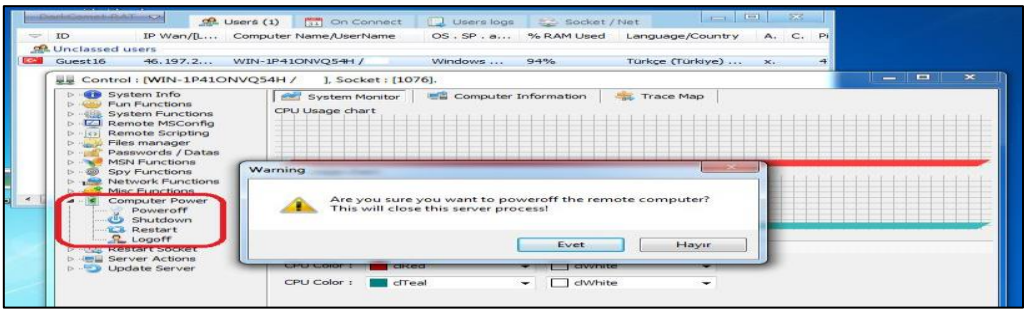
Passwords in the Target Computer can be Accessed: Any type of information written by using the keyboard in the target computer can be seized wth the Keylogger property of DarkComet software. The data captured with

Keylogger is saved according to date and hour. In the sample application, the victim's e-mail address and his/her password were obtained, as is clear from Picture 20.



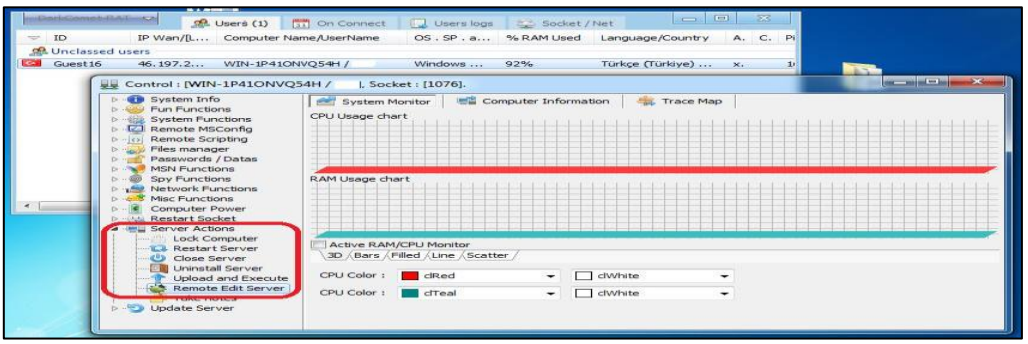
Picture 20. The victim's e-mail address and password

Target Computer can be Shut off or Restarted: As is clear from Picture 21, the target computer can be exposed to such procedures as power off, shutdown, and logoff.



Picture 21. Shutting off the target computer

Trojan (server) in the Target Computer can be Interfered in: Trojan (server) can be restarted, closed/opened, modifications can made to it, it can be completely removed from the computer and connection with the computer can be ended. Picture 22 shows the menu for the transactions.

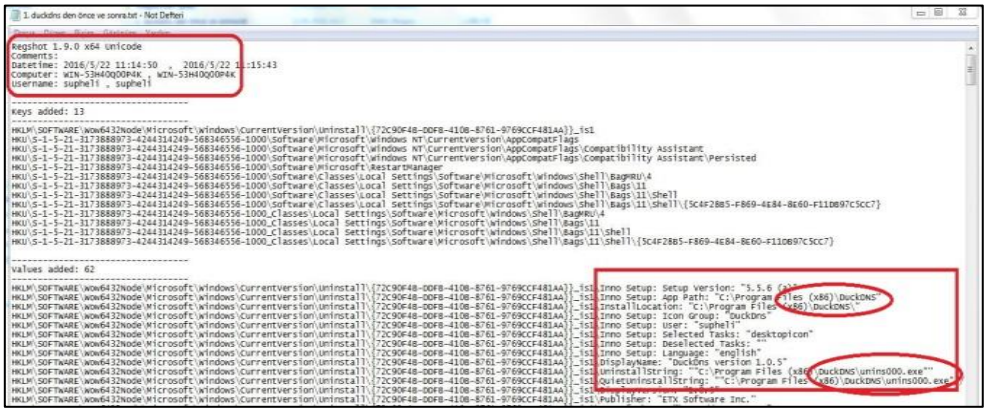


Picture 22. Ending the connection

Computer Forensics Findings In Relation To Darkcomet Software

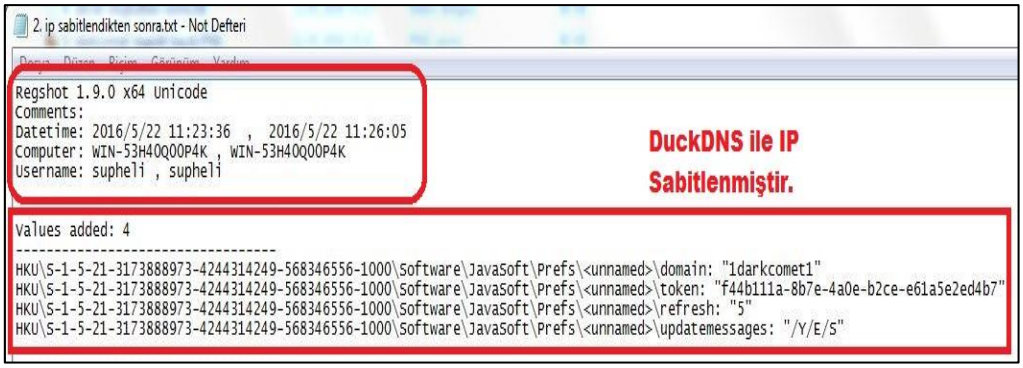
IP number should be fixed and port should be opened in order to be able to use DarkComet in a computer. Now, let us look at what the computer forensics findings may be in a computer where DarkComet is run.
DuckDns software and the internet site of the software were used in our application in order to fix the IP number. Besides, the user name for the computer of application was "supheli": *"WIN-53H40Q00P4K"*. the port opened for the application was (1604).

- Having installed the DuckDNS software in the computer, changes occurring in the registry were detected through Regshot.exe software, and they are shown in Picture 23.



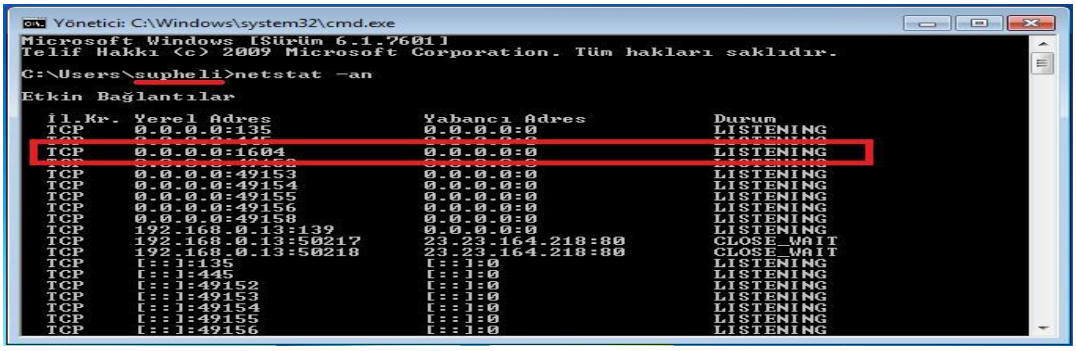
Picture 23. Changes in the registry after duckdns was installed

- After IP number was fixed with DuckDNS, changes occurring in the registry were detected through Regshot.exe software, and they are shown in Picture 24.



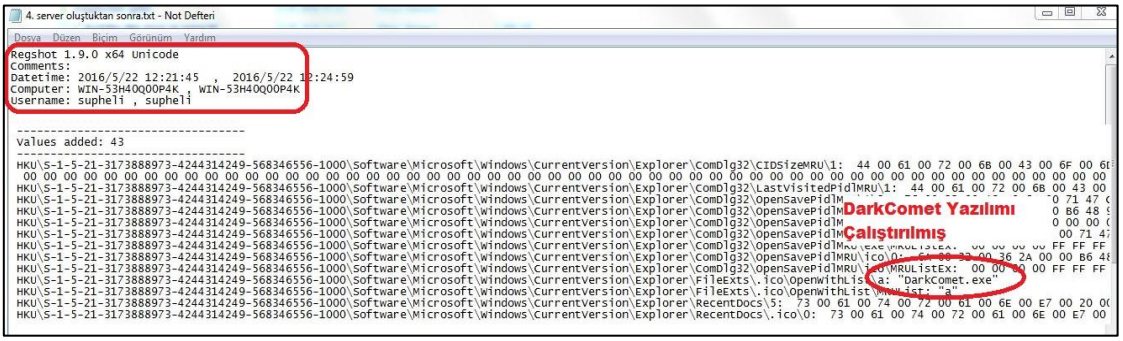
Picture 24. Changes in the registry after ip number was fixed with DuckDNS

- On listing the computer's ports on cmd.exe command screen, it was found that port (1604) was open and was in the LISTENING mode, as is shown in Picture 25.



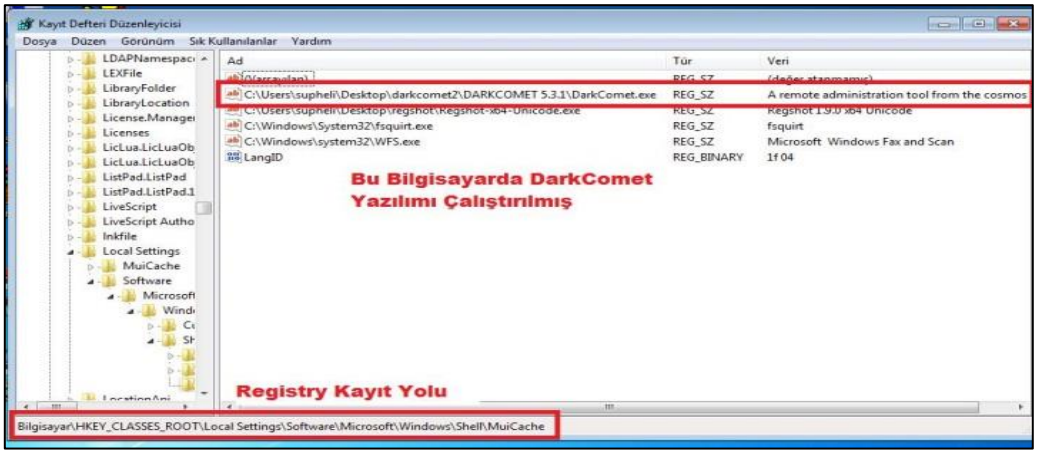
Picture 25. List of ports

- Having created the Trojan with DarkComet (after running the DarkComet software on the computer), changes occurring in the registry were found through Regshotiexe software, as is shown in Picture 26.



Picture 26. Changes in the registry after darkcomet is run.

- Registry record showing that DarkComet software is used in the computer is shown in Picture 27.

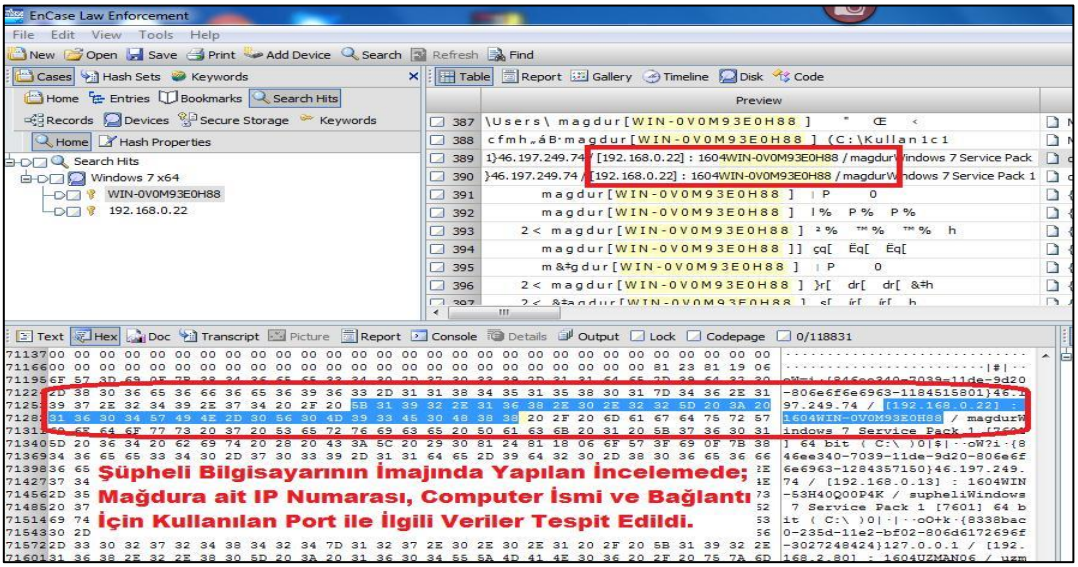


Picture 27. Registry record showing that darkcomet software is used in the computer

Computer Forensics Findings in the Suspect and the Victimized Computers in Relaton to Encase Computer Forensics Software

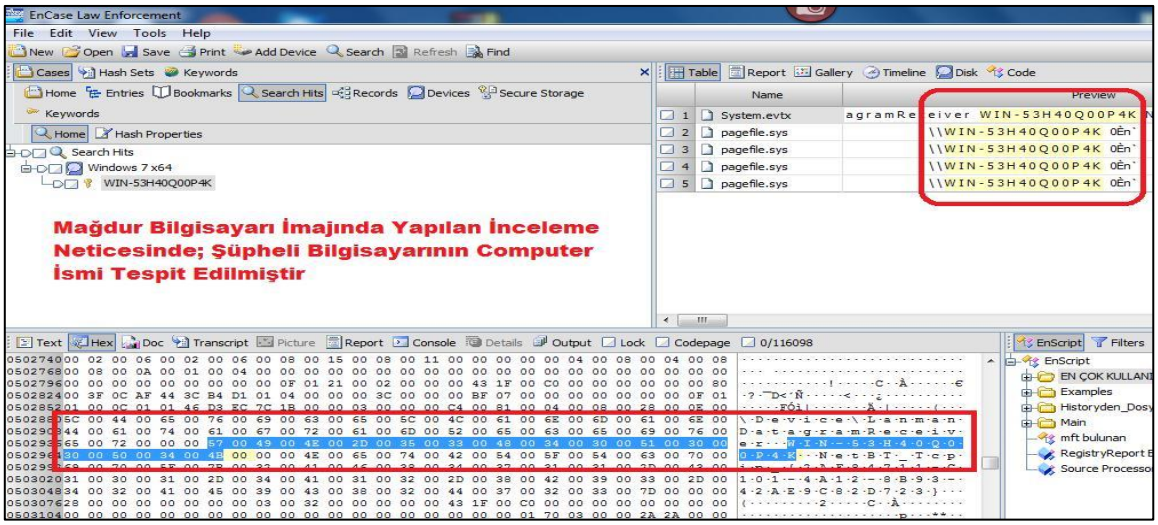
Remote access was made with DarkComet software between the computers which were called the suspect computer and the victimized computer to exemplify the application through VMware Workstation software; images of both computers were taken after the application and the following findings were obtained through analyses with EnCase computer forensics software. The port opened was (1604). In the application:
Username for the computer having unauthorized access was: "supheli", computer was: *"WIN-53H40Q00P4K*, IP number was: "*192.168.0.13*".
User name for the target computer was "magdur", computer name was "*WIN-0V0M93E0H88"*" and IP number was "*192.168.0.22*".

- Following the analyses performed with the image of the suspect computer, the IP number and computer name for the victimized computer and the data for port (1604) were found, as is shown below in Picture 28.



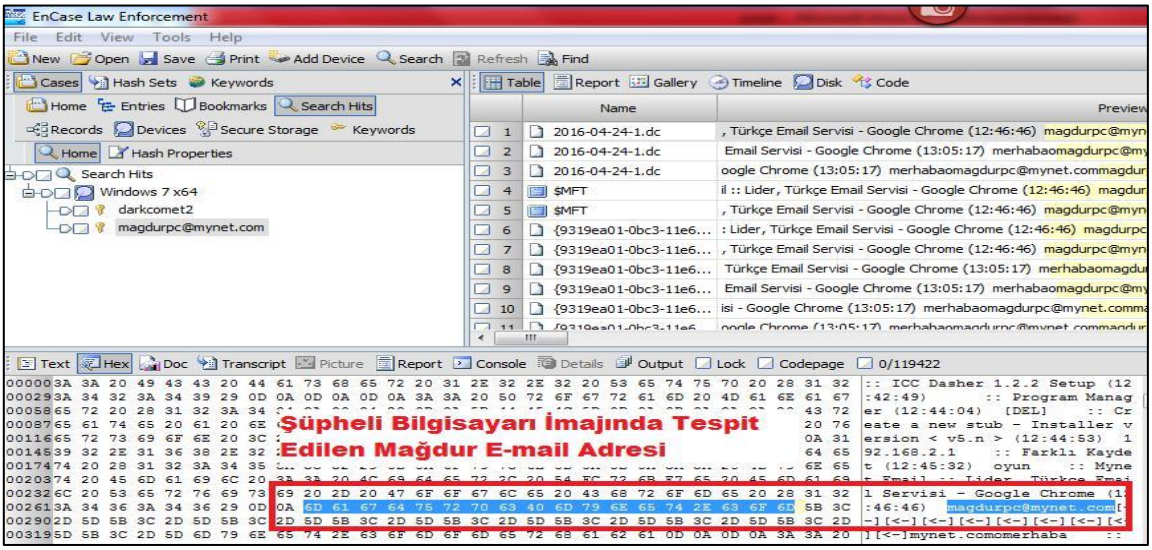
Picture 28. EnCase analysis of the suspect computer

- After analyses on the victimized computer, computer name for the suspect computer was found, as is shown in Picture 29 below.

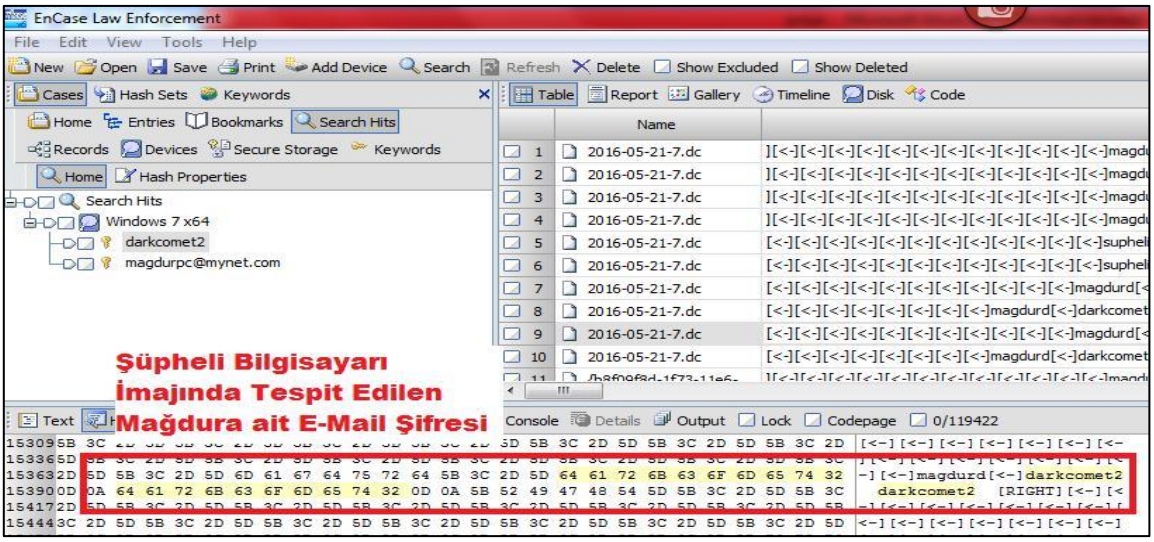


Picture 29. EnCase analysis of the victimized computer

- Following the analyses performed with the image of the suspect computer, the e-mail address and password obtained by the suspect person by means of Keylogger property from the victim's computer were found, as is clear from Pictures 30 and 31 below.



Picture 30. EnCase analysis of the suspect computer (the victim's e-mail address)



Picture 31. EnCase analysis of the suspect computer (the password for the victim's e-mail address)

Conclusions

This study aimed to attract attention to the issue of "unauthorized access" from the aspect of personal information security, to raise computer users' consciousness about the issue and to offer help to those who are to work in the field of computer forensics in finding evidence when they encounter actions which Turkish criminal law consider as crime.

This study has demonstrated that the percentage of malware contamination in computers in Turkey is higher than the average in the world. This situation shows that Turkey is among the countries "targeted" by those who commit computer crimes or classical crimes by using the field of information technology.
In the light of the data, it is believed that the following precautions about personal information security should absolutely be implemented.

- A licenced anti-virus programme should be used along with firewall in the computer, the virus programme should be kept up to date, and viruses should be scanned and cleaned at certain intervals.
- Virtual keyboard should be used while writing information such as a password on the computer.
- Files to be run and links arriving in e-mails should only be opened if users are sure about the sources of them.
- Anti-spyware should be used against spyware.
- Software used in computers should be licenced. The probability that harmful software might have been included in freeware should not be forgotten.

- Important documents stored in the computer should be encoded in a mixed technique (letters-numbers, special signs). It should not be forgotten that a code composed of letters and number is difficult to break than the one containing only numbers even if both have the same number of characters.
- It should be remembered that most of the attacks on the internet attain their goal by benefiting from human factor and only by arousing computer users' curiosity.

Since IP address should be fixed and port should be opened in computers where the software will be run in order to be able to use DarkComet, it is thought that information on whether or not DarkComet has been used in a computer which is claimed to use the software can be obtained by doing registry analysis on that computer.
Because information concerning the victimized computer (IP number, computer name, port number) is found in the image of the suspect computer and information concerning the suspect computer (computer name) is found in the image of the victimized computer in the application of evidence finding done through EnCase computer forensics software, it is believed that remote access connection can be said to have occurred between the two computers.
And because the e-mail address of the user of the victimized computer and the password for the e-mail address are found in the image of the suspect computer in applications of evidence finding through EnCase computer forensics software, it is thought that it may be said that Keylogger property has been used in the suspect computer.
As has been mentioned above, this study has been performed so as to raise consciousness of computer users in terms of personal information security and to function as a resource in computer forensics. It should also be remembered that use with ill will can be punished according to articles 243 and 244 of Turkish criminal law. Therefore, DarkComet should not be used; instead, software requiring consent from the user of the target computer should be used.

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UTILIZATION OF ISSR MARKERS FOR SELECTION OF MUNGBEAN BACKCROSS PROGENIES FOR POWDERY MILDEW RESISTANCE

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Abstract: An inter-simple sequence repeat (ISSR) marker associated with a powdery mildew resistance gene derived from V4718 were used for marker-assisted selection (MAS) of 11 BC_2F_1 progenies of the crosses between a susceptible mungbean (*Vigna radiata* (L.) Wilczek) variety with high yield (CN72) and the powdery mildew resistant lines, carrying different resistance genes from V4718, V4758 and/or V4785. Genetic diversity and relatedness to CN72 were also evaluated among these 11 BC_2F_1 and 4 parental lines, CN72, V4718, V4758 and V4785 using 12 ISSR primers. In total, 211 ISSR fragments were amplified with 60% polymorphism. The number of amplified fragments varied from 13 (ISSR 840) to 23 (ISSR 888), with a size range of 300-2,072 bp. The average numbers of fragments per primer and polymorphic fragments per primer were 17.6 and 10.4, respectively. Polymorphism information content (PIC) values ranged from 0.21 (ISSR 886) to 0.42 (ISSR 811) with an average of 0.31 across all the genotypes. Genetic similarity varied from 0.653 (CN72 and SUT15BC2-29) to 0.894 (SUT15BC2-34 and SUT15BC2-36). Unweighted pair-group method arithmetic average (UPGMA) cluster analysis grouped these 15 genotypes into 2 major clusters; cluster I and II. The first cluster was further divided into 3 subclusters and an individual (CN72), while cluster II consisted of 2 backcross progenies. All 15 genotypes can be effectively distinguished by only 12 ISSR primers, suggesting the applicability of ISSR analysis for variety identification and relatedness analysis. Three backcross progenies, SUT15BC2-25, SUT15BC2-31 and SUT15BC2-34, exhibited a 416 bp DNA band associated with powdery mildew resistance similar to V4718 when amplified with ISSR 884 primer. Moreover, two of them, SUT15BC2-31 and SUT15BC2-34, were also genetically closely related to the recurrent parent CN72 (0.789-0.810), therefore they were selected for further backcrossing to accelerate the breeding program. These results suggest that ISSR markers can be used in MAS both as foreground selection for powdery mildew resistance and background selection for accelerated backcrossing.

Keywords: Genetic relatedness, marker-assisted selection, recurrent parent, *Vigna radiata*

Introduction

Mungbean (*Vigna radiata* (L.) Wilczek) is an important legume crops, widely grown in the tropics and subtropics for human consumption, animal feed and pulse because of the high protein (23.4%) and carbohydrate (64%) contents together with substantial amount of vitamin, calcium and iron. However, in Thailand the production of mungbean is still limited largely due to high cost of production, low yield and asynchronous maturity. The major constraints for achieving higher yield are inherently low yielding potential of the cultivars from lack of genetic variability, absence of suitable ideotypes for different cropping systems, poor harvest index and susceptibility to abiotic stresses (i.e. drought, alkaline or saline soil) or biotic stresses (diseases and insects) (Souframanien and Gopalakrishna, 2004; Srinives, 2006). Therefore, new varieties with higher yield, more adaptive to environmental constraints, and more resistant to disease and insect pests, are urgently needed. The rapid transfer of resistance gene(s) to high yielding varieties by conventional breeding is an alternative to achieve this goal.

Molecular markers such as restriction fragment length polymorphism (RFLP), randomly amplified polymorphic DNA (RAPD), amplified fragment length polymorphism (AFLP), microsatellite or simple sequence repeat (SSR) and inter-SSR (ISSR) portrayed genetic variation at the DNA level thereby overcoming the influence of environments and providing more precise characterization of genotypes and measurement of genetic relationships than morphological and protein markers (Autrique et al., 1996; Souframanien and Gopalakrishna, 2004). In *Vigna* spp., mungbean and cowpea, RAPD, AFLP, SSR and ISSR have been applied to assess molecular polymorphism (Kaga et al., 1996; Mignouna et al., 1998; Santalla et al., 1998; Ajibade et al., 2000; Lakhanpaul et al., 2000; Srujana and Lakshmi Bhavani, 2016). ISSR analysis was developed based on DNA amplification with a single 15- to 20-bp primer homologous to a microsatellite repeat and has a short (1-4 bp) random degenerated sequence (an anchor) at the 3' or 5' end. These ISSR primers allow DNA amplification of regions located between two closely spaced, oppositely oriented SSRs, yielding a reproducible pattern of genomic fragments, which is similar to a RAPD pattern but usually includes more bands and is more reproducible. Therefore, ISSRs have high potential to reveal polymorphism useful for genetic diversity and

relatedness analysis as compared to other arbitrary primers including RAPDs (Ajibade et al., 2000; Souframanien and Gopalakrishna, 2004).

Previous reports showed that ISSRs were useful for the intraspecific or interspecific classification of genetic diversity and identification of varieties in various crops including tomato, potato, rice, grapevine, soybean and chickpea (Moreno et al. 1998; Wang et al., 1998; Blair et al., 1999; Prevost and Wilkinson, 1999; Kochieva et al., 2002; Gautam et al., 2016). In mungbean and blackgram, we have previously identified a set of ISSR primers with high polymorphism information content (PIC) scores which are useful in surveying genetic diversity among accessions of mungbean, blackgram and perhaps other *Vigna* species (Tantasawat et al., 2010). Moreover, ISSR markers have been proven highly efficient for verification of mungbean F_1 hybrids (Khajudparn et al., 2012).

The objectives of this study were (i) to select the backcross progenies carrying a powdery mildew resistance gene from V4718 using an ISSR marker significantly associated with the powdery mildew resistance, (ii) to study the genetic relationships among these backcross progenies and their parental lines using ISSR analysis, (iii) to perform background selection for backcross progenies with the highest genetic similarity to recurrent parent in order to accelerate backcrossing.

Methods

Plant Materials

A total of 15 mungbean genotypes (11 BC_2F_1 progenies, 3 powdery mildew resistant lines [V4718, V4758 and V4785] and a high yield variety [CN72]) were evaluated in this present study (Table 1).

Table 1. Description of backcross progenies and parental lines

Plant genotypes	Description
CN72	High yield, susceptible to powdery mildew and Cercospora leaf spot
V4718	Resistant to powdery mildew and Cercospora leaf spot
V4758	Resistant to powdery mildew
V4785	Resistant to powdery mildew
SUT15BC2-23	BC_2F_1 of the CN72 × ((14B×19C) × (2A×47B)) cross
SUT15BC2-24	BC_2F_1 of the CN72 × ((14B×35C) × (2A×47B)) cross
SUT15BC2-25	BC_2F_1 of the CN72 × ((14B×41C) × (2A×47B)) cross
SUT15BC2-26	BC_2F_1 of the CN72 × ((14B×19C) × (181A×14C)) cross
SUT15BC2-28	BC_2F_1 of the CN72 × ((14B×19C) × (181A×35C)) cross
SUT15BC2-29	BC_2F_1 of the CN72 × ((14B×19C) × (181A×41C)) cross
SUT15BC2-31	BC_2F_1 of the CN72 × ((14B×41C) × (181A×14C)) cross
SUT15BC2-34	BC_2F_1 of the CN72 × ((14B×41C) × (181A×41C)) cross
SUT15BC2-36	BC_2F_1 of the CN72 × ((14B×182C) × (181A×14C)) cross
SUT15BC2-40	BC_2F_1 of the CN72 × ((14B×182C) × (181A×181C)) cross
SUT15BC2-41	BC_2F_1 of the CN72 × ((14B×14C) × (181A×19C)) cross

2A, 181A = $F_{2:8}$ lines of the CN72 × V4758 cross
14B, 47B = $F_{2:7}$ lines of the CN72 × V4718 cross
14C, 19C, 35C, 41C, 181C, 182C = $F_{2:9}$ lines of the CN72 × V4785 cross

DNA Isolation

Young leaves were freshly harvested from each genotype and rapidly frozen in liquid N_2. DNA extraction was performed by the cetyl trimethyl ammonium bromide (CTAB) method as described by Saghai-Maroof et al. (1984). The concentration and purity of DNA were determined by ND-1000 spectrophotometer (NanoDrop Technologies, Inc., Wilmington, DE, USA) at A_{260} and A_{280} and adjusted to a final concentration of 150 ng μL^{-1} for use in PCR analysis.

Inter-Simple Sequence Repeat (ISSR) Analysis

Twelve ISSR primers homologous to microsatellite repeats and containing additional selective anchor nucleotides that were developed from the University of British Columbia and some were used successfully in mungbean (Tantasawat et al., 2010; Khajudparn et al., 2012; Poolsawat et al., unpublished results) were chosen for the analysis (Table 2). These primers are homologous to microsatellite repeats (AC, AG, CA, CT or GA) anchored at either 3' or 5'end by 1-3 nucleotides, some of which have been used to reveal polymorphism in blackgram and mungbean, and to verify F_1 hybrids in mungbean (Souframanien and Gopalakrishna, 2004; Tantasawat et al., 2010; Khajudparn et al., 2012). Five of these contained AG repeat motif, four contained GA repeat motif, and one each contained AC, CA, or CT repeat motif. Eight of these possessed a one to two nucleotide anchor sequence at 3' end and the others were anchored at the 5' end with 3 nucleotides. Each 20 µl PCR reaction contained 150 ng of genomic DNA template, 1X buffer (50 mM KCl, 10 mM Tris-HCl, pH 9.0, 0.01% Triton X-100), 3.5 mM $MgCl_2$, 250 µM of each dNTPs, 1 unit of *Taq* DNA polymerase, and 0.4 µM of each ISSR primer. The PCR reactions were subjected to amplification with initial denaturation at 95°C for 5 min; 35 cycles of denaturing at 95°C for 1 min, annealing at 50°C for 1 min, extension at 72°C for 1 min; and final extension at 72°C for 10 min in a Amplitronyx™ 6 Thermal Cycler (Nyx Technik, Inc., San Diego, CA, USA). The amplified products were revealed on 6% denaturing polyacrylamide gel and detected by silver nitrate according to Sambrook and Russell (2001). Molecular weights of the bands were estimated by using 100 bp DNA ladder (Invitrogen, CA, USA) as standards. All amplifications were repeated at least twice and only reproducible bands were considered for analysis.

Table 2. Primer sequences, annealing temperature, numbers of total scorable DNA bands, numbers of polymorphic DNA bands, percentages of polymorphism and polymorphic information content (PIC) for each ISSR primer used for the analysis of 11 mungbean backcross progenies and 4 parental lines

Primers	Primer sequences	Annealing temperature (°C)	No. of total bands	No. of polymorphic bands	Polymor-phism (%)	PIC
ISSR 807	$(AG)_8T$	50	22	10	45.5	0.29
ISSR 808	$(AG)_8C$	50	17	11	64.7	0.36
ISSR 811	$(GA)_8C$	50	15	9	60.0	0.42
ISSR 812	$(GA)_8A$	50	19	16	84.2	0.35
ISSR 827	$(AC)_8G$	50	15	11	73.3	0.26
ISSR 834	$(AG)_8YT$[a]	50	20	11	55.0	0.32
ISSR 835	$(AG)_8YC$	50	17	12	70.6	0.37
ISSR 840	$(GA)_8YT$	50	13	8	61.5	0.30
ISSR 884	$HBH(AG)_7$ [b]	50	15	7	46.7	0.27
ISSR 885	$BHB(GA)_7$	50	19	13	68.4	0.28
ISSR 886	$VDV(CT)_7$ [c]	50	16	10	62.5	0.21
ISSR 888	$BDB(CA)_7$	50	23	7	30.4	0.25
	Total		**211**	**125**		
	Average		**17.6**	**10.4**	**60.2**	**0.31**

[a] Y = pyrimidines (C, T)
[b] B = C, G, T; H = A, C, T
[c] D = A, G, T; V = A, C, G

Data Scoring, Cluster and Principal Coordinate Analysis

DNA bands with the same mobility were treated as identical fragments. Clearly amplified band was coded as 0 and 1 for its absence and presence, respectively. Similarity coefficients between various genotypes, in a pair-wise comparison, were computed using Jaccard's coefficient and the resulting similarity matrix was further analyzed using unweighted pair-group method arithmetic average (UPGMA) clustering algorithm; the computations were carried out using NTSYSpc version 2.1 (Rohlf, 2000). The goodness of fit of the genotypes to a specific cluster in the UPGMA cluster analysis was determined by the Mantel's correlation test (Mantel, 1967). The polymorphism information content, a measure of the allelic diversity at a locus, was determined. PIC = $1-\Sigma Pi^2$ where Pi is the frequency of the i^{th} allele in the examined test lines.

NTSYSpc version 2.1 was also used to perform principal coordinate analysis (PCoA), which is more informative regarding distances among major groups, to show multiple dimensions of the distribution of the genotypes in a scatter-plot (Keim et al., 1992; Tar'an et al., 2005).

Results and Findings

Level of Polymorphism

The PCR amplification using eight 3'-anchored dinucleotide repeat primers and four 5'-anchored dinucleotide repeat primers gave rise to reproducible PCR products. The 12 ISSR primers produced 211 scorable fragments of which 125 fragments were found to be polymorphic (60%; Table 2). The extent of polymorphism found was moderate. The polymorphism percentage was found to be mainly affected by the sequences of primers or probes of markers, and types and number of lines being evaluated (Keim et al., 1992). In this study genotypes were selected to represent 4 parental varieties/lines and 11 backcross progenies resulting from the multiple crosses among them (Table 1). The self-pollinated nature of mungbean and the genetically relatedness among progenies of the same parents may limit the polymorphism levels. The size of fragments scored ranged from approximately 300 to 2,072 bp. Each primer produced an average of 17.6 fragments and 10.4 fragments of these were polymorphic. The minimum and maximum numbers of polymorphic fragments were obtained from ISSR 884 and 888 (7) and 812 (16) primers, respectively.

Allelic diversity for a specific locus was portrayed by PIC values. The higher the PIC values for a locus, the higher the probability that polymorphism will exist between two accessions at that locus (Li and Nelson, 2001). The range of PIC values in this study was 0.21 to 0.42 with an average of 0.31. Because ISSR markers are usually dominant markers, 0.50 will be the highest PIC value for any marker. And the PIC values of ≥ 0.3 in 6 of the 12 markers used here suggested that these markers are useful for the genetic diversity and relatedness analysis. The success in identifying polymorphism is due to the use of a number of prescreened highly informative primers. Among these markers, ISSR 811, 835 and 808 (PIC values 0.42, 0.37 and 0.36, respectively) were the most informative for distinguishing among mungbean genotypes. Note that these primers have AG or GA repeat motif in their sequences. ISSR primers with AG, GA and CA repeats have been shown to reveal high polymorphism among *Vigna* genotypes (Ajibade et al., 2000; Tantasawat et al., 2010). Our results substantiate the applicability of ISSRs for multilocus analysis of mungbean genome which is useful for genotyping, measuring genetic diversity and relatedness, mapping and marker-assisted selection (MAS) etc.

Genetic Relationships among Mungbean Genotypes

The pairwise genetic similarity between mungbean genotypes varied from 0.653 (between CN72 and SUT15BC2-29) to 0.894 (between SUT15BC2-34 and SUT15BC2-36) with an average of 0.759 (Table 3). Note that both SUT15BC2-34 and SUT15BC2-36 are progenies from the same cross, CN72 × ((14B×41C) × (181A×41C)). The Mantel test with a cophenetic correlation coefficient value of 0.77 indicated that data in the similarity matrix were relatively well represented by the dendrogram. The cluster analysis separated the 15 genotypes into 2 major clusters; cluster I and cluster II. Cluster I was further subdivided into 3 subclusters; 1A (V4718, V4785 and V4758), IB (3 backcross progenies from the CN72 × ((B×C) × (A×B)) crosses and 1 backcross progeny from the CN72 × ((B×C) × (A×C)) cross), and IC (5 backcross progenies from the CN72 × ((B×C) × (A×C)) crosses) and an individual (CN72). The cluster II consisted of 2 backcross progenies of the CN72 × ((B×C) × (A×C)) crosses that are quite distantly related to one another (0.733). Among the powdery mildew resistant parental lines in the subcluster IA, V4718 and V4785 were the most closely related (85.7% genetic similarity). CN72 variety was, however, more distinct from the others in cluster I and had 0.776, 0.707 and 0.802 genetic similarity to V4718, V4758 and V4785, respectively (Table 3; Fig. 1).

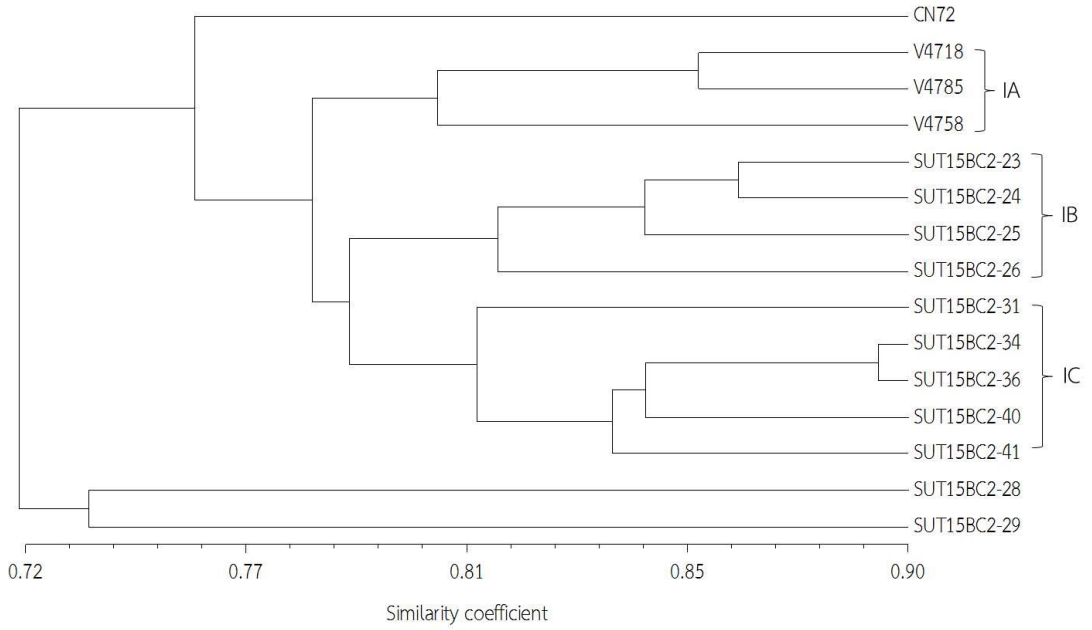

Figure 1. Inter-simple sequence repeat (ISSR) derived dendrogram of 11 backcross progenies and 4 parental varieties/lines of mungbean generated by unweighted pair group method with arithmetic average. dendrogram shows similarity coefficient and genetic relationships among 15 genotypes of mungbean

PCoA was used to identify multidimensional relationships that describe portions of the genetic variance in a data set. The three coordinates explained 16.64, 13.96 and 12.5% of the total variance, respectively. These first three principal coordinates of the ISSR data explained 43.14% of the total variance (Fig. 2). PCoA separated the genotypes into two distinctive groups, cluster I and II, in general consistent with the UPGMA cluster analysis, but the separation of cluster IC from the rest of cluster I was more clearly observed. Most backcross progenies appeared in one cluster together with the 4 parental varieties/lines, suggesting their genetic relatedness consistent with the pedigree. However, two backcross progenies, SUT15BC2-28 and SUT15BC2-29, appear to be more distinct from other genotypes in the PCoA.

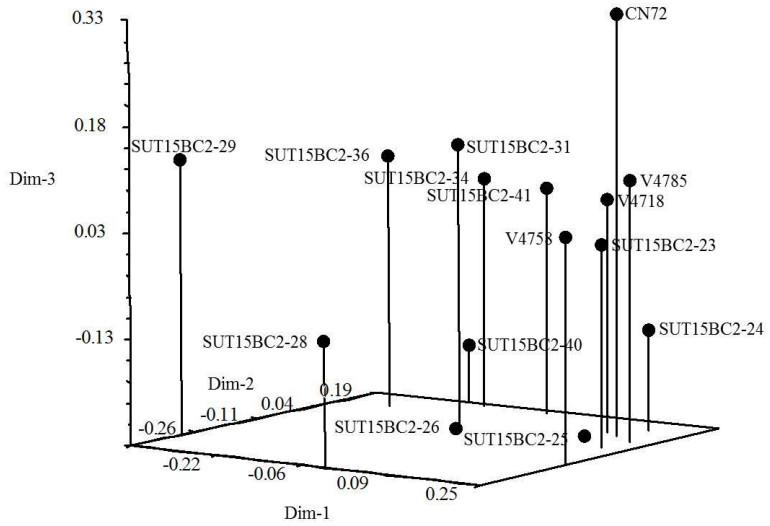

Figure 2. Inter-simple sequence repeat (ISSR) derived three dimensional plot based on the first three principal coordinates from a principal coordinate analysis of 11 backcross progenies and 4 parental varieties/lines of mungbean

Table 3. Similarity matrix of 11 backcross progenies and 4 parental varieties/lines of mungbean

Name	CN72	V4718	V4758	V4785	SUT15BC2-23	SUT15BC2-24	SUT15BC2-25	SUT15BC2-26	SUT15BC2-28	SUT15BC2-29	SUT15BC2-31	SUT15BC2-34	SUT15BC2-36	SUT15BC2-40	SUT15BC2-41
CN72	1.000														
V4718	0.776	1.000													
V4758	0.707	0.805	1.000												
V4785	0.802	0.857	0.803	1.000											
SUT15BC2-23	0.797	0.830	0.786	0.827	1.000										
SUT15BC2-24	0.770	0.840	0.767	0.773	0.865	1.000									
SUT15BC2-25	0.705	0.816	0.756	0.795	0.833	0.859	1.000								
SUT15BC2-26	0.730	0.754	0.719	0.757	0.791	0.817	0.841	1.000							
SUT15BC2-28	0.684	0.740	0.745	0.740	0.750	0.711	0.738	0.781	1.000						
SUT15BC2-29	0.653	0.699	0.667	0.671	0.716	0.656	0.684	0.718	0.733	1.000					
SUT15BC2-31	0.810	0.816	0.745	0.774	0.789	0.809	0.780	0.788	0.743	0.763	1.000				
SUT15BC2-34	0.789	0.846	0.718	0.805	0.800	0.803	0.787	0.803	0.728	0.752	0.821	1.000			
SUT15BC2-36	0.725	0.797	0.711	0.742	0.764	0.776	0.748	0.772	0.710	0.790	0.842	0.894	1.000		
SUT15BC2-40	0.676	0.794	0.693	0.778	0.727	0.791	0.800	0.825	0.712	0.710	0.791	0.873	0.820	1.000	
SUT15BC2-41	0.766	0.810	0.758	0.812	0.790	0.813	0.795	0.759	0.701	0.722	0.795	0.859	0.829	0.831	1.000

Marker-Assisted Selection for Powdery Mildew Resistance and Similarity to Recurrent Parent

An ISSR marker, I84416, was found to be significantly associated (R^2 = 0.44; LOD score = 11.745) with a major powdery mildew resistance gene in V4718 in our previous study (Poolsawat et al., unpublished results). When this marker was used to screen the 11 backcross progenies potentially carrying powdery mildew resistance genes from V4718, V4758 and V4785, it was found that three of them, SUT15BC2-25, SUT15BC2-31 and SUT15BC2-34, possessed a 416 DNA band similar to that of V4718 (Fig. 3), suggesting that they likely carried the major powdery mildew resistance gene from V4718. Background selection was also performed with 131 other ISSR loci generated by ISSR 884 and eleven other ISSR primers reported to be informative from our previous work (Tantasawat et al., 2010; Khajudparn et al., 2012; Poolsawat et al., unpublished results). High genetic similarity (0.789-0.810) with CN72, the recurrent parent, was observed in two of the three putative powdery mildew resistant backcross progenies, SUT15BC2-31 and SUT15BC2-34, therefore, they were selected for further backcrossing to accelerate the breeding program. Similarly, background selection for progenies resembling the recurrent parent has been used successfully in rice, shortening the backcross procedure from 6 generations to 2-3 generations (Hasan et al., 2015).

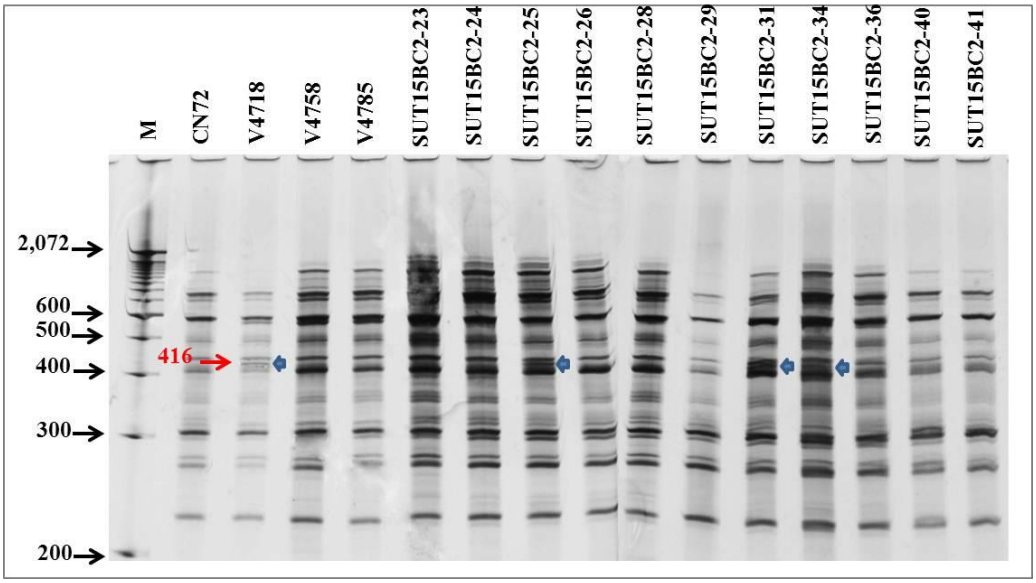

Figure 3. Electrophoregrams of ISSR 884 products amplified from 11 backcross progenies and 4 parental varieties/lines of mungbean. M = 100 bp DNA ladder. arrows identify a 416 bp DNA band associated with powdery mildew resistance derived from v4718

Conclusion

Our results suggest the potential utilization of ISSR makers in MAS both as foreground selection for powdery mildew resistance and background selection for accelerated backcrossing.

Recommendations

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INCIDENCE OF PENICILLIN-RESISTANT STREPTOCOCCUS PNEUMONIAE IN SPUTUM AMONG CHILDREN AND ELDERLY PNEUMONIC PATIENTS ATTENDING TWO MAJOR HOSPITALS IN KHARTOUM

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Abstract: The prevalence of pneumococcal diseases is particularly high among young children and the elderly. *Streptococcus pneumoniae*, is one of the major causative agents of pneumonia. The emergence of antimicrobial resistant strains threatens successful treatment by antibiotics. Penicillin resistance has been encountered with increasing frequency in strains of *S. pneumoniae* around the world. Study of prevalence of drug-resistant *Streptococcus pneumoniae* in Sudan is deficient. The purpose of this study was to evaluate the incidence of penicillin-resistant *Streptococcus pneumoniae* isolated from sputum samples collected from pneumonic patients diagnosed by clinicians in two main major hospitals in Khartoum State. We noticed that there are cases which were difficult to treat among elderly patients (above 60 years) and children (5-18 years) attending the two major hospitals. Two hundred samples of sputum were collected from two groups of **100** patients each, who were clinically diagnosed with pneumonia. Standard microscopic, cultural and sensitivity methods were used for identification of *S. pneumoniae* and determination of its resistance to penicillin. *S. pneumoniae* has been isolated from 40 samples (20%). One-hundred and sixty samples (80%) showed either no growth or growth of other types of bacteria. The incidence of pneumonia caused by *Streptococcus pneumoniae* among patients attending two major hospitals in Khartoum is higher among children than in elderly. Twenty four samples (60%) that showed positive growth were collected from children while 40% were collected from elderly patients. Using oxacillin discs, complete resistance to penicillin was detected in 7.5% of the isolates of *S. pneumoniae*. Eighty percent of the samples were sensitive to oxacillin while 12.5% showed intermediate resistance. The present study indicates that the incidence of complete resistance of *S. pneumoniae* to penicillin (7.5%) in two major hospitals in Khartoum State is lower than what has been reported in some African and Asian countries.

Keywords: Streptococcus pneumoniae, penicillin resistance, sputum, pneumonic patients

Introduction

Pneumococcal disease is a major public health problem. *Streptococcus pneumoniae* was recognized as a major cause of pneumonia in late 19th century and remains to be the main cause of community-acquired pneumonia (CAP) in children and the elderly. *S. pneumoniae* resides asymptomatically in the nasopharynx of healthy carriers. However, in susceptible individuals, such as elderly and immunocompromised people and children, the bacterium may become pathogenic, spread to other locations and cause disease. Despite the name, the organism causes many types of invasive pneumococcal infections other than pneumonia such as bronchitis, acute sinusitis, otitis media, conjunctivitis, meningitis, bacteremia, sepsis, osteomyelitis, septic arthritis, endocarditis, peritonitis, pericarditis, cellulitis, and brain abscess (Siemieniuk et al., 2011). Other pathogens have been reported to cause pneumonia in the community, and their order of importance depends on the location and population studied. These include long-recognized pathogens such as *Haemophilus influenzae*, *Mycoplasma pneumoniae*, and influenza A, along with newer pathogens such as *Legionella* sp. and *Chlamydophilia pneumoniae*. Other common causes in the immunocompetent patient include *Moraxella catarrhalis*, *Mycobacterium tuberculosis*, and aspiration pneumonia (Mandell et al., 2003).

Penicillin Resistant *Streptococcus pneumoniae* (PRSP)

Streptococcus pneumoniae, is a Gram-positive, alpha-hemolytic, aero tolerant, aerobic member of the genus *Streptococcus* (Ryan and Ray 2004). In the past, *S. pneumoniae* was completely susceptible to penicillin and other betalactam antibiotics. Clinical isolates with intermediate sensitivity were first reported in 1967. However, since mid-1980s an increase in incidence of resistance of this organism to penicillin and other antimicrobial agents has been reported in both developed and developing countries affecting all age groups (Mcluckie, 2009; Guthrie, 2001). In recent years there has been a substantial increase worldwide in the incidence of penicillin-

resistant *S. pneumoniae* strains "PRSPs" (Dagan, 2000; Marco et al., 2000; Whitney et al., 2002; Song et al., 2004; Marchese et al., 2005).

According to a study carried out in 1996-1997 by Asian Net-work for Surveillance of Resistant Pathogens (ANSORP), Asian countries have reported increasing prevalence of penicillin resistance. The rates of non-susceptibility were 80% in Korea, 65% in Japan, 61% in Vietnam and 58% in Thailand (Song et al., 1999). Another ANSORP study carried in 11 countries during 2000-2001, reported that 29.4% of the *S. pneumoniae* isolates were resistant to penicillin and a further 23% exhibited intermediate susceptibility (Song et al., 2004). In Vietnam 71.4% of *S. pneumoniae* isolates were resistant, Korea being the second with 54.8% resistance. In Sir Lanka, the intermediate resistant strains represented 71.4% of all isolates while 14.3% were resistant. In contrast no resistant isolates were found in India or in the Philippines (Sahm et al., 2008).

Large scale antibiotics surveillance studies carried during 2000-2005 revealed a considerable uneven distribution of penicillin resistance among *Streptococcus pneumoniae* isolates (Sahm et al., 2007; Felmingham et al., 2007). According to these studies, more than a third of all respiratory tract isolates had reduced susceptibility to penicillin. However, during the period 2000-2005 respective figures from several developing countries such as South Africa, the Far East and from Middle East were much higher, being 74%, 63% and 54% respectively (Sahm et al., 2007).

In a study conducted in southern and eastern Mediterranean region between 2003-2005. Twenty-six percent of a total of 1298 isolates of *Streptococcus pneumoniae* were reported as non-susceptible to penicillin, with the highest proportions being reported from Algeria (44%), Lebanon (40%), Morocco (17%), and Malta (15%). There was significant decrease in the proportion of non-susceptible invasive strains in Egypt from 39% to 17% while an increase from 12.8% to 24.3% was experienced during the same time in Turkey (Borg et al., (2009). A separate study carried among 300 Children in Tanzania showed that 35.0% were positive for *Streptococcus pneumoniae* while 67.8% were penicillin-non-susceptible pneumococci (Moyo et al., 2012).

Methods

Sputum samples were collected from two groups of patients diagnosed with pneumonia by clinicians during the period March to June 2014 at two major hospitals in Khartoum state namely: (i) Al-Shaab Teaching Hospital (ii) Omdurman Hospital. The study population include 100 elderly(above 60years) patients and 100 pneumonic children (between 5-18years)

Inclusion Criteria

A signed written consent was taken from patients participating voluntarily in this study. For a patient to be included three conditions must apply:-
(a) Age between 5-18 years and older than 60 years
(b) Participant must not have been on antibiotic therapy for the past 7 days.
(c) Participant must have been confirmed of having pneumonia by the consulting clinician**.**
This information was obtained from the patients' folders before participating in this study.
Clearance was obtained from international review board (SIRB) at University of Medical Sciences and Technology

Exclusion Criteria

The study did not include:-
(a) Patients between 18 and 60 years old.
(b) Any patient under treatment of antibiotics.

Sampling And Samples Collection:

A total of two hundred (200) sputum samples (100 from each group) were collected from children and elderly patients who were diagnosed clinically as having pneumonia following procedures described by Collee et al. (1996), Cheesbrough (2000), and Garcia and Isenberg (2010) for the collection, examination and identification of the samples. The sputum samples were collected separately in clean, 100 mL wide mouth, leak proof, screw

capped containers. The patients were requested to take deep breath and cough deeply to produce sputum into the containers. The specimens were processed immediately within two hours

Macroscopical Examination

The specimens were examined visually and the appearance was recorded as purulent green, yellow, or blood stained, mucopurulent, mucoid or watery saliva. Sample with saliva only or food particles were not processed and were reported as unsuitable for culture. Thick, mucopurulent, blood stained sputum indicates bacterial infection. Sputum samples were mixed with equal amount of sputolysin and shaken gently before being incubated at 37 °C for 30 minutes.

Microscopical Examination

A smear from the sputum was stained with Gram stain and several fields were examined under microscope (x10 objective). The number of pus cells and epithelial cells per LPF was recorded. Presence of >25 squamous epithelial cells indicates that the sample consists mostly of saliva; in such case culture was not carried out to avoid misleading findings (Garcia and Isenberg, 2010).

Culture and Iincubation

A loopful of the collected sputum sample was inoculated semi quantitatively on the following media:

Blood Agar:

Contains sheep blood at a concentration of 5%.blood agar usually enriched, differential media used to isolate fastidious organisms and detect haemolytic activity.

Examination And Report Of Culture:

Twenty-five colonies or more in the main inoculums of culture plate was considered significant and insignificant if fewer than 25 colonies. The number and types of colonies present in primary, secondary and tertiary streaked areas were noted and graded as scanty, moderate or heavy growth. All plates showing significant bacterial growth was subjected to further testing to identify the grown organism using Gram stain and catalase test.

Gram Stain

A colony from the culture was emulsified in sterile normal saline and a thin smear on a slide was prepared. Slides were stained using Gram's method and examined.

Catalase Test

With an inoculating wire loop a colony of the test organism was transferred from the culture into a test tube containing about 2 mL of 3% hydrogen peroxide solution. The rapid and sustained appearance of bubbles indicated a positive result. This test is usually positive in *Staphylococcus* spp. and negative in *Streptococcus* spp

Sensitivity To Optochin

The surface of blood agar was inoculated evenly with pure culture of alpha haemolytic streptococci under test. Optochin disc was then placed aseptically on the inoculated surface and incubated for 24 h at 37 °C. Pneumococci show a zone of inhibition of at least 5 mm from the edge of the disc.

Bile Solubility Test

A valuable identifying property is the solubility of cultures in bile salt which brings about autolysis of the *Streptococcus*. The suspected *S. pneumoniae* colony was incubated in 5 mL serum digest broth for 18 h at 37 °C. An aliquot (0.5 mL) of 10%s odium deoxycholate solution was added and incubated at 37 °C. Pneumococci were lysed within 15-30 min and turbid culture becomes clear

Antimicrobial Susceptibility Testing

All the isolates were tested for penicillin resistance by Kirby-Bauer disc diffusion method using 1-µg oxacillin disks (Oxoid) . The medium (Muller Hinton with 5%sheep blood) was prepared and sterilized as instructed by the manufacture, then was poured into 90 mm diameter sterile petri-dish to a depth of 4mm and stored at 2-8c, emulsification of several colonies of test organism was done in a small volume of sterile peptone water and this was then matched with the suspension of turbidity standard (Mc Far land 0.5 turbidity standard).for spreading the inoculum evenly across the plate, sterile cotton swab was used. The antimicrobial disc; oxacillin were placed on the medium using sterile forceps. The plates were then incubated aerobically at 37c for 24hrours. The results were obtained by measuring the radius of the inhibition zone and interpreted according to the recommendations of the National Committee for Clinical Laboratory Standards. (23)

Results

A total of two hundred samples of sputum collected from children between 5- 18 years old and elderly above 60 years were investigated during the present study. The patients, of different gender, were diagnosed by clinicians with pneumonia in two main hospitals in Khartoum state, AL-Shaab teaching hospital and Omdurman teaching hospital. Ttable 1 shows that significant positive growth of *Streptococcus pneumoniae* occurred in 40 sputum samples while 160 samples showed either no growth or growth for other organisms.

Table 1. Frequency of microorganisms and their percent occurrence in sputum samples

Bacterial aetiology	Frequency in children	Frequency in elderly	Total	Percent
Streptococcus pneumoniae	24	16	40	20%
Other organisms/no growth	76	84	160	80%
TOTAL	100	100	200	100%

Sixty percent of the samples that show significant growth of *Streptococcus pneumoniae* were collected from children while the rest samples were collected from elderly patients (40%).

The results of the antimicrobial susceptibility pattern for penicillin using oxacillin discs of the isolated *Streptococcus pneumonia* are represented in Table 2. This study revealed that (7.5%)of *Streptococcus pneumonia* were resistant to oxacillin disc, while 12.5% show intermediate resistance and the majority were sensitive to oxacillin (Table 2)

Table 2. Resistance of isolated *s. pneumonia* to penicillin

Variables	Frequency	Percent
Sensitive	32	80%
Resistant	3	7.5%
Intermediate	5	12.5%
Total	40	100%

Discussion

Multi-resistant bacteria is becoming a worldwide concern. In the past decades there was a substantial increase in the prevalence of penicillin-resistant *S. pneumoniae* in both developed and developing countries. Sudan is no

exception. Significant growth of *Streptococcus pneumonia* was obtained from 20% of the sputum samples collected. This result is comparable to those found in South Nigeria where (22.4%) of sputum samples collected from pneumonic patients were positive for *Streptococcus pneumonia* (Enwa et al., 2015). The negative results in the present study study may be attributed to viral and other etiological agents**.**

The overall rate of isolation of *Streptococcus pneumoniae* was more prevalent in children (60%) than elderly (40%). This result may be attributed to fact that children usually has a high percentage of carriage of nasopharyngeal flora as documented by Rutebemberwa et al. (2015) where the percentage of *Streptococcus pneumoniae* carriage was 58.6%, in healthy children while most isolates (80.9%) had intermediate resistance to penicillin, but none was highly resistant.

In this study the clinical isolates of *S. pneumoniae* were tested for sensitivity to penicillin. Seven and a half percent (7.5%) of the isolates were found to be resistant to penicillin while 12.5% were with intermediate resistance. These percentages are not alarmingly high although higher than what had been reported by Rattanaumpawan et al. (2005) in Thailand where only 3.9% of the total isolates were highly resistant to penicillin. The values which had been found by this study not high but still it rings a bell, it is higher than what had been found in Thailand (2000- 2003) where (3.9%) of the total isolates were highly resistant to penicillin and(13.5%) showed intermediate resistance (Rattanaumpawan et al., 2005).

Previous antibiotic exposure has been documented as a risk factor for penicillin resistance in many studies, (Ruhe et al, 2004) but this could not be confirmed in our study. Resistance to penicillin maybe explained by the miss-use or excessive use which enhances the resistance to penicillin, the emergence (PRSP) strains will be as an alarming result in high morbidity and mortality. An European study on outpatient antibiotics use demonstrated a significant positive correlation between the volume of penicillin consumption in 19 countries and the prevalence of antibiotic resistance in *S. pneumoniae* (Goossens et al., 2005).

In Sudan there is no kind of any no policy that controls dispensing of antibiotics by prescriptions. A study conducted in Khartoum State by Elhada et al. (2014) to estimate the prevalence of self-medication with antibiotics/antimalarials concluded that the self-medication is alarmingly high where 71% of the population used such medicines. Taking into consideration the growing global resistance for antibiotic and the documented health related issues to inappropriate use of such medicines; this has major impact on public health and implications of health policies for countries like Sudan. The increasing incidence of penicillin-resistant *S. pneumoniae* has been paralleled by an increase in resistance to other antimicrobial agents (Schito and Felmingham, 2005).

This finding suggests that penicillin resistance can serves as a marker of resistance to other drugs. With the increasing number of immune-compromised and medically compromised individuals receiving regular penicillin treatment, the penicillin-resistant *Streptococcus pneumoniae* poses a serious risk of infection by means of community acquired between individuals infection. In this regard, effective practical methods for controlling microbial resistance for penicillin need to be developed.

Conclusion

In conclusion, our data indicate that a total of (20%) of the isolates were positive for *Streptococcus pneumonia* and its more predominant in children (60%) than elderly (40%). At present the prevalence of PRSP infection is relatively low (7.5%) compared with other parts of the world. The percentage of strains showing intermediate sensitivity or relative resistance to Penicillin was (12.5%) whether some of these strains will develop definite resistance or not is a matter of time.

Pneumococci with intermediate sensitivity to Penicillin generally will respond to higher doses of Penicillin therapy. However it is important to monitor the drug susceptibility of *S. pneumoniae* in our community, to see if there are differences in the susceptibility pattern of the species as has been observed in other countries.

Most respiratory infections are viral, and many prescriptions for antimicrobials are therefore superfluous. The emergence of PRSP is driven partially by selection pressure of antimicrobial use (Siemieniuk et al., 2011). When patients present with infections which may be due to PRSP, diagnostic specimens should be obtained for culture whenever possible.

Recommendations

It is essential that medical practitioners be informed of developing patterns of resistance in common organisms. This information can influence their prescribing patterns, both in terms of prevention of the emergence of resistant organisms and treatment of infections by them. Most respiratory infections are viral, and many prescriptions for antimicrobials are therefore superfluous. When patients present with infections which may be due to PRSP, diagnostic specimens should be obtained for culture whenever possible. Routine surveillance of resistance in pneumonia pathogens is needed as well as research on treatment efficacy in cases with resistant strains.

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ROLE OF UAE'S ACADEMIC INSTITUTIONS IN IMPLEMENTING SOLAR ENERGY RESEARCH

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Abstract: This paper presents the role of universities in the United Arab Emirates in implementing projects for the technological development in solar energy. According to published data taken from Scopus database, there are 8 major higher academic institutions that contribute to solar energy research in the UAE. They are: (a) Masdar Institute, (b) Petroleum Institute, (c) United Arab Emirates University, (d) American University of Sharjah, (e) University of Sharjah, (f) Khalifa University, (g) New York University at Abu Dhabi, and (h) American University of Ras Al Khaimah. The contribution is considered in terms of published work, with a total of 762 documents published by end of year 2016. The above academic institutions have a combined number of publications of 595 documents (i.e., representing about 80% of the total). Of course this couldn't have happened without the international contribution. The highest five contributing countries with the UAE are (a) USA, (b) United Kingdom, (c) Canada, (d) Australia, and (e) Italy.

Keywords: Solar energy, United Arab Emirates, scopus database

Introduction

Achieving sustainable development requires collaboration between different sectors and institutions, as well as the participation of all relevant stakeholders and individuals. The major contribution of institutions of higher education and research centers to society's efforts at achieving sustainability is well recognized. In the UAE most of the research work conducted is performed by academic institutions or research centers that are part of academic institutions. For example, American University of Ras Al Khaimah has a major research center devoted to sustainability called RAK Research and Innovation Center (RAKRIC; its website address is http://rakric.com/). It is a state of art research and development center specializing in sustainable system solutions. This center is has an area of 87,000 m^2 of land. It is located in the industrial zone, outside the university campus. Unique Solar R&D facilities are built on site. They are open to cooperation with world leading academic, technology and industrial development centers. Today this center includes seven R&D test platforms focusing on photovoltaic, solar cooling, solar hybrid minigrid, green building, solar water desalination, solar island and concentrated solar power. One of the most promising applications of renewable sources in UAE is to harness the energy required to supply fresh water. Water desalination using renewable energy technologies, such as solar is possible. Employing such new systems to produce fresh potable water in the future gives solutions from feasibility, sustainability, environmental and safety issues to national economy, and social benefits. The need for sustainable approach to tackle the issue of bottled water has motivated us to develop an in-house water purification unit based on membrane distillation (MD) technology. MD is a novel process that could be adapted effectively for many water purification applications. A difference in partial pressure serves as the driving force, and the presence of a hydrophobic membrane ensures high water quality regardless of feedstock parameters. Hot-side temperatures below 90 °C are suitable and this process has been proven ideal for exploiting waste heat or solar thermal resources for small scale applications. There is an acute increase in the energy utilization as well as its production in UAE. This is because of increase in population and economy, which results is an increase in CO_2 emission and global warming.

Methodology

In this work, Scopus-database was used to analyze and investigate the status of solar energy research in the United Arab Emirates. Scopus-database provides a huge source of information that can be used for many purposes. One purpose is to analyze and track the history and range of peer-reviewed published articles and their citations of an author, affiliation, or a country. It is a large abstract and citation database of peer-reviewed literature: scientific journals, book chapters, and conference proceedings. The study will lead to a better understanding of the current and future status of research in the field of solar energy in the UAE. Hopefully, the results of this study will be of benefit to energy policy makers and those active in research improve solar energy in the UAE. Scopus data were used in number of publications in literature. Scopus allows different search parameters such as "Document search", "Author search", "Affiliation search", and "Advanced search" for many fields such as "Article Title, Abstract, Keywords", "Source Title", "Year of Publication", etc. Keyword used in this study is simply "solar" in document search for the various countries, then the selection was limited to United

Arab Emirates. The data collated were used to gather the following facts: (a) Publication activities of UAE as compared to other countries, (b) Top cited solar energy-related articles in UAE, (c) Solar energy related publication distribution in various academic institutions, (d) Top journal titles with solar energy publications with UAE affiliations. The data were limited until the end of year 2016.

Energy in United Arab Emirates

The Share of buildings in total energy consumption in the UAE and its utilization is huge around 20%-40% depending upon country and it is used in cooling, heating, hot water, home appliances, lighting and cooking etc. In UAE 40% is the buildings share of total energy consumption of which cooling is around 70% of building load. Lighting and other appliance is the next that accounts to about 20%. Hence, thermal insulation of building represents a big potential in energy savings in UAE. A theoretical study is made at the site on different cost-effective and thermally efficient solutions, related to solar insulation materials for buildings. To perform a real outdoor test for savings obtained with solar insulating materials, a solar calorimeter test facility has been designed and builds. The present design is aimed to determine the heat flux reduction and the energy savings of different measures with similar indoor conditions, with and without solar insulating materials for the same ambient conditions. RAKRIC has one the world's first high precision solar tracking platform which can be used for concentrating solar panels. The platform floats on a cushion of air and is equipped with state of art rotating systems to track the movement of the sun in the order of 10-2. This platform has been tested for the load rotation test and it can take up to 150 tons of loads distributed over its top. This high precision structure is study various technology requiring high precision tracking for the optimum energy production. This platform has the potential to be deployed on land or offshore. Both versions are based on the principle of a torus floating on water and rotating to track the sun’s azimuth, thus ensuring optimal use of primary solar radiation received on earth. Solar radiation being concentrated can be used in solar thermal processes or photovoltaic applications

Results and Discussion

It was found that more than 85% of published work on solar energy in UAE, was conducted just in the past 10 years as shown in Figure 1. The figure shows a good progress of the number of published article by UAE affiliations in the past 10 years. The share of academic institutions was the biggest. About 84% of this research was conducted by academic institutions. The top 8 institutions has conducted about 80% of the total research work. Figure 2 shows these 8 institutions; they are: Masdar Institute (46%), Petroleum Institute (15%), UAE University (14%), American University of Sharjah (9%), University of Sharjah (6%), Khalifa University (5%), New York University Abu Dhabi (3%), and American University of Ras Al Khaimah (2%). This shows that the academic institutions account for most of the research in the solar energy research conducted in the UAE. Some of the work is a result of contribution on other countries. The highest contribution comes from collaborations with the following countries: USA (19%), Canada (6%), UK (6%), Australia (5%), Malaysia (5%), Germany (4%), India (4%), Italy (3%), and France (3%) as shown in Figure 3.

How does the UAE compare to other counties? Figure 4 shows comparison between UAE and other regional countries. It is doing better than Jordan, Qatar, Oman, and Bahrain, but less than Saudi Arabia, Egypt, Algeria, or Tunisia. The work was published in various publications. Figure 5 shows that about 25% of these publications is published in the following 10 journals: (a) *Desalination*, (b) *Renewable Energy*, (c) *Solar Energy*, (d) *Applied Energy*, (e) *Renewable and Sustainable Energy Reviews*, (f) *Energy Conversion and Management*, (g) *International Journal of Energy Research*, (h) *Energy*, (i) *Energy and Buildings*, (j) *ASME Journal of Solar Energy Engineering*, and (k) *Desalination and Water Treatment.* The top 10 most cited papers are listed in Table 1, which shows that all of these publications are fairly new with the oldest being published in year 2009.

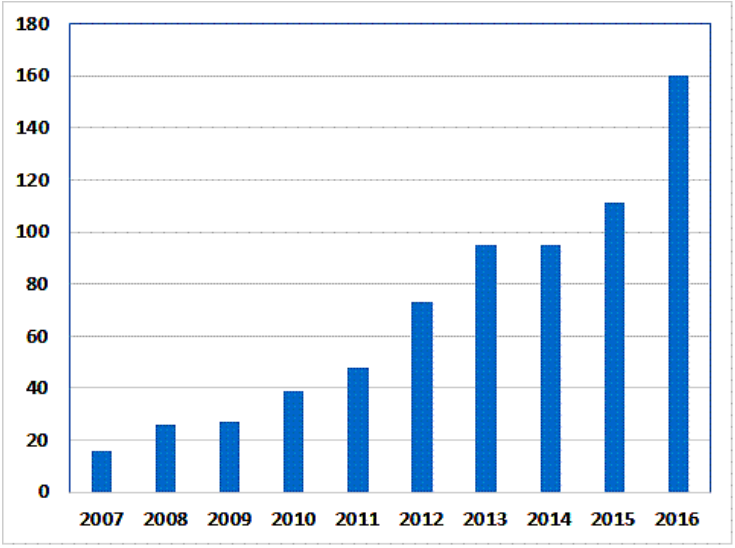
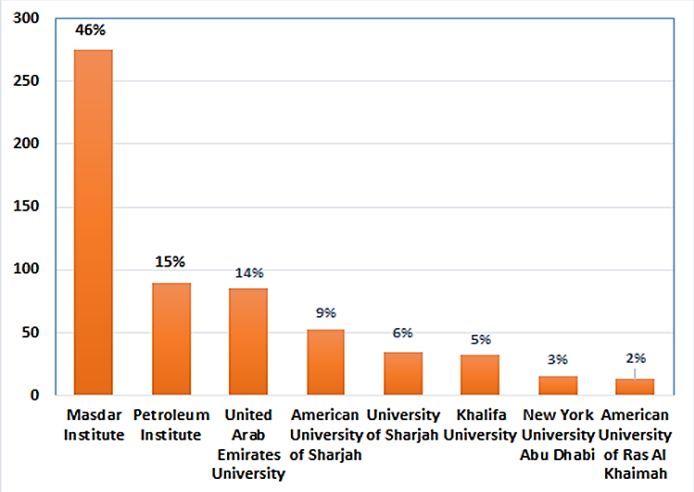


Fig. 1. Progress of published articles by UAE institutions



`Fig. 2. Total published articles by various UAE institutions

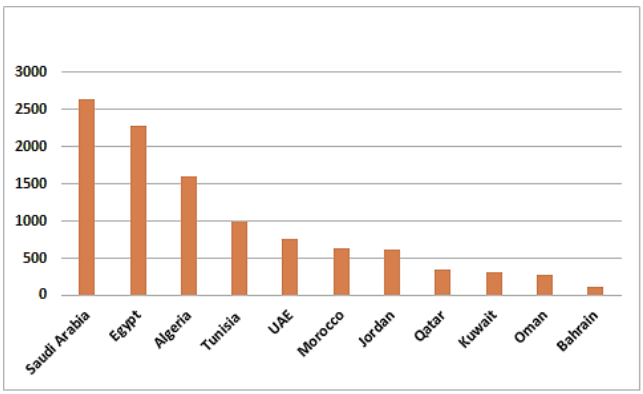


Fig. 3. Most popular collaborative countries with UAE working on solar energy research

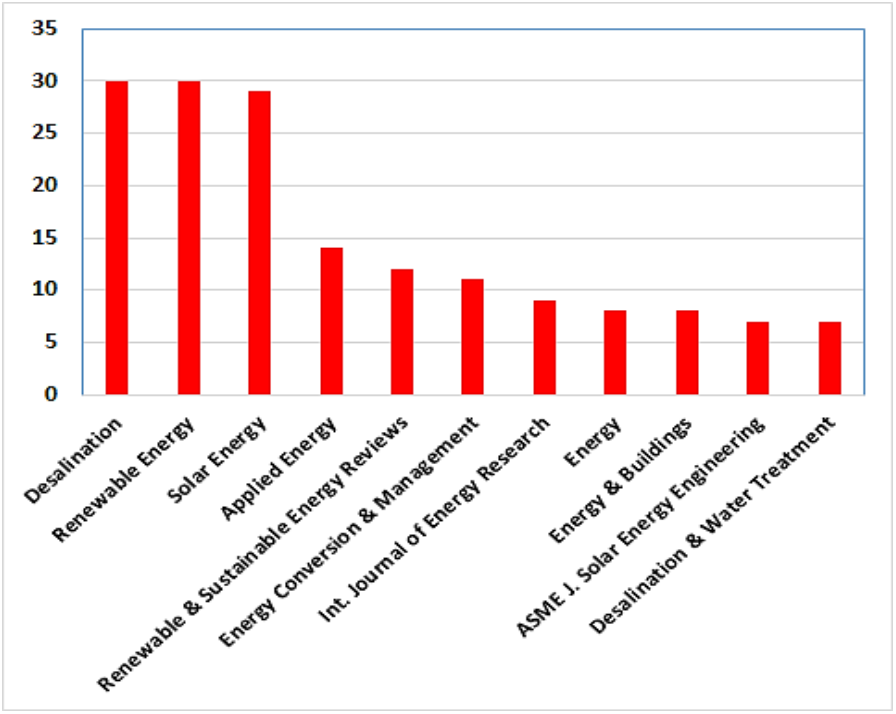


Fig. 4. Published articles by UAE as compared to other selected countries

Table 1. Top cited articles on solar energy in UAE

Publication	Times cited
Kraemer, D., Poudel, B., Feng, H.-P., Caylor, J.C., Yu, B., Yan, X., Ma, Y., Wang, X., Wang, D., Muto, A., McEnaney, K., Chiesa, M., Ren, Z., Chen, G. High-performance flat-panel solar thermoelectric generators with high thermal concentration, (2011) *Nature Materials*, 10 (7), 532-538.	358
Yoong, L.S., Chong, F.K., Dutta, B.K. Development of copper-doped TiO2 photocatalyst for hydrogen production under visible light, (2009) *Energy*, 34 (10), 1652-1661.	184
El Chaar, L., Lamont, L.A., El Zein, N. Review of photovoltaic technologies, (2011) *Renewable and Sustainable Energy Reviews*, 15 (5), 2165-2175.	109
Al Nabulsi, A., Dhaouadi, R. Efficiency optimization of a dsp-based standalone PV system using fuzzy logic and dual-MPPT control, (2012) *IEEE Transactions on Industrial Informatics*, 8 (3), art. # 6176009, 573-584.	103
Martin-Puertas, C., Matthes, K., Brauer, A., Muscheler, R., Hansen, F., Petrick, C., Aldahan, A., Possnert, G., Van Geel, B. Regional atmospheric circulation shifts induced by a grand solar minimum, (2012) *Nature Geoscience*, 5 (6), 397-401.	71
Reznik, A., Simoes, M.G., Al-Durra, A., Muyeen, S.M. LCL Filter design and performance	70

analysis for grid-interconnected systems, (2014) *IEEE Transactions on Industry Applications*, 50 (2), art. # 6571219, 1225-1232.

Mahmoud, Y.A., Xiao, W., Zeineldin, H.H. A parameterization approach for enhancing PV model accuracy (2013) *IEEE Transactions on Industrial Electronics*, 60 (12), art. # 6365813, 5708-5716. 68

Xiao, W., Edwin, F.F., Spagnuolo, G., Jatskevich, J. Efficient approaches for modeling and simulating photovoltaic power systems, (2013) *IEEE Journal of Photovoltaics*, 3 (1), art. # 6361258, 500-508. 68

Ransom, S.M., Stairs, I.H., Archibald, A.M., Hessels, J.W.T., Kaplan, D.L., Van Kerkwijk, M.H., Boyles, J., Deller, A.T., Chatterjee, S., Schechtman-Rook, A., Berndsen, A., Lynch, R.S., Lorimer, D.R., Karako-Argaman, C., Kaspi, V.M., Kondratiev, V.I., McLaughlin, M.A., Van Leeuwen, J., Rosen, R., Roberts, M.S.E., Stovall, K. A millisecond pulsar in a stellar triple system, (2014) *Nature*, 505 (7484), 520-524. 65

Qtaishat, M.R., Banat, F. Desalination by solar powered membrane distillation systems, (2013) *Desalination*, 308, 186-197. 65

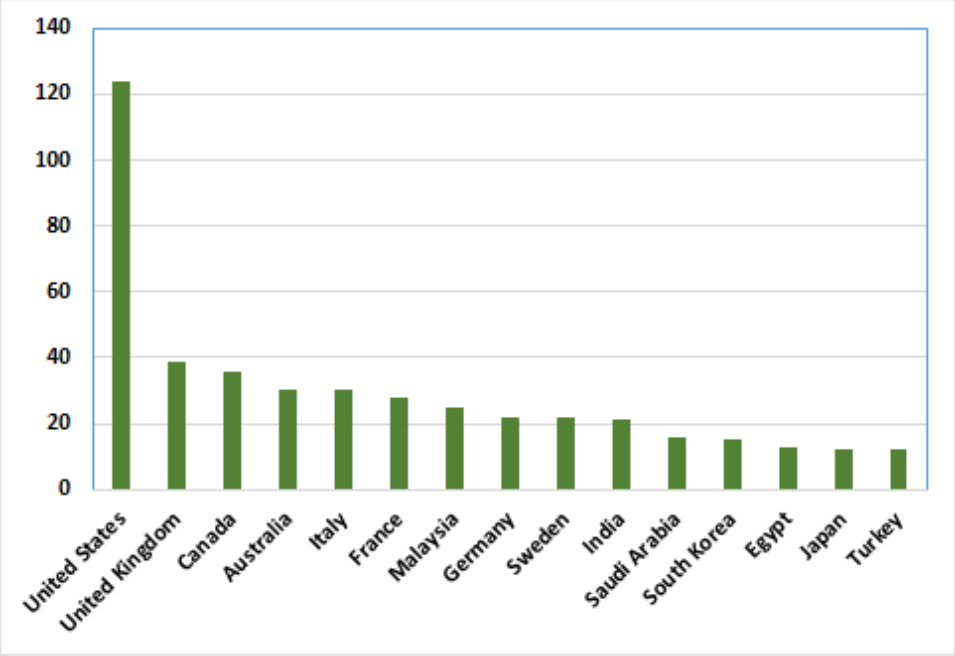


Fig. 5. Most popular journals used as the main publication medium for solar energy in UAE

Conclusion

The role of the academic institutions in the United Arab Emirates in implementing solar energy research is very obvious. This can be seen by analyzing the number of published articles by UAE affiliations using the Scopus database. The majority of this work was conducted in last 10 years. About 85% of this research is conducted by academic institutions. 8 institutions have conducted about 80% of the work. The highest institution was Masdar Institute, which conducted 46% of the research work. If the UAE institutions continue their support in the area of solar energy research then we may see big improvements in the upcoming years.

Acknowledgements

Financial support of American University of Ras Al Khaimah is acknowledged.

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IS EXPORT-LED GROWTH HYPOTHESIS VALID FOR JAPAN

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Abstract: This paper investigates the validity of export led hypothesis in Japan for the period 1982-2015. It estimates the error correction model (ECM) employing Bounds Testing mechanism in order to find the short run causality and long run association among the variables under investigation. Results of the paper suggests that there exists short run causality between export and GDP growth and export influence output growth inversely in the long run. Moreover, the paper finds that there exists causal relationship between import and GDP growth in the short run and import influences output growth positively in the long run. The study also finds the system stable in the long run as it has tendency to correct its short run disequilibrium in the long run for Japan.

Keywords: Japan, exports, imports, bound test

Introduction

In matters of economic growth the last 50 years have been dominated by what have come to be known as export-led growth (ELG) strategy for industrialization. Export-led growth is a trade and economic policy that aims to speed up the industrialization process of a country by exporting goods for which the nation has a comparative advantage (D. Ricardo, 1817).

One of the basis of ELGH is Keynesian theory that increase in export ends with an increase in output because of the multiplier effect. Export-led growth implies to open domestic markets to foreign competition in exchange for market access in other countries. ELG began in Germany and Japan in the 1950s. By the 1980s, a number of developing nations (East Asian Tigers) that had earlier been following import substitution strategies were now beginning to liberalize trade, (Washington Concensus-the new classical model provided economic foundation) adopting the export-oriented model instead (Reaganomics- supplyside economics, opposite of Keynesian demand-stimulus economics). GATT (in 1995 WTO) was suggesting for a new model of export-led growth for developing countries. Manufactured goods- manufacturing is the value added production of merchandise for use or sale using labor and machines, chemical and biological processing- are the exports most commonly used to achieve export-led growth. Export led growth strategy has to spark investments. Exports impact investment by adding to aggregate demand -directly and spillover effects- and increasing total output due to creating positive hopes for future economic growth, providing foreign exchange for intermediate and capital goods and allowing entree to the world's capital market (Castenada, 2003).

The 'export-led growth' hypothesis in which export expansion has a significant impact on economic growth has been studied extensively in the economic growth literature (Bhagwati, 1978; Krueger, 1978) Balassa (1971) argued that the export oriented policies, to sales in domestic market as well as foreign market, will lead to resource allotment in the line of comparative advantage, allow for greater capacity utilization, the economies of scale, generate technological improvement in response to foreign competition and in labor surplus countries contribute to increased employment (traditionally labor intensive agriculture sector at LDCs) as performance of the Newly Industrialized Countries (NICs) which adopted ELG policies during the 60's (Mukharjee, 2012) According to the supporters of ELGH such as Michaely (1977) Heller and Porter (1978) back up the view that export growth promotes overall economic growth for developing countries. Rodrik (2008) says " export-led growth is the way to go" also according to Ram (1985) and Awokuse (2006) and supports that exportation is the engine of growth and has extensive effects on economy.

Despite its support in mainstream economic view, ELG success has been increasingly questioned over recent years. A growing number of examples in which it has not reached the expected results for export oriented

industrialization (EOI) increases market sensitivity to exogenous factors, it is also criticized for its lack of product diversity as economies pursue their comparative advantage, which makes such economies vulnerable when demand for their products decrease (less demand in the developed countries) which happened during the financial crisis of 2007–08. Also export oriented industrialization has limited success if the economy due to experiencing a decline in its terms of trade (TOT), where prices for its exports are rising at a slower rate than of its imports which stated in Singer-Prebisch (1950) thesis. Krugman (1994) warned that, "East Asia could not continue its growth under the law of diminishing returns because East Asian growth has mainly depended on the mobilization of inputs rather than efficiency improvement" Krugman's critical view on East Asian growth is based on a series of empirical studies that reported inadequate total factor productivity (TFP) growth in East Asia. (Kim and Lau (1994) and Young(1992, 1993, and 1995)). The neoclassical economic growth model says that, the growth based on solely physical capital accumulation is meant to a end as it reaches the stabilize state, since the growth rate is driven by the rate of productivity growth in the long run, Kim and Lau (1994) Palley (2011) argued that "Japan continues to suffer from weak internal demand, has an aging population, and is also still depends on export-oriented growth. The export-led growth model is now showing several structural problems; debt saturation of US consumers, also the new -China-centric- global supply chain (E. Asian country exports go to China and China's exports then go to the industrialized economies) China's economic rise sets two problems for other developing and EM (Emerging Markets) economies: its size blocks access for newcomers and its entrance on the global precence has introduced South–South competition and also North–South competition, so there is a need to shift from export-led growth to a domestic demand-led growth model" He also emphasied on J. Robinson (1947) beggar-thy-neighbor critique applied to export led development, the Robinson critique suggests there may be a misconception of composition and developing countries may crowd out each-others exports (Blecker 2000; Palley 2003 b; Blecker and Razmi 2010). Because the export paradigm depends upon foreign demand and since the global financial crisis in 2008, developed nations have not regained strength to be the main supplier of global demand. Also Chang (2002) argued no country has successfully industrialized without import-substitution and trade protection policies (as industrialized countries did in 19th and 20th century) in his "Kicking the Ladder " book.

Japan is frequently referred to as 'economic miracle' as a consequence of its remarkable success of economic growth achieved after World War II (Goto, 2001) After the adoption of export-oriented policy in the 1950s, Japan developed rapidly with an annual GDP growth rate of 10.5% between 1960 and 1970 (Magaziner and Hout, 1980; Nakamura, 1985). The rapid growth of the Japanese economy has been the most remarkable economic phenomena of the post war period between 1953 and 1971 real GNP grew at an average annual rate of 10%.

Japan has few natural resources and depends on massive imports of raw materials (crude oil, natural gas etc.). It has to export to pay for its imports. In Japan initial development had state intervention. The Ministry of International Trade and Investment (MITI) created in 1949 (in 2001 METI, has been responsible areas of exports and imports also for all domestic industries and businesses) formulating industrial policies, promoting selected sectors (infant industries), supplying finance, allowing technology imports, enforcing discriminatory tariffs and forming cartels (keiretsus, like Mitsui, Fuyo, Sanwa, Sumitomo, Mitsubishi, Mitsui, Toyota, Honda and Dai-Ichi Kangyo bank groups.) to regulate competition and coordinate investments. Japan's success in heavy industries was affected by two elemens in the initial stages: a leading position of steel production that would be used to produce thin steel sheets for the manufacture of consumer durable goods (second to the US producing steel in the 1960s); and in order to reduce the energy price of steam-powered plants, high-capacity power plants installed in the 1960s (Das 1996). Main investments were made in electric power, coal, steel, and chemicals during this period. By the mid-1950s, production reached prewar levels. As a result, Japan's strength was in mass-market technology products such as automobiles, video cameras, advanced color televisions, computer displays, semiconductor manufacturing equipment, and computer-controlled machine tools (an Japanese selected areas in which it could develop high-quality goods to produce in huge quantities at competitive prices) From 1975 (two oil crisis hit its economy) large trade surpluses strengthened the yen and a recession caused by appreciation of Japanese Yen. The recession has been closely linked to the "Plaza Accord" of September 1985, which led to the strong appreciation of the Japanese Yen, in 1985 a dollar equals to 254 Yen and in 1990 equals 145 Yen) When Japan started losing competitiveness in the US market, Japanese FDI tended to relocate from the USA to other regions such as E. Asian tigers up to 1989 and China in the 1990s. As a summary Japanese success is because of state intervention (MITI), its state being market friendly, establishing keiretsus (cartels), the utilizing of different type of technology with adoption of R&D, concentrate on selected industries reproduce comparative advantages, and a modern management style, (Jayanthakumaran 2016, 80-84) such as "Seven Spirits of Matsushita" total production control (TQC) and zero defects (ZD) programs.
An appreciated currency, lowers profit margins in the tradables sector, weakens the demand spillovers of exports by allowing competitive imports to misplace local input provaders, and reduces the price competitiveness of the tradables sector as the actual and expected growth of exports and output (Ibarra, 2010).

The begining of the NAFTA (in 1994) presents Japanese firms with export-platform associates in Mexico the incentive of reconstructing production networks within the NAFTA to reinforce their competitiveness. In his study, he finds that more productive firms enter upon FDI into the NAFTA countries and Mexico, compared to Japanese domestic firms. Japanese associates in Mexico that export to the US and Canada tend to source inputs from the US and Canada, not from Japan (Kondo, 2015).

Since the burst of the "Bubble Economy" in 1991 (from 1986 to 1991 in which real estate and stock market prices were greatly inflated) Japan has experienced slowing growth in the economy overall. By the early 2000s economic growth hardly accelerated, resulting in what described as "Two Lost Decades"or "Lost 20 years" because of the factors that Japan's labor service input growth was negative (population is in decline, 1.7% annually between 1955 and 1973 and now an average annual rate of 0.3%), TFP growth declined sharply and capital labor ratio increased continue markedly (marginal productivity of capital and rate of return to capital declines over time) Japan has suffered from deflation and to escape from its liquidity trap simply by securing sufficient inflation to keep real interest rates negative. (Fukao et al.) During the global economic recession, between 2008-2009, exports from Japan decreased from 746.5 billion in U.S. dollars to 545.3 billion in U.S. dollars from 2008 to 2009, a 27% fall. A decline of Japanese trade for April-September 2009 relative to that for 2008. Numbers points a 36% decrease in the volume of Japanese export and a 40% shrink in import volumes (Tanaka, 2009).

Export Performance of Japan

In the 1980s Japan was a closely studied example of economic drive. In the decades since, it has holded attention mainly for its economic stagnation. After years of falling prices and irregular growth, Japan's nominal GDP was around the same in 2015 as it was 20 years earlier. USA's grew by 134% in the same time period; even Italy's went up by two-thirds (The Economist, Jul 30, 2016) In order to push down the value of the yen against the US dollar to stimulate the domestic economy by making Japanese exports cheaper; in 2010 BoJ (Bank of Japan) bought US$60 billion asset but it did not enough so on April 4, 2013, the Bank of Japan (BOJ) proclaimed that they would expand their Asset Purchase Program by $1.4 trillion in two years. The Bank of Japan wishes to bring Japan from deflation to inflation, aiming for 2% inflation (BoJ's price stability target) and in September 20-21 2016 the Bank decided to introduce "Quantitative and Qualitative Monetary Easing (QQE) with Yield Curve Control." The Bank will apply a negative interest rate of minus 0.1 percent, purchasing J-REIT's funds and 2.2 to 3.2 trillion Yen of bonds.

Nickname for the economic program of Japanese prime minister Shinzō Abe. (has elected in 2006 till now) "Abenomics" seeks to rectify two decades of stagnation by increasing the nation's money supply, raising government spending and legislating reforms to make the economy more competitive. Abe's program has three "arrows." The first consists of printing additional currency – between 60 trillion yen to 70 trillion yen – to make Japanese exports more attractive and generate mild inflation and in The second arrow entails new government spending programs to stimulate domestic demand. The third component of Abenomics is more complex – a reform of various regulations to make Japanese industries more competitive.

Table 1. Japan's major macro-economic indicators (2005-2016)

	2005	2006	2007	2008	2009	2010	2011	2013	2014	2015	2016
GDP (Billion dollar)	4553	4362	4378	4909	5070	5291	5423	4,809	4,807	4,830	4,348
Growth (%)	1,9	2,0	2,3	-0,7	-5,5	1,5	1,0	1,4	0	0,5	1,1
Per capita income	35,669	34,210	34,353	38,556	39,900	41,270	42,880	37,800	37,800	38,100	34,414
Unemployment (%)	4,4	4,1	3,8	4,0	5,1	5,6	5,5	4,1	3,6	3,4	3,0
Inflation (%)	-0,4	0,3	0,7	0,4	-1,1	0,2	1,2	036	2,7	0,8	0,0

Exchange Rate (Yen)	118,0	119,0	114,0	90,8	90,0	90,0	89,0	97.44	105,86	121,02	115
Export (billion dollar)	568	616	678	746	532	634	680	715,1	699,1	622	
Import (billion dollar)	474	535	573	708	496	580	615	833,3	799	627,3	
Balance of Payments (billion dollar)	94	81	105	38	36	54	65	-118,2	-99,9	-5,3	

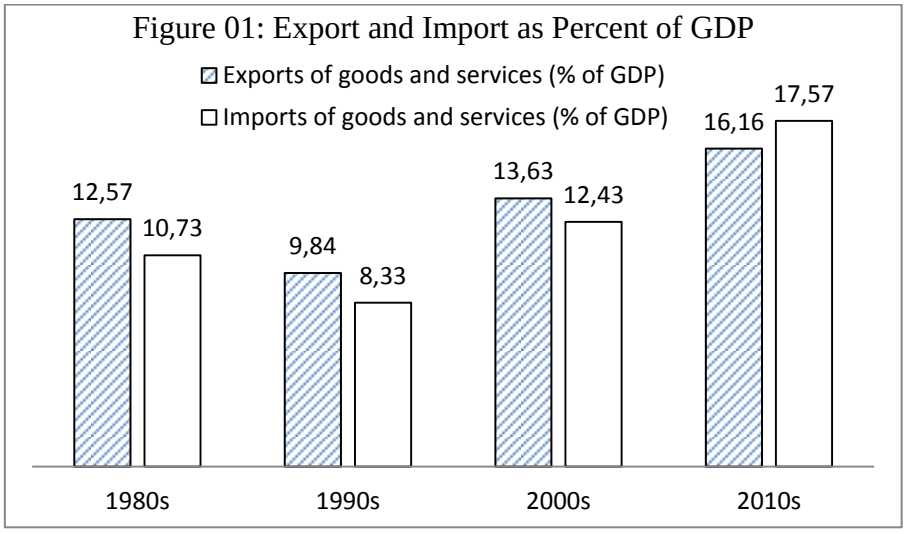
Source: Economist Intelligence Unit Projection. CIA World Factbook.

As seen in the table-1 Japan's growth rate decreases steadly from 1,9% to 1,1% from 2005 through 2016. As seen in table-2 Japan's imports biggest share belongs to crude oil and natural gas from middle eastern countries.

Table 2: Japan's major export & import partners (2015)

2015 EXPORT ($ billion)	**2015 IMPORT** ($ billion)	EXPORT PARTNERS	IMPORT PARTNERS
TOTAL: $625,1	**TOTAL**: $648,4	China: $131	China: $166
Automotive: $93,3	Crude Oil: $116	USA $128	USA: $67,5
Car parts: $33,9	Natural Gas: $80,1	S.Korea: $52,5	Avustralia: $43,1
Integrated circuits: $31,1	Rafinated Oil: $23,9	Asia: $37,4	S.Arabia $42,5
Industrial printers: $15,2	Computers: $19,7	Hong Kong: $36	UAE: $37,5
Rafinated Oil: $12,7	Coil: $16,7	Taiwan: $40,2	Qatar: $33,7

(Source: www.atlas.media.mit.edu)



Source: World Bank, World Development Indicators, 2016

Figure 1 shows the relative share of export and import in GDP and it is evident that for the first three decades of the sample period, export had a greater percentage share in GDP, however, the gap covers gradually and it reversed in the first half of the ongoing decade.

Literature Review

Malhotra & Kumari (2016) studied East Asian economies such as Japan, Korea and China and analyzes the effect of export performance on economic growth fort he period 1980-2012. ADF and PP unit root tests has applied, Johansen test for long run relationship and VECM for short run dynamics. Results suggested that export-led growth hypothesis was not found valid for all three countries in short run and for Japan supported growth led exports for short run. The results highlight that Japanese economy will have to promote growth domestically due it's past teo decades of stagnation.

Zang & Baimbridge (2012) investigates relationship between exports, imports and economic growth for Korea and Japan. Datas for Japan collected from IMF's International Financial Statisitcs for time period of 1957-2003 seasonally adjusted quarterly time-series. They used a VAR model with three variables. Causality is examined between real GDP, real exports and real imports. Results are, three variables are coingrated for two countries, showing a long-run steady state exists. There is a casual effect from export growth to GDP growth for Japan. Also evidence of bi-directional causality between imports and economic growth for Japan and Korea. Finally Japan has experiencing export-led growth due to export goods in Japan presents greater non-price competitiveness although its success fails to generate since growth fails to lead to increased exports.

Awokuse (2005b) did explore casual relationship between real exports and GDP growth in Japan by using augmented VAR methodology to test for Granger non-casuality. The data set is quarterly fort he period 1960-1991 that obtained from IMF database. The empirical results reveals the casual path between exports and GDP growth (productivity) is bi-birectional in Japan for that period while capital and foreign output variables are significant determinants of productivity growth in Japan.

Konya (2004) investigates possibility of export-led growth and growth-driven export by testing for Granger casuality between real exports and real GDP in 25 OECD countries. All data utilised are from EconData, WB World Tables and sample period is 1960-1996 for all countries. Casuality is tested with Wald tests with VAR models in levels and/or in first-differences then a modified Wald (MWald) procedure is used in augmented level VAR systems. The results indicate that growth causes exports in Canada, Japan and Korea.
Hatemi (2002) tested causality between export growth and economic growth in Japan fort he period of 1960-1999 by performing augmented Granger-causality tests. The results show that the Granger-causality is bidirectional, which means the expansion of exports is an integral part of the economic growth process in Japan for that period, however, they point to a causal relationship between international trade and exports and economic growth.

Model Specification, Methodology and Data Sources

Sample Period and Data Sources

The study covers data of the period from 1982 to 2015. Annual secondary data of export, import and GDP in US doller values were collected from World Development Indicators of World Bank (2016). The real values of the variables consider 2010 as base year and logarithmic transformation is performed before conducting necessary tests. The study applies Phillips-Perron test to identify the order of integration of the variables. As table 3 shows, all the variables are found stationary at first difference level, and hence the variables are.

Table 3: Phillips-Perron test for stationarity

Variables	Test in	Includes	t-statistic	p-value	Decision
Real GDP	Level	Intercept	-4.340233	0.0016	Stationary
		Trend, Intercept	-1.849871	0.6580	Non-Stationary
		None	2.883177	0.9985	Non-Stationary
	First Difference	Intercept	-3.742262	0.0079	Stationary
		Trend, Intercept	-4.916168	0.0020	Stationary
		None	-2.786700	0.0068	Stationary
Real Export	Level	Intercept	-0.957756	0.7569	Non-Stationary
		Trend, Intercept	-3.315384	0.0808	Non-Stationary
		None	6.534209	1.0000	Non-Stationary
	First Difference	Intercept	-7.266706	0.0000	Stationary
		Trend, Intercept	-7.210026	0.0000	Stationary
		None	-5.579850	0.0000	Stationary
Real Import	Level	Intercept	-1.356781	0.5915	Non-Stationary
		Trend, Intercept	-1.483106	0.8158	Non-Stationary
		None	4.073695	0.9999	Non-Stationary
	First Difference	Intercept	-4.626813	0.0008	Stationary
		Trend, Intercept	-7.874939	0.0000	Stationary
		None	-3.712372	0.0005	Stationary

Model Specification and Methodology

To overcome the small sample bias, the study avoids Engle-Granger method of cointegration (Alam & Quazi, 2003) and also turn aside the Johansen cointegration approach requires large sample size for the validity of results (Ghatak & Siddiki (2001). The study applies the procedure of ARDL Bounds Testing approach as it relies on a small sample size.

Vector Autoregression Estimates (VAR) is used to select the optimum number of lags, that allows one to estimate the following ARDL scheme.

$$\Delta y_t = \beta_0 + \Sigma\, \beta_i \Delta y_{t-i} + \Sigma\, \eta_i \Delta x_{t-i} + \Sigma\, \rho_i \Delta_{t-i} + \delta_1 y_{t-1} + \delta_2 x_{t-1} + \delta_3 m_{t-1} + e_t$$

(y for GDP, x for export and m for import)

If the ARDL scheme mentioned above is free from serial correlation and stable, it can be used for examing the existence of long run relationship considering null hypothesis H_0: $\delta_1=\delta_2=\delta_3=0$ using Wald test. The presence of long-run relationship will determine whether the long-run estimates of coefficients and ECM would be necessary or not to explain the long-run equilibrium relationship between export, import and economic growth.

The Error Correction Model using ARDL scheme is as follow-

$$\Delta y_t = \beta_0 + \Sigma\, \beta_i \Delta y_{t-i} + \Sigma\, \eta_i \Delta x_{t-i} + \Sigma\, \rho_i \Delta m_{t-i} + \theta z_{t-1} + e_t$$

where the error correction term z represents OLS residuals from the following long run model-

$$y = a_1 + a_2 x + a_3 m + u$$

Estimated Results

The appropriate model based on Akaike information criterion (AIC) from the study is an ARDL(4,1,3) model as shown in appendix which is found stable and free from serial autocorrelation and therefore applicable for testing the long run association of the variables using Bounds test. Bounds test result is shown in table 4. The null hypothesis $\delta_1 = \delta_2 = \delta_3 = 0$ is rejected at 5 percent level of significance as the Pesaran lower bound and upper bound of F-statistic are 3.1 and 3.87 respectively at the said significance level and the computed value of F-statistic which is 12.342 lies entirely above these two critical values. It means that there exist long run association among the variables.

Table 4. Bounds test for ARDL scheme

Test Statistic	**Value**	
F-statistic	12.342	
Critical Value Bounds		
Significance	Lower Bound	Upper Bound
10%	2.63	3.35
5%	3.1	3.87
2.50%	3.55	4.38
1%	4.13	5

The estimated long run model, as presented below, shows that all the coefficients are statistically significant at 5 percent significance level and the model specifies that export exerts an inverse effect on GDP while import stimulates GDP in the long run.

y	=	17.82821	-	0.159014 x	+	0.578956 m	+	u
S_e		0.506258		0.074465		0.077650		
t-ratio		35.21565		-2.135423		7.456005		
p-value		0.0000		0.0405		0.0000		

R-squared = 0.940244

Adjusted R-squared = 0.936509

When we estimate the ECM (see table 05), we find that the system corrects its short run disequilibrium at the rate of more than 25 percent in the long run per period. We dropped GDP and export with lag 2 as they are found to be highly insignificant.

$$\Delta y_t = \beta_0 + \Sigma\, \beta_i \Delta y_{t-i} + \Sigma\, \eta_j \Delta x_{t-j} + \Sigma\, \rho_j \Delta m_{t-j} + \theta z_{t-1} + e_t$$

Table 5. Error correction model

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.013112	0.005215	2.514018	0.0198
D(lnY(-1))	0.499011	0.257188	1.940253	0.0653
D(lnY(-3))	0.742597	0.247401	3.001592	0.0066
D(lnX(-1))	-0.197820	0.063287	-3.125752	0.0049
D(lnM(-2))	-0.096898	0.059444	-1.630070	0.1173
D(lnM(-3))	-0.140987	0.075508	-1.867188	0.0753
ECT(-1)	-0.252041	0.120287	-2.095330	0.0479
R-squared	0.647461	Adjusted R-squared		0.519264

Table 6. Wald test results

H_0	Chi-sq	P-values
Export does not cause GDP	11.832	0.003
Import does not cause GDP	11.432	0.001

For the error correction model (ECM), Wald test results on coefficients of exports as summarized in table 6 confirms causality between export and GDP in the short run as it rejects the null hypothesis H_0: export does not cause GDP at 5 percent level of significance. However, it also rejects the null hypothesis H_0: import does not cause GDP meaning that imports has association with GDP, that is, import causes GDP in the short run.

Concluding Remarks

In this paper an effort was made in order to examine the relationship between exports, imports economic growth under assumption of ELGH in Japan which is the one of the major exporting countries of the world. The analysis based on ARLD(4,1,3) model selected by Akaike information criterion (AIC) leads us to conclude as follows: Though there is a long run cointegrating relationship between export and economic growth, but the long run model exibits that export has an inverse impact on output growth while import has a positive influence over output growth for the case of Japan, which means that, rather thatn export led, Japanies growth is necessarily import led for the period of the study. The system has a tendency to get back its long run equilibrium value correctting over 25 percent of its short run disequilibrium per period Moreover, there exists short run causal relationship among export, import and economic growth.

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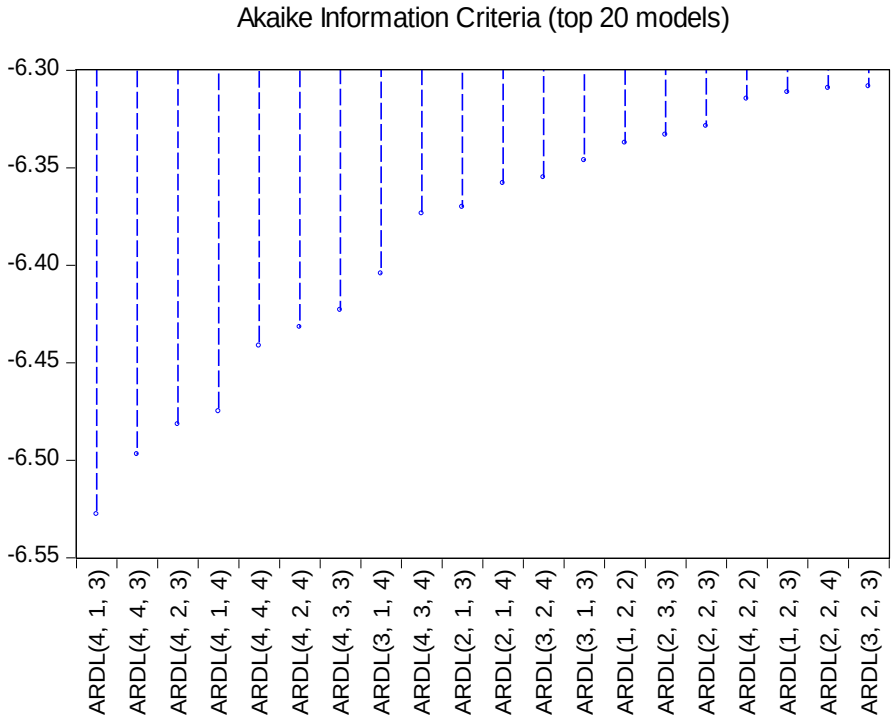
Appendix


Akaike Information Criteria (top 20 models)
-6.30
-6.35
-6.40
-6.45
-6.50
-6.55
ARDL(4, 1, 3)
ARDL(4, 4, 3)
ARDL(4, 2, 3)
ARDL(4, 1, 4)
ARDL(4, 4, 4)
ARDL(4, 2, 4)
ARDL(4, 3, 3)
ARDL(3, 1, 4)
ARDL(4, 3, 4)
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ARDL(3, 2, 4)
ARDL(3, 1, 3)
ARDL(1, 2, 2)
ARDL(2, 3, 3)
ARDL(2, 2, 3)
ARDL(4, 2, 2)
ARDL(1, 2, 3)
ARDL(2, 2, 4)
ARDL(3, 2, 3)

SYNTHESIS OF NEW 1-(MORPHOLINE-4-YL-METHYL)-3-ALKYL(ARYL)-4-[3-ETHOXY-4-(BENZENESULFONYLOXY)-BENZYLIDENAMINO]-4,5-DIHYDRO-1*H*-1,2,4-TRIAZOL-5-ONES

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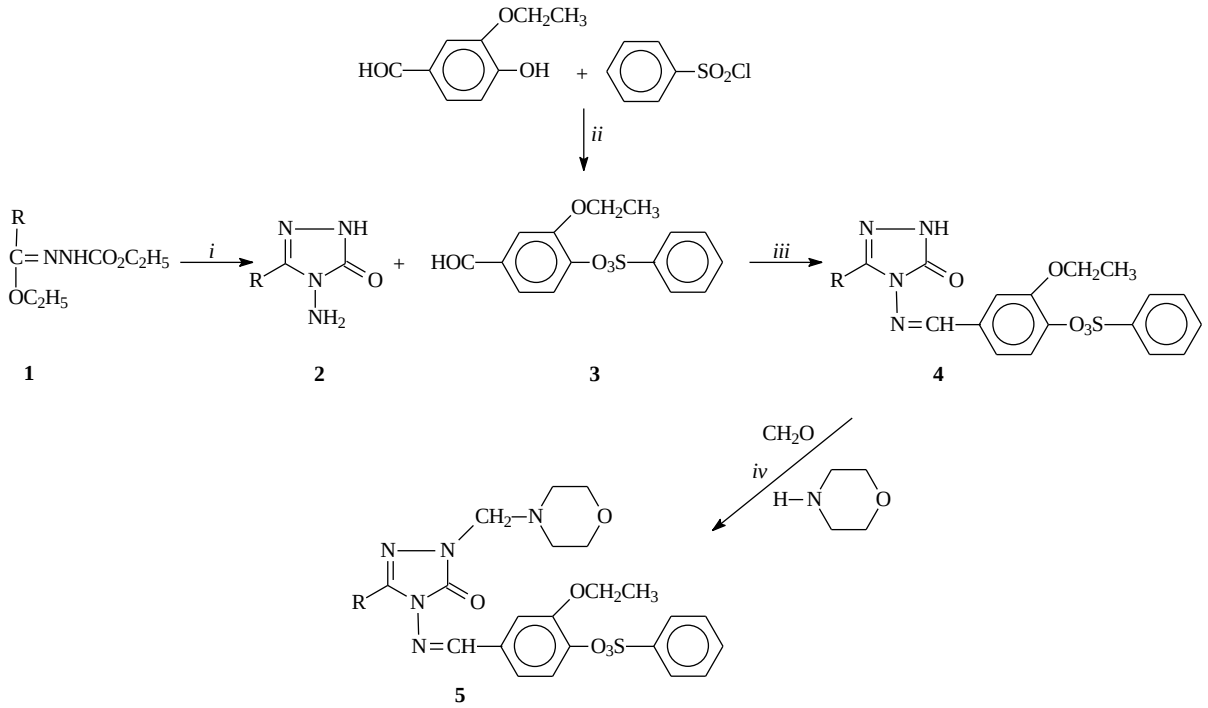
Abstract: Considering about the development of new hetero moieties by combining potential biological active scaffolds, an attempt was made here to obtain 1,2,4-triazoles bearing morpholine ring. In this regard, 3-alkyl(aryl)-4-[3-ethoxy-4-(benzenesulfonyloxy)-benzylidenamino]-4,5-dihydro-1*H*-1,2,4-triazol-5-ones (**4**) reacted with formaldehyde and morpholine to afford 1-(morpholine-4-yl-methyl)-3-alkyl(aryl)-4-[3-ethoxy-4-(benzenesulfonyl-oxy)-benzylidenamino]-4,5-dihydro-1*H*-1,2,4-triazol-5-ones (**5**). The structures of six new Mannich bases were established from the spectral data.

Keywords: 1,2,4-Triazol-5-one, schiff base, synthesis

Introduction

1,2,4-Triazole and 4,5-dihydro-1H-1,2,4-triazol-5-one derivatives have been found to have a broad spectrum of biological activities (Yuksek et al., 1997; Kahveci et al., 2008; Henen et al., 2012; Yuksek et al., 2013; Al-Abdullah et al., 2014; Aktas-Yokus et al., 2015). In addition, several articles about the synthesis of some N-arylidenamino-4,5-dihydro-1H-1,2,4-triazol-5-one derivatives have been published (Yuksek et al., 2013; Aktas-Yokus et al, 2015; Yuksek et al., 2015). A few literatures have shown that Mannich bases posses potent biological activities (Karthikeyan et al., 2006; Satyanarayana & George, 2002; Ying et al., 2008; Al-Abdullah et al., 2014; Vishnu et al., 1986).

In the present paper, the synthesis of six novel 1-(morpholine-4-yl-methyl)-3-alkyl(aryl)-4-[3-ethoxy-4-(benzenesulfonyl-oxy)-benzylidenamino]-4,5-dihydro-1*H*-1,2,4-triazol-5-ones (**5a-f**) were synthesized by the reactions of 3-alkyl(aryl)-4-[3-ethoxy-4-(benzenesulfonyloxy)-benzylidenamino]-4,5-dihydro-1*H*-1,2,4-triazol-5-ones (**4a-f**) with formaldehyde and morpholine (Scheme **1**).



i) $N_2H_4.H_2O$, reflux, 6h; *ii*) Et_3N, 0 °C, 3h; *iii*) AcOH, reflux, 1h; *iv*) abs. EtOH, reflux, 3h
a) R = CH_3, b) R = CH_2CH_3, c) R = $CH_2C_6H_5$, d) R = $CH_2C_6H_4CH_3$ (*p*-),
e) R = $CH_2C_6H_4OCH_3$ (*p*-), f) R = $CH_2C_6H_4Cl$ (*p*-)

Scheme 1.

Methods

Chemical reagents and all solvents used in this study were purchased from Merck AG, Aldrich and Fluka. Melting points which were uncorrect were determined in open glass capillaries using an Electrothermal 9100 digital melting point apparatus. The IR spectra were obtained on a Perkin-Elmer Instruments Spectrum One FT-IR spectrometer. ^{1}H and ^{13}C NMR spectra were recorded in deuterated dimethyl sulfoxide with TMS as internal standard using a Bruker Ultrashield spectrometer at 200 MHz and 50 MHz, respectively. The starting compounds **4a-f** were prepared according to the literature (Ikizler & Yuksek, 1979; Ikizler & Yuksek, 1993; Ozdemir, 2016).

General procedure for the synthesis of 1-(morpholıne-4-yl-methyl)-3-alkyl(aryl)-4-[3-ethoxy-4-(benzenesulfonyloxy)-benzylıdenamıno]-4,5-dıhydro-1*h*-1,2,4-trıazol-5-ones (5a-f)

3-alkyl(aryl)-4-[3-ethoxy-4-(benzenesulfonyloxy)-benzylidenamino]-4,5-dihydro-1*H*-1,2,4-triazol-5-one (**4**) (5 mmol) dissolved in ethanol was treated with formaldehyde (10 mmol) and morpholine (6 mmol). The reaction mixture was refluxed for 3 h. Then the reaction mixture were cooled and filtrated. Several recrystallizations of the residue from an appropriate solvent gave pure compounds **5a-f** as colourless crystals.

1-(Morpholine-4-yl-methyl)-3-methyl-4-[3-ethoxy-4-(benzenesulfonyloxy)-benzylidenamino]-4,5-dihydro-1*H*-1,2,4-triazol-5-one (5a): Yield 81 %, m.p. 102-104 °C. IR: 1704 (C=O), 1610, 1576 (C=N), 1377 and 1197 (SO_2), 760 and 689 (monosubstituted benzenoid ring) cm^{-1}. ^{1}H NMR (DMSO-d_6): δ 1.10 (t, 3H, OCH_2CH_3, *J*=6.80 Hz), 2.31 (s, 3H, CH_3), 2.57 (t, 4H, $2CH_2$, *J*=4.40 Hz), 3.55 (t, 4H, $2CH_2$, *J*=4.40 Hz), 3.83 (q, 2H, OCH_2CH_3, *J*=6.80 Hz), 4.53 (s, 2H, NCH_2N), 7.31 (d, 1H, ArH, *J*=8.00 Hz), 7.47 (d, 1H, ArH, *J*=8.40 Hz), 7.49 (s, 1H, ArH), 7.67 (d, 2H, ArH, *J*=8.00 Hz), 7.80-7.85 (m, 3H, ArH), 9.66 (s, 1H, N=CH). ^{13}C NMR (DMSO-d_6): δ 10.91 (CH_3), 14.04 ($OCH_2\underline{C}H_3$), 49.95 (CH_2NCH_2), 64.05 ($O\underline{C}H_2CH_3$), 65.92 (NCH_2N), 66.02 (CH_2OCH_2), [112.84, 120.15, 124.20, 128.14 (2C), 129.48 (2C), 133.57, 134,85, 135.13, 139.61, 150.88] (arom-C), 143.12 (triazole C_3), 150.14 (triazole C_5), 153.08 (N=CH). MS: m/z 503 (M+2, 32), 502 (M+1, 100), 143 (5), 115 (22).

1-(Morpholine-4-yl-methyl)-3-ethyl-4-[3-ethoxy-4-(benzenesulfonyloxy)-benzylidenamino]-4,5-dihydro-1*H*-1,2,4-triazol-5-one (5b): Yield 78 %, m.p. 142-144 °C. IR: 1692 (C=O), 1610, 1577 (C=N), 1356 and 1179 (SO_2), 760 and 702 (monosubstituted benzenoid ring) cm^{-1}. ^1H NMR (DMSO-d_6): δ 1.10 (t, 3H, OCH_2CH_3, *J*=7.20 Hz), 1.22 (t, 3H, CH_2CH_3, *J*=7.20 Hz), 2.57 (t, 4H, $2CH_2$, *J*=4.40 Hz), 2.70 (q, 2H, CH_2CH_3, *J*=7.20 Hz), 3.56 (t, 4H, $2CH_2$, *J*=4.40 Hz), 3.83 (q, 2H, OCH_2CH_3, *J*=7.20 Hz), 4.54 (s, 2H, NCH_2N), 7.31 (d, 1H, ArH, *J*=8.40 Hz), 7.47 (d, 1H, ArH, *J*=8.40 Hz), 7.49 (s, 1H, ArH), 7.65-7.69 (m, 2H, ArH), 7.82-7.86 (m, 3H, ArH), 9.66 (s, 1H, N=CH). ^{13}C NMR (DMSO-d_6): δ 9.94 ($CH_2\underline{C}H_3$), 14.03 ($OCH_2\underline{C}H_3$), 18.33 ($\underline{C}H_2CH_3$), 49.97 (CH_2NCH_2), 64.04 ($O\underline{C}H_2CH_3$), 65.96 (NCH_2N), 66.02 (CH_2OCH_2), [112.87, 120.05, 124.33, 128.13 (2C), 129.48 (2C), 133.59, 134,85, 135.15, 139.61, 150.88] (arom-C), 146.83 (triazole C_3), 150.28 (triazole C_5), 153.10 (N=CH). MS: m/z 517 (M+2, 35), 516 (M+1, 100), 173 (6), 159 (12), 132 (28), 129 (38), 118 (28).

1-(Morpholine-4-yl-methyl)-3-benzyl-4-[3-ethoxy-4-(benzenesulfonyloxy)-benzylidenamino]-4,5-dihydro-1*H*-1,2,4-triazol-5-one (5c): Yield 83 %, m.p. 152-153 °C. IR: 1712 (C=O), 1602, 1573 (C=N), 1375 and 1199 (SO_2), 753 and 696 (monosubstituted benzenoid ring) cm^{-1}. ^1H NMR (DMSO-d_6): δ 1.12 (t, 3H, OCH_2CH_3, *J*=6.80 Hz), 2.59 (t, 4H, $2CH_2$, *J*=4.40 Hz), 3.56 (t, 4H, $2CH_2$, *J*=4.40 Hz), 3.80 (q, 2H, OCH_2CH_3, *J*=6.80 Hz), 4.09 (s, 2H, CH_2Ph), 4.58 (s, 2H, NCH_2N), 7.23 (m, 1H, ArH), 7.28-7.32 (m, 5H, ArH), 7.37-7.40 (m, 2H, ArH), 7.64-7.68 (m, 2H, ArH), 7.81-7.85 (m, 3H, ArH), 9.61 (s, 1H, N=CH). ^{13}C NMR (DMSO-d_6): δ 14.02 ($OCH_2\underline{C}H_3$), 30.98 (CH_2Ph), 49.98 (CH_2NCH_2), 64.00 ($O\underline{C}H_2CH_3$), 66.03 (NCH_2N + CH_2OCH_2), [111.97, 120.73, 124.28, 126.77, 128.13 (2C), 128.49 (2C), 128.59 (2C), 129.47 (2C), 133.52, 134,85, 135.12, 135.66, 139.63, 150.82] (arom-C), 144.87 (triazole C_3), 150.16 (triazole C_5), 152.50 (N=CH). MS: m/z 579 (M+2, 4), 578 (M+1, 12), 173 (27), 159 (23), 132 (100), 129 (48), 118 (52).

1-(Morpholine-4-yl-methyl)-3-(*p*-methylbenzyl)-4-[3-ethoxy-4-(benzenesulfonyloxy)-benzylidenamino]-4,5-dihydro-1*H*-1,2,4-triazol-5-one (5d): Yield 76 %, m.p. 123-125 °C. IR: 1699 (C=O), 1591, 1575 (C=N), 1363 and 1197 (SO_2), 820 (1,4-disubstituted benzenoid ring), 753 and 689 (monosubstituted benzenoid ring) cm^{-1}. ^1H NMR (DMSO-d_6): δ 1.12 (t, 3H, OCH_2CH_3, *J*=7.20 Hz), 2.25 (s, 3H, $PhCH_3$), 2.58 (t, 4H, $2CH_2$, *J*=4.40 Hz), 3.56 (t, 4H, $2CH_2$, *J*=4.40 Hz), 3.80 (q, 2H, OCH_2CH_3, *J*=6.80 Hz), 4.04 (s, 2H, CH_2Ph), 4.57 (s, 2H, NCH_2N), 7.10 (d, 2H, ArH, *J*=7.60 Hz), 7.20 (d, 2H, ArH, *J*=8.00 Hz), 7.30 (d, 1H, ArH, *J*=8.00 Hz), 7.38-7.40 (m, 2H, ArH), 7.65-7.69 (m, 2H, ArH), 7.81-7.85 (m, 3H, ArH), 9.61 (s, 1H, N=CH). ^{13}C NMR (DMSO-d_6): δ 14.03 ($OCH_2\underline{C}H_3$), 20.56 ($PhCH_3$), 30.59 (CH_2Ph), 49.98 (CH_2NCH_2), 63.98 ($O\underline{C}H_2CH_3$), 66.03 (NCH_2N + CH_2OCH_2), [111.96, 120.73, 124.28, 128.13 (2C), 128.47 (2C), 129.04 (2C), 129.47 (2C), 132.53, 133.54, 134,84, 135.14, 135.84, 139.62, 150.82] (arom-C), 145.02 (triazole C_3), 150.16 (triazole C_5), 152.45 (N=CH). MS: m/z 593 (M+2, 4), 592 (M+1, 16), 173 (16), 159 (18), 132 (85), 129 (100), 118 (41).

1-(Morpholine-4-yl-methyl)-3-(*p*-methoxylbenzyl)-4-[3-ethoxy-4-(benzenesulfonyloxy)-benzylidenamino]-4,5-dihydro-1*H*-1,2,4-triazol-5-one (5e): Yield 85 %, m.p. 143-145 °C. IR: 1699 (C=O), 1595, 1577 (C=N), 1364 and 1177 (SO_2), 813 (1,4-disubstituted benzenoid ring), 752 and 689 (monosubstituted benzenoid ring) cm^{-1}. ^1H NMR (DMSO-d_6): δ 1.12 (t, 3H, OCH_2CH_3, *J*=6.80 Hz), 2.58 (t, 4H, $2CH_2$, *J*=4.40 Hz), 3.56 (t, 4H, $2CH_2$, *J*=4.40 Hz), 3.71 (s, 3H, OCH_3), 3.82 (q, 2H, OCH_2CH_3, *J*=6.80 Hz), 4.02 (s, 2H, CH_2Ph), 4.57 (s, 2H, NCH_2N), 6.86 (d, 2H, ArH, *J*=8.80 Hz), 7.23 (d, 2H, ArH, *J*=8.80 Hz), 7.30 (d, 1H, ArH, *J*=8.00 Hz), 7.39-7.42 (m, 2H, ArH), 7.65-7.68 (m, 2H, ArH), 7.81-7.85 (m, 3H, ArH), 9.61 (s, 1H, N=CH). ^{13}C NMR (DMSO-d_6): δ 14.03 ($OCH_2\underline{C}H_3$), 30.12 (CH_2Ph), 49.98 (CH_2NCH_2), 55.02 (OCH_3), 64.00 ($O\underline{C}H_2CH_3$), 66.03 (NCH_2N + CH_2OCH_2), [112.08, 113.92 (2C), 120.67, 124.30, 127.28, 128.13, 129.47 (2C), 129.66 (2C), 133.54 (2C), 134.84, 135.14, 139.62, 150.83, 158.11] (arom-C), 145.16 (triazole C_3), 150.17 (triazole C_5), 152.54 (N=CH). MS: m/z 609 (M+2, 4), 608 (M+1, 12), 173 (15), 159 (24), 132 (60), 129 (100), 118 (44).

1-(Morpholine-4-yl-methyl)-3-(*p*-chlorobenzyl)-4-[3-ethoxy-4-(benzenesulfonyloxy)-benzylidenamino]-4,5-dihydro-1*H*-1,2,4-triazol-5-one (5f): Yield 92%, m.p. 145-147 °C. IR: 1700 (C=O), 1612, 1576 (C=N), 1359 and 1196 (SO_2), 818 (1,4-disubstituted benzenoid ring), 753 and 692 (monosubstituted benzenoid ring) cm^{-1}. ^1H NMR (DMSO-d_6): δ 1.12 (t, 3H, OCH_2CH_3, *J*=6.80 Hz), 2.58 (t, 4H, $2CH_2$, *J*=4.40 Hz), 3.56 (t, 4H, $2CH_2$, *J*=4.40 Hz), 3.79 (q, 2H, OCH_2CH_3, *J*=6.80 Hz), 4.11 (s, 2H, CH_2Ph), 4.57 (s, 2H, NCH_2N), 7.29-7.40 (m, 7H, ArH), 7.65-7.69 (m, 2H, ArH), 7.83-7.85 (m, 3H, ArH), 9.62 (s, 1H, N=CH). ^{13}C NMR (DMSO-d_6): δ 14.03 ($OCH_2\underline{C}H_3$), 30.32 (CH_2Ph), 49.96 (CH_2NCH_2), 63.99 ($O\underline{C}H_2CH_3$), 66.03 (NCH_2N), 66.10 (CH_2OCH_2), [112.02, 120.72, 124.29, 128.13 (2C), 128.42 (2C), 129.47 (2C), 130.52 (2C), 131.45, 133.47, 134.66, 134.84, 135.12, 139.65, 150.83] (arom-C), 144.53 (triazole C_3), 150.15 (triazole C_5), 152.64 (N=CH). MS: m/z 614 (M+2, 4), 613 (M+1, 3), 612 (M^+, 6), 173 (19), 159 (15), 132 (80), 129 (100), 118 (37).

Results and Findings

In this study, the structures of six new 1-(morpholine-4-yl-methyl)-3-alkyl(aryl)-4-[3-ethoxy-4-(benzenesulfonyloxy)-benzylidenamino]-4,5-dihydro-1*H*-1,2,4-triazol-5-ones (**5a-f**), which were synthesized by the reactions of 3-alkyl(aryl)-4-[3-ethoxy-4-(benzenesulfonyloxy)-benzylidenamino]-4,5-dihydro-1*H*-1,2,4-triazol-5-ones (**4a-f**) with formaldehyde and morpholine, were identified using IR, ^{1}H-, ^{13}C-NMR and ms spectral data, and the observed spectral values were seen to be compatible with literature values (Yuksek et al., 1997; Yuksek et al., 2013; Aktas-Yokus et al., 2015; Yuksek et al., 2015].

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PREPARATION AND ANTIOXIDANT ACTIVITIES OF SOME NEW 3-ALKYL(ARYL)-4-(3-METHOXY-4-ACETOXYBENZYLIDENAMINO)-4,5-DIHYDRO-1*H*-1,2,4-TRIAZOL-5-ONES

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Abstract: In this study, nine novel 3-alkyl(aryl)-4-(3-methoxy-4-acetoxybenzylidenamino)-4,5-dihydro-1*H*-1,2,4-triazol-5-ones (**4**) were synthesized by the reactions of 3-alkyl(aryl)-4-amino-4,5-dihydro-1*H*-1,2,4-triazol-5-ones (**2**) with 3-methoxy-4-acetoxybenzaldehyde (3). The newly synthesized compounds were characterized using IR, ^{1}H NMR, ^{13}C NMR, and UV spectral data. In addition, the synthesized compounds were analyzed for their in vitro potential antioxidant activities in three different methods, including reducing power, free radical scavenging and metal chelating activity.

Keywords: 1,2,4-triazol-5-one, schiff base, synthesis, antioxidant activity

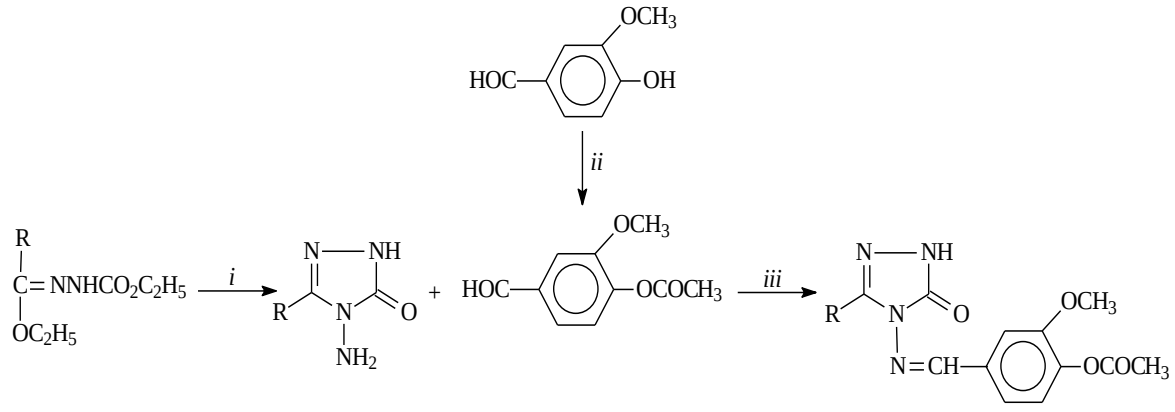
Introduction

In the last two decades there has been a growing attention in the role of reactive oxygen species (ROS) and nitrogen species (RNS) in food, drugs, and even living system. Therefore, scientists in diverse disciplines have become more curious about naturally-occurring antioxidant as well as in related synthetic derivatives that could supply active components which prohibit or decrease the effect of oxidative stress (Hussain et al., 2003).

External chemicals and internal metabolic processes in the human body or in the food system may generate highly reactive free radicals. At high concentrations, they could be important mediators of damage among cell structures, including lipids and membranes, proteins, and nucleic acids (McClements & Decker, 2000). In this regard, it is important to search for and synthesize new classes of compounds that have antioxidant properties.

1,2,4-Triazole derivatives are recorded to own a wide variety of pharmacological activities like antibacterial (Yuksek et al., 1997), antioxidant (Gürsoy-Kol & Ayazoglu, 2014), anti-inflammatory (Uzgören-Baran et al., 2012), antiparasitic (Saadeh, Mosleh, Al-Bakri, & Mubarak, 2010), analgesic (Chidananda et al., 2012), antiviral (Henen, El Bialy, Goda, Nasr, & Eisa, 2012), antitumor (Demirbas, Ugurluoglu, & Demirbas, 2002), anti-HIV (Li et al., 2013), antihypertensive and diuretic (Ali, Ragab, Farghaly, & Abdalla, 2011) properties. Besides, a few articles declaring the synthesis of several N-arylidenamino-4,5-dihydro-1*H*-1,2,4-triazol-5-one derivatives have been reported so far (Gürsoy-Kol & Ayazoglu, 2014; Yuksek et al., 1997).

In this paper, we present the synthesis of a series of 3-alkyl(aryl)-4-(3-methoxy-4-acetoxybenzylidenamino)-4,5-dihydro-1*H*-1,2,4-triazol-5-ones **(4a-i)**. The starting compounds 3-alkyl(aryl)-4-amino-4,5-dihydro-1*H*-1,2,4-triazol-5-ones **(2a-i)** were prepared from the reactions of the corresponding ester ethoxycarbonylhydrazones **(1a-i)** with an aqueous solution of hydrazine hydrate as described in the literature (Ikizler & Un, 1979; Ikizler & Yüksek, 1993). Compounds **4a-i** were obtained from the reactions of compounds **2a-i** with 3-methoxy-4-acetoxybenzaldehyde (**3**) (Takaya et al., 2011), which was synthesized by the reaction of 3-methoxy-4-hydroxybenzaldehyde with acetic anhydride (Scheme **1**). In addition, due to a wide range of applications to find their possible antioxidant activity, the newly synthesized compounds were investigated by using different antioxidant methodologies: 1,1-diphenyl-2-picryl-hydrazyl (DPPH$^{\cdot}$) free-radical scavenging, reducing power and metal chelating activities.



1 **2** **3** **4**

i) $N_2H_4.H_2O$, reflux, 6 h; ii) Et_3N, AcOEt, 0-5°C; iii) AcOH, reflux, 1 h

a) R = CH_3, b) R = CH_2CH_3, c) R = $CH_2CH_2CH_3$, d) R = $CH_2C_6H_5$,
e) R = $CH_2C_6H_4CH_3$ (p-), f) R = $CH_2C_6H_4Cl$ (p-), g) R = C_6H_5

Scheme 1. Synthesis route compounds 2-4

Methods

Chemical reagents and all solvents used in this study were purchased from Merck AG, Aldrich and Fluka. Melting points which were uncorrect were determined in open glass capillaries using an Electrothermal 9100 digital melting point apparatus. The IR spectra were obtained on a Perkin-Elmer Instruments Spectrum One FT-IR spectrometer. ^{1}H and ^{13}C NMR spectra were recorded in deuterated dimethyl sulfoxide with TMS as internal standard using a Bruker Ultrashield spectrometer at 200 MHz and 50 MHz, respectively. UV absorption spectra were measured in 10 mm quartz cells between 200 and 400 nm using a Schimadzu-1201 UV/VIS spectrometer. Extinction coefficients (ε) are expressed in $L \cdot mol^{-1} \cdot cm^{-1}$.

General Procedure for the Synthesis of 3-alkyl(aryl)-4-(3-methoxy-4-acetoxybenzylidenamino)-4,5-dihydro-1*H*-1,2,4-triazol-5-ones (4a-i)

3-Methoxy-4-hydroxybenzaldehyde (0.01 mol) was refluxed with acetic anhydride (15 mL) for 0.5 h. After addition of absolute ethanol (50 mL), the mixture was refluxed for 1 h. more. Evaporation of the resulting solution at 40-45 °C *in vacuo* and several recrystallized from ethanol to afford compound **3**. m.p. 87 °C. IR (υ, cm^{-1}): 2842 and 2782 (CHO), 1763, 1677 (C=O), 1249 (COO). UV λmax (ε): 324 (3050), 258 (9740), 226 (12770). The corresponding compound **2** (0.01 mol) was dissolved in acetic acid (20 mL) and treated with 3-methoxy-4-acetoxybenzaldehyde (**3**) (0.01 mol). The mixture was refluxed for 2 h and then evaporated at 50–55 °C in *vacuo*. Several recrystallizations of the residue from ethanol gave pure compound **4** as colorless crystals.

3-Methyl-4-(3-methoxy-4-acetoxybenzylidenamino)-4,5-dihydro-1*H*-1,2,4-triazol-5-one (4a)

Yield: 97%, m.p. 195-6°C. IR (υ, cm^{-1}): 3183 (NH), 1770, 1700 (C=O), 1596, 1578 (C=N), 1267 (COO). ^{1}H NMR (DMSO-d_6): δ 2.24 (s, 3H, CH_3), 2.30 (s, 3H, $OCOCH_3$), 3.80 (s, 3H, OCH_3), 6.83-7.51 (m, 3H, ArH), 9.80 (s, 1H, N=CH), 11.78 (s,1H, NH). ^{13}C NMR (DMSO-d_6): δ 11.77 (CH_3), 20.77 ($OCO\underline{C}H_3$), 56.27 (OCH_3), 118.13, 119.89, 127.58, 127.68, 144.87, 152.10 (arom-C), 144.90 (triazole C_3), 148.93 (N=CH), 151.99 (triazole C_5), 169.05 (COO). UV λ_{max} (ε): 296 (10650), 264 (9830), 260 (8140), 234 (9560) nm.

3-Ethyl-4-(3-methoxy-4-acetoxybenzylidenamino)-4,5-dihydro-1H-1,2,4-triazol-5-one (4b)

Yield: 95%, m.p. 184-5°C. IR (υ, cm^{-1}): 3178 (NH), 1773, 1709 (C=O), 1600, 1588 (C=N), 1253 (COO). ^{1}H NMR (DMSO-d_6): δ 1.20 (t, 3H, $CH_2\underline{CH_3}$, *J*=7.2 Hz), 2.30 (s, 3H, $OCOCH_3$), 2.64 (q, 2H, $\underline{CH_2}CH_3$, *J*=7.2 Hz), 3.82 (s, 3H, OCH_3), 6.84-7.50 (m, 3H, ArH), 9.81 (s, 1H, N=CH), 11.73 (s,1H, NH). ^{13}C NMR (DMSO-d_6): δ 10.67 ($CH_2\underline{CH_3}$), 19.23 ($\underline{CH_2}CH_3$), 20.75 ($OCO\underline{C}H_3$), 56.59 (OCH_3), 118.27, 119.94, 127.62, 127.71, 139.93, 152.14 (arom-C), 148.63 (triazole C_3), 148.93 (N=CH), 152.10 (triazole C_5), 169.03 (COO). UV λ_{max} (ε): 296 (10080), 260 (9580), 234 (8710) nm.

3-n-Propyl-4-(3-methoxy-4-acetoxybenzylidenamino)-4,5-dihydro-1H-1,2,4-triazol-5-one (4c)

Yield: 93%, m.p. 185-6°C. IR (υ, cm^{-1}): 3205 (NH), 1769, 1719 (C=O), 1590, 1576 (C=N), 1254 (COO). ^{1}H NMR (DMSO-d_6): δ 0.92 (s, 3H, $CH_2CH_2\underline{CH_3}$, *J*=7.4 Hz), 1.65 (sext, 2H, $CH_2\underline{CH_2}CH_3$, *J*=7.4 Hz), 2.30 (s, 3H, $OCOCH_3$), 2.60 (t, 2H, $\underline{CH_2}CH_2CH_3$, *J*=7.4 Hz), 3.81 (s, 3H, OCH_3), 6.80-7.51 (m, 3H, ArH), 9.79 (s, 1H, N=CH), 11.80 (s,1H, NH). UV λ_{max} (ε): 294 (12540), 270 (10940), 260 (10380), 232 (12280) nm.

3-Benzyl-4-(3-methoxy-4-acetoxybenzylidenamino)-4,5-dihydro-1H-1,2,4-triazol-5-one (4d)
Yield: 92%, m.p. 198-9°C. IR (υ, cm^{-1}): 3188 (NH), 1773, 1718 (C=O), 1591, 1575 (C=N), 1277 (COO), 779 and 704 (monosubstituted benzenoid ring). ^{1}H NMR (DMSO-d_6): δ 2.28 (s, 3H, $OCOCH_3$), 3.79 (s, 3H, OCH_3), 4.03 (s, 2H, CH_2Ph), 6.81-7.51 (m, 8H, ArH), 9.78 (s, 1H, N=CH), 11.98 (s,1H, NH). ^{13}C NMR (DMSO-d_6): δ 20.74 ($OCO\underline{C}H_3$), 31.67 (CH_2Ph), 56.80 (OCH_3), 117.76, 127.38, 127.42, 127.65, 127.67, 129.12 (2C), 129.39, 129,46 (2C), 138.38, 152.08 (arom-C), 146.84 (triazole C_3), 148.65 (N=CH), 151.96 (triazole C_5), 169.06 (COO). UV λ_{max} (ε): 294 (12480), 268 (10865), 232 13510), 216 (12050) nm.

3-p-Methylbenzyl-4-(3-methoxy-4-acetoxybenzylidenamino)-4,5-dihydro-1H-1,2,4-triazol-5-one (4e)
Yield: 97%, m.p. 194-6°C. IR (υ, cm^{-1}): 3188 (NH), 1777, 1715 (C=O), 1592 (C=N), 1281 (COO), 827 (1,4-disubstituted benzenoid ring). ^{1}H NMR (DMSO-d_6): δ 2.21 (s, 3H, $PhCH_3$), 2.27 (s, 3H, $OCOCH_3$), 3.78 (s, 3H, OCH_3), 3.95 (s, 2H, CH_2Ph, 6.79-7.48 (m, 7H, ArH), 9.76 (s, 1H, N=CH), 11.91 (s,1H, NH). ^{13}C NMR (DMSO-d_6): δ 20.76 ($OCO\underline{C}H_3$), 21.29 ($PhCH_3$), 31.29 (CH_2Ph), 56.77 (OCH_3), 115.91, 117.71, 120.01, 127.74, 129.33 (2C), 129,72 (2C), 133.25, 136.51, 139.95, 152.05 (arom-C), 147.87 (triazole C_3), 148.77 (N=CH), 151.97 (triazole C_5), 169.14 (COO). UV λ_{max} (ε): 294 (10060), 268 (9210), 232 (9840), 214 (8150) nm.

3-p-Methoxybenzyl-4-(3-methoxy-4-acetoxybenzylidenamino)-4,5-dihydro-1H-1,2,4-triazol-5-one (4f)
Yield: 95%, m.p. 165-6°C. IR (υ, cm^{-1}): 3181 (NH), 1775, 1717 (C=O), 1592 (C=N), 1249 (COO), 826 (1,4-disubstituted benzenoid ring). ^{1}H NMR (DMSO-d_6): δ 2.27 (s, 3H, $OCOCH_3$), 3.67 (s, 3H, *p*-$PhOCH_3$), 3.78 (s, 3H, OCH_3), 3.93 (s, 2H, CH_2Ph, 6.83 (d, 2H, ArH, J=7.8 Hz), 7.03-7.46 (m, 3H, ArH), 7.19 (d, 2H, ArH, J=8.6 Hz), 9.76 (s, 1H, N=CH), 11.89 (s,1H, NH). ^{13}C NMR (DMSO-d_6): δ 20.78 ($OCO\underline{C}H_3$), 30.81 (CH_2Ph), 55.65 (*p*-$PhOCH_3$), 56.77 (OCH_3), 114.53 (2C), 115.91, 118.06, 120.02, 127.59, 1597 (triazole C_5), 169.17 (COO). UV λ_{max} (ε): 294 (11220), 270 (10890), 234 (12370), 216(10675) nm.

3-p-Chlorobenzyl-4-(3-methoxy-4-acetoxybenzylidenamino)-4,5-dihydro-1H-1,2,4-triazol-5-one (4g)
Yield: 97%, m.p. 178-9°C. IR (υ, cm^{-1}): 3182 (NH), 1777, 1714 (C=O), 1603, 1589 (C=N), 1251 (COO), 850 (1,4-disubstituted benzenoid ring). ^{1}H NMR (DMSO-d_6): δ 2.29 (s, 3H, $OCOCH_3$), 3.79 (s, 3H, OCH_3), 4.03 (s, 2H, CH_2Ph, 6.81-7.46 (m, 7H, ArH), 9.78 (s, 1H, N=CH), 11.97 (s,1H, NH). ^{13}C NMR (DMSO-d_6): δ 20.75 ($OCO\underline{C}H_3$), 31.00 (CH_2Ph), 56.81 (OCH_3), 116.02, 117.77, 127.61, 127.68, 129.06 (2C), 131.33, 131.40 (2C), 133.35, 135.45, 152.09 (arom-C), 146.50 (triazole C_3), 148.75 (N=CH), 151.93 (triazole C_5), 169.04 (COO). UV λ_{max} (ε): 294 (10895), 270 (9500), 232 (12370), 218 (11120) nm.

3-m-Chlorobenzyl-4-(3-methoxy-4-acetoxybenzylidenamino)-4,5-dihydro-1H-1,2,4-triazol-5-one (4h)
Yield: 94%, m.p. 187-9°C. IR (υ, cm^{-1}): 3188 (NH), 1766, 1699 (C=O), 1592 (C=N), 1266 (COO), 779 and 693 (1,3-disubstituted benzenoid ring). ^{1}H NMR (DMSO-d_6): δ 2.28 (s, 3H, $OCOCH_3$), 3.78 (s, 3H, OCH_3), 4.05 (s, 2H, CH_2Ph, 6.83-7.44 (m, 7H, ArH), 9.76 (s, 1H, N=CH), 12.01 (s,1H, NH). ^{13}C NMR (DMSO-d_6): δ 20.79 ($OCO\underline{C}H_3$), 31.27 (CH_2Ph), 56.78 (OCH_3), 116.00, 117.68, 120.62, 127.49, 128.25, 129.65, 131.01, 133.61, 138.75, 139.98, 146.38, 152.05 (arom-C), 147.89 (triazole C_3), 148.78 (N=CH), 151.96 (triazole C_5), 169.15 (COO). UV λ_{max} (ε): 294 (9895), 270(8670), 232 (10140), 214 (8510) nm.

3-Phenyl-4-(3-methoxy-4-acetoxybenzylidenamino)-4,5-dihydro-1H-1,2,4-triazol-5-one (4g)
Yield: 98%, m.p. 258-9°C. IR (υ, cm^{-1}): 3164 (NH), 1770, 1708 (C=O), 1600 (C=N), 1251 (COO), 778 and 693 (monosubstituted benzenoid ring). ^{1}H NMR (DMSO-d_6): δ 2.18 (s, 3H, $OCOCH_3$), 3.79 (s, 3H, OCH_3), 6.80-7.39 (m, 3H, ArH), 7.48-7.50 (m, 3H, ArH), 7.83 (m, 2H, ArH), 9.91 (s, 1H, N=CH), 12.32 (s,1H, NH). UV λ_{max} (ε): 270 (18110), 226 (25650), 218 (25220) nm.

Antioxidant Activity

Chemistry

Butylated hydroxytoluene (BHT) was purchased from E. Merck. Ferrous chloride, α-tocopherol, 1,1-diphenyl-2-picryl-hydrazyl ($DPPH^{\cdot}$), 3-(2-pyridyl)-5,6-bis(phenylsulfonic acid)-1,2,4-triazine (ferrozine), butylated hydroxyanisole (BHA) and trichloracetic acid (TCA) were bought from Sigma (Sigma–Aldrich GmbH, Sternheim, Germany).

Reducing Power

The reducing power of the synthesized compounds was determined according to the method of Oyaizu (1986). Different concentrations of the samples (50-250 μg/mL) in DMSO (1 mL) were mixed with phosphate buffer (2.5 mL, 0.2 M, pH = 6.6) and potassium ferricyanide (2.5 mL, 1%). The mixture was incubated at 50^{o}C for 20 min. after which a portion (2.5 mL) of trichloroacetic acid (10%) was added to the mixture, which was then centrifuged for 10 min at 1000 x g. The upper layer of solution (2.5 mL) was mixed with distilled water (2.5 mL) and $FeCl_3$ (0.5 mL, 0.1%), and then the absorbance at 700 nm was measured in a spectrophometer. Higher absorbance of the reaction mixture indicated greater reducing power.

Free Radical Scavenging Activity

Free radical scavenging activity of compounds was measured by DPPH$^{\cdot}$, using the method of Blois (1958). Briefly, 0.1 mM solution of DPPH$^{\cdot}$ in ethanol was prepared, and this solution (1 mL) was added to sample solutions in DMSO (3 mL) at different concentrations (50-250 μg/mL). The mixture was shaken vigorously and allowed to stand at room temperature for 30 min. Then the absorbance was measured at 517 nm in a spectrophotometer. Lower absorbance of the reaction mixture indicated higher free radical scavenging activity. The DPPH$^{\cdot}$ concentration (mM) in the reaction medium was calculated from the following calibration curve and determined by linear regression (R: 0.997):

$$\text{Absorbance} = 0.0003 \times \text{DPPH}^{\cdot} - 0.0174$$

The capability to scavenge the DPPH radical was calculated using the following equation:

$$\text{DPPH}^{\cdot}\text{ scavenging effect (\%)} = (A_0 - A_1/A_0) \times 100$$

where A_0 is the absorbance of the control reaction and A_1 is the absorbance in the presence of the samples or standards.

Metal Chelating Activity

The chelation of ferrous ions by the synthesized compounds and standards were estimated by the method of Dinis et al. (1994). Shortly, the synthesized compounds (50–250 mg/mL) were added to a 2 mM solution of $FeCl_2$ (0.05 mL). The reaction was initiated by the addition of 5 mM ferrozine (0.2 mL), and then the mixture was shaken vigorously and left remaining at the room temperature for 10 min. After the mixture had reached equilibrium, the absorbance of the solution was measured at 562 nm in a spectrophotometer. All tests and analyses were carried out in triplicate and averaged. The percentage of inhibition of ferrozine–Fe^{+2} complex formation was given by the formula: Inhibition% = (A_0 - A_1 / A_0) x 100, where A_0 is the absorbance of the control, and A_1 is the absorbance in the presence of the samples or standards. The control did not contain compound or standard.

Results and Findings

In this study, the structures of nine new 3-alkyl(aryl)-4-(3-methoxy-4-acetoxybenzylidenamino)-4,5-dihydro-1*H*-1,2,4-triazol-5-ones **(4a-i)** were identified using by IR, ^{1}H-NMR, ^{13}C-NMR and UV spectral data.

Antioxidant Activity

The compounds **4a-i** were screened for their *in-vitro* antioxidant activities. Several methods are used to determine antioxidant activities. The methods used in this study are discussed below.

Total reductive capability using the potassium ferricyanide reduction method

The reducing power of the compounds **4a-i** and standard antioxidants was determined as explained in (Chung, Chang, Chao, Lin, & Chou, 2002; Yildirim, Mavi, & Kara, 2001). In this study, all the amount of the compounds showed lower absorbance than standard antioxidants. Hence, no activities were observed to reduce metal ions complexes to their lower oxidation state or to take part in any electron transfer reaction. In other words, synthesized compounds did not show the reductive activities, but compounds **4a-c** showed higher activities than blank and the other compounds also their reductive ability was concentration-dependent as seen in Figure **1**. Reducing power of the compounds and the standards were found as following order: BHA > BHT > α-tocopherol > **4c** > **4b** > **4a** for the highest concentration.

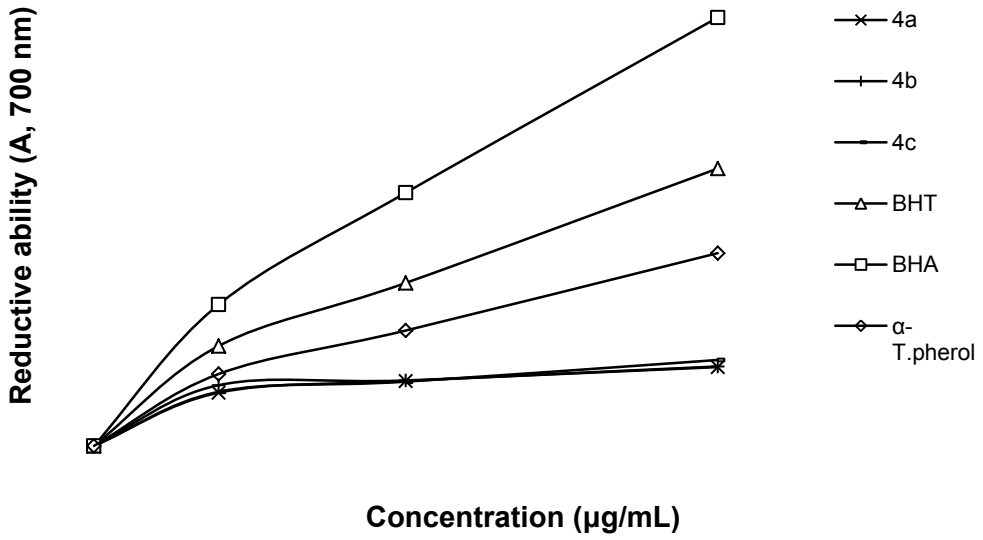


Figure 1. Total reductive potential of different concentrations of compounds 4a-c, BHT, BHA and α-tocopherol

DPPH• Radical Scavenging Activity

Free radical scavenging effect of the compounds **4a-i** was estimated by DPPH·, as explained in (Baumann, Wurn, & Bruchlausen, 1979; Soares, Dinis, Cunha, & Almeida, 1997). BHT and BHA were used as a reference to antioxidant compounds. Compounds **4a, 4b, 4d, 4h** and **4i** tested with this method exhibited moderate DPPH· scavenging activity with concentration-dependent manner as seen in Figure **2**. The radical scavenging effect of the compounds and the standards were found as following order: BHA > BHT > **4b** > **4a** > **4h** > **4d** > **4i**.

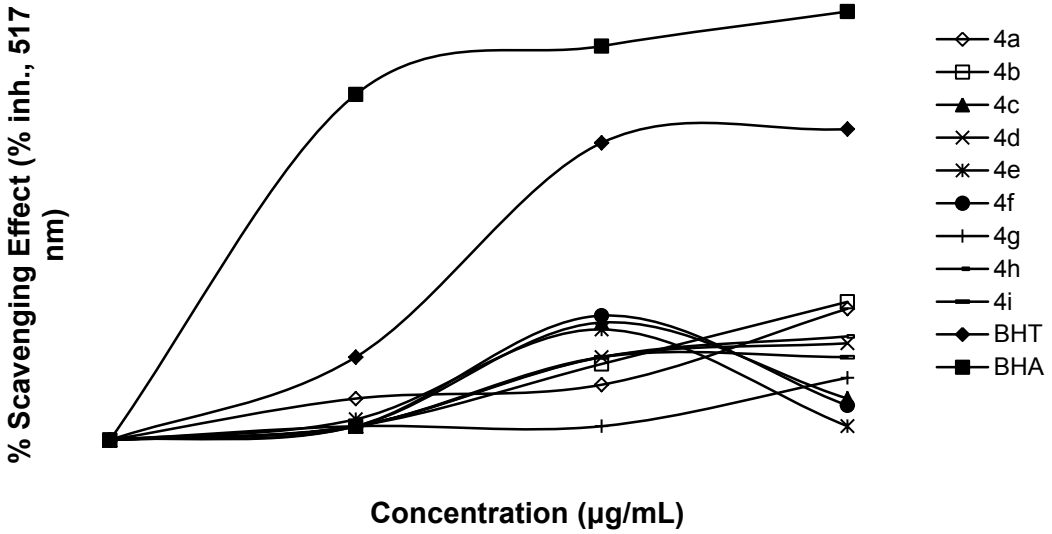


Figure 2. Scavenging effect of compounds 4a-i, BHT and BHA at different concentrations

Ferrous ion chelating activity

The chelating of ferrous ions by the compounds **4a-i** and references was measured as explained in (Finefrock, Bush, & Doraiswamy, 2003; Halliwell, 1996; Yamaguchi, Ariga, Yoshimura, & Nakazawa, 2000). Ferrous ion chelating activities of the synthesized compounds, BHT and α-tocopherol are shown in Figure **3**. The data obtained from Figure **3** reveal that the compounds **4b** and **4g** demonstrate a marked capacity for iron binding in a

concentration-dependent manner, suggesting that their action as peroxidation protectors may be related to their iron binding capacity. The metal chelating effect of the compounds and standards decreased in the order of **4g** > BHT > **4b** > α-tocopherol which were 66.4, 65.7, 65.0, 53.3 (%), at the highest concentration, respectively.

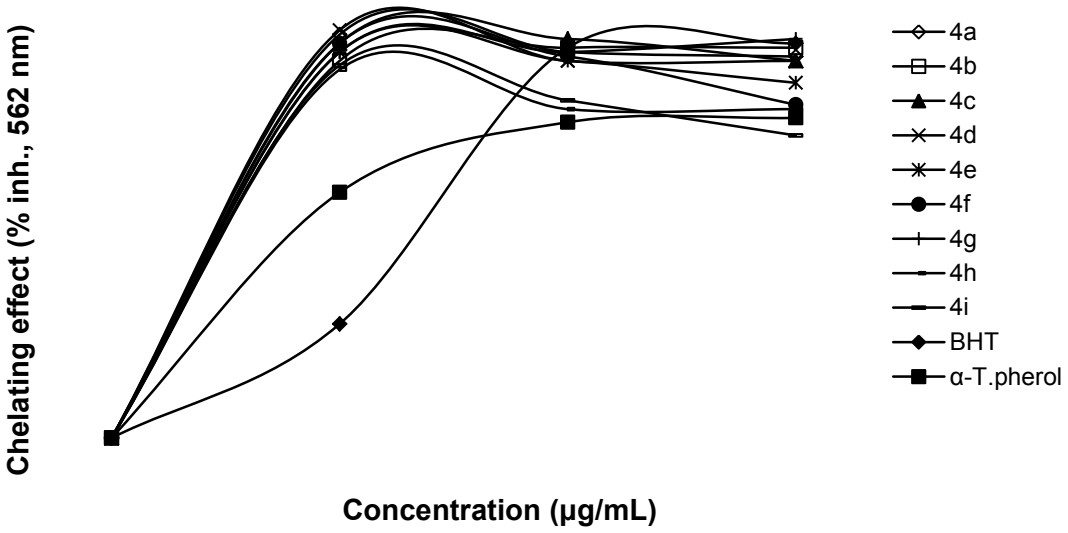


Figure 3. metal chelating effect of different amount of the compounds 4a-i, BHT and α-tocopherol on ferrous Ions

Conclusion

The synthesis and *in-vitro* antioxidant and antimicrobial evaluation of new 4,5-dihydro-1*H*-1,2,4-triazol-5-one derivatives are described. Compound **4b** demonstrates a marked capacity for antioxidant activities. Design and synthesis of novel small molecules can play specifically a protective role in biological systems and in modern medicinal chemistry. These results may also provide some guidance for the development of novel triazole-based therapeutic target.

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THEORETICAL CALCULATIONS OF 3-(*p*-METHYLBENZYL)-4-CHLOROACETYLAMINO-4,5-DIHYDRO-1*H*-1,2,4-TRIAZOL-5-ONE USING B3LYP AND HF BASIS SETS

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Abstract: Firstly, 3-(*p*-methylbenzyl)-4-chloroacetylamino-4,5-dihydro-1*H*-1,2,4-triazol-5-one, which was described in the literature, was optimized by using the B3LYP/6311G (d,p) and HF/6311G (d,p) basis sets. Then, IR absorption frequencies of analyzed molecule were calculated by two methods. The veda4f program was used in defining IR data, which were calculated theoretically. ^{1}H-NMR and ^{13}C-NMR isotropic shift values were calculated by the method of GIAO using the program package Gaussian G09. Experimental and theoretical values were inserted into the graphic according to equitation of δ exp$_{=}$a+b. δ calc. The standard error values were found via Sigma Plot program with regression coefficient of a and b constants. The experimental and the obtained theoretical values were compared and found by regression analysis that is accurate. Additionally, dipole moments, the HOMO-LUMO energy, total energy of the molecule, bond lengths and Mulliken charges from both methods were calculated.

Keywords: GIAO, 6311G (d,p), mulliken charge, B3LYP, HF

Introduction

Quantum chemical calculation methods have widely been used to theoretically predict the structural, spectroscopic, electronic and thermodynamic properties of molecular systems. The quantum chemical calculation methods ensure support for experimental structural and spectroscopic studies (Yüksek et.al., 2005a; Yüksek et.al., 2005b; Yüksek et.al., 2008a; Yüksek et.al., 2008b; Gökçe et. al., 2013; Gökçe et. al., 2014). In this study, having a large number of theory and basic set options, including molecular mechanics, semi-empirical and ab-initio methods, Gaussian 09W (Frisch et al., 2009) package is used. Hartree-Fock (HF) and Density Functional Theory (B3LYP) methods are used for the determination of the structure of molecules and the investigated of spectroscopy, electronics, nonlinear optical properties. Firstly, 3-(*p*-methylbenzyl)-4-chloro-acetylamino-4,5-dihydro-1*H*-1,2,4-triazol-5-one (1) compound was obtained according to the literature (Yüksek et.al., 2004). The compound was analyzed with IR, ^{1}H-NMR and ^{13}C-NMR, UV-vis spectral data and experimental spectrums were drawn. 3-(*p*-methylbenzyl)-4-chloroacetylamino-4,5-dihydro-1*H*-1,2,4-triazol-5-one has been optimized using B3LYP/6311G(d) and HF/6311G(d) basis set (Frisch et al., 2009; Wolinski, Hilton&Pulay, 1990). ^{1}H-NMR and ^{13}C-NMR isotropic shift values were calculated by the method of GIAO using the program package Gaussian G09W (Frisch et al., 2009). Experimental (Yüksek et.al., 2004) and theoretical values (Özdemir et al., 2012) were inserted into the graphic according to equitation of δ exp$_{=}$a+b. δ calc. The standard error values were found via SigmaPlot program with regression coefficient of a and b constants. IR absorption frequencies of analyzed molecule were calculated by two methods. The veda4f program was used in defining IR data, which were calculated theoretically (Jamróz, 2004). Furthermore, molecule's experimental and theoretical UV-Vis values, theoretical bond lengths, dipole moments, Mulliken charges, HOMO-LUMO energies and total energy of the molecule for both methods were calculated (Özdemir et al., 2012).

Methods

The quantum chemical calculations were carried out with density functional theory (DFT) and Hartree-Fock (HF) methods using 6-31G (d) basis set at the Gaussian 09W program package on a computing system (Frisch et

al., 2009). Firstly, the compound was optimized by using the B3LYP/6311G (d) and HF/6311G (d) basis sets (Frisch et al., 2009; Wolinski, Hilton&Pulay, 1990). Thus, the most stable geometrical conformer of compound was obtained. Then, ^{1}H-NMR and ^{13}C-NMR isotropic shift values were calculated with method of GIAO (Frisch et al., 2009). The veda4f program was used in defining IR data (Jamróz, 2004). Otherwise, bond angles, bond lengths, the HOMO-LUMO energy, electronegativity and Mulliken charges of compound were calculated theoretically on the computer (Özdemir et al., 2012).

Theoretical Calculations

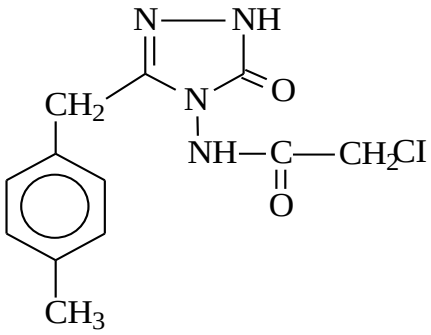


Figure 1. Structural formula of molecule

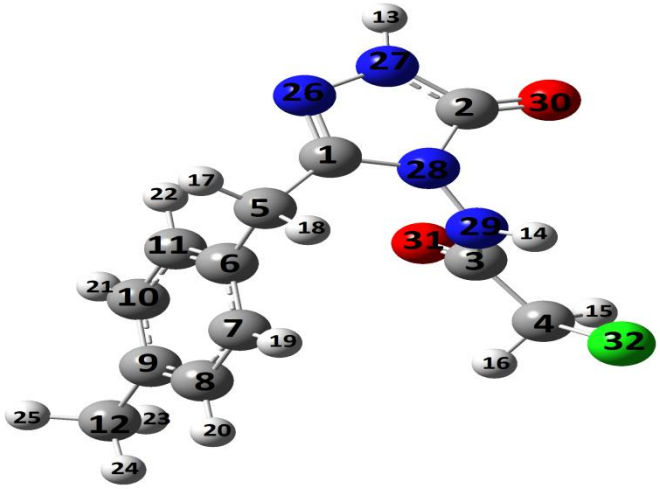


Figure 2. The optimized molecular structure of the molecule with DFT/B3LYP/6311G(d,p) level

Table 1. Data calculated ^{13}C and ^{1}H-NMR DMSO(B3LYP/ HF 6311G(d,p) isotropic chemical shifts of the molecule (δ/ppm)

No	DFT/dmso	HF/dmso	No	Exp.	DFT/dmso	HF/dmso	Differ./DFT	Differ/HF
C1	170,39	161,36	**H13**	11,84	8,02	7,11	3,82	4,73
C2	170,77	160,59	**H14**	11,22	8,20	6,41	3,02	4,81
C3	185,30	175,66	**H15**	4,28	4,47	4,24	-0,19	0,04
C4	67,44	49,64	**H16**	4,28	4,19	4,17	0,09	0,11
C5	53,40	35,24	**H17**	3,66	4,54	3,91	-0,88	-0,25
C6	154,93	141,23	**H18**	3,66	4,33	3,56	-0,67	0,10
C7	150,13	141,05	**H19**	7,12	8,02	7,85	-0,90	-0,73
C8	150,29	138,11	**H20**	7,12	7,96	7,74	-0,84	-0,62
C9	160,61	149,51	**H21**	7,12	8,04	7,86	-0,92	-0,74
C10	149,95	139,44	**H22**	7,12	8,01	7,87	-0,89	-0,75
C11	150,83	140,02	**H23**	2,26	3,13	2,71	-0,87	-0,45
C12	38,56	24,79	**H24**	2,26	2,62	2,73	-0,36	-0,47
			H25	2,26	3,12	2,29	-0,86	-0,03

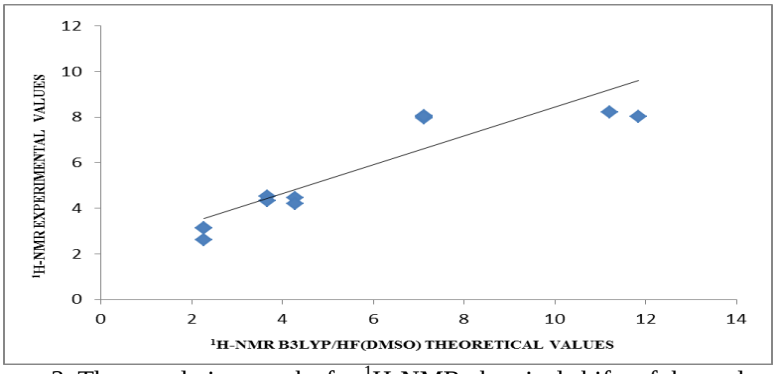


Figure 3. The correlation graphs for ^{1}H-NMR chemical shifts of the molecule

The Relation between R^2 Values of the Compound

B3LYP/6311G(d,p): ^{13}C: 0.9977, ^{1}H: 0.9853; HF/6311G(d,p): ^{13}C: 0.9960, ^{1}H: 0.9867, B3LYP/6311G(d,p) (DMSO): ^{13}C: 0.9974, ^{1}H: 0.9921; HF/6311G(d,p) (DMSO): ^{13}C: 0.9954, ^{1}H: 0.9874. There is such a relationship between R^2 values of the compound. Found standard error rate and a, b constants regression values were calculated according to formula exp =a +b.δ calc Eq. These values for compound were shown in the table 2 (Özdemir et al., 2012).

Table 2. The correlation data for chemical shifts of the molecule

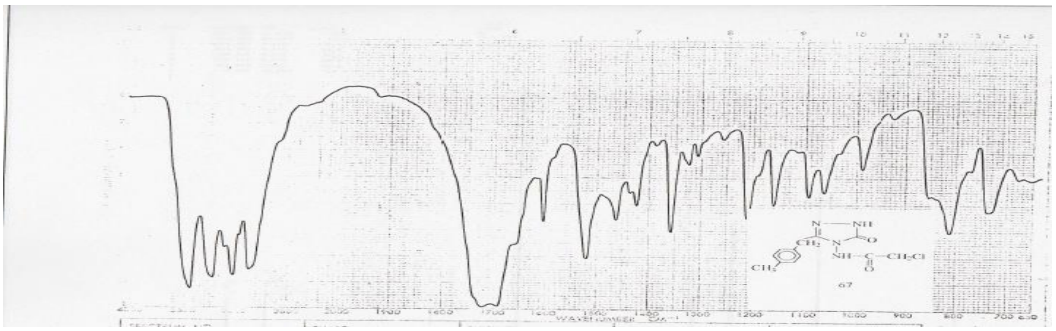
	^{1}H/DMSO			
	R^2	**S. error**	**a**	**b**
DFT	0.7925	1.5298	1.2526	-1.4855
HF	0.6451	0.6128	1.1566	-0.3824

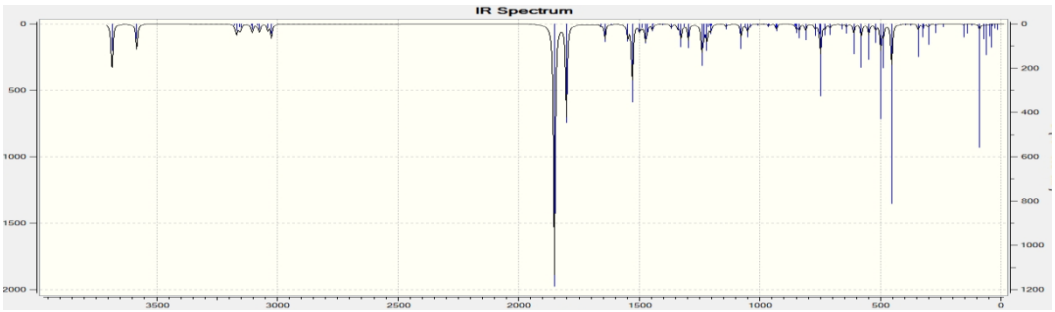
The Vibration Frequency of the Compound

Theoretically IR values were calculated with the veda4f program and scalar values were obtained. The negative frequency in the data was not found. This result shows that the structure of compound was shown to be stable. IR spectrums were drawn with obtained values according to HF and DFT method. Theoretical IR values were compared with experimental IR counterparts. The result of this compare were found corresponding with each other of values. Experimental carbonyl peak (C=O) was found in 1694 cm^{-1} and theoretical (C=O) peak was found in 1794 cm^{-1} (Özdemir et al., 2012).

	Vibration Types	B3LYP	HF
1	τ NCCN(21)	16	16
2	τ CCCC(33)	27	22
3	τ HCCC(56)	35	26
4	τ CICCN(46)	39	34
5	δ CCC(10), τ NNCC(15), τ CCCC(44)	46	45
6	δ NNC(12), τ CNNC(14), τ CCNN(20)	62	56
7	τ NCCN(45)	70	67
8	τ HCCN(12), τ CNNC(18), τ CNCC(37)	87	76
9	τ CCCC(17), τ NCNC(18)	118	118
10	δ NNC(21), CICC(25)	135	139
11	δ CCC(12), δ CICC(11), τ CCCC(12), τ CNNC(12)	151	148
12	δ NCC(24), δ CCC(27)	233	226
13	δ NCC(14), δ CCC(27)	264	274
14	δ CNN(15), τ HNNC(18)	292	295
15	δ CCC(10), τ HCCN(15), τ CCCC(21)	311	315
16	δ NNC(21)	317	325
17	δOCN(15), δ CNN(18), δ CICC(10)	334	352
18	δ CCN(24), CICC(11)	364	369
19	ν CIC(27)	385	390
20	τ HCCC(21), τ CCCC(77)	403	413
21	τ HNNC(39)	440	431
22	τ CCCC(32)	473	476
23	τ HNNC(45)	484	483
24	δ OCN(11), τ CCCC(11)	505	507
25	δ OCN(10), δ CCC(14)	532	528
26	δ OCN(10), τ HCCN(14), τ ONNC(14)	562	590
27	δ OCN(11), τ HCCN(12), τ ONNC(12)	592	604
28	δCCC(14), τ NCNC(10)	620	633
29	δCCC(36)	641	651
30	τ CCCC(17), τ NCNC(10)	688	695
31	ν CC(10), δ NNC(13), τ CCCC(14)	708	711
32	ν CIC(49)	725	7569
33	ν CIC(10)	730	766
34	τ HCCC(20)	748	782
35	δ NNC(13), τ HCCC(29)	786	803
36	ν CC(10), δ NNC(13), τ HCCC(17)	811	813
37	τ HCCC(11)	822	839
38	ν OC(59), τ HCCC(63)	825	854
39	ν CC(15), τ HCCC(23)	829	859
40	τ CCCI(11), τ HCCN(22), τ CICCN(20), τ HCCC(36), τ ONNC(12)	902	917
41	τ HCCN(23)	903	930
42	τ HCCC(36), τ CCCC(14)	931	954
43	ν NC(14)	937	971
44	τ HCCC(56), τ CCCC(12)	952	980
45	δ HCC(10), τ HCCC(52)	976	998
46	δ CCC(12), δ HCC(15), δ CCC(52)	1007	1007
47	ν NC(10), δ NNC(28)	1019	1051

48	τ HCCC(55)	1029	1053
49	ν NN(58), δ HNN(13)	1045	1067
50	ν CC(22), δ HCC(51)	1105	1076
51	δHCC(72), τ HCCN(14)	1162	1150
52	δHCC(33), τ HCCN(10)	1167	1171
53	ν CC(13), δHCC(47)	1170	1173
54	ν CC(27), δHCC(24)	1177	1176
55	ν NC(25), ν CC(10)	1182	1197
56	ν CC(18), δ HCC(18), δCCC(10)	1195	1210
57	ν NC(13), δ OCN(12), δ CNN(10)	1202	1234
58	τ HCCN(80)	1257	1255
59	ν CC(17), δ HCC(16), τ HCCN(28)	1273	1293
60	ν CC(25), ν NN(10), δ CNN(11)	1286	1306
61	δ HCC(58)	1298	1318
62	δ HCC(20)	1325	1356
63	δ HNN(68)	1359	1394
64	δ HCH(88)	1371	1404
65	ν CC(18), δ HCC(35)	1399	1413
66	δ HCH(79)	1401	1429
67	δ HCH(80), τ HCCN(14)	1422	1448
68	ν NN(25)	1429	1454
69	δ HCH(42), τ HCCC(19)	1442	1462
70	δ HCH(33), τ HCCC(18)	1453	1485
71	δ HNC(70)	1481	1518
72	δ CCC(15), δ HCC(57)	1499	1543
73	ν CC(26), δ CCC(10)	1566	1593
74	ν NC(63)	1591	1639
75	ν CC(55), δ HCC(19)	1607	1692
76	ν CH(64)	1746	1788
77	ν OC(59)	1794	1811
78	ν CH(91)	2930	2868
79	ν CH(97)	2944	2911
80	ν CH(98)	2978	2915
81	ν CH(97)	2985	2939
82	ν CH(91)	3006	2953
83	ν CH(100)	3012	2957
84	ν CH(53)	3053	3000
85	ν CH(50)	3059	3004
86	ν CH(63)	3070	3019
87	ν CH(100)	3071	3022
89	ν NH(50)	3471	3502
90	ν NH(50)	3570	3560





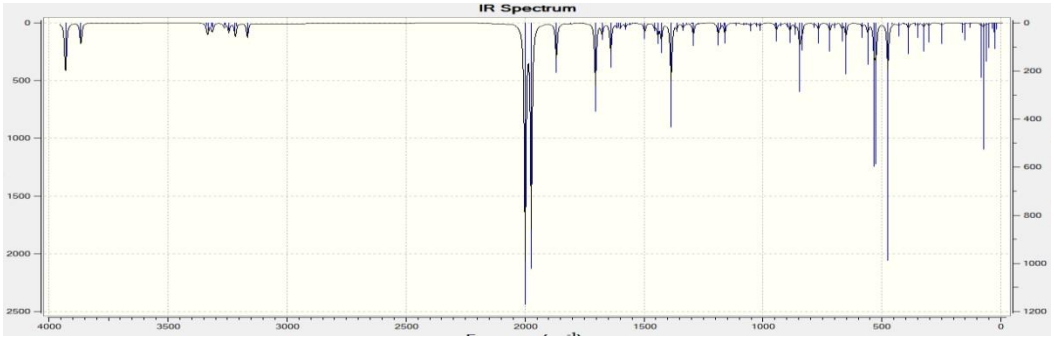
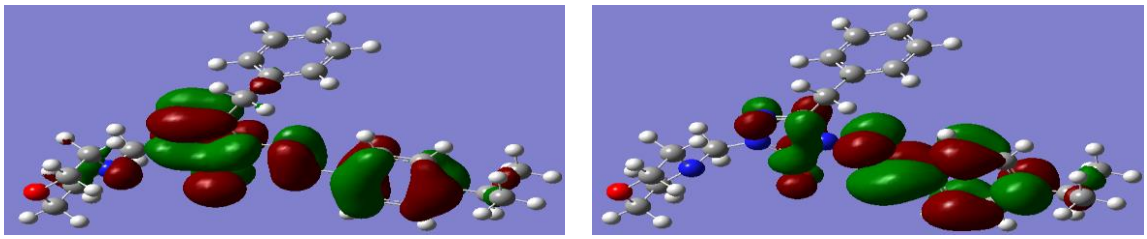
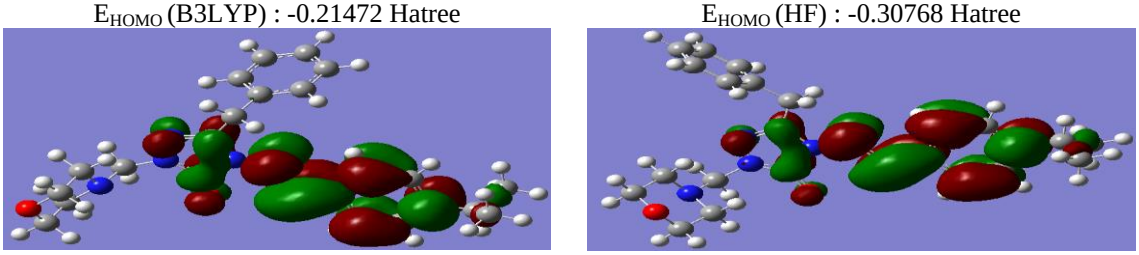


Figure 3. IR spectra experimental and simulated with DFT/B3LYP/6311G(d) and HF/B3LYP/6311G(d) levels of the molecule



E_{HOMO} (B3LYP) : -0.21472 Hatree

E_{HOMO} (HF) : -0.30768 Hatree



E_{LUMO} (B3LYP) : -0.05370 Hatree

E_{LUMO} (HF) : 0.08899 Hatree

Figure 6. HOMO-LUMO energy calculated with DFT/B3LYP/6311G(d,p) and HF/B3LYP/6311G(d,p) levels of the molecule.

Table 5. The calculated Mulliken charges data DFT/B3LYP/HF 6311G(d,p) of the molecule

	DFT	HF		DFT	HF
C1	0.354	0.497	**H17**	0.154	0.154
C2	0.492	0.691	**H18**	0.125	0.139
C3	0.409	0.530	**H19**	0.082	0.090
C4	-0.304	-0.224	**H20**	0.084	0.090
C5	-0.144	-0.131	**H21**	0.087	0.091
C6	-0.137	-0.157	**H22**	0.096	0.106
C7	-0.076	-0.076	**H23**	0.126	0.109
C8	-0.078	-0.080	**H24**	0.105	0.094
C9	-0.099	-0.125	**H25**	0.123	0.110
C10	-0.069	-0.090	**N26**	-0.218	-0.280
C11	-0.014	-0.039	**N27**	-0.302	-0.370
C12	-0.257	-0.172	**N28**	-0.369	-0.448
C13	0.252	0.261	**N29**	-0.286	-0.356
C14	0.269	0.287	**O30**	-0.366	-0.503
C15	0.201	0.192	**O31**	-0.328	-0.447
C16	0.202	0.185	**CI32**	-0.114	-0.131

Table 6. The calculated bond lengths DFT/B3LYP/HF 6311G(d,p) of the molecule.

No	Bond Lengths	B3LYP	HF	No	Bond Lengths	B3LYP	HF
1	C(1)-N(26)	1.295	1.264	**17**	C(5)-C(6)	1.521	1.494
2	C(1)-N(28)	1.388	1.380	**18**	C(5)-H(17)	1.093	1.082
3	C(1)-C(5)	1.493	1.494	**19**	C(5)-H(18)	1.094	1.083
4	N(26)-N(27)	1.382	1.373	**20**	C(6)-C(7)	1.393	1.382
5	N(27)-H(13)	1.005	0.990	**21**	C(7)-H(19)	1.085	1.076
6	N(27)-C(2)	1.370	1.347	**22**	C(7)-C(8)	1.394	1.389

7	C(2)-O(30)	1.208	1.189	**23**	C(8)-H(20)	1.085	1.076
8	C(2)-N(28)	1.418	1.388	**24**	C(8)-C(9)	1.395	1.383
9	N(28)-N(29)	1.368	1.355	**25**	C(9)-C(12)	1.509	1.510
10	N(29)-C(3)	1.380	1.366	**26**	C(12)-H(23)	1.091	1.086
11	N(29)-H(14)	1.011	0.993	**27**	C(12)-H(24)	1.094	1.083
12	N(29)-O(31)	1.205	1.184	**28**	C(12)-H(25)	1.094	1.086
13	C(3)-C(4)	1.524	1.517	**29**	C(9)-C(10)	1.400	1.393
14	C(4)-H(15)	1.087	1.079	**30**	C(10)-H(21)	1.085	1.076
15	C(4)-H(16)	1.087	1.075	**31**	C(10)-C(11)	1.388	1.378
16	C(4)-CI(32)	1.816	1.789	**32**	C(11)-H(22)	1.084	1.076

Table 6. The calculated dipole moments data B3LYP/HF 6311G(d,p) of the molecule

	DFT/6311G	**HF/631G**
μ_x	7.9855	-7.1781
μ_y	0.1683	0.1882
μ_z	-1.6051	-0.2271
μ_{Toplam}	8.1470	7.1842

Results and Discussion

In this work, geometrical and spectroscopic parameters such as IR, ^{1}H-NMR and ^{13}C-NMR spectra of 3-(*p*-methylbenzyl)-4-chloroacetylamino-4,5-dihydro-1*H*-1,2,4-triazol-5-one are calculated by density functional theory (DFT) and Hartree-Fock (HF) methods with the 6311G(d,p) basis set. Obtained spectroscopic parameters are compared with experimental data. The chemical shifts in the calculations ^{1}H-NMR and ^{13}C-NMR and IR vibrational frequencies are found to be compatible with the experimental data. Theoretical and experimental carbon and proton chemical shifts ratios between according to a, b ve R^2 values, a linear correlation were observed. Furthermore, IR vibrational frequencies experimental carbonyl peak (C=O) was found in 1706 cm^{-1} and theoretical (C=O) peak was found in 1838 cm^{-1}. The negative frequency in the IR data was not found. This result shows that the structure of compound was shown to be stable. In addition, bond lengths, the HOMO-LUMO energy, Mulliken charges and dipole moment were also calculated theoretically by using the B3LYP/6311G (d,p) and HF/6311G (d,p) basis sets.

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EVALUATION OF THEORETICAL AND EXPERIMENTICAL PROPERTIES OF 3-PHENYL-4-DICHLOROACETYLAMINO-4,5-DIHYDRO-1*H*-1,2,4-TRIAZOL-5-ONE

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Abstract: The study, 3-phenyl-4-dichloroacetylamino-4,5-dihydro-1*H*-1,2,4-triazol-5-one was optimized by using the B3LYP/6-31G (d) and HF/6-31G (d) basis sets. ^{1}H-NMR and ^{13}C-NMR isotropic shift values were calculated by the method of GIAO using the program package Gaussian G09W. Experimental and theoretical values were inserted into the grafic according to equatation of δ exp=a+b. δ calc. The standard error values were found via SigmaPlot program with regression coefficient of a and b constants. The veda4f program was used in defining IR data which were calculated theoretically. The geometric properties (bond angles, bond lengths), thermodynamic parameters, electronic properties (total energy, dipole moment), HOMO and LUMO energies, Mulliken atomic charges of 3-phenyl-4-dichloroacetylamino-4,5-dihydro-1*H*-1,2,4-triazol-5-one has been investigated by using Gaussian 09W program.

Keywords: Gaussian09W, theoretical, experimentical, 1,2,4-triazol-5-one.

Introductıon

The 3-phenyl-4-dichloroacetylamino-4,5-dihydro-1*H*-1,2,4-triazol-5-one (Alkan, 2001) was optimized by using B3LYP/6-31G(d) and HF/6-31G(d) basis sets (Frisch et al., 2009; Wolinski, Hilton & Pulay, 1990). ^{1}H-NMR and ^{13}C-NMR isotropic shift values were calculated by the method of GIAO using the program package Gaussian G09 (Wolinski, Hilton & Pulay, 1990). Experimental (Alkan, 2001) and theoretical values were inserted into the grafic according to equatation of δ exp=a+b. δ calc. The standard error values were found via SigmaPlot program with regression coefficient of a and b constants. Theoretically calculated IR data were multiplied with appropriate adjustment factors and the data obtained according to HF and DFT method were formed using theoretical infrared spectrum. IR absorption frequencies of this compound were calculated by two methods. The veda4f program was used in defining IR data which were calculated theoretically (Jamróz, 2004). The geometric properties (bond angles, bond lengths), thermodynamic parameters, electronic properties (total energy, dipole moment), HOMO and LUMO energies, Mulliken atomic charges of 3-phenyl-4-dichloroacetylamino-4,5-dihydro-1*H*-1,2,4-triazol-5-one has been investigated by using Gaussian 09W program. The spectroscopic and structural data of this compound has been calculated by using 6-31G(d) basis set with density functional method (DFT/B3LYP) and Hatree-Fock method (HF) and compared with experimental values (Alkan, 2001).

Theoretical Calculations

The optimized molecular geometric parameters (bond lengths and bond angles) of the molecule by using B3LYP/6-31G(d) and HF/6-31G(d) levels are listed in Table **1**.

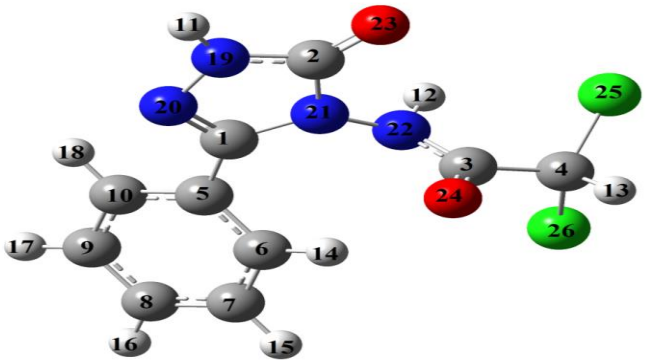


Figure 1. Optimized molecular structure of 3-phenyl-4-dichloroacetylamino-4,5-dihydro-1*H*-1,2,4-triazol-5-one with DFT/B3LYP/6-31G(d) level

Table 1.The calculated bond angles and bond lengths of the molecule

Bond Angles	**B3LYP**	**HF**	**Bond Lenghts**	**B3LYP**	**HF**
C(1)-N(21)-N(22)	128.67	128.08	C(1)-N(20)	1.30	1.30
C(1)-N(20)-N(19)	105.42	105.77	C(1)-N(21)	1.40	1.40
C(1)-N(21)-C(2)	109.49	108.98	C(1)-C(5)	1.47	1.47
C(1)-C(5)-C(6)	121.66	121.14	C(5)-C(6)	1.40	1.40
C(5)-C(6)-H(14)	120.11	120.15	C(6)-H(14)	1.08	1.08
C(1)-C(5)-C(10)	118.73	118.97	C(6)-C(7)	1.39	1.39
C(5)-C(6)-C(7)	119.90	119.88	C(7)-H(15)	1.08	1.08
H(14)-C(6)-C(7)	119.94	119.94	C(7)-C(8)	1.40	1.40
C(6)-C(7)-C(8)	120.34	120.16	C(8)-H(16)	1.08	1.08
C(6)-C(7)-H(15)	119.49	119.69	C(8)-C(9)	1.40	1.40
H(15)-C(7)-C(8)	120.16	120.14	C(9)-H(17)	1.08	1.08
C(7)-C(8)-C(9)	119.88	120.03	C(9)-C(10)	1.39	1.39
C(7)-C(8)-H(16)	120.05	119.97	C(10)-H(18)	1.08	1.08
C(7)-C(8)-C(9)	119.88	120.03	C(5)-C(10)	1.40	1.40
H(16)-C(8)-C(9)	120.06	120.00	N(21)-C(2)	1.42	1.42
C(8)-C(9)-H(17)	120.16	120.19	C(2)-O(23)	1.22	1.22
C(8)-C(9)-C(10)	120.13	120.03	N(19)-C(2)	1.37	1.37
H(17)-C(9)-C(10)	119.70	119.78	N(19)-H(11)	1.01	1.01
C(9)-H(10)-C(5)	120.14	120.04	N(19)-N(20)	1.38	1.38
H(18)-C(10)-C(5)	119.13	119.52	N(21)-N(22)	1.37	1.37
N(21)-N(22)-C(3)	118.88	117.88	N(22)-C(3)	1.38	1.38
N(21)-N(22)-H(12)	114.76	113.40	N(22)-H(12)	1.02	1.02
N(22)-C(3)-C(4)	115.33	112.03	C(3)-O(24)	1.21	1.21
H(12)-N(22)-C(3)	118.37	117.96	C(3)-C(4)	1.54	1.54
N(22)-C(3)-O(24)	124.69	123.83	C(4)-H(13)	1.09	1.09
O(24)-C(3)-C(4)	119.78	123.88	C(4)-Cl(25)	1.80	1.80
C(3)-C(4)-H(13)	107.35	109.15	C(4)-Cl(26)	1.80	1.80
C(3)-C(4)-Cl(25)	113.27	111.60			
C(3)-C(4)-Cl(26)	109.64	110.19			
Cl(25)-C(4)-Cl(26)	111.45	111.45			
Cl(25)-C(4)-H(13)	107.54	107.54			
Cl(26)-C(4)-C(13)	107.32	107.32			

Table 2. Mulliken atomic charges of the molecule

Mulliken Atomic Charges	B3LYP	HF
Atoms	Charges (a.u.)	
C1	0.48	0.60
C2	0.48	1.02
C3	0.66	0.79
C4	-0.41	-0.46
C5	0.11	-0.02
C6	-0.16	-0.21
C7	-0.14	-0.21
C8	-0.12	-0.19
C9	-0.14	-0.21
C10	-0.15	-0.18
H11	0.36	0.42
H12	0.37	0.42
H13	0.27	0.29
H14	0.17	0.25
H15	0.14	0.22
H16	0.14	0.21
H17	0.14	0.21
H18	0.15	0.23
N19	-0.50	-0.65
N20	-0.33	-0.33
N21	-0.44	-0.62
N22	-0.45	-0.55
O23	.-0.52	-0.63
O24	-0.45	-0.51
Cl25	0.01	0.02
Cl26	0.02	0.05

Table 3. The calculated and experimental ^{1}H NMR isotropic chemical shifts of the molecule

No	Experim.	DFT/Vacum	DFT/DMSO	HF/Vacum	DFT/DMSO
H11	12,35	7,14	7,66	6,32	6,79
H12	11,92	7,01	7,43	4,99	5,56
H13	6,85	6,31	6,52	4,73	5,32
H14	8,00	7,67	7,64	7,37	7,38
H15	7,85	7,71	7,88	7,32	7,53
H16	7,80	7,77	8,00	7,53	7,78
H17	7,85	7,74	7,95	7,39	7,61
H18	8,02	8,08	8,07	7,69	7,78

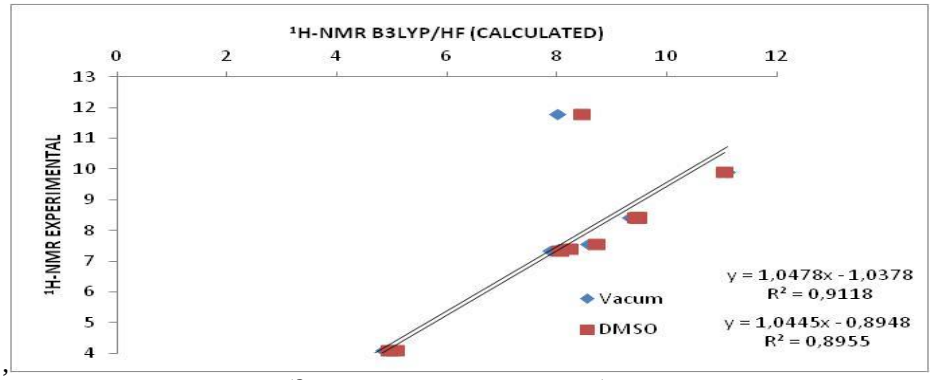


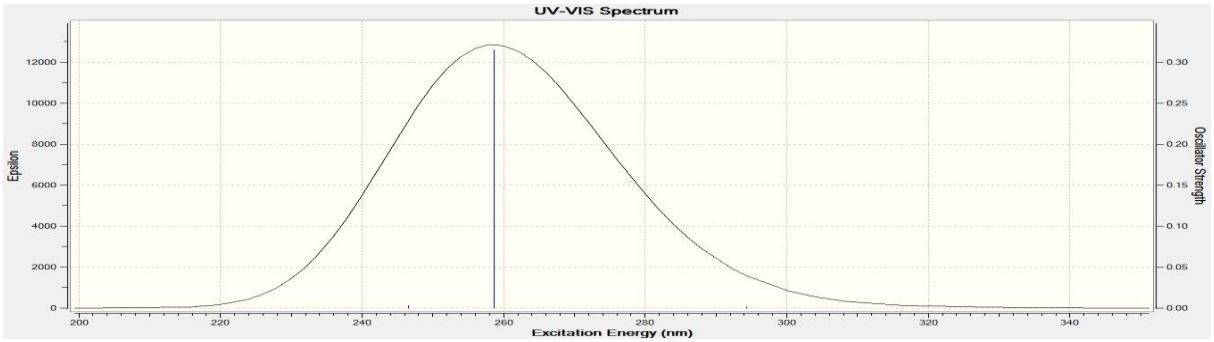
Figure 2. The correlation graphics of ^{13}C-NMR (Vacum, DMSO), ^{1}H-NMR (Vacum, DMSO) chemical shift values of 3-phenyl-4-[2-(4-nitrobenzoxy)-3-ethoxy-benzylideneamino]-4,5-dihydro-1*H*-1,2,4-triazol-5-one

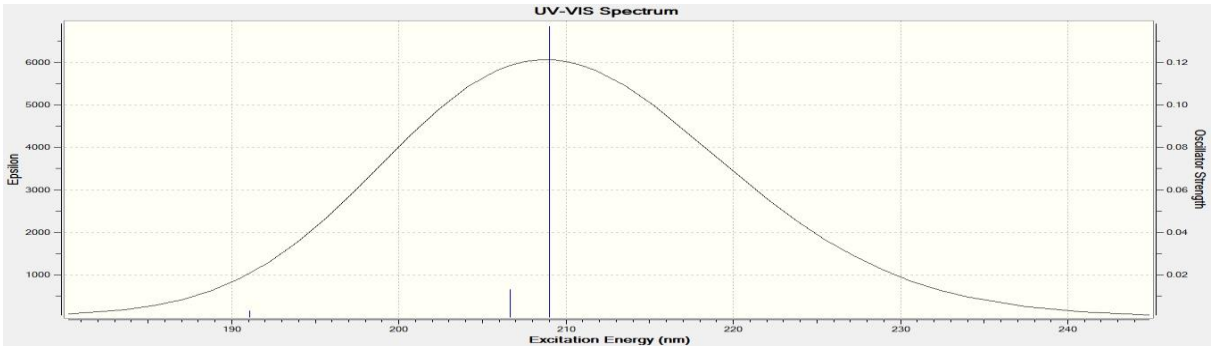
Table 4. The calculated frequencies values of the molecule

Vibration Types	Scaled DFT	Scaled HF
τ ClCCN(80), τ CCNN(10)	**18**	**13**
δ NNC(12), δ CCN(10), τ CCNN(18)	**29**	**29**
τ CCNN(18), τ NCCN(20), τ CCCC(11), τ CNNC(13)	**42**	**42**
τ CCCC(18), τ CNNC(11), τ NCCN(28)	**65**	**61**
τ ClCCN(10), τ CNNC(31)	**69**	**73**
τ CNNC(27), τ CCCC(19)	**80**	**80**
δ CCN(25), τ CNNC(17)	**101**	**99**
δ CCN(21), ClCCl(16)	**142**	**154**
δ CCC(13), τ CNNC(19)	**162**	**181**
δ ClCC(22), τ ClCCl(16)	**185**	**213**
δ NNC(16), δ CCN(29)	**250**	**247**
δ ClCCl(19)	**266**	**270**
δ CNN(14), δ OCN(11), τ HNNC(15)	**279**	**288**
ν CC(18), δ ClCCl(13)	**309**	**309**
τ NNCN(12), τ HNNC(15)	**330**	**324**
ν ClC(15), δ OCN(16)	**379**	**343**
δ CNN(12), δ OCN(14), τ NNCN(11)	**397**	**401**
τ CCCC(22), τ HCCC(15)	**402**	**407**
τ HNNC(23)	**438**	**446**
τ CCCC(17), τ HNNC(14)	**490**	**496**
δ OCN(10), τ HNNC(33)	**510**	**531**
δ ClC(17), τ ONNC(12)	**554**	**576**
δ CCC(57)	**606**	**603**
ν NC(11), δ OCN(21)	**611**	**616**
δ CCC(33), δ CNN(13)	**631**	**648**
τ CCCC(33), τ HCCC(10)	**665**	**691**
ν NN(10), ν ClC(14), δ OCN(13)	**675**	**703**
τ NNCN(22), τ CNNC(17), τ HCCC(10)	**684**	**706**
τ ONNC(48)	**706**	**757**
δ CNN(17)	**736**	**770**
τ CCCC(10), τ HCCC(18), τ ONNC(13)	**754**	**778**
τ ONNC(23), τ ClCClC(25)	**762**	**789**
ν ClC(36), τ ClCClC(10)	**777**	**807**
τ HCCC(94)	**835**	**864**
ν ClC(13), δ CCN(10)	**838**	**868**
δ NNC(17), τ HCCC(21)	**909**	**948**
ν NC(21)	**934**	**954**
ν CC(19), δ NNC(24)	**941**	**961**
ν CC(19), δ CCC(40)	**944**	**975**
τ HCCC(74)	**966**	**996**
ν CC(18), δ CCC(17), δ HCC(23)	**980**	**1012**
τ HCCC(41)	**1018**	**1015**
ν CC(28), δ HCC(27)	**1052**	**1058**
ν NN(469, δ HNN(14)	**1076**	**1068**
ν CC(27), δ HCC(22)	**1116**	**1095**
ν NC(14)	**1150**	**1127**
ν CC(13), ν NC(18), δ HCCl(14), τ CClCH(14)	**1171**	**1142**
ν CC(18), δ HCC(72)	**1175**	**1166**
ν CC(15), δ HCC(34)	**1203**	**1196**
ν NC(16), ν NN(12)	**1216**	**1236**
δ HCCl(47), τ CClCH(32)	**1234**	**1243**
ν CC(20), ν ClC(10), δ HCCl(11), τ CClCH(17), τ ClCClC(10)	**1292**	**1303**
δ HCC(62)	**1302**	**1319**
ν CC(14), ν NC(10), δ CNN(16)	**1318**	**1328**
δ HNN(68)	**1359**	**1391**
ν CC(19), δ HCC(24)	**1409**	**1437**

ν NC(14), ν NN(30), δ HCC(10)	**1439**	**1459**
δ HCC(47)	**1487**	**1499**
δ HNC(71)	**1503**	**1535**
ν CC(30), δ HCC(10)	**1554**	**1589**
ν CC(50), δ HCC(21)	**1582**	**1616**
ν NC(61), ν CC(12)	**1601**	**1665**
ν OC(57)	**1755**	**1790**
ν OC(62)	**1795**	**1827**
ν CH(91)	**3066**	**2985**
ν CH(48)	**3076**	**3004**
ν CH(84)	**3077**	**3015**
ν CH(53)	**3086**	**3025**
ν CH(65)	**3098**	**3035**
ν CH(67)	**3106**	**3039**
ν NH(50)	**3421**	**3423**
ν NH(50)	**3540**	**3518**

ν, stretching; δ, bending; δs, scissoring; ρ, rocking; γ, out-of-plane bending; τ, torsion





λ (nm)B3LYP/HF	**Excitation Energy(eV) B3LYP/HF**	***f*(Oscillator values) B3LYP/HF**
294.38/209.03	4.2117/5.9315	0.0010/0.1369
258.62/206.66	4.7941/5.9993	0.3151/0.0129
246.56/191.07	5.0286/6.4889	0.0034/0.0029

Figure 3. The absorption wavelength (λ), excitation energies and oscillator strengths (*f*) of the molecule

Table 5. The calculated dipole moment values of 3-phenyl-4-[2-(4-nitrobenzoxy)-3-ethoxy-benzylideneamino]-4,5-dihydro-1*H*-1,2,4-triazol-5-one

Dipole Moment	**B3LYP**	**HF**
μ_x	-3.6097	-4.2584
μ_y	-1.7751	-2.8553
μ_z	-0.2036	-0.1801
μ_{Toplam}	4.0277	5.1302

Table 6. The total energy of 3-phenyl-4-[2-(4-nitrobenzoxy)-3-ethoxy-benzylideneamino]-4,5-dihydro-1*H*-1,2,4-triazol-5-one

Energy	**B3LYP**	**HF**
(a.u.)	-1675.697	-1669.794

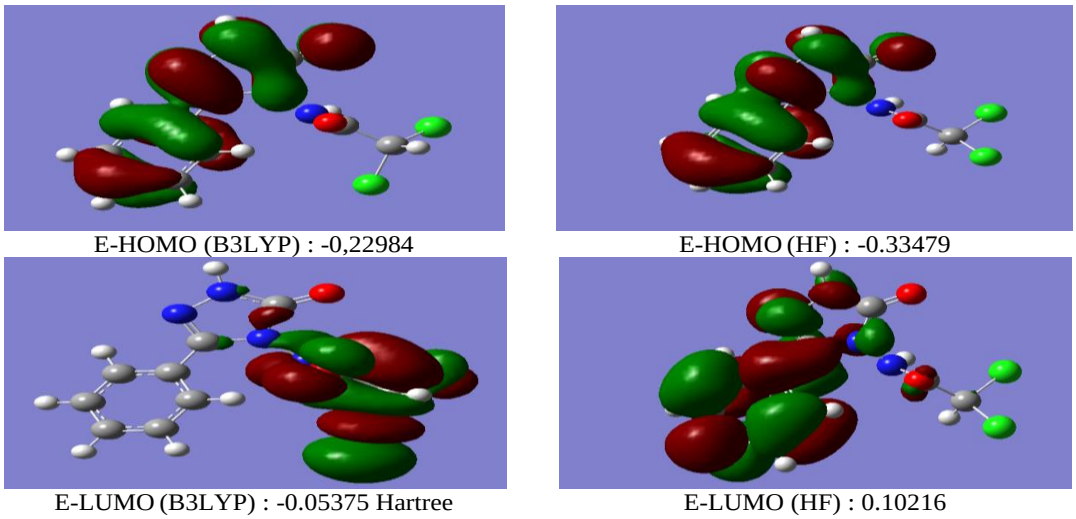


Figure 4. The calculated HOMO-LUMO energies of the molecule according to DFT/HF 6-31G(d) levels

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INVESTIGATION OF BIOLOGICAL PROPERTIES OF NEW 3-ALKYL(ARYL)-4-(3-ACETOXY-4-METHOXYBENZYLIDENAMINO)-4,5-DIHYDRO-1*H*-1,2,4-TRIAZOL-5-ONES

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Abstract: Some novel 3-alkyl(aryl)-4-(3-acetoxy-4-methoxybenzylidenamino)-4,5-dihydro-1*H*-1,2,4-triazol-5-ones (**4a-h**) were synthesized from the reactions of 3-alkyl(aryl)-4-amino-4,5-dihydro-1*H*-1,2,4-triazol-5-ones (**2a-h**) with 3-acetoxy-4-methoxybenzaldehyde (**3**). The new compounds were characterized using by elemental analyses and IR, ^{1}H-NMR, ^{13}C-NMR and UV spectral data. Antimicrobial activity of the compounds **4a-h** were also evaluated against six bacteria such as *Escherichia coli, Pseudomonas aeruginosa, Staphylococcus aureus, Bacillus subtilis, Bacillus cereus and Klebsiella pneumoniae.*

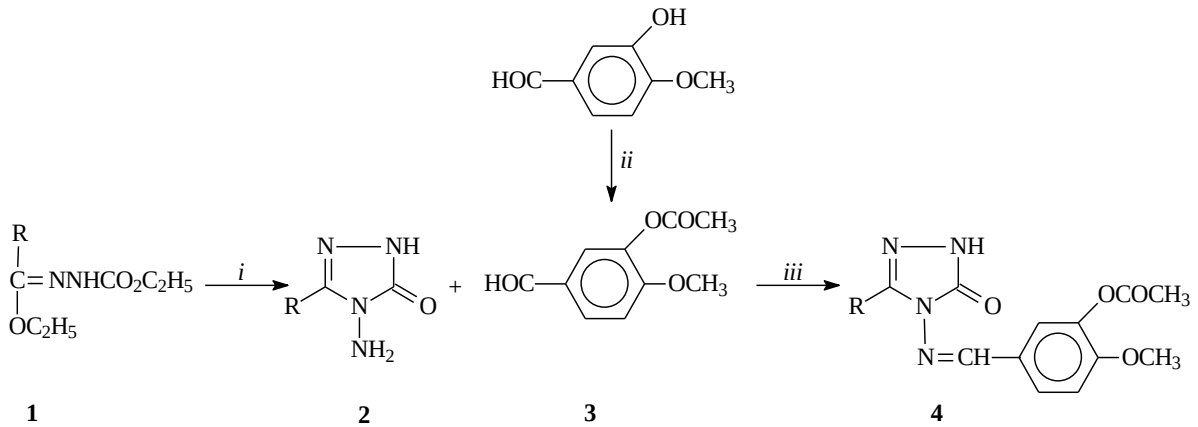
Keywords: 4,5-Dihydro-1*H*-1,2,4-triazol-5-one, Schiff base, Synthesis, Antimicrobial activity

Introduction

1,2,4-Triazole and 4,5-dihydro-1*H*-1,2,4-triazol-5-one derivatives are reported to possess a broad spectrum of biological activities such as antifungal, antimicrobial, hypoglycemic, antihypertensive, analgesic, antiviral, antitumor, antioxidant and anti-HIV properties (Aktas-Yokus, Yuksek, Gursoy-Kol, & Alpay-Karaoglu, 2015; Ali, Ragab, Farghaly, & Abdalla, 2011; Chidananda et al., 2012; Demirbas & Ugurluoglu, 2004; Henen, El Bialy, Goda, Nasr, & Eisa, 2012; Li et al., 2013; Yuksek et al., 1997; Yüksek et al., 2013). In addition, several articles reporting the synthesis of some N-arylidenamino-4,5-dihydro-1*H*-1,2,4-triazol-5-one derivatives have been published (Aktas-Yokus et al., 2015; Yuksek et al., 1997).

In the past 25 years, the incidence of microbial infection has increased on alarming levels all over the world as a result of antimicrobial resistance. A growing number of immuno-compromised patients are as a result of cancer chemotherapy, organ transplantation and HIV infection which are the major factors contributing to this increase. The health problem demands to search and synthesize a new class of antimicrobial compounds effective against pathogenic microorganisms that developed resistance to the antibiotics used in the current regiment (Bayrak, Demirbas, Karaoglu, & Demirbas, 2009; Bonde & Gaikwad, 2004; Koca et al., 2005; Yu & Huiyuan, 2002).

In the present study, the antimicrobial activities of eight new 3-alkyl(aryl)-4-(3-acetoxy-4-methoxybenzylidenamino)-4,5-dihydro-1*H*-1,2,4-triazol-5-ones (**4a-h**), which were synthesized by the reactions of 3-alkyl-4-amino-4,5-dihydro-1*H*-1,2,4-triazol-5-ones (**3a-h**) with 3-acetoxy-4-methoxy-benzaldehyde were determined (Scheme **1**).



1 **2** **3** **4**

i) $N_2H_4.H_2O$, reflux, 6 h; ii) Ac_2O, reflux, 1h; iii) AcOH, reflux, 1 h
a) R = CH_3, b) R = CH_2CH_3, c) R = $CH_2CH_2CH_3$, d) R = $CH_2C_6H_5$, e) R = $CH_2C_6H_4CH_3$ (p-), f) R = $CH_2C_6H_4OCH_3$ (*p*-), g) R = $CH_2C_6H_4Cl$ (*p*-), h) R = C_6H_5

Scheme 1. Synthesis pathway compounds 4

Methods

Chemical reagents and all solvents used in this study were purchased from Merck AG, Aldrich and Fluka. Melting points which were uncorrected were determined in open glass capillaries using an Electrothermal 9100 digital melting point apparatus. The IR spectra were obtained on a Perkin-Elmer Instruments Spectrum One FT-IR spectrometer. ^{1}H and ^{13}C NMR spectra were recorded in deuterated dimethyl sulfoxide with TMS as internal standard using a Bruker Ultrashield spectrometer at 200 MHz and 50 MHz, respectively. UV absorption spectra were measured in 10 mm quartz cells between 200 and 400 nm using a Schimadzu-1201 UV/VIS spectrometer. Extinction coefficients (ε) are expressed in $L \cdot mol^{-1} \cdot cm^{-1}$. Elemental analyses were carried out on a Leco Truspec (CHN).

The starting compounds **2a-h** were prepared from the reactions of the corresponding ester ethoxycarbonylhydrazones (**1a-h**) with an aqueous solution of hydrazine hydrate as described in the literature (Ikizler & Yüksek, 1993; Ikizler & Un, 1979).

General procedure for the synthesis of 3-alkyl(aryl)-4-(3-acetoxy-4-methoxybenzyliden-amino)-4,5-dihydro-1*H*-1,2,4-triazol-5-ones (4a-h)
3-Hydroxy-4-methoxybenzaldehyde 3 (0.01 mol) was refluxed with acetic anhydride (15 mL) for 0.5 h. After addition of absolute ethanol (50 mL), the mixture was refluxed for 1 h more. Evaporation of the resulting solution at 40-45 °C in vacuo and several recrystallizations of the residue from EtOH gave pure compound **3**. White solid; m.p: 86-88°C; IR (KBr) 2862 and 2750 (CHO), 1764, 1678 (C=O) cm^{-1}. The corresponding compound **2** (0.01 mol) was dissolved in acetic acid (15 ml) and treated with 3-acetoxy-4-methoxybenzaldehyde (**3**) (0.01 mol). The mixture was refluxed for 1.5 h and then evaporated at 50-55 °C *in vacuo*. Several recrystallizations of the residue from an appropriate solvent gave pure compounds **4a-h** as colourless crystals.

3-Methyl-4-(3-acetoxy-4-methoxybenzylidenamino)-4,5-dihydro-1*H*-1,2,4-triazol-5-one (4a)
Yield 96%, m.p. 206-208°C. IR (KBr): 3179 (NH), 1757, 1710 (C=O), 1608 (C=N), 1273 (COO) cm^{-1}. ^{1}H NMR (DMSO-d_6): δ 2.26 (s, 3H, CH_3), 2.28 (s, 3H, $COCH_3$), 3.85 (s, 3H, OCH_3), 7.24 (d, 1H, ArH, *J*=8.60 Hz), 7.61 (s, 1H, ArH), 7.67 (d, 1H, ArH, *J*=8.60 Hz), 9.60 (s, 1H, N=CH), 11.57 (s, 1H, NH). ^{13}C NMR (DMSO-d_6): δ 11.57 (CH_3), 20.83 ($CO\underline{C}H_3$), 56.57 (OCH_3), 113.35, 121.21, 126.75, 128.60, 140.18, 154.82 (arom-C), 144.70 (triazole C_3), 151.73 (N=CH), 153.44 (triazole C_5), 168.95 (C=O). UV λ_{max} (ε): 302 (16800), 272 (14980), 234 (16540) nm. Anal. Calcd. For $C_{13}H_{14}N_4O_4$: C, 53.79; H, 4.86; N, 19.30. Found: C, 53.89; H, 4.97; N, 19.50.

3-Ethyl-4-(3-acetoxy-4-methoxybenzylidenamino)-4,5-dihydro-1H-1,2,4-triazol-5-one (4b)
Yield 98%, m.p. 258-260°C. IR (KBr): 3190 (NH), 1760, 1710 (C=O), 1605 (C=N), 1270 (COO) cm^{-1}. ^{1}H NMR (DMSO-d_6): δ 1.20 (m, 3H, $CH_2\underline{CH_3}$), 2.30-2.60 (m, 5H, $\underline{CH_2}CH_3$ + $COCH_3$), 3.86 (s, 3H, OCH_3), 6.98-7.51 (m, 3H, ArH), 9.49 (s, 1H, N=CH), 11.74 (s, 1H, NH). UV λ_{max} (ε): 318 (17690), 308 (17280), 238 (18940), 214 (13080) nm.

3-n-Propyl-4-(3-acetoxy-4-methoxybenzylidenamino)-4,5-dihydro-1H-1,2,4-triazol-5-one (4c)
Yield 99%, m.p. 172-174°C. IR (KBr): 3178 (NH), 1765, 1705 (C=O), 1604, 1590 (C=N), 1276 (COO) cm^{-1}. ^1H NMR (DMSO-d_6): δ 0.95 (t, 3H, $CH_2CH_2CH_3$, *J*=7.40 Hz), 1.68 (sext, 3H, $CH_2\underline{CH_2}CH_3$, *J*=7.40 Hz), 2.30 (s, 3H, $COCH_3$), 2.63 (t, 3H, $\underline{CH_2}CH_2CH_3$, *J*=7.30 Hz), 3.83 (s, 3H, OCH_3), 7.24 (d, 1H, ArH, *J*=8.60 Hz), 7.59 (s, 1H, ArH), 7.68 (d, 1H, ArH, *J*=8.60 Hz), 9.60 (s, 1H, N=CH), 11.80 (s, 1H, NH). UV λ_{max} (ε): 316 (16020), 302 (16650), 296 (16760), 236 (16520) nm.

3-Benzyl-4-(3-acetoxy-4-methoxybenzylidenamino)-4,5-dihydro-1H-1,2,4-triazol-5-one (4d)
Yield 94%, m.p. 191-193°C. IR (KBr): 3158 (NH), 1758, 1705 (C=O), 1606, 1592 (C=N), 1276 (COO), 760 and 704 (monosubstituted benzenoid ring) cm^{-1}. ^1H NMR (DMSO-d_6): δ 2.30 (s, 3H, $COCH_3$), 3.85 (s, 3H, OCH_3), 4.05 (s, 2H, CH_2Ph), 7.17-7.31 (m, 6H, ArH), 7.55 (s, 1H, ArH), 7.65 (d, 1H, ArH, *J*=8.60 Hz), 9.58 (s, 1H, N=CH), 11.90 (s, 1H, NH). UV λ_{max} (ε): 306 (17990), 234 (21870), 208 (14050) nm. Anal. Calcd. For $C_{19}H_{18}N_4O_4$: C, 62.29; H, 4.95; N, 15.29. Found: C, 62.12; H, 4.45; N, 14.30.

3-(p-Methylbenzyl)-4-(3-acetoxy-4-methoxybenzylidenamino)-4,5-dihydro-1H-1,2,4-triazol-5-one (4e)
Yield 99%, m.p. 194-196°C. IR (KBr): 3159 (NH), 1768, 1706 (C=O), 1604, 1590 (C=N), 1278 (COO), 802 (1,4-disubstituted benzenoid ring) cm^{-1}. ^1H NMR (DMSO-d_6): δ 2.20 (s, 3H, CH_3), 2.30 (s, 3H, $COCH_3$), 3.85 (s, 3H, OCH_3), 3.98 (s, 2H, CH_2Ph), 7.09 (d, 2H, ArH, *J*=8.00 Hz), 7.17-7.25 (m, 3H, ArH), 7.54 (s, 1H, ArH), 7.65 (d, 1H, ArH, *J*=8.60 Hz), 9.55 (s, 1H, N=CH), 11.90 (s, 1H, NH). ^{13}C NMR (DMSO-d_6): δ 20.66 (CH_3), 20.85 ($CO\underline{C}H_3$), 31.18 (CH_2Ph), 56.58 (OCH_3), 113.39, 121.47, 126.63, 128.38, 129.14 (2C), 129.48 (2C), 133.17, 136.21, 140.13, 153.97 (arom-C), 146.81 (triazole C_3), 151.71 (N=CH), 153.10 (triazole C_5), 168.94 (C=O). UV λ_{max} (ε): 302 (19620), 296 (19300), 234 (19700), 226 (18220) nm.

3-(p-Methoxybenzyl)-4-(3-acetoxy-4-methoxybenzylidenamino)-4,5-dihydro-1H-1,2,4-triazol-5-one (4f)
Yield 94%, m.p. 189-191°C. IR (KBr): 3158 (NH), 1752, 1705 (C=O), 1614, 1591 (C=N), 1275 (COO), 802 (1,4-disubstituted benzenoid ring) cm^{-1}. ^1H NMR (DMSO-d_6): δ 2.30 (s, 3H, $COCH_3$), 3.70 (s, 3H, *p*-OCH_3), 3.85 (s, 3H, OCH_3), 3.95 (s, 2H, CH_2Ph), 6.85 (d, 2H, ArH), 7.15-7.25 (m, 3H, ArH), 7.56 (s, 1H, ArH), 7.66 (d, 1H, ArH, *J*=8.60 Hz), 9.58 (s, 1H, N=CH), 11.60 (s, 1H, NH). ^{13}C NMR (DMSO-d_6): δ 20.85 (CH_3), 20.85 ($CO\underline{C}H_3$), 30.71 (CH_2Ph), 55.45 (*p*-OCH_3), 56.58 (OCH_3), 113.40, 114.33 (2C), 121.49, 126.65, 128.04, 128.38, 130.59 (2C), 140.15, 153.97, 158.52 (arom-C), 146.97 (triazole C_3), 151.80 (N=CH), 153.13 (triazole C_5), 168.95 (C=O).

3-(p-Chlorolbenzyl)-4-(3-acetoxy-4-methoxybenzylidenamino)-4,5-dihydro-1H-1,2,4-triazol-5-one (4g)
Yield 98%, m.p. 208-210°C. IR (KBr): 3159 (NH), 1770, 1705 (C=O), 1603, 1590 (C=N), 1276 (COO), 801 (1,4-disubstituted benzenoid ring) cm^{-1}. ^1H NMR (DMSO-d_6): δ 2.30 (s, 3H, $COCH_3$), 3.85 (s, 3H, OCH_3), 3.95 (s, 2H, CH_2Ph), 7.24 (d, 1H, ArH, *J*=8.60 Hz), 7.33-7.39 (m, 4H, ArH), 7.55 (s, 1H, ArH), 7.66 (d, 1H, ArH, *J*=8.60 Hz), 9.60 (s, 1H, N=CH), 11.95 (s, 1H, NH). UV λ_{max} (ε): 306 (21690), 232 (26100) nm.

3-Phenyl-4-(3-acetoxy-4-methoxybenzylidenamino)-4,5-dihydro-1H-1,2,4-triazol-5-one (4h)
Yield 91%, m.p. 182-184°C. IR (KBr): 3192 (NH), 1763, 1689 (C=O), 1611, 1595 (C=N), 1278 (COO), 769 and 689 (monosubstituted benzenoid ring) cm^{-1}. ^1H NMR (DMSO-d_6): δ 2.38 (s, 3H, $COCH_3$), 3.86 (s, 3H, OCH_3), 7.26 (d, 1H, ArH, *J*=8.60 Hz), 7.50-7.55 (m, 4H, ArH), 7.71 (d, 1H, ArH, *J*=8.60 Hz), 7.86-7.90 (m, 2H, ArH), 9.50 (s, 1H, N=CH), 12.30 (s, 1H, NH). ^{13}C NMR (DMSO-d_6): δ 20.83 ($CO\underline{C}H_3$), 56.65 (OCH_3), 113.53, 121.94, 123.01, 125.83, 126.45, 128.28 (2C), 128.76 (2C), 130.55, 140.13, 156.83 (arom-C), 147.51 (triazole C_3), 151.62 (N=CH), 154.21 (triazole C_5), 169.10 (C=O). UV λ_{max} (ε): 312 (19330), 304 (19900), 292 (19930), 260 (19900), 24 (20430), 222 (16840) nm.

Antimicrobial Activity

Simple susceptibility screening test using agar-well diffusion method (Perez, Pauli, & Bazerque, 1990) as adapted earlier (Ahmad, Mehmood, & Mohammad, 1998) was used for determination of antimicrobial activities of 4a-h compounds. All test microorganisms were obtained from the Microbiologics Environmental Protection Laboratories Company in France and are as follows; *Escherichia coli* ATCC 259222, *Pseudomonas aeruginosa* ATCC 27853, *Klebsiella pneumoniae* ATCC 4352, *Staphylococcus aureus* ATCC 6538, *Bacillus subtilis* ATCC 11774, *Bacillus cereus* ATCC 11778. All the newly synthesized compounds were weighed and dissolved in dimethylsulphoxide (DMSO) to prepare extract stock solution of 1 mg/ml.

Each microorganism was suspended in Mueller-Hinton Broth and diluted to 106 colony forming unit (cfu) per ml. They were "flood-inoculated" onto the surface of Mueller Hinton Agar and then dried. Five-millimeter diameter wells were cut from the agar using a sterile cork-borer and 250–5000 µg/50 µl of the chemical

substances were delivered into the wells. The plates were incubated for 18 h at 35 °C. Antimicrobial activity was evaluated by measuring the zone of inhibition against the test organism. Dimethylsulphoxide was used as solved control.

Results and Findings

In this study, the structures of eight new 3-alkyl(aryl)-4-(3-acetoxy-4-methoxybenzylidenamino)-4,5-dihydro-1*H*-1,2,4-triazol-5-ones (**4a-h**) were identified using by elemental analyses and IR, ^{1}H-NMR, ^{13}C-NMR and UV spectral data.

Antimicrobial Activity

The observed data for the antimicrobial activity of **4a-h** compounds are given in Table **1**. The data reveal that, the highest zone diameter was obtained from **4a** compound against Ec: *Escherichia coli* (ATCC 25922). The screening data also indicate that all of the compounds were found to be effective against *Klepsiella pneumoniae* (ATCC 4352) and *Escherichia coli* (ATCC 25922) strains.

Table 1: Screening for antimicrobial activity of the 4 type compounds

Compound	Microorganisms and inhibition zone (mm)					
	Bs	**Bc**	**Pa**	**Kp**	**Sa**	**Ec**
4a	-	13	-	18	-	26
4b	-	9	-	16	-	13
4c	-	11	-	19	-	14
4d	-	7	-	13	-	16
4e	9	8	-	13	-	17
4f	-	12	-	15	-	13
4g	-	-	-	15	-	11
4h	-	-	-	15	-	14

Bs: *Bacillus subtilis* (ATCC 10978), Bc: *Bacillus cereus* (ATCC 11778), Pa: *Pseudomonas aeruginosa (*ATCC 43288), Kp: *Klepsiella pneumoniae* (ATCC 4352), Sa: *Staphylococcus aureus* (ATCC 6538), Ec: *Escherichia coli* (ATCC 25922).

Conclusion

The synthesis and *in-vitro* antimicrobial evaluation of new 4,5-dihydro-1*H*-1,2,4-triazol-5-one derivatives were described. From the screening results, all of the compounds, especially compound **4a**, were found to be effective against *Klepsiella pneumoniae* and *Escherichia coli* strains. Design and synthesis of novel small molecules can play specifically a protective role in biological systems and in modern medicinal chemistry.

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WEB BASED MEDICAL ARCHIVE SYSTEM DESIGN AND IMPLEMENTATION

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Abstract: Along with the developments in technology and internet, the need of moving data to electronic environment is increasing. In addition, also the management of the increased amount of data is becoming more difficult and the data needs to be checked. Nowadays, one of the most important institutions in which large amounts of data need to be controlled is the hospitals. In hospitals, to which hundreds of patients enter each day, many different types of data related to the patients need to be stored. For effectively use of the right of knowledge acquisition of individuals, the institutions; have to submit the subjects of information and documents entering into the field of their duties and services and the file plans showing in which units they are included, by using information communication technologies. Many hospitals are performing the job of data storage by using the archive shelves. However, this method makes fulfilling their duties such as archiving, reaching to information difficult information retrieval etc., in parallel with the increasing amount of data. For this reason, archival software programs, which will ensure to transfer the files into electronic environment, are needed. Within this study, an archive and file tracking system has been developed for hospitals. With the developed system, it is ensured to archive the patient files, as well as it is aimed to prevent file losses. At the same time, the length of time that is spent by the hospital staff to access to retrospective patient information has also been significantly reduced.

Keywords: E- archive, medical data, three tiered architecture

Introduction

Documents have existed from the first registration procedures. Nowadays, along with the transformation of institutions into information processing units, the importance of document and information management has increased. Institutions use Management Information Systems (MIS) in order to organize the information and they use Document Management Systems in order to access documents in a timely manner (Guan et al., 2012, T.C. MEB (Ministry Of National Educatıon) 2008). With these developed systems, while the flow of documents is accelerated, the duration of access to documents decreases significantly (Isaac 1993).

Public and private institutions use electronic documents in order to be able to perform the transactions faster and more efficiently. Using of electronic documents has many benefits. Some of these may be listed as; taking the documents with high historical value under protection, their occupying little physical space, their being useful especially for some types of services in terms of speed, and administrative control (Bian et al., 2010).

Because of various computer programs, electronic documents used in corporations can be archived and the workflow can be managed virtually. By means of these programs, fax / e-mail processes can be done in electronic environment without using paper. These systems at the same time store documents created in virtual environments, they also allow you to add more than one criteria to the document (Kawano 2011). Thus, we can reach the information fast by making query with additional information that will make it easier for us to find it, as well as its pure content of the information. In recent years, storing of medical data electronically has also become an important field of study. There are many academic researches made on this subject (Hiroyasu et al., 2012, Huang 2003, Munch et al., 2004, Suh et al., 2002). When the studies made are examined, it is seen that most of the systems developed are only the systems that ensure to store only these high-resolution patient images (x-ray, ultrasound, etc.) and the systems that ensure to reach the stored images fast. In this study, an archiving system, which stores patient images effectively as well as all the information related to the patient, all notes

taken by the doctors and results related to the patient, was developed differently than the other existing systems in literature.

Archiving systems are divided into two main classes including software-based products and hardware-based products (Cook 1986). Software-based products are often confronted as packages, which have been built on databases and have text processing and indexing abilities. The main goal here is to upload the basic information related to an organization, which has a large number of documents, into a single computer one by one and to find out the information being searched for by searching the data on the computer when information is needed on a particular subject (Emmerson 1989). This is, in a sense, is a computerized form of a document register in government offices.

On the other hand, hardware-based products usually consist of a scanner and an optical disc. The main goal here is to do what the software-based products do not, in short, to bring the document in front of us. For this purpose, firstly it is required to create the image of the document and transfer it to the computer. At this stage, scanners are used. Since the scanned document images occupy large areas in the electronic environment, they must first be compressed and then recorded in the optical disc (Peterson, 1987).

The improved system is both software and hardware-based. The main goal is to transfer the patient files kept in the hospital archive into the electronic environment. For this purpose, a software and hardware based archiving structure has been created along with a server, in which files will be stored by using browsers through which the files will be transferred into electronic environment. The created system is a system, which is appropriate for the structure of the documents of hospitals. It is therefore a dynamic system, which is open also to future developments in order to meet all of the archiving requirements of the hospitals. The categorization of the contents of the patient files also has been done completely according to hospital's patient file system. The personal T.R. Identity numbers and the file numbers created previously have been associated to each other and transferred to electronic environment. At the same time, various data compression techniques also have been used in order to store the scanned data efficiently. Thus, the filing errors that may occur in the future and the memory requirement also have been minimized.

In the second part of the study, firstly the three-tiered client-server architecture used to initially store the data will be explained in detail. In the third section, experimental studies, which show the effectiveness of the system, will be taken place. On the other hand, in the fourth section, the results related to the developed system will be explained.

System Architecture

When the hospital archives are considered, it is seen that the data to be stored in the system will be large-scale data. A three-tiered client-server architecture, shown in Figure 1, has been preferred to enable the system to be used in the future to have a flexible architecture and to ensure fault management efficiently. The three-tiered architecture ensures task sharing among the servers, for this reason it ensures increase in both security and system performance.

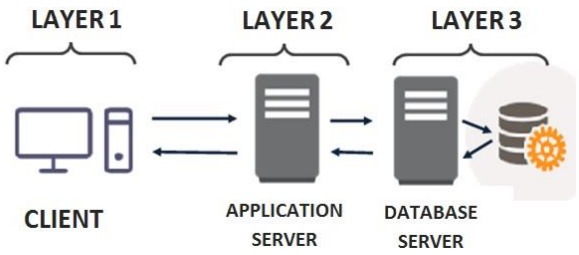
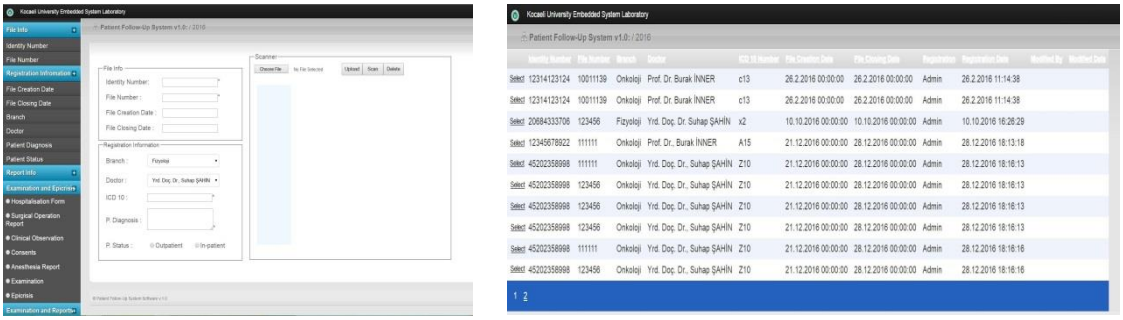


Figure 1. Three three-tier archive system architecture

In the architecture shown in Figure 1, the client located in the first layer transmits the requests to the server on the internet and the server located in the second layer returns results to the server in accordance with the request of the client. The application software is stored in the application server. Documents / information sent via the client are sent to the database server for being stored. In the database, there is a hierarchical database structure, which is suitable for hospital data. MS SQL is used as the database infrastructure. A dynamic database has been designed. The MS SQL database also enables data sent from many scanners to be able to be simultaneously transferred to the database along with its multi-user support.

The main goal of the developed system is to make the documents reachable from anywhere. The network architecture to be established for this purpose must also be an improvable and scalable architecture. A file passes through three different stages during the archiving process. These can be listed as the documents' being scanned and transferred to the system through the users; transmitting the documents transferred to the system to the main server/ servers to be stored and ensuring the coordination between the software and the hardware. When these stages are examined, it has been determined that the system will consist of three different modules. These can be listed as user module, administrative module and communication module.

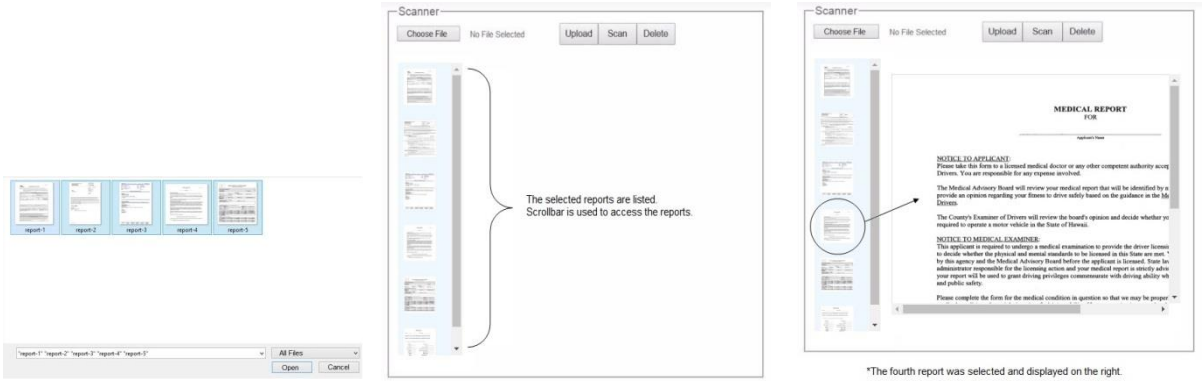


(a) (b)

Figure 2. User and administrator module interfaces

The user module represents the software that will run on the client side of the system. This module has different functions such as adding new documents into the system, organizing the added documents at later times, listing, searching and deleting of the documents. The second module, which is the administrator module, will be active on the server side. This module has features such as institution-specific document structure and identification of new users, authorization of identified users, identifying of new categories into the system and arrangement of existing categories, evaluation of requests coming from the user module, user-based restriction of access to documents and reporting. The aim of the last module, which is the communication module, is to provide coordination between client/server and software/hardware. This module is responsible for both the integration of the scanner with the application and of transmission and storage of documents into the servers without any problems. In Figure 2, the interfaces developed according to user and manager modules are shown.

The user module consists of six main parts as shown also in Figure 2. These are file details, recording details, report details, examination and epicrisis, judicial health board and the other sections of the module. The file details section contains the number of the file, the ID number of the user to which it belongs, and the opening and closing dates of the file. In the record details section, there are diagnostic and treatment details related to the illness in the file of the relevant patient. In reporting details, examination, epicrisis and other sections, there is more detailed disease and conclusion information related to the patient. There is a section on the right of user screen, where the reports available in the patient's system can be displayed and in short, where the reports can be filed by being scanned as batch. A display image, which shows that the report displaying process can be done as batch, is shown in Figure 3. The system allows files with .jpg, .png and .jpeg extensions to be uploaded into the system. Otherwise, a warning screen, which shows that the file format is not appropriate, is displayed. In Figure 3(b), how the five reports uploaded into the system after the batch report uploading are listed via the scroll bar is shown. The reports scanned or desired to be displayed by batch uploading are listed in the scroll bar alphabetically. The reports desired to be displayed in detail can be selected and displayed as shown in Figure 3(c).



(a) (b) (c)

Figure 3. User module file upload and file scan interfaces

An administrator module has been developed as shown in Figure 2(b) in order to control the authenticity of the data uploaded by the archivists to the system via the user module. On this page, all data entered by the archivists will be able to be displayed. Since the module's aim is to control the authenticity of the desired data, all new-opened files enter the system in unauthorized way and only the files approved by the administrator are allowed to be archived. As it can be viewed also in Figure 2(b), the system enables the files to be filtered with and without authorization.

Results and Findings

8 GB RAM, 3.60 GHz AMD FX(tm)-4100 Quad Core Processor and application server with 200 GB memory and a Canon brand DR-M160II model scanner have been used in order to get performance results related to the system. The selected scanner is an ideal desktop device for intensive scanning works. It has the feature to simultaneously scan 60 pages on single face and 120 pages on double face. In Table 1, the processing durations required by the system developed to store 2, 4, 8, 16 and 32 documents in the archive system for scanning operations at different resolution values are shown. Similarly, in Table 2, the processing durations gained for different resolution values to be able to transfer a document into the system when more than one user performs concurrent process on the system.

Table 1. Process time under different resolutions for different number of documents

		Resolution (dpi)			
	# of document	**200 dpi**	**300 dpi**	**400 dpi**	**600 dpi**
Process Time (sec.)	**2**	10	10	10	11
	4	16	17	17	17
	8	30	30	31	32
	16	57	58	58	59
	32	112	111	112	113

Table 2. Average process time for concurrent requests for a specific document

		Resolution (dpi)			
	# of users	**200 dpi**	**300 dpi**	**400 dpi**	**600 dpi**
Process Time (sec.)	**1**	10	10	10	11
	2	12	12	13	14
	3	16	16	16	16
	4	20	20	21	21

When the results in Table 1 are examined, it is seen that there is a 1 second or 2 seconds of difference in the process duration even though the scanning resolution increases for the documents to be archived. Changing of the scan resolution does not have a serious effect on the response time of the system. On the other hand, when the number of documents to be simultaneously archived is increased, around 4 sec was needed for each document to be archived. From this, it has been determined that a document of the system can be archived in about 4 seconds independent from resolution. When the results in Table 2 are examined, it has been determined that the scanning resolution, which was selected in tests made with different number of users for a document, did not have any influence over the process time as similar to the results in Table 1. It has been determined that when the number of users, who are simultaneously requesting, reaches to four times, the system response time also became double, as well. This response time is approximately 20 seconds for 4 users. As can be understood from the results, process times are less than 1 minute even for 4 simultaneous users. The obtained results show that the developed archive software can perform the archiving process efficiently and productively.

Conclusion

With this study made, Patient Files Archiving and Tracking System was developed for Kocaeli University Hospital. Thus, while it has been ensured to archive the patient files, as well as file losses have also been prevented. The system has a filing architecture which is appropriate for hospital infrastructure. While creating the electronic folder infrastructure all file types that can be used have been considered. With a lot of user-support in the system, the data was scanned by many users simultaneously and was ensured to be transferred to the database simultaneously via the clients. Integration of the hardware (scanner/computers) used with the software has been done correctly and completely. A secure access infrastructure has been provided with the authorization of users at different levels. Because of the compression mechanism used, the documents have been ensured to be stored without occupying unnecessary place, this way storage area problems that may occur in the future has

been prevented. With the performance tests performed, the effectiveness of the archive software and its appropriateness for large file systems are also shown. Since the system ensures to create a database dynamically, it is an efficient and fast system that can be used not only in hospitals but also in all institutions in need of archiving.

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POTENTIOMETRIC TITRATIONS OF SOME [2-METHOXY-5-(3-ALKYL/ARYL-4,5-DIHYDRO-1*H*-1,2,4-TRIAZOL-5-ONE-4-YL)-AZOMETHIN]PHENYL BENZOATES

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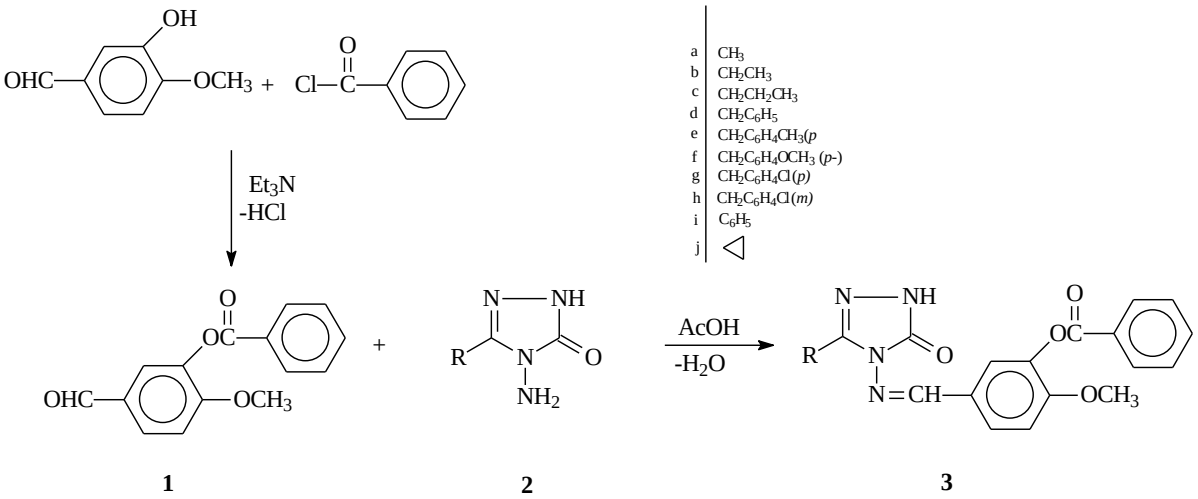
Abstract: Determination of pK_a values of the active constituent of certain pharmaceutical preparations is important because the distribution, transport behaviour, bonding to receptors, and contributions to the metabolic behaviour of the active constituent molecules depend on the ionization constant. In the present study, ten synthesized [2-methoxy-5-(3-alkyl/aryl-4,5-dihydro-1*H*-1,2,4-triazol-5-one-4-yl)-azomethin]phenyl benzoates which were obtained according to Bahçeci et al, were titrated potentiometrically with tetrabutylammonium hydroxide in four non-aqueous solvents such as acetonitrile, isopropyl alcohol, tert-butyl alcohol, and *N*,*N*-dimethylformamide, and the half-neutralization potential values. The corresponding pK_a values were determined for all cases.

Keywords: 4,5-Dihydro-1H-1,2,4-triazol-5-one, schiff base, acidity, potentiometric titration

Introduction

1,2,4-Triazole and 4,5-dihydro-1*H*-1,2,4-triazol-5-one derivatives are reported to possess a broad spectrum of biological activities such as antifungal, antimicrobial, hypoglycemic, antihypertensive, analgesic, antiparasitic, hypocholesteremic, antiviral, anti-inflammatory, antitumor and anti-HIV properties (Bhat, Bhat & Shenoy, 2001; Modzelewska-Banachiewicz et al., 2000; Varvaresou, 2000; Witkowski, 1973; Burzozowski, 1998; Katica et al., 2001; Wang, You & Xu, 1996; Ikizler, 1998; Demirbaş, 2001; Ulusoy, Gursoy & Otuk, 2001; Yüksek et al., 1997; Ikizler et al., 1997; Ikizler et al., 1998). In addition, several articles reporting the synthesis of some *N*-arylidenamino-4,5-dihydro-1*H*-1,2,4-triazol-5-one derivatives have been published (Ikizler et al., 1997; Ikizler et al., 1998; Ikizler & Yüksek, 1994; Bahçeci et al., 2002a; Bahçeci et al., 2002b). The acetylation and methylation of 4,5-dihydro-1*H*-1,2,4-triazol-5-one derivatives have also been reported (Yüksek et al., 1997; Bahçeci et al., 2002a; Bahçeci et al., 2002b; Ikizler & Yüksek, 1993). On the other hand, it is known that 1,2,4-triazole and 4,5-dihydro-1*H*-1,2,4-triazol-5-one rings have weak acidic properties, so some 1,2,4-triazole and 4,5-dihydro-1*H*-1,2,4-triazol-5-one derivatives were titrated potentiometrically with tetrabutylammonium hydroxide in non-aqueous solvents, and the corresponding p*K*a values of the compounds were determined (Bahçeci et al., 2002a; Bahçeci et al., 2002b; Yüksek et al., 2003; Yüksek et al., 2004; Ikizler et al., 1988; Ikizler & Erdoğan, 1988; Ikizler et al., 1988).

This paper describes the synthesis of a series of [2-methoxy-5-(3-alkyl/aryl-4,5-dihydro-1H-1,2,4-triazol-5-one-4-yl)-azomethin]phenyl benzoates **(3)** from the reactions of 3-alkyl(aryl)-4-amino-4,5-dihydro-1*H*-1,2,4-triazol-5-ones **(2)** with 3-benzoxy-4-methoxybenzaldehyde **(1)** (Bahçeci et al., 2016) (Scheme **1**). The starting compounds **2a-j** were prepared from the reactions of the corresponding ester ethoxycarbonylhydrazones with an aqueous solution of hydrazine hydrate as described in the literatüre (Ikizler & Yüksek, 1994; Ikizler & Un, 1991). Furthermore, we also examined the potentiometric titrations of the synthesized compounds **3a-j** with tetrabutylammonium hydroxide (TBAH) in four non-aqueous solvents (isopropyl alcohol, *tert*-butyl alcohol, acetone and *N*,*N*-dimethylformamide} to determine the corresponding half-neutralization potentials (HNP) and the corresponding p*K*a values. The data obtained from the potentiometric titrations were interpreted and the effects of molecular structure and solvents were studied (Bahçeci et al., 2002a; Bahçeci et al., 2002b; Yüksek et al., 2003; Yüksek et al., 2004; Ikizler et al., 1988; Ikizler & Erdoğan, 1988; Ikizler et al., 1988; Gündüz, 1998).



Scheme 1: Synthesis of compounds of type 3

Method

In this study, a Jenway 3040 ion analyser pH meter equipped with an Ingold pH electrode was used for potentiometric titrations. For each compound titrated, a 0.001 M solution was separately prepared in each non-aqueous solvent. A 0.05 M solution of TBAH in isopropyl alcohol, which is widely used in the titration of acids, was used as titrant. The mV values obtained on the pH meter were recorded. Finally, the half-neutralization potential (HNP) values were determined by plotting the volume (mL) (TBAH)-mV graph.

Results and Discussion

In order to determine the pKa values of the compounds **3a–j**, they were titrated potentiometrically with TBAH in four non-aqueous solvents: isopropyl alcohol, tert-butyl alcohol, acetone and DMF. The mV values read in each titration were plotted against 0.05 M TBAH volumes (mL) added, and potentiometric titration curves were obtained for all the cases. From the titration curves, the HNP values were measured, and the corresponding pKa values were calculated.

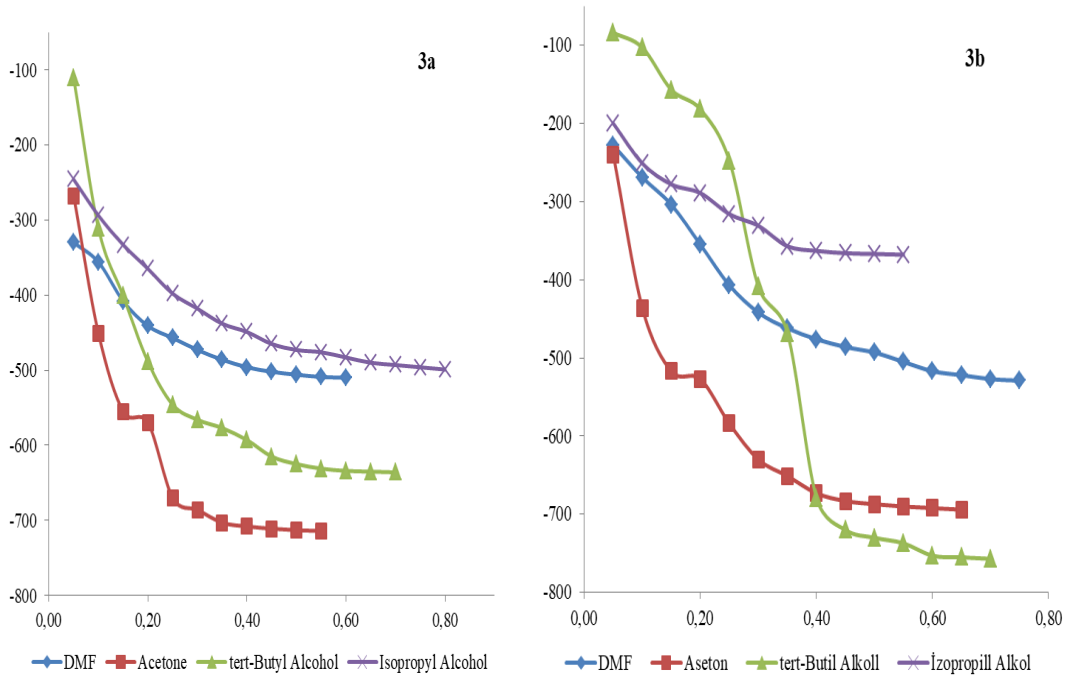


Figure 1. Potentiometric titration curves of 0.001 M solutions of compounds 3a and 3b titrated with 0.05 M TBAH in isopropyl alcohol, tert-butyl alcohol, DMF and acetone at 25 °C.

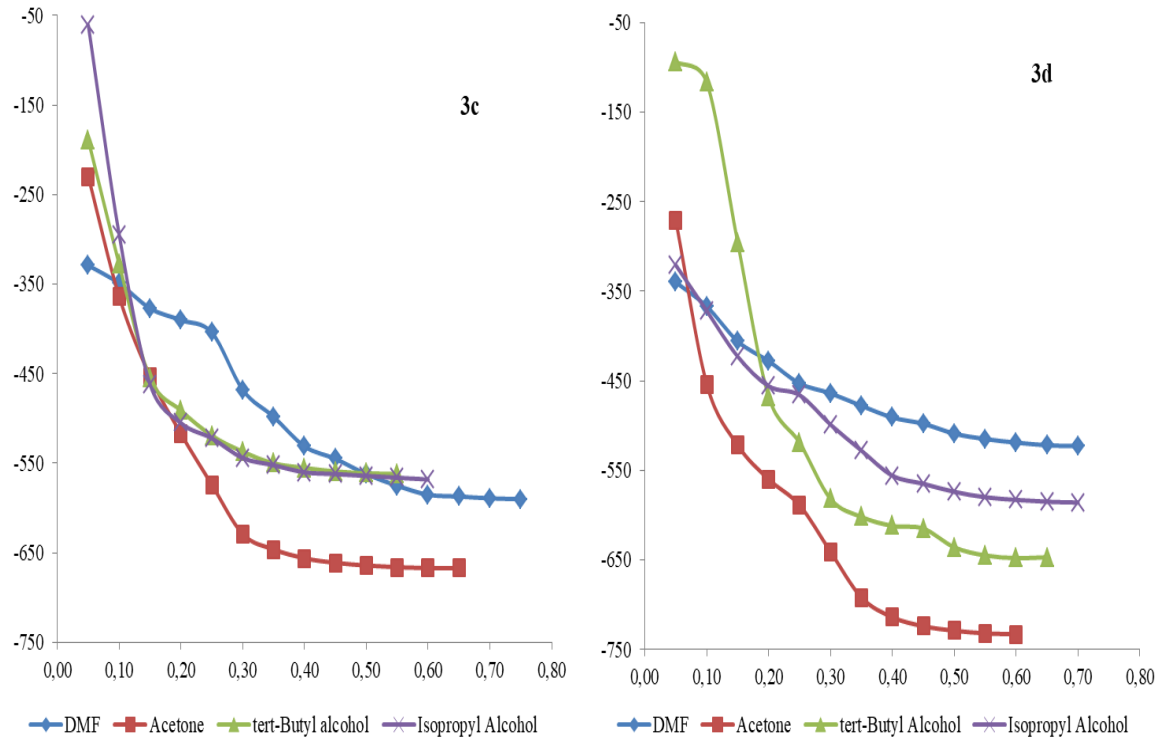


Figure 2. Potentiometric titration curves of 0.001 M solutions of compounds 3c and 3d titrated with 0.05 M TBAH in isopropyl alcohol, tert-butyl alcohol, DMF and acetone at 25 °C.

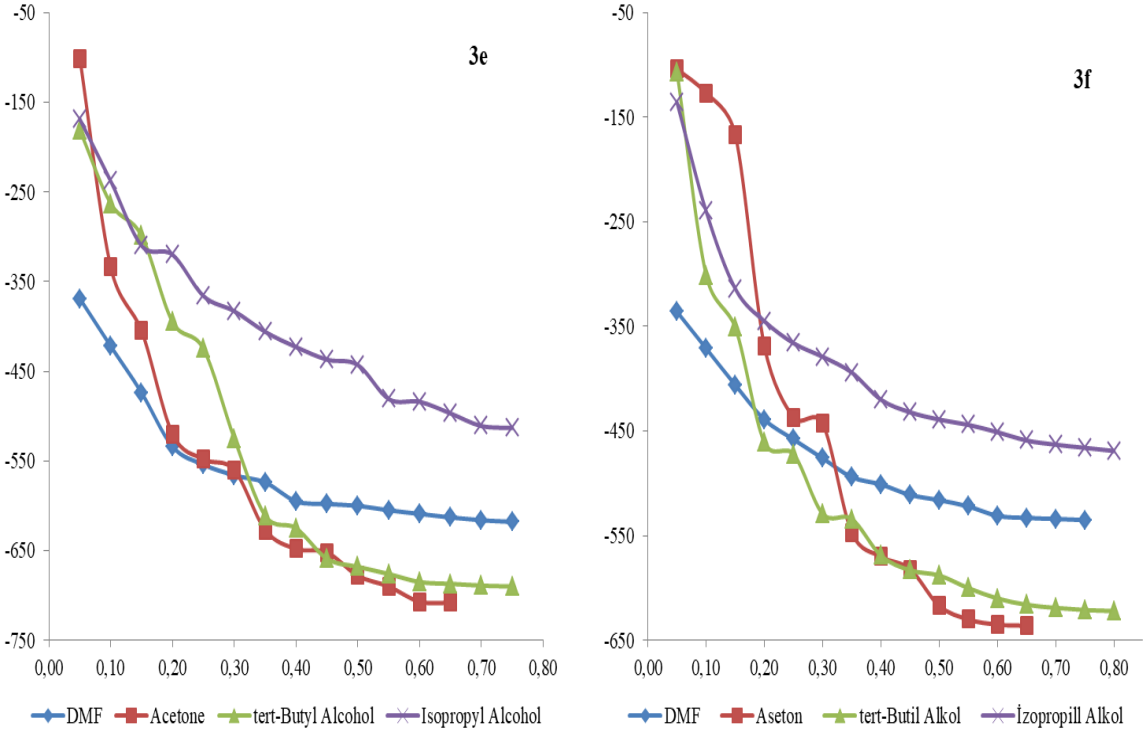


Figure 3. Potentiometric titration curves of 0.001 M solutions of compounds 3e and 3f titrated with 0.05 M TBAH in isopropyl alcohol, tert-butyl alcohol, DMF and acetone at 25 °C.

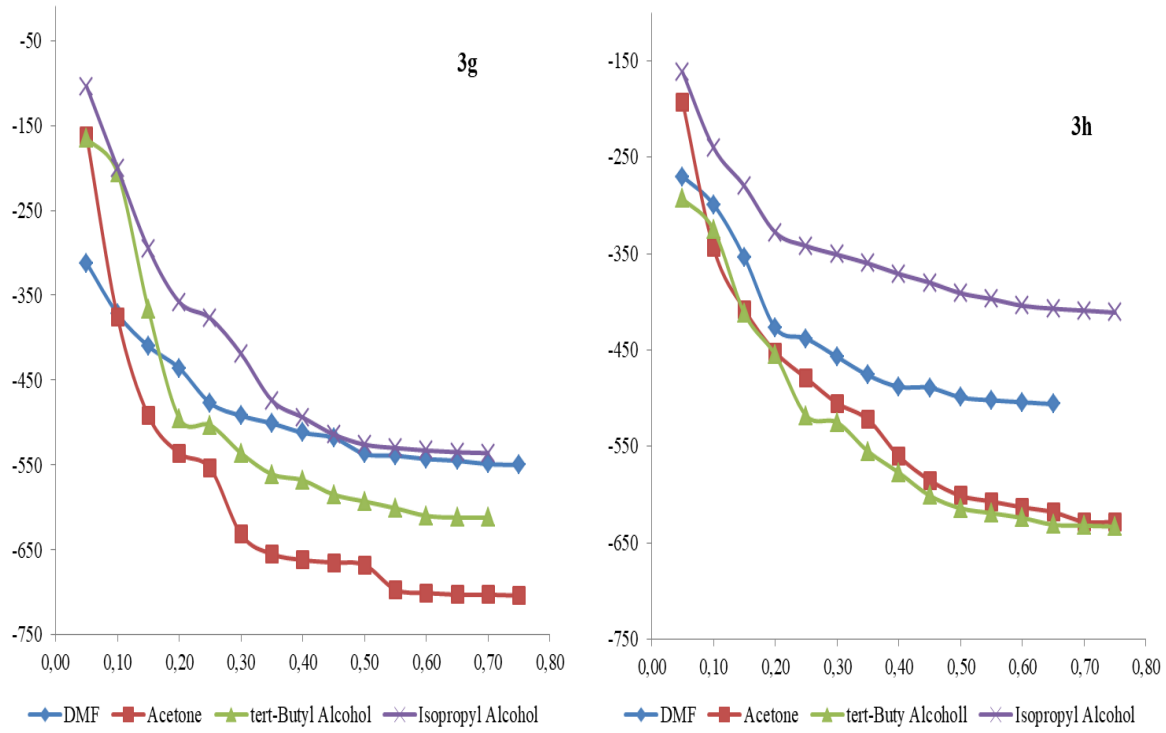


Figure 4. Potentiometric titration curves of 0.001 M solutions of compounds 3g and 3h titrated with 0.05 M TBAH in isopropyl alcohol, tert-butyl alcohol, DMF and acetone at 25 °C.

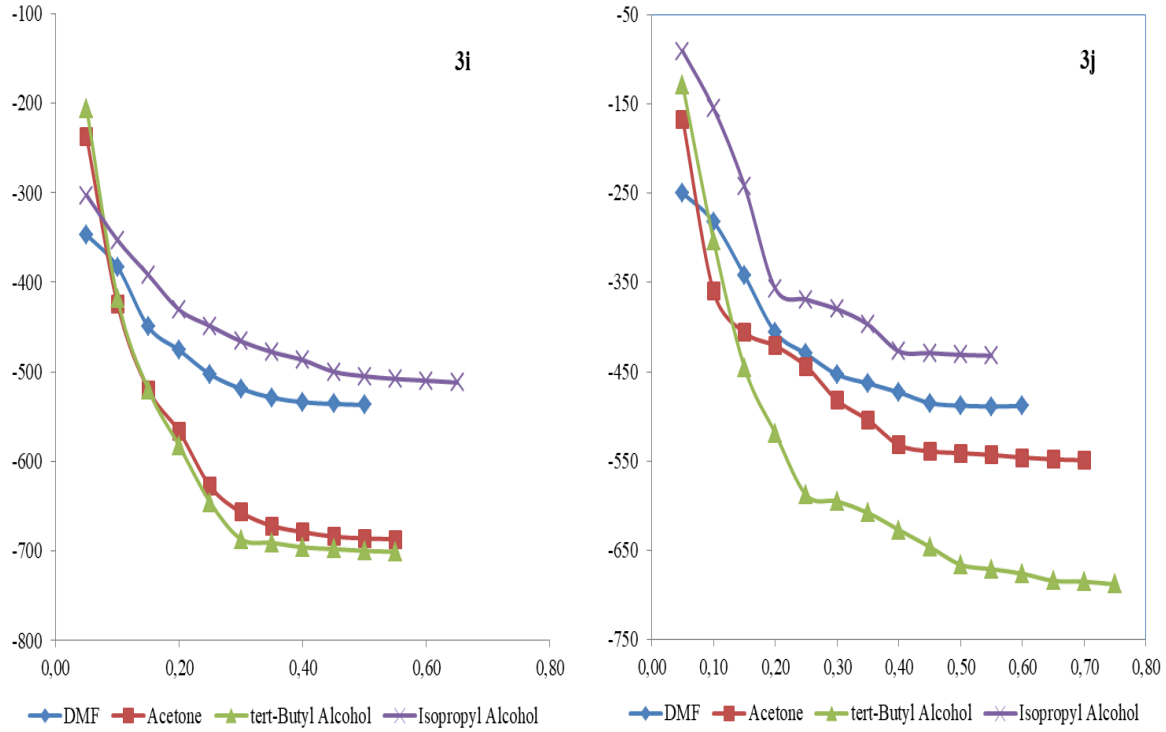


Figure 5. Potentiometric titration curves of 0.001 M solutions of compounds 3i and 3j titrated with 0.05 M TBAH in isopropyl alcohol, tert-butyl alcohol, DMF and acetone at 25 °C.

Table 1. The HNP and the corresponding pK_a values of compounds 3a-j in isopropyl alcohol, *tert*-butyl alcohol, DMF and acetone.

	DMF		**Acetone**		**tert-butyl alcohol**		**isopropyl alcohol**	
	HNP	pKa	HNP	pKa	HNP	pKa	HNP	pKa

3a	-	-	-117	6,70	-330	14,84	-451	16,67
3b	-278	12,97	-130	10,21	-269	13,32	-436	16,31
3c	-	-	-	-	-363	15,49	-	-
3d	-397	15,55	-94	10,24	-367	15,59	-488	17,53
3e	-238	12,67	-281	13,52	-504	18,09	-405	16,76
3f	-329	14,02	-204	11,48	-	-	10	6,62
3g	-295	12,31	-165	10,43	-372	15,10	-434	16,35
3h	-201	10,99	-293	14,06	-284	13,16	-430	16,20
3i	-	-	-	-	-347	15,15	-425	15,78
3j	-284	12,96	-	-	-	-	-201	10,99

The data obtained from the potentiometric titrations were interpreted, and the effect of the C-3 substituent in the 4,5-dihydro-1H-1,2,4-triazol-5-one ring as well as solvent effects was studied. As an example for the potentiometric titration curves for 0.001M solutions of compounds **3a-i** (Bahçeci et al, 2016) titrated with 0.05 M TBAH in isopropyl alcohol, tert-butyl alcohol, DMF and acetone are shown in Fig. **1-5**.

When the dielectric permittivity of solvents is taken into consideration, the acidity order can be given as follows: DMF (e= 36.7)> acetone (e =36) >isopropyl alcohol (e= 19.4)> tert-butyl alcohol (e =12).

3a **:** tert-butyl alcohol > acetone
3b **:** tert-butyl alcohol > N,N-dimethylformamide > isopropyl alcohol> acetone
3c **:** N,N-dimethylformamide
3d **:** tert-butyl alcohol > N,N-dimethylformamide > isopropyl alcohol> acetone
3e **:** isopropyl alcohol > tert-butyl alcohol > acetone > N,N-dimethylformamid
3f **:** acetone > tert-butyl alcohol > isopropyl alcohol
3g **:** tert-butyl alcohol >isopropyl alcohol > N,N-dimethylformamide > acetone
3h **:** isopropyl alcohol > N,N-dimethylformamide > tert-butyl alcohol >acetone
3i **:** N,N-dimethylformamide > acetone
3j **:** isopropyl alcohol > N,N-dimethylformamide

Moreover, as seen in Table **1**, for compounds **3a, 3c** and **3i** in DMF, for compounds **3c** and **3i** in acetone, for compound **3f** in tert-butyl alcohol and for compound **3c** in tert-butyl alcohol the HNP values and the corresponding pKa values were not obtained.

When examined according to functional groups: The effect of the R functional groups on the distance from the acidic proton is very small. When the acidity of the compounds according to each solvent is examined;

***N,N*-dimethylformamid** **:** 3h > 3g > 3e > 3j > 3b > 3d
Acetone **:** 3a > 3b > 3d > 3h > 3f > 3e > 3h
tert-Butyl alcohol **:** 3h > 3b > 3a > 3g > 3i > 3c > 3d > 3e
isopropyl alcohol **:** 3f > 3j > 3h > 3b > 3g > 3a > 3e > 3d

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SYNTHESIS AND CHARACTERIZATION OF SOME NOVEL DI-{2-METHOXY-4-[(3-ALKYL-4,5-DIHYDRO-1H-1,2,4-TRIAZOL-5-ON-4-YL)-AZOMETHINE]PHENYL} ADIPATES

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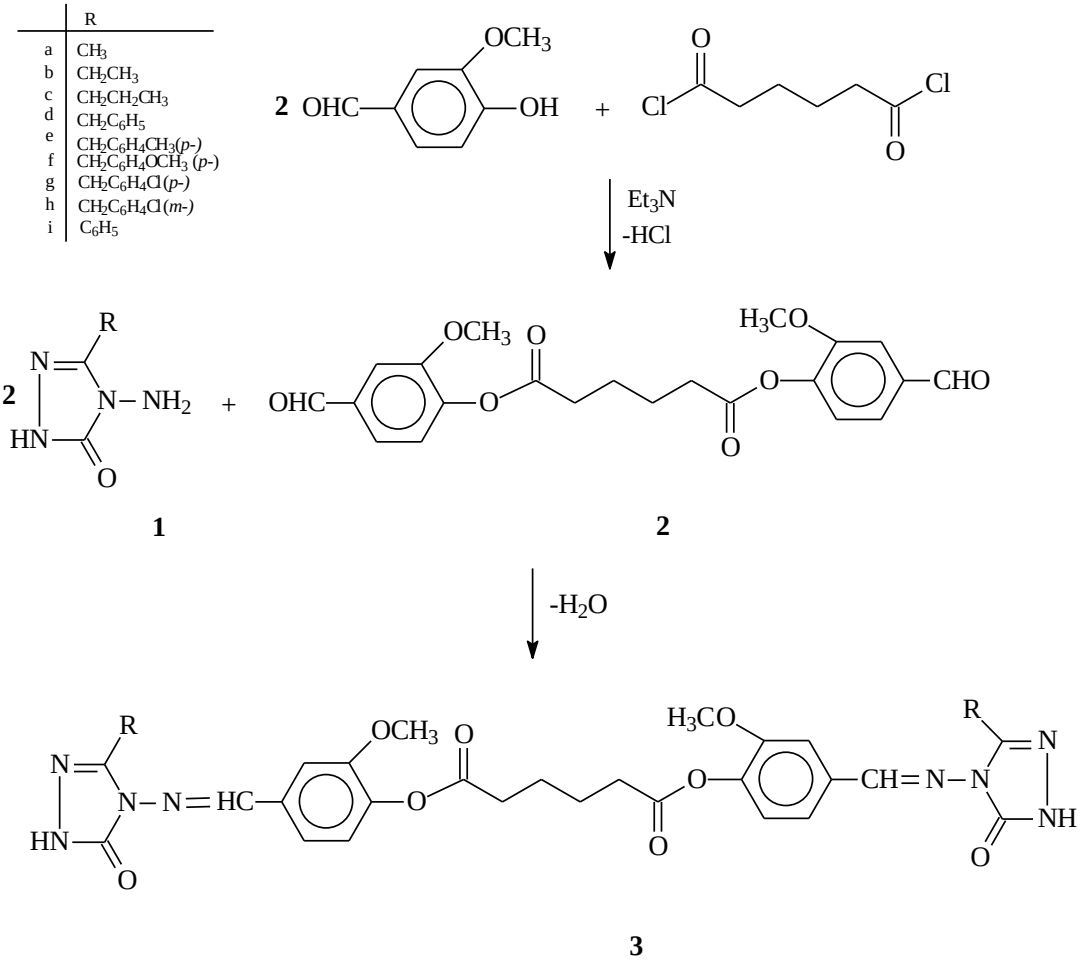
Abstract: In the present study, nine novel di-{2-methoxy-4-[(3-alkyl-4,5-dihydro-1H-1,2,4-triazol-5-on-4-yl)-azomethine]phenyl} adipates were synthesized from the reactions of 3-alkyl-4-amino-4,5-dihydro-1H-1,2,4-triazol-5-ones with di-(2-methoxy-4-formylphenyl) adipate, which was obtained from the reaction of 3-methoxy-4-hydroxybenzaldehyde with adipoyl chloride by using triethylamine. The starting compounds 3-alkyl(aryl)-4-amino-4,5-dihydro-1H-1,2,4-triazol-5-ones were prepared from the reactions of the corresponding ester ethoxycarbonylhydrazones with an aqueous solution of hydrazine hydrate as described in the literature. The new compounds were characterized by using IR, ^{1}H-NMR and ^{13}C-NMR spectral data.

Keywords: Schiff base, 1,2,4-triazol-5-one, synthesis, characterization

Introduction

1,2,4-Triazoles and 4,5-dihydro-1H-1,2,4-triazol-5-one derivatives are reported to possess a broad spectrum of biological activities such as antibacterial (Yuksek et al., 1997; Pitucha et al., 2010), antifungal (Kahveci et al., 2008), antioxidant (Arslantas et al., 2012; Gursoy-Kol et al., 2012), anti-inflammatory (Uzgoren-Baran et al., 2012), anticonvulsant (Zhang et al., 2012), antiparasitic (Saadeh et al., 2010), analgesic (Chidananda et al., 2012), antiviral (Henen et al., 2012), antitumor (Demirbas et al., 2002), anti-HIV (Li et al., 2013), antihypertensive and diuretic (Ali et al., 2011) properties. In addition, several articles reporting the synthesis of some N-arylidenamino-4,5-dihydro-1H-1,2,4-triazol-5-one derivatives have been published so far (Yuksek et al., 1997, Arslantas et al., 2012; Gursoy-Kol et al., 2012).

In this study, firstly nine 3-alkyl(aryl)-4-amino-4,5-dihydro-1H-1,2,4-triazol-5-one compounds (**1**) requiring for this study were synthesized according to the literature (Ikizler & Un 1979; Ikizler & Yuksek 1993). Then, the reactions of these compounds with di-(2-methoxy-4-formylphenyl) adipate (**2**), which were synthesized by the reaction of 3-methoxy-4-hydroxybenzaldehyde with adipoyl chloride by using triethylamine, were investigated and nine novel di-{2-methoxy-4-[(3-alkyl-4,5-dihydro-1H-1,2,4-triazol-5-on-4-yl)-azomethine]phenyl} adipates (**3**) were obtained (Scheme **1**).



Scheme 1. Synthesis pathway of compound 3

Experimental

Chemical reagents and all solvents used in this study were purchased from Merck AG, Aldrich and Fluka. Melting points which were uncorrect were determined in open glass capillaries using an Stuart SMP30 digital melting point apparatus. The IR spectra were obtained on a ALPHA-P BRUKER FT-IR spectrometer. ^{1}H and ^{13}C NMR spectra were recorded in deuterated dimethyl sulfoxide with TMS as internal standard using a BRUKER ULTRASHIELD PLUS BIOSPIN spectrometer at 400 MHz and 10 MHz, respectively. The starting compounds **1a-i** were prepared from the reactions of the corresponding ester ethoxycarbonylhydrazones with an aqueous solution of hydrazine hydrate as described in the literature (Ikizler & Un, 1979; Ikizler & Yüksek, 1993).

Di-{2-methoxy-4-[(3-methyl-4,5-dihydro-1H-1,2,4-triazol-5-on-4-yl)-azomethine]phenyl}adipate (3a): yield 94.6%, m.p. 220 °C; IR(υ, cm^{-1}): 3167(NH), 3041(C=CH), 1756,1704(C=O), 1604,1584(C=N), 1265(COO) . ^{1}H-NMR (DMSO-d$_6$, δ ppm): 1.79 (m, 4H, 2CH$_2$), 2.30 (s, 6H, 2CH$_3$), 2.68 (m, 4H, 2CH$_2$), 3.87 (s, 6H, 2OCH$_3$), 7.24 (d, 2H, ArH; *J*=8.00 Hz), 7.47 (d, 2H, ArH; *J*=8.00Hz), 7.60 (d, 2H, ArH; *J*=10.20 Hz), 9.73 (s, 2H, N=CH), 11,85 (s, 2H, NH). ^{13}C-NMR (DMSO-d$_6$, δ ppm): 11.56 (2CH$_3$), 24.19 (2CH$_2$), 33.30 (2CH$_2$), 56.34 (2OCH$_3$), [111.82(2C); 120.93(2C); 123.87(2C); 132.89(2C); 142.19(2C); 151.70(2C)] (ArC), 144.77 (2Triazole C$_3$), 151.68 (2Triazole C$_5$), 153.30 (2N=CH), 171.29 (2COO).

Di-{2-methoxy-4-[(3-ethyl-4,5-dihydro-1H-1,2,4-triazol-5-on-4-yl)-azomethine]phenyl}adipate (3b): yield 98%, m.p. 205 °C; IR(υ, cm^{-1}): 3312(NH), 3083(C=CH), 1748,1718(C=O), 1606,1581(C=N), 1262(COO) .^{1}H-NMR (DMSO-d$_6$, δ ppm): 1.22 (t, 6H,2CH$_2$<u>CH$_3$</u>; *J*=7.60 Hz), 1.78-1.79 (m, 4H, 2CH$_2$), 2.66-2.67 (m, 4H, 2CH$_2$), 2.70 (q, 4H, 2<u>CH$_2$</u>CH$_3$; *J*=7.60 Hz), 3.84 (s, 6H, 2OCH$_3$), 7.24 (d, 2H, ArH; *J*=8.00 Hz), 7.46 (dd, 2H, ArH; *J*=8.00 Hz, 1.60 Hz), 7.58 (d, 2H, ArH; *J*=1.60 Hz), 9.72 (s, 2H,2N=CH), 11,86 (s, 2H, 2NH). ^{13}C-NMR (DMSO-d$_6$, δ ppm): 9.99 (2CH$_2$<u>C</u>H$_3$), 18.48 (2<u>C</u>H$_2$CH$_3$), 23.72 (2CH$_2$), 32.83 (2CH$_2$), 55.00 (2OCH$_3$), [111.45(2C); 120.35(2C); 123.44(2C); 132.45(2C); 141.73(2C); 151.34(2C)] (ArC), 148.05 (2Triazole C$_3$), 151.25 (2Triazole C$_5$), 152.93 (2N=CH), 170.80 (2COO).

Di-{2-methoxy-4-[(3-*n*-propyl-4,5-dihydro-1H-1,2,4-triazol-5-on-4-yl)-azomethine]phenyl}adipate (3c): yield 90.9%, m.p. 171 °C; IR(υ, cm^{-1}): 3179(NH), 3061(C=CH), 1756,1704(C=O), 1594,1583(C=N), 1224(COO) .^{1}H-NMR (DMSO-d_6, δ ppm): 0.96 (t, 6H, $2CH_2CH_2\underline{CH_3}$; *J*=7.60 Hz), 1.70 (sext, 4H, $2CH_2\underline{CH_2}CH_3$; *J*=7.60 Hz), 1.79 (m, 4H, $2CH_2$), 2.65-268 (m, 4H, $2CH_2$) 2.66 (t, 4H, $2\underline{CH_2}CH_2CH_3$; *J*=7.60 Hz), 3.84 (s, 6H, $2OCH_3$), 7.24 (d, 2H, ArH; *J*=8.00 Hz), 7.46 (dd, 2H, ArH; *J*=8.40 Hz, 1.60 Hz), 7.57 (d, 2H, ArH; *J*=2.00 Hz), 9.72 (s, 2H, 2N=CH), 11,87 (s, 2H, 2NH). ^{13}C-NMR (DMSO-d_6, δ ppm): 13.49 ($2CH_2CH_2\underline{C}H_3$), 18.96 ($2CH_2\underline{CH_2}CH_3$), 23.72($2CH_2$), 26.69 ($2\underline{C}H_2CH_2CH_3$), 32.83 ($2CH_2$), 55.85 ($2OCH_3$), [111.47(2C); 120.28(2C); 123.45(2C); 132.46(2C); 141.72(2C); 151.27(2C)] (ArC), 146.92 (2Triazole C_3), 151.24 (2Triazole C_5), 152.88 (2N=CH), 170.80 (2COO).

Di-{2-methoxy-4-[(3-benzyl-4,5-dihydro-1H-1,2,4-triazol-5-on-4-yl)-azomethine]phenyl}adipate (3d): yield 97.2%, m.p. 215 °C; IR(υ, cm^{-1}): 3344(NH), 3083(C=CH), 1738,1723(C=O), 1599,1582(C=N), 1278(COO), 768,711(monosubstituted aromatic ring).^{1}H-NMR (DMSO-d_6, δ ppm): 1.78 (m, 4H, $2CH_2$), 2.67 (m, 4H, $2CH_2$), 3.84 (s, 6H, $2OCH_3$), 4.07 (s, 4H, $2CH_2Ph$), 7.21-7.23 (m, 6H, ArH), 7.29-7.35 (m, 6H, ArH), 7.39 (dd, 2H, ArH; *J*=8.00 Hz, 2.00 Hz), 7.50 (d, 2H, ArH; *J*=1.60 Hz), 9.67 (s, 2H, 2N=CH), 12,01 (s, 2H, 2NH). ^{13}C-NMR (DMSO-d_6, δ ppm): 23.71 ($2CH_2$), 31.20 ($2CH_2Ph$), 32.82 ($2CH_2$), 55.87 ($2OCH_3$), [110.62(2C); 121.04(2C); 123.40(2C); 126.70(2C); 128.45(4C); 128,69(4C); 132.39(2C); 135.87(2C); 141.77(2C); 151.22(2C)] (ArC), 146.21 (2Triazole C_3), 151.20 (2Triazole C_5), 152.34 (2N=CH), 170.81 (2COO).

Di-{2-methoxy-4-[(3-*p*-methylbenzyl-4,5-dihydro-1H-1,2,4-triazol-5-on-4-yl)-azomethine]phenyl}adipate (3e): yield 98.5%, m.p. 188 °C; IR(υ, cm^{-1}): 3179(NH), 3050(C=CH), 1759,1712(C=O), 1588,1511(C=N), 1267(COO), 846(1,4-disubstituted aromatic ring) .^{1}H-NMR (DMSO-d_6, δ ppm): 1.79 (m, 4H, $2CH_2$), 2.23 (s, 6H, $2PhCH_3$), 2.68 (m, 4H, $2CH_2$), 3.85 (s, 6H, $2OCH_3$), 4.01 (s, 4H, $2CH_2Ph$), 7.11 (d, 4H, ArH; *J*=7.60 Hz), 7.22 (d, 4H, ArH; *J*=8.00 Hz), 7.23 (d, 2H, ArH; *J*=8.40 Hz), 7.39 (dd, 2H, ArH; *J*=8.00 Hz, 2.00 Hz), 7.50 (d, 2H, ArH; *J*=2.00 Hz), 9.67 (s, 2H, 2N=CH), 11,99 (s, 2H, 2NH). ^{13}C-NMR (DMSO-d_6, δ ppm): 20.57 ($2PhCH_3$), 23.71 ($2CH_2$), 30.81 ($2CH_2Ph$), 32.83 ($2CH_2$), 55.84 ($2OCH_3$), [110.59(2C); 121.05(2C); 123.40(2C); 128.56(2C); 129.01(4C); 132.42(2C); 132.75(2C); 135.76(2C); 141.76(2C); 151.22(2C)] (ArC), 146.36 (2Triazole C_3), 151.20 (2Triazole C_5), 152.26 (2N=CH), 170.82 (2COO).

Di-{2-methoxy-4-[(3-*p*-methoxybenzyl-4,5-dihydro-1H-1,2,4-triazol-5-on-4-yl)-azomethine]phenyl}adipate (3f): yield 95.8%, m.p. 203 °C; IR(υ, cm^{-1}): 3301(NH), 3076(C=CH), 1742,1708(C=O), 1608,1582(C=N), 1247(COO), 836(1,4-disubstituted aromatic ring).^{1}H-NMR (DMSO-d_6, δ ppm): 1.79 (m, 4H, $2CH_2$), 2.68 (m, 4H, $2CH_2$), 3.69 (s, 6H, $2OCH_3$), 3.85 (s, 6H, $2OCH_3$), 3.99 (s, 4H, $2CH_2Ph$), 6.87 (d, 4H, ArH; *J*=8.80 Hz), 7.22 (d, 2H, ArH; *J*=8.40 Hz), 7.25 (d, 4H, ArH; *J*=8.80 Hz), 7.41 (dd, 2H, ArH; *J*=8.00 Hz, 1.60 Hz), 7.52 (d, 2H, ArH; *J*=1.60 Hz), 9.67 (s, 2H, 2N=CH), 11,97 (s, 2H, 2NH). ^{13}C-NMR (DMSO-d_6, δ ppm): 23.72 ($2CH_2$), 30.33 ($2CH_2Ph$), 32.83 ($2CH_2$), 54.98 ($2OCH_3$), 55.88 ($2OCH_3$), [110.69(2C); 113.85(4C); 121.00(2C); 123.41(2C); 127.61(2C); 129.76(4C); 132.43(2C); 141.76(2C); 151.23(2C); 158.05(2C)] (ArC), 146.52 (2Triazole C_3), 151.21 (2Triazole C_5), 152.35 (2N=CH), 170.82 (2COO).

Di-{2-methoxy-4-[(3-*p*-chlorobenzyl-4,5-dihydro-1H-1,2,4-triazol-5-on-4-yl)-azomethine]phenyl}adipate (3g): yield 98.5%, m.p. 212 °C; IR(υ, cm^{-1}): 3342(NH), 3064(C=CH), 1752,1713(C=O), 1599,1581(C=N), 1225 (COO), 858 (1,4-disubstituted aromatic ring).^{1}H-NMR (DMSO-d_6, δ ppm): 1.79 (m, 4H, $2CH_2$), 2.68 (m, 4H, $2CH_2$), 3.84 (s, 6H, $2OCH_3$), 4.09 (s, 4H, $2CH_2Ph$), 7.23 (d, 2H, ArH; *J*= 8.40 Hz), 7.37-7.39 (m, 8H, ArH), 7.40 (dd, 2H, ArH; *J*=8.00 Hz, 1.60 Hz), 7.49 (d, 2H, ArH; *J*=1.60 Hz), 9.68 (s, 2H, 2N=CH), 12.03 (s, 2H, 2NH). ^{13}C-NMR (DMSO-d_6, δ ppm): 23.72 ($2CH_2$), 30.50 ($2CH_2Ph$), 32.83 ($2CH_2$), 55.87 ($2OCH_3$), [110.67(2C); 121.02(2C); 123.40(2C); 128.39 (4C); 130.62 (4C); 131.40(2C); 132.35; 134.86(2C); 141.80(2C); 151.23(2C)] (ArC), 145.87 (2Triazole C_3), 151.18 (2Triazole C_5), 152.46 (2N=CH), 170.81 (2COO).

Di-{2-methoxy-4-[(3-*m*-chlorobenzyl-4,5-dihydro-1H-1,2,4-triazol-5-on-4-yl)-azomethine]phenyl}adipate (3h): yield 95.3%, m.p. 210 °C; IR(υ, cm^{-1}): 3165(NH), 3028(C=CH), 1758,1701(C=O), 1595,1574(C=N), 1267 (COO), 784(1,3-disubstituted aromatic ring) .^{1}H-NMR (DMSO-d_6, δ ppm): 1.79 (m, 4H, $2CH_2$), 2.67 (m, 4H, $2CH_2$), 3.85 (s, 6H, $2OCH_3$), 4.11 (s, 4H, $2CH_2Ph$), 7.22 (d, 2H, ArH; *J*= 8.40 Hz), 7.28-7.35 (m, 6H, ArH), 7.40 (dd, 2H, ArH; *J*=8.00 Hz, 2.00 Hz), 7.45 (d, 2H, ArH; *J*=1.60 Hz), 7.52 (d, 2H, ArH; *J*=2.00 Hz), 9.68 (s, 2H, 2N=CH), 12.04 (s, 2H, 2NH). ^{13}C-NMR (DMSO-d_6, δ ppm): 23.71 ($2CH_2$), 30.73 ($2CH_2Ph$), 32.83 ($2CH_2$), 55.87 ($2OCH_3$), [110.58 (2C); 121.11 (2C); 123.39 (2C); 126.75 (2C); 127.47 (2C); 128.76 (2C); 130.28 (2C); 132.33 (2C); 132.94 (2C); 138.31 (2C); 141.82 (2C); 151.25 (2C)] (ArC), 145.69 (2Triazole C_3), 151.16 (2Triazole C_5), 152.46 (2N=CH), 170.80 (2COO).

Di-{2-methoxy-4-[(3-phenyl-4,5-dihydro-1H-1,2,4-triazol-5-on-4-yl)-azomethine]phenyl}adipate (3i). yield 94.4%, m.p. 138 °C; IR(υ, cm^{-1}): 3186(NH), 3077(C=CH), 1757,1700(C=O), 1585,1552(C=N), 1269(COO), 869,692(monosubstituted aromatic ring).^{1}H-NMR (DMSO-d_6, δ ppm): 1.79 (m, 4H, $2CH_2$), 2.68 (m, 4H, $2CH_2$), 3.82 (s, 6H, $2OCH_3$), 7.25 (d, 2H, ArH; *J*= 8.40 Hz), 7.44 (dd, 2H, ArH; *J*=8.00 Hz, 2.00 Hz), 7.53-7.56 (m, 6H,

ArH), 7.57 (d, 2H, ArH; *J*=2.00 Hz), 7.91-7.94 (m, 4H, ArH), 9.67 (s, 2H, 2N=CH), 12.40 (s, 2H, 2NH). ^{13}C-NMR (DMSO-d_6, δ ppm): 23.71 ($2CH_2$), 32.82 ($2CH_2$), 55.79 ($2OCH_3$), [111.25 (2C); 120.87 (2C); 123.54 (2C); 126.56 (2C); 127.99(4C); 128.49 (4C); 130.14 (2C); 132.28 (2C); 141.93 (2C); 151.31 (2C)] (ArC), 144.54 (2Triazole C_3), 151.26 (2Triazole C_5), 155.34 (2N=CH), 170.81 (2COO).

Results and Discussion

In the present study, nine new di-{2-methoxy-4-[(3-alkyl-4,5-dihydro-1H-1,2,4-triazol-5-on-4-yl)-azomethine]phenyl} adipates **(3)** were synthesized by the reactions of of 3-alkyl-4-amino-4,5-dihydro-1H-1,2,4-triazol-5-ones (**1**) with di-(2-methoxy-4-formylphenyl) adipate (2). The structures of compound **3** were identified by using IR, ^{1}H and ^{13}C-NMR spectral data. The observed spectral values were seen to be compatible with literature values (Yuksek et al., 1997; Yuksek et al., 2013; Aktas-Yokus et al., 2015; Yuksek et al., 2015).

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SYNTHESIS AND POTENTIOMETRIC TITRATIONS OF 2-METHOXY-4-[(3-ALKYL(ARYL)-4,5-DIHYDRO-1H-1,2,4-TRIAZOL-5-ON-4-YL)-AZOMETHINE]PHENYL IZOBUTYRATES

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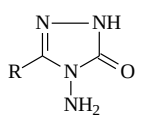
Abstract: In the present study, nine novel 2-methoxy-4-[(3-alkyl(aryl)-4,5-dihydro-1*H*-1,2,4-triazol-5-on-4-yl)-azomethine]phenyl izobutyrates were synthesized from the reactions of the corresponding 3-alkyl(aryl)-4-amino-4,5-dihydro-1H-1,2,4-triazol-5-ones with 4-formyl-2-methoxyphenyl izobutyrate, which was obtained from the reaction of 4-hydroxy-3-methoxybenzaldehyde with izobutyryl chloride by using triethylamine. The new compounds synthesized were characterized by using IR and ^{1}H-NMR, ^{13}C-NMR spectral data. The second part of the study, nine novel 2-methoxy-4-[(3-alkyl(aryl)-4,5-dihydro-1H-1,2,4-triazol-5-on-4-yl)-azomethine]phenyl izobutyrates were titrated potentiometrically with TBAH (tetrabutylammonium hydroxide) in four different non-aqueous solvents (isopropyl alcohol, tert-butyl alcohol, acetone and *N*,*N*-dimethylformamide) and graphs were drawn for all cases. The half notralization potentials and pKa values were determined by half neutralization method. The effects of solvents and molecular structure upon acidity were also discussed.

Keywords: Synthesis, characterization, TBAH, pK_a, Half-neutralization method

Introduction

1,2,4-triazole and 4,5-dihydro-1H-1,2,4-triazol-5-one derivatives are reported to show a broad spectrum of biological activities such as antifungal, antimicrobial, hypoglycemic, antihypertensive, analgesic, antiparasitic, hypocholesteremic, antiviral, anti-inflammatory, antioxidant, antitumor and anti-HIV properties (Yüksek et al., 1997; Demirbaş & Uğurlu,2004; İkizler et al., 1997; Bhat et al., 2001; Yüksek et al.,2006a; Yüksek et al., 2006b). On the other hand, it is known that 1,2,4-triazole and 4,5-dihydro-1H-1,2,4-triazol-5-one rings have weak acidic properties, so some 1,2,4-triazole and 4,5-dihydro-1*H*-1,2,4-triazol-5-one derivatives were titrated potentiometrically with tetrabutylammonium hydroxide (TBAH) in non-aqueous solvents, and the pK_a values of the compounds were determined (Yüksek et al.,2004a; Yüksek et al., 2004b; Bahçeci et al., 2002a; Bahçeci et al., 2002b; Yüksek et al.,2006a; Yüksek et al., 2006b). Determination of pK_a values of the active constituent of certain pharmaceutical preparations is important because the distribution, transport behavior, bonding to receptors, and contributions to the metabolic behavior of the active constituent molecules depend on the ionization constant (Demirbas et al., 1998; Frey, Kokesh & Westheimer, 1971; Putun, Bereket & Keskin, 1995). In the paper, nine novel 2-methoxy-4-[(3-alkyl(aryl)-4,5-dihydro-1*H*-1,2,4-triazol-5-on-4-yl)-azomethine]phenyl izobutyrates were synthesized from the reactions of the corresponding 3-alkyl(aryl)-4-amino-4,5-dihydro-1H-1,2,4-triazol-5-ones with 4-formyl-2-methoxyphenyl izobutyrate, which was obtained from the reaction of 4-hydroxy-3-methoxybenzaldehyde with izobutyryl chloride by using triethylamine. The starting compounds **1a-i** were prepared according to the literature (Ikizler & Yuksek, 1979; Ikizler & Yuksek, 1993).



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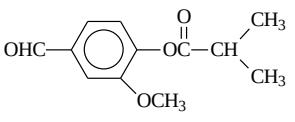

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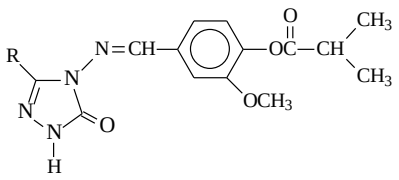

3

	R
a	CH_3
b	CH_2CH_3
c	$CH_2CH_2CH_3$
d	$CH_2C_6H_5$
e	$CH_2C_6H_4CH_3$(*p-*)
f	$CH_2C_6H_4OCH_3$ (*p-*)
g	$CH_2C_6H_4Cl$(*p-*)
h	$CH_2C_6H_4Cl$(*m-*)
i	C_6H_5

Experimental

Preparation of 2-methoxy-4-[(3-alkyl(aryl)-4,5-dihydro-1H-1,2,4-triazol-5-on-4-yl)-azomethine]phenyl izobutyrates (3) For the General Procedure. The corresponding the corresponding 3-alkyl(aryl)-4-amino-4,5-dihydro-1H-1,2,4-triazol-5-ones (0.01 mol) was dissolved in acetic acid (15 mL) and treated with 4-formyl-2-

methoxyphenyl izobutyrate (**2**) (0.01 mol). The mixture was refluxed for 2 h and then evaporated at 50-55 °C in vacuo. Several recrystallizations of the residue from ethanol gave pure compounds **3a-i** as colorless crystals.

2-Methoxy-4-[(3-methyl-4,5-dihydro-1H-1,2,4-triazol-5-on-4-yl)-azomethine]phenyl izobutyrate (3a): yield 97.4%, m.p. 159 °C; IR(υ, cm^{-1}): 3170(NH), 3039(C=CH), 1750,1707(C=O), 1605, 1581 (C=N), 1222 (COO) .^{1}H-NMR (DMSO-d_6, δ ppm): 1.25 (d, 6H, $2CH_3$; *J*=6.92 Hz), 2.30 (s, 3H, CH_3), 2.84 (hept, 1H, CH; *J*=6.96 Hz), 3.84 (s, 3H, OCH_3), 7.22 (d, 1H, ArH; *J*=8.12 Hz), 7.46 (dd, 1H, ArH; *J*=8.20Hz, 0.80 Hz), 7.58 (d, 1H, ArH; *J*=1.60 Hz), 9.72 (s, 1H, N=CH), 11,85 (s, 1H, NH). ^{13}C-NMR (DMSO-d_6, δ ppm): 11.55 (CH_3), 19.19 ($2CH_3$), 33.65 (CH), 56.43 (OCH_3), [111.82; 120.88; 123.79; 132.81; 142.33; 151.73] (ArC), 144.74 (Triazole C_3), 151.68 (N=CH), 153.31 (Triazole C_5), 174.70 (COO).

2-Methoxy-4-[(3-ethyl-4,5-dihydro-1H-1,2,4-triazol-5-on-4-yl)-azomethine]phenyl izobutyrate (3b): yield 96.3%, m.p. 169 °C; IR(υ, cm^{-1}): 3169 (NH), 3052 (C=CH), 1762, 1701 (C=O), 1597 (C=N), 1232 (COO). ^{1}H-NMR (DMSO-d_6, δ ppm): 1.21 (t, 3H, CH_2CH_3; *J*=7.60 Hz), 1.24 (d, 6H, $2CH_3$; *J*=7.20 Hz), 2.70 (q, 2H, CH_2CH_3; *J*=7.60 Hz), 2.84 (hept, 1H, CH; *J*=7.20 Hz), 3.83(s, 3H, OCH_3), 7.21 (d, 1H, ArH; *J*=8.40 Hz), 7.45 (dd, 1H, ArH; *J*=8.20 Hz, 1.60 Hz), 7.56 (d, 1H, ArH; *J*=1.60 Hz), 9.71 (s, 1H, N=CH), 11,84 (s, 1H, NH). ^{13}C-NMR (DMSO-d_6, δ ppm): 9.98 ($CH_2\underline{C}H_3$), 18.48 ($\underline{C}H_2CH_3$), 18.72 ($2CH_3$), 33.17 (CH), 56.00 (OCH_3), [111.47; 120.34; 123.36; 132.37; 141.90; 151.35] (ArC), 148.04 (Triazole C_3), 151.29 (N=CH), 153.00 (Triazole C_5), 174.20 (COO).

2-Methoxy-4-[(3-*n*-propyl-4,5-dihydro-1H-1,2,4-triazol-5-on-4-yl)-azomethine]phenyl izobutyrate (3c): yield 93.9%, m.p. 133 °C; IR(υ, cm^{-1}): 3169 (NH), 3068 (C=CH), 1754, 1703 (C=O), 1597, 1582 (C=N), 1232 (COO) .^{1}H-NMR (DMSO-d_6, δ ppm): 0.96 (t, 3H, $CH_2CH_2C\underline{H}_3$; *J*=7.60 Hz), 1.24 (d, 6H, $2CH_3$; *J*=7.20 Hz), 1.70 (sext, 2H, $CH_2C\underline{H}_2CH_3$; *J*=7.20 Hz), 2.66 (t, 2H, $C\underline{H}_2CH_2CH_3$; *J*=7.20 Hz), 2.84 (hept, 1H, CH; *J*=7.20 Hz), 3.83 (s, 3H, OCH_3), 7.21 (d, 1H, ArH; *J*=8.00 Hz), 7.45 (dd, 1H, ArH; *J*=8.40 Hz, 1.60 Hz), 7.56 (d, 1H, ArH; *J*=1.60 Hz), 9.71 (s, 1H, N=CH), 11,84 (s, 1H, NH). ^{13}C-NMR (DMSO-d_6, δ ppm): 13.48 ($CH_2CH_2\underline{C}H_3$), 18.73 ($2CH_3$), 18.95 ($CH_2\underline{C}H_2CH_3$), 26.69 ($\underline{C}H_2CH_2CH_3$), 33.17 (CH), 55.98 (OCH_3), [111.49; 120.30; 123.39; 132.38; 141.90; 151.28] (ArC), 146.92 (Triazole C_3), 151.28 (N=CH), 152.98 (Triazole C_5), 174.21 (COO).

2-Methoxy-4-[(3-benzyl-4,5-dihydro-1H-1,2,4-triazol-5-on-4-yl)-azomethine]phenyl izobutyrate (3d): yield 97.8%, m.p. 154 °C; IR(υ, cm^{-1}): 3154 (NH), 3073 (C=CH), 1758, 1704 (C=O), 1599, 1575 (C=N), 1227 (COO), 758,702 (monosubstituted aromatic ring).^{1}H-NMR (DMSO-d_6, δ ppm): 1.24 (d, 6H, $2CH_3$; *J*=6.80 Hz), 2.83 (hept, 1H, CH; *J*=6.80 Hz), 3.85 (s, 3H, OCH_3), 4.08 (s, 2H, CH_2Ph), 7.19 (d, 1H, ArH; *J*=8.00 Hz), 7.22-7.24 (m, 1H, ArH), 7.29-7.36 (m, 4H, ArH), 7.29-7.36 (m, 4H, ArH), 7.37 (dd, 1H, ArH; *J*=8.00 Hz, 1.60 Hz), 7.49 (d, 1H, ArH; *J*=1.60 Hz), 9.67 (s, 1H, N=CH), 11,99 (s, 1H, NH). ^{13}C-NMR (DMSO-d_6, δ ppm): 18.72 ($2CH_3$), 31.22 (CH_2Ph), 33.17 (CH), 55.98 (OCH_3), [110.66; 121.00; 123.32; 126.69; 128.44(2C); 128,70(2C); 132.32; 135.87; 141.94; 151.26] (ArC), 146.20 (Triazol C_3), 151.20 (N=CH), 152.38 (Triazol C_5), 174.21 (COO).

2-Methoxy-4-[(3-*p*-methylbenzyl-4,5-dihydro-1H-1,2,4-triazol-5-on-4-yl)-azomethine]phenyl izobutyrate (3e): yield 97.9%, m.p. 151 °C; IR(υ, cm^{-1}): 3167 (NH), 3072 (C=CH), 1750, 1709 (C=O), 1595, 1575 (C=N), 1238 (COO), 865 (1,4-disubstituted aromatic ring) .^{1}H-NMR (DMSO-d_6, δ ppm): 1.24 (d, 6H, $2CH_3$; *J*=6.80 Hz), 2.24 (s, 3H, $PhCH_3$), 2.83 (hept, 1H, CH; *J*=6.80 Hz), 3.83 (s, 3H, OCH_3), 4.01 (s, 2H, CH_2Ph), 7.11 (d, 2H, ArH; *J*=8.00 Hz), 7.19 (d, 2H, ArH; *J*=8.00 Hz), 7.21 (d, 1H, ArH; *J*=8.00 Hz), 7.38 (dd, 1H, ArH; *J*=8.00 Hz, 1.60 Hz), 7.49 (d, 1H, ArH; *J*=1.60 Hz), 9.66 (s, 1H, N=CH), 11,96 (s, 1H, NH). ^{13}C-NMR (DMSO-d_6, δ ppm): 18.73 ($2CH_3$), 20.57 ($PhCH_3$), 30.83 (CH_2Ph), 33.17 (CH), 55.97 (OCH_3), [110.64; 121.02; 123.33; 128.57; 129.01(2C); 132.34; 132.75; 135.76; 141.93; 151.76] (ArC), 146.35 (Triazole C_3), 151.21 (N=CH), 152.33 (Triazole C_5), 174.22 (COO).

2-Methoxy-4-[(3-*p*-methoxylbenzyl-4,5-dihydro-1H-1,2,4-triazol-5-on-4-yl)-azomethine]phenyl izobutyrate (3f): yield 94.3%, m.p. 171 °C; IR(υ, cm^{-1}): 3163 (NH), 3031 (C=CH), 1759, 1695 (C=O), 1611, 1581 (C=N), 1245 (COO), 836(1,4-disubstituted aromatic ring).^{1}H-NMR (DMSO-d_6, δ ppm): 1.24 (d, 6H, $2CH_3$; *J*=7.20 Hz), 2.84 (hept, 1H, CH; *J*=7.20 Hz), 3.70 (s, 3H, *p*-OCH_3), 3.84 (s, 3H, OCH_3), 3.99 (s, 2H, CH_2Ph), 6.87 (d, 2H, ArH; *J*=8.80 Hz), 7.20 (d, 1H, ArH; *J*=8.40 Hz), 7.24 (d, 2H, ArH; *J*=8.40 Hz), 7.39 (dd, 1H, ArH; *J*=8.40 Hz, 1.60 Hz), 7.51 (d, 1H, ArH; *J*=1.60 Hz), 9.67 (s, 1H, N=CH), 11,95 (s, 1H, NH). ^{13}C-NMR (DMSO-d_6, δ ppm): 18.73 ($2CH_3$), 30.34 (CH_2Ph), 33.17 (CH), 50.00 (*p*-OCH_3), 56.00 (OCH_3), [110.74; 113.87(2C); 120.97; 123.34; 127.62; 129.76(2C); 132.35; 141.93; 151.28; 158.07 (ArC), 146.51] (Triazole C_3), 151.22 (N=CH), 152.42 (Triazole C_5), 174.23 (COO).

2-Methoxy-4-[(3-*p*-chlorobenzyl-4,5-dihydro-1H-1,2,4-triazol-5-on-4-yl)-azomethine]phenyl izobutyrate (3g): yield 97.3%, m.p. 177 °C; IR(υ, cm^{-1}): 3169 (NH), 3061 (C=CH), 1755, 1700 (C=O), 1598, 1578 (C=N), 1267 (COO), 852 (1,4-disubstituted aromatic ring).^{1}H-NMR (DMSO-d_6, δ ppm): 1.24 (d, 6H, $2CH_3$; *J*= 6.80

Hz), 2.84 (hept, 1H,CH; *J*= 6.80 Hz), 3.83 (s, 3H, OCH_3), 4.09 (s, 2H, CH_2Ph), 7.20 (d, 2H, ArH; *J*= 8.00 Hz), 7.34-7.37 (m, 3H, ArH), 7.38 (dd, 1H, ArH; *J*=8.40 Hz, 2.00 Hz), 7.48 (d, 1H, ArH; *J*=1.60 Hz), 9.67 (s, 1H, N=CH), 12.01 (s, 1H, NH). ^{13}C-NMR (DMSO-d_6, δ ppm): 18.72 ($2CH_3$), 30.52 (CH_2Ph), 33.17 (CH), 55.99 (OCH_3), [110.73; 120.99; 123.34; 128.38 (2C); 130.62 (2C); 131.40; 132.27; 134.87; 141.97; 151.27] (ArC), 145.86 (Triazole C_3), 151.19 (N=CH), 152.54 (Triazole C_5), 174.21 (COO).

2-Methoxy-4-[(3-*m*-chlorobenzyl-4,5-dihydro-1H-1,2,4-triazol-5-on-4-yl)-azomethine]phenyl izobutyrate (3h): yield 95.3%, m.p. 179 °C; IR(υ, cm^{-1}): 3130 (NH), 3052 (C=CH), 1755, 1709 (C=O), 1595, 1574 (C=N), 1267 (COO), 792 (1,3-disubstituted aromatic ring) .^{1}H-NMR (DMSO-d_6, δ ppm1.24 (d, 6H, $2CH_3$; *J*= 6.80 Hz), 2.83 (hept, 1H, CH; *J*= 6.80 Hz), 3.84 (s, 3H, OCH_3), 4.11 (s, 2H, CH_2Ph), 7.20 (d, 1H, ArH; *J*= 8.00 Hz), 7.28-7.35 (m, 3H, ArH), 7.38 (dd, 1H, ArH; *J*=8.00 Hz, 1.60 Hz), 7.44-7.45 (m, 1H, ArH), 7.50 (d, 1H, ArH; *J*=1.60 Hz), 9.67 (s, 1H, N=CH), 12.01 (s, 1H, NH). ^{13}C-NMR (DMSO-d_6, δ ppm): 18.72 ($2CH_3$), 30.74 (CH_2Ph), 33.17 (CH), 56.00 (OCH_3), [110.66; 121.07; 123.32; 126.75; 127.48; 128.76; 130.28; 132.25; 132.95; 138.30; 141.99; 151.29] (ArC), 145.69 (Triazole C_3), 151.17 (N=CH), 152.56 (Triazole C_5), 174.20 (COO).

2-Methoxy-4-[(3-phenyl-4,5-dihydro-1H-1,2,4-triazol-5-on-4-yl)-azomethine]phenyl izobutyrate (3i). yield 97.2%, m.p. 172 °C; IR(υ, cm^{-1}): 3159 (NH), 3056 (C=CH), 1754, 1700 (C=O), 1584 (C=N), 1264 (COO), 771, 694 (monosubstituted aromatic ring). ^{1}H-NMR (DMSO-d_6, δ ppm): 1.24 (d, 6H, $2CH_3$; *J*=7.20 Hz), 2.84 (hept, 1H, CH; *J*=7.20 Hz), 3.81 (s, 3H, OCH_3), 7.23 (d, 1H, ArH; *J*= 8.40 Hz), 7.43 (d, d, 1H, ArH; *J*=8.40 Hz, 2.00 Hz), 7.52 (d, 1H, ArH; *J*=2.00 Hz), 7.53-7.56 (m, 3H, ArH), 7.91-7.94 (m, 2H, ArH), 9.66 (s, 1H, N=CH), 12.38 (s, 1H, NH). ^{13}C-NMR (DMSO-d_6, δ ppm): 18.73 ($2CH_3$), 33.17 (CH), 55.90 (OCH_3), [111.26; 120.88; 123.47; 126.59; 127.98 (2C); 128.48 (2C); 130.13; 132.20; 142.10; 151.31] (ArC), 144.55 (Triazole C_3), 151.31 (N=CH), 155.40 (Triazole C_5), 174.22 (COO).

Results and Findings

In this study, synthesized **3a-i** type compounds were titrated potentiometrically with TBAH in four non-aqueous solvents such as isopropyl alcohol, tert-butyl alcohol, acetonitrile and *N*,*N*-dimethylformamide. The mV values read in each titration were plotted against TBAH volumes added (mL), and potentiometric titration curves were formed for all the cases. From the titration curves, the HNP values were measured, and the corresponding pK_a values were calculated. The half-neutralization potential (HNP) values and the corresponding pK_a values of compounds **3a-i**, obtained from the potentiometric titrations with 0.05 M TBAH in isopropyl alcohol, tert-butyl alcohol, acetonitrile and N,N-dimethylformamide.

The values obtained from the potentiometric titrations were interpreted, and the effect of the C-3 substituent in the 4,5-dihydro-1H- 1,2,4-triazol-5-one ring as well as solvent effects was studied. As an example for the potentiometric titration curves for 0.001M solutions of compounds **3a-i** titrated with 0.05 M TBAH in isopropyl alcohol, tert-butyl alcohol, DMF and acetone are shown in Figure **1-5**.

When the dielectric permittivity of solvents is taken into consideration, the acidity order can be given as follows: DMF (e= 36.7)> acetone (e =36) >isopropyl alcohol (e= 19.4)> tert-butyl alcohol (e =12). As seen in Table **10**,

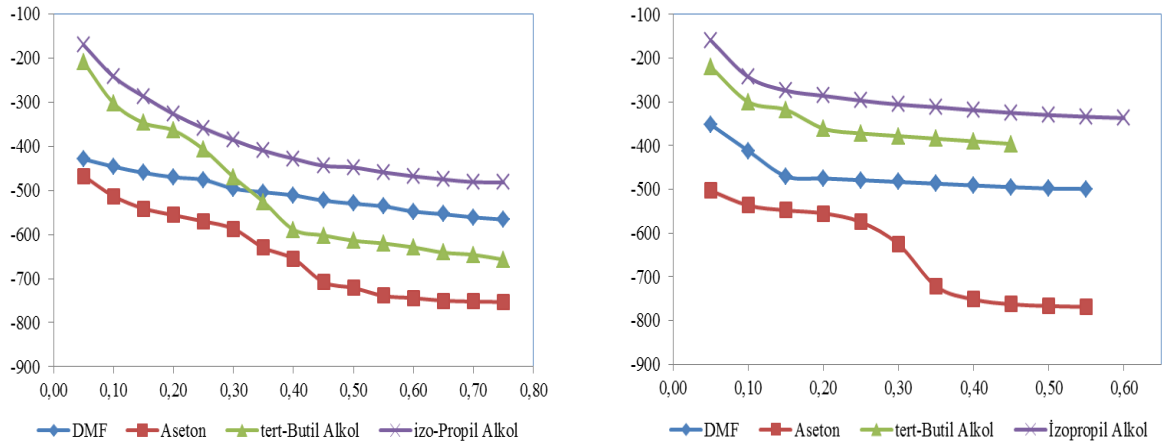

Figure 1. Potentiometric titration curves of 0.001 M solutions of compound 3a and 3b titrated with 0.05 M TBAH in isopropyl alcohol, tert-butyl alcohol, DMF and acetone at 25 °C.

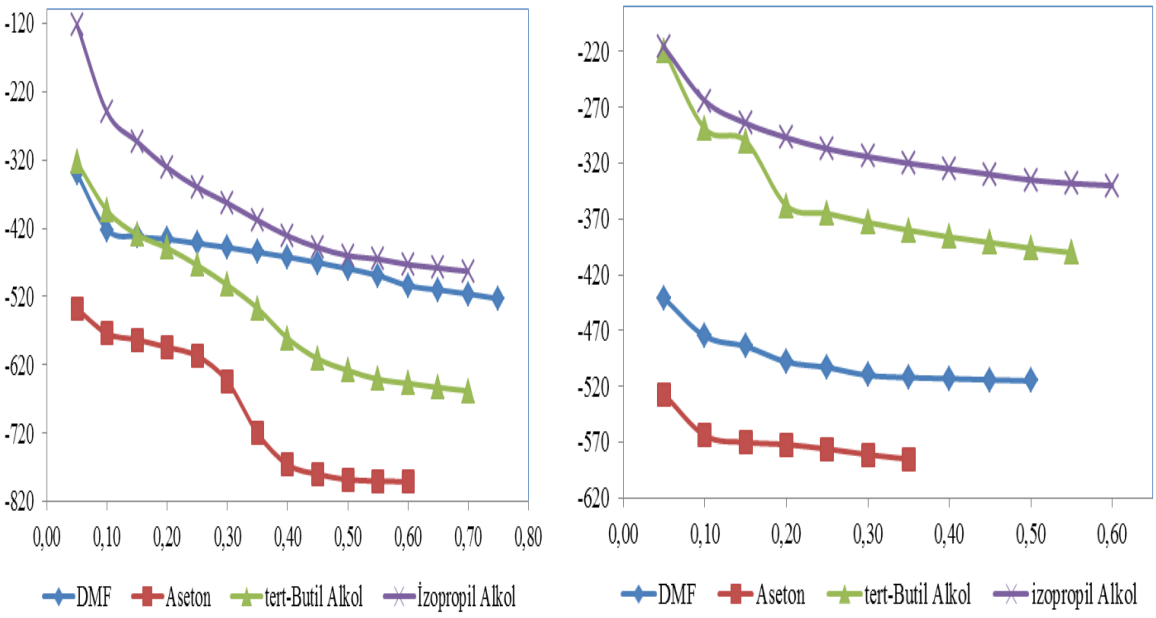

Figure 2. Potentiometric titration curves of 0.001 M solutions of compound 3c and 3d titrated with 0.05 M TBAH in isopropyl alcohol, tert-butyl alcohol, DMF and acetone at 25 °C.

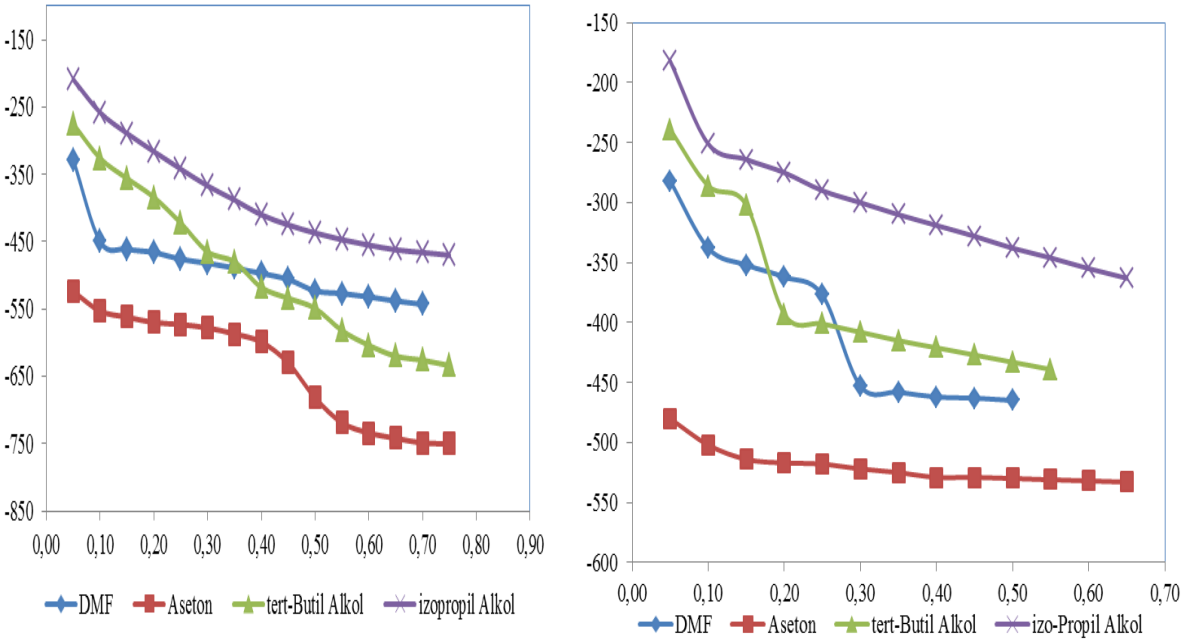

Figure 3. Potentiometric titration curves of 0.001 M solutions of compound 3e and 3f titrated with 0.05 M TBAH in isopropyl alcohol, tert-butyl alcohol, DMF and acetone at 25 °C.

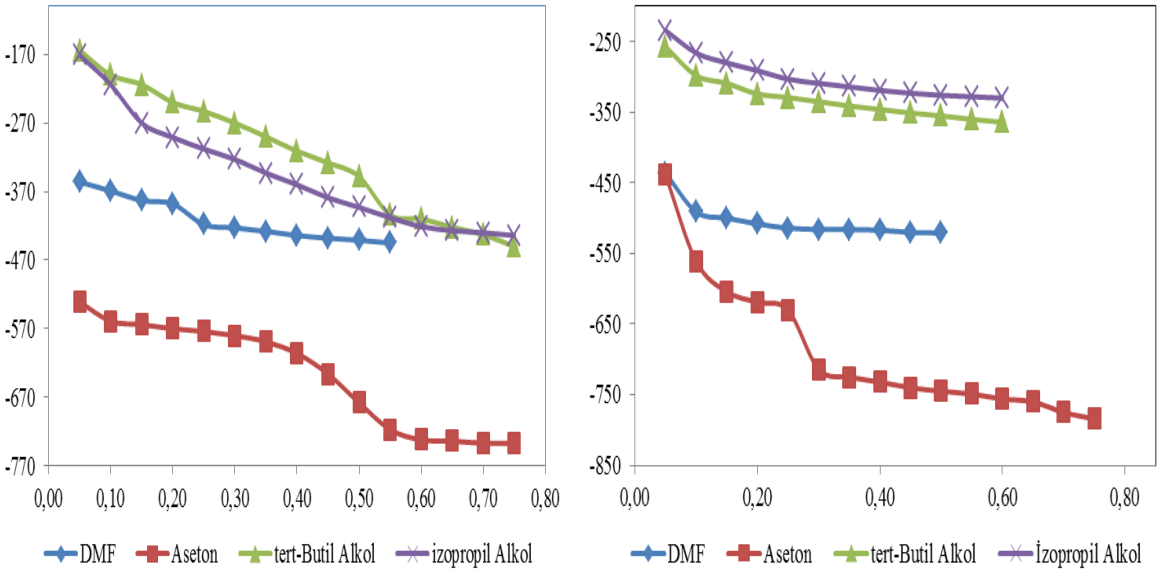

Figure 4. Potentiometric titration curves of 0.001 M solutions of compound 3g and 3h titrated with 0.05 M TBAH in isopropyl alcohol, tert-butyl alcohol, DMF and acetone at 25 °C.

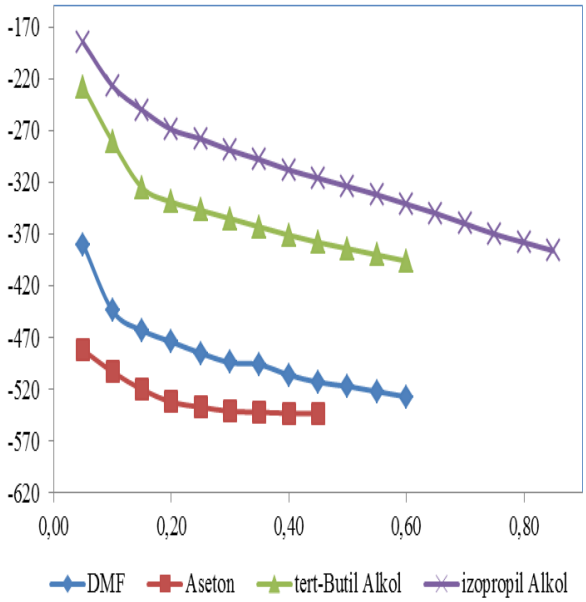

Figure 5. Potentiometric titration curves of 0.001 M solutions of compound 3i titrated with 0.05 M TBAH in isopropyl alcohol, tert-butyl alcohol, DMF and acetone at 25 °C.

Table 1. The HNP and the corresponding pKa values of compounds 3a-i in isopropyl alcohol, tert-butyl alcohol, DMF and acetone.

compounds	DMF		Acetone		Tert-butyl alcohol		Isopropyl alcohol	
	pK_a	HNP	pK_a	HNP	pK_a	HNP	pK_a	Hnp
3a	-	-	16.52	-556	13.19	-355	-	-
3b	-	-	16.34	-548	11.64	-260	-	-
3c	-	-	16.93	-583	14.49	-439	-	-
3d	-	-	-	-	-	-	-	-
3e	-	-	16,63	-571	-	-	-	-
3f	12,97	-345	-	-	11.37	-262	-	-
3g	-	-	16.62	-572	11.39	-253	-	-
3h	-	-	16.97	-582	-	-	-	-
3i	-	-	-	-	11.55	-254	-	-

the acidity order for compounds:

3a : Tert-butyl alcohol > Acetone
3b : Tert-butyl alcohol > Acetone
3c : Tert-butyl alcohol > Acetone
3d : -
3e : Acetone
3f : Tert-butyl alcohol > *N*,*N*-dimethylformamide
3g : Tert-butyl alcohol > Acetone
3h : Acetone
3i : Tert-butyl alcohol

Conclusion

In this study, nine novel 2-methoxy-4-[(3-alkyl(aryl)-4,5-dihydro-1*H*-1,2,4-triazol-5-on-4-yl)-azomethine]phenyl izobutyrates were synthesized and characterized by using IR and ^{1}H-NMR, ^{13}C-NMR spectral data. The synthesized new compounds **3a-i** were titrated potentiometrically with tetrabutylammonium hydroxide in four non-aqueous solvents such as isopropyl alcohol, tert-butyl alcohol, acetone and N,N-dimethylformamide (DMF), and the half-neutralization potential values and the corresponding pK_a values were determined for all cases.

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SYNTHESIS AND *IN-VITRO* ANTIOXIDANT ACTIVITIES OF SOME NOVEL 1-ACETYL-3-ALKYL(ARYL)-4-[4-(4-METHOXYBENZOXY)-BENZYLIDENAMINO]-4,5-DIHYDRO-1*H*-1,2,4-TRIAZOL-5-ONES

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Abstract: In this study, five novel 1-acetyl-3-alkyl(aryl)-4-[4-(4-methoxybenzoxy)-benzylidenamino]-4,5-dihydro-1*H*-1,2,4-triazol-5-ones (**4**) were synthesized by the reactions of 3-alkyl(aryl)-4-[4-(4-methoxybenzoxy)-benzylidenamino]-4,5-dihydro-1*H*-1,2,4-triazol-5-ones (**3**) with acetic anhydride. In order to identify the new compounds synthesized, spestroscopic methods including IR, ^{1}H-NMR, and ^{13}C-NMR were used. Also, compounds **4** were analyzed for their *in vitro* potential antioxidant activities by three different methods (reducing power, free radical scavenging activity, metal chelating activity).

Keywords: 1,2,4-Triazol-5-one, schiff base, synthesis, antioxidant activity

Introduction

Antioxidants are extensively studied for their capacity to protect organism and cell from damage that is induced by the oxidative stress. A great deal of research has been devoted to the study of different types of natural and synthetic antioxidant. A large number of heterocyclic compounds, containing the 1,2,4-triazole ring, are associated with diverse biological properties such as antioxidant, anti-inflammatory, antimicrobial and antiviral activity. Exogenous chemicals and endogenous metabolic processes in human body or in food system might produce highly reactive free radicals, especially oxygen derived radicals, which are capable of oxidizing biomolecules by resulting in cell death and tissue damage. Oxidative damages play a significantly pathological role in human diseases (McClements & Decker, 2000).

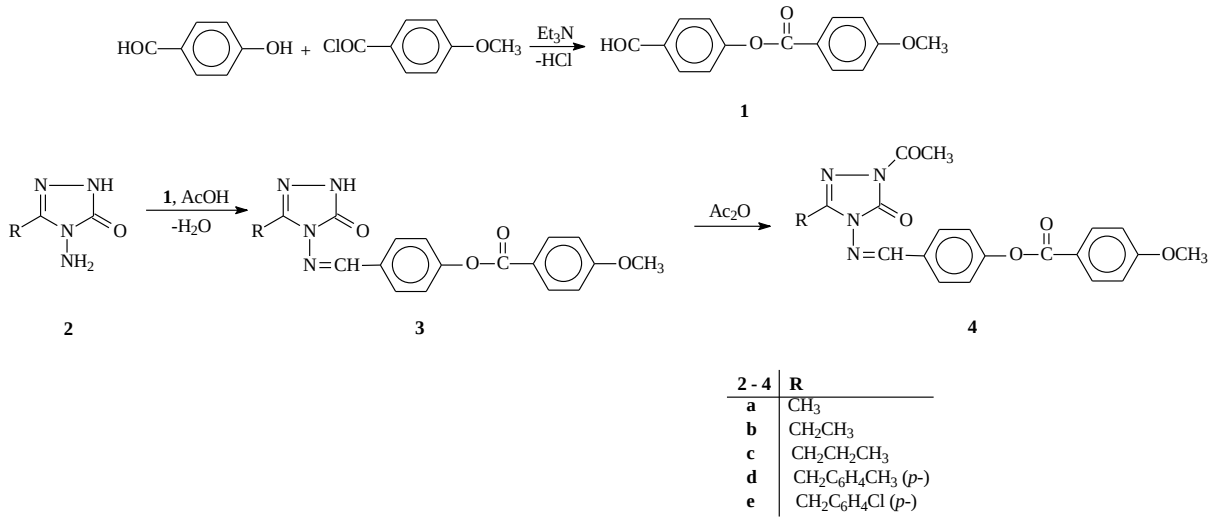
In this study, firstly five novel 1-acetyl-3-alkyl(aryl)-4-[4-(4-methoxybenzoxy)-benzylidenamino]-4,5-dihydro-1*H*-1,2,4-triazol-5-ones (**4a-e**) were synthesized by the reactions of 3-alkyl(aryl)-4-[4-(4-methoxybenzoxy)-benzylidenamino]-4,5-dihydro-1*H*-1,2,4-triazol-5-ones (**3a-e**) (Medetalibeyoğlu & Yüksek, 2011) with acetic anhydride. In order to identify new compounds synthesized in the study, spectroscopic methods including IR, ^{1}H-NMR, and ^{13}C-NMR were used. Compounds **2a-e** were synthesized according to literature (İkizler & Yüksek, 1993; İkizler & Ün, 1979).

In the second part of the study, antioxidant activities of the newly synthesized compounds were screened using different antioxidant methodologies: free radical scavenging activity (Blois, 1968), reducing power activity (Oyaizu, 1986) and metal chelating activity (Dinis, Madeira & Almeida, 1994).

Experimental

General procedure for the synthesis of compounds 4

The corresponding compound **3** (0.01 mol) was refluxed with acetic anhydride (20 mL) for 0.5 h. After the addition of absolute ethanol (100 mL), the mixture was refluxed for 1 h more. Evaporation of the resulting solution at 40-45 °C in vacuo and several recrystallizations of the residue from ethyl alcohol gave pure compounds **4a-e** as colorless needles.



2 - 4	R
a	CH_3
b	CH_2CH_3
c	$CH_2CH_2CH_3$
d	$CH_2C_6H_4CH_3$ (*p*-)
e	$CH_2C_6H_4Cl$ (*p*-)

1-Acetyl-3-methyl-4-[4-(4-methoxybenzoxy)-benzylidenamino]-4,5-dihydro-1*H*-1,2,4-triazol-5-one (4a): yield 97%, m.p. 209 °C; IR(υ, cm^{-1}): 3067 (CH), 1767, 1720 (C=O), 1599,1510 (C=N), 1256 (COO), 846 (1,4-disubstituted aromatic ring) .^{1}H-NMR (DMSO-d_6, δ ppm): 2.39 (s, 3H, CH_3), 2.52 (s, 3H, $COCH_3$), 3.92 (s, 3H, OCH_3), 7.15 (d, 2H, ArH; *J*=8.80 Hz), 7.45 (d, 2H, ArH; *J*=8.80 Hz), 7.98 (d, 2H, ArH; *J*=8.80 Hz), 8.13 (d, 2H, ArH; *J*=8.80 Hz), 9.63 (s, 1H, N=CH). ^{13}C-NMR (DMSO-d_6, δ ppm): 11.59 (CH_3), 23.69 ($COCH_3$), 56.20 (OCH_3), 114.88 (2C), 121.41, 123.09 (2C), 129.81 (2C), 131.18, 132.55 (2C), 154.04, 164.35 (ArC), 147.11 (Triazol C_3), 148.40 (Triazol C_5), 155.90 (N=CH), 164.52 (COO), 166.35 ($\underline{CO}CH_3$).

1-Acetyl-3-ethyl-4-[4-(4-methoxybenzoxy)-benzylidenamino]-4,5-dihydro-1*H*-1,2,4-triazol-5-one (4b): yield 84%, m.p. 163 °C; IR(υ, cm^{-1}): 3009 (NH), 1771, 1732 (C=O), 1601, 1511 (C=N), 1262 (COO), 847 (1,4-disubstituted aromatic ring).^{1}H-NMR (DMSO-d_6, δ ppm): 1.26 (t, 3H, CH_3; *J*=7.60 Hz), 2.51 (s, 3H, $COCH_3$), 2.78 (q, 2H, CH_2CH_3; *J*=7.60 Hz), 3.88 (s, 3H, OCH_3), 7.14 (d, 2H, ArH; *J*=8.80 Hz), 7.45 (d, 2H, ArH; *J*=8.80 Hz), 7.97 (d, 2H, ArH; *J*=8.80 Hz), 8.11 (d, 2H, ArH; J=8.80 Hz), 9.63(s, 1H, N=CH). ^{13}C-NMR (DMSO-d_6, δ ppm): 9.52 ($CH_2\underline{CH_3}$), 11.59 ($\underline{CH_2}CH_3$), 23.49 ($COCH_3$), 55.68 (OCH_3), 114.33 (2C), 120.62, 122.85 (2C), 129.81 (2C), 130.72, 132.13 (2C), 153.37, 168.88 (ArC), 148.12 (Triazol C_3), 150.21 (Triazol C_5), 154.92 (N=CH), 163.91 (COO), 165.98 ($\underline{CO}CH_3$).

1-Acetyl-3-*n*-propyl-4-[4-(4-methoxybenzoxy)-benzylidenamino]-4,5-dihydro-1*H*-1,2,4-triazol-5-one (4c): yield 71%, m.p. 198 °C; IR(υ, cm^{-1}): 3095 (CH), 1763, 1724 (C=O), 1601,1509 (C=N), 1256 (COO), 846 (1,4-disubstituted aromatic ring). ^{1}H-NMR (DMSO-d_6, δ ppm): 1.00 (t, 3H, CH_3; *J*=7.20 Hz), 1.73 (sext, 2H, $CH_2\underline{CH_2}CH_3$; *J*=7.20 Hz), 2.51 (s, 3H, $COCH_3$), 2.73 (t, 2H, $\underline{CH_2}CH_2CH_3$; *J*=7.20 Hz), 3.88 (s, 3H, OCH_3), 7.14 (d, 2H, ArH; *J*=8.80 Hz), 7.45 (d, 2H, ArH; *J*=8.80 Hz), 7.97 (d, 2H, ArH; *J*=8.80 Hz), 8.11 (d, 2H, ArH; *J*=8.80 Hz), 9.63 (s, 1H, N=CH). ^{13}C-NMR (DMSO-d_6, δ ppm): 13.47 ($CH_2CH_2\underline{CH_3}$), 18.47 ($CH_2\underline{CH_2}CH_3$), 23.50 ($COCH_3$), 26.68 ($\underline{CH_2}CH_2CH_3$), 55.68 (OCH_3), 114.33 (2C), 120.62, 122.87 (2C), 129.30 (2C), 130.71, 132.73 (2C), 153.38, 168.88 (ArC), 148.06 (Triazol C_3), 149.07 (Triazol C_5), 154.97 (N=CH), 163.91 (COO), 165.99 ($\underline{CO}CH_3$).

1-Acetyl-3-*p*-methylbenzyl-4-[4-(4-methoxybenzoxy)-benzylidenamino]-4,5-dihydro-1*H*-1,2,4-triazol-5-one (4d): yield 97%, m.p. 156 °C; IR(υ, cm^{-1}): 3086 (CH), 1761, 1727 (C=O), 1599,1510 (C=N), 1262 (COO), 840 (1,4-disubstituted aromatic ring). ^{1}H-NMR (DMSO-d_6, δ ppm): 2.28 (s, 3H, $PhCH_3$), 2.52 (s, 3H, $COCH_3$), 3.90 (s, 3H, OCH_3), 4.12 (s, 2H, CH_2Ph), 7.14-7.16 (m, 4H, ArH), 7.28 (d, 2H, ArH; *J*=8.00 Hz), 7.44 (d, 2H, ArH; *J*=8.80 Hz), 7.92 (d, 2H, ArH; *J*=8.80 Hz), 8.12 (d, 2H, ArH; *J*=9.20 Hz), 9.59 (s, 1H, N=CH). ^{13}C-NMR (DMSO-d_6, δ ppm): 21.01 ($PhCH_3$), 23.74 ($COCH_3$), 31.22 (CH_2Ph), 56.18 (OCH_3), 114.87 (2C), 121.41; 123.07 (2C), 129.28 (2C), 130.15, 132.00, 132.54 (2C), 136.61, 154.03, 164.35 (ArC), 148.50 (Triazol C_3), 148.84 (Triazol C_5), 155.62 (N=CH), 164.52 (COO), 166.32 ($\underline{CO}CH_3$).

1-Acetyl-3-*p*-chlorobenzyl-4-[4-(4-methoxybenzoxy)-benzylidenamino]-4,5-dihydro-1*H*-1,2,4-triazol-5-one (4d): yield 80%, m.p. 204 °C; IR(υ, cm^{-1}): 3055 (CH), 1778, 1724 (C=O), 1601,1506 (C=N), 1254 (COO), 836 (1,4-disubstituted aromatic ring). ^{1}H-NMR (DMSO-d_6, δ ppm): 2.51 (s, 3H, $COCH_3$), 3.88 (s, 3H, OCH_3), 4.17 (s, 2H, CH_2Ph), 7.13 (m, 4H, ArH; *J*=8.80 Hz), 7.38-7.44 (m, 6H, ArH), 7.92 (d, 2H, ArH; *J*=8.40 Hz), 8.10 (d, 2H, ArH; *J*=8.80 Hz), 9.60 (s, 1H, N=CH). ^{13}C-NMR (DMSO-d_6, δ ppm): 23.49 ($CO\underline{CH_3}$), 30.33 (CH_2Ph), 55.63 (OCH_3), 114.27 (2C), 120.60, 122.75 (2C), 128.43 (2C), 129.31, 130.60, 130.95 (2C), 132.09, 133.61(2C), 134.73, 148.00 (Triazol C_3+C_5), 153.36, 163.86 (ArC), 154.41 (N=CH), 163.86 (COO), 165.89 ($\underline{CO}CH_3$).

Results and Findings

Antioxidant activity

The antioxidant activities of compounds 4a-e were determined. Several methods are used to determine antioxidant activities. The methods used in the study are given below:

Total reductive capability using the potassium ferricyanide reduction method: The reductive capabilities of compounds were assessed by the extent of conversion of the Fe^{3+}/ferricyanide complex to the Fe^{2+}/ferrous form. The reducing powers of the compounds were observed at different concentrations, and results were compared with BHA and α-tocopherol. It has been noticed that the reducing capacity of a compound may serve as a significant indicator of its potential antioxidant activity (Meir et al., 1995). In this study, all the amount of the compounds showed lower absorbance than standard antioxidants. Hence, no activities were observed to reduce metal ions complexes to their lower oxidation state or to take part in any electron transfer reaction. In other words, synthesized compounds did not show the reductive activities.

DPPH· radical scavenging activity: The model of scavenging the stable DPPH radical model is a widely used method to evaluate antioxidant activities in a relatively short time compared with other methods. The effect of antioxidants on DPPH radical scavenging was thought to be due to their hydrogen donating ability (Baumann, Wurn & Bruchlausen, 1979). The reduction capability of DPPH radicals was determined by decrease in its absorbance at 517 nm induced by antioxidants. The absorption maximum of a stable DPPH radical in ethanol was at 517 nm. The decrease in absorbance of DPPH radical was caused by antioxidants because of reaction between antioxidant molecules and radical, progresses, which resulted in the scavenging of the radical by hydrogen donation. It is visually noticeable as a discoloration from purple to yellow. Hence, DPPH. is usually used as a substrate to evaluate antioxidative activity of antioxidants (Duh, Tu & Yen 1999). In the study, antiradical activities of compounds and standard antioxidants such as BHA and α-tocopherol were determined by using DPPH. method. In the study, antiradical activities of compounds and standard antioxidants such as BHA, BHT and α-tocopherol were determined by using DPPH· method. Figure **1** illustrates that the radical scavenging effects of the compounds **4c**, **4d** and **4e** were concentration-dependent, the other compounds were not. These newly synthesized compounds **4a-e** showed moderate radical scavenging activity.

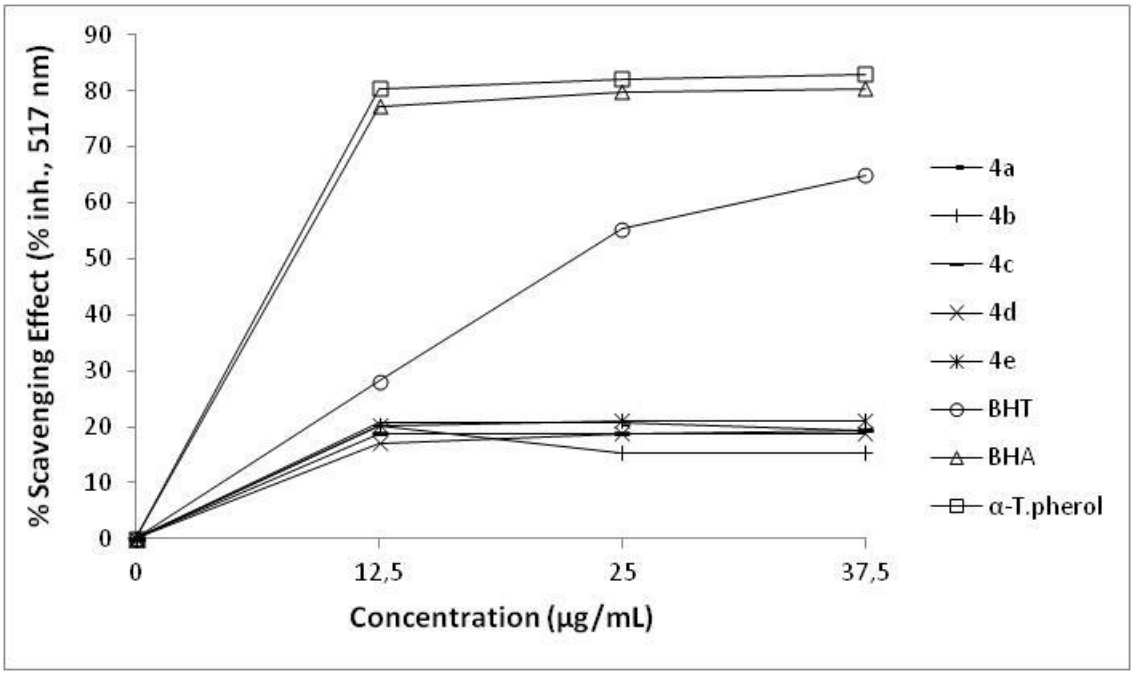


Figure 1. Scavenging effect of compounds 4a-e, BHT, BHA and α-tocopherol at different concentrations (12,5-25-37.5 µg/mL)

Ferrous ion chelating activity: The chelating effect towards ferrous ions by the compounds and standards was determined. Ferrozine can quantitatively form complexes with Fe^{2+}. In the presence of chelating agents, the complex formation is disrupted with the result that the red colour of the complex is decreased. Transition metals have pivotal role in the generation oxygen free radicals in living organism. Among the transition metals, iron is known as the most important lipid oxidation pro-oxidant due to its high reactivity. The ferrous state of iron

accelerates lipid oxidation by breaking down the hydrogen and lipid peroxides to reactive free radicals via the Fenton reactions:

$$Fe^{2+} + H_2O_2 \rightarrow Fe^{3+} + OH^- + OH^\cdot$$

Fe^{3+} ion also produces radicals from peroxides, even though the rate is tenfold less than that of Fe^{2+} ion, which is the most powerful pro-oxidant among the various types of metal ions (Çaliş et al., 1993). Fe^{3+} ion also produces radicals from peroxides, although the rate is tenfold less than that of Fe^{2+} ion, which is the most powerful pro-oxidant among the various types of metal ions. Ferrous ion chelating activities of the compounds **4a-e**, EDTA and α-tocopherol are shown in Figure **2**. Low absorbance at 562 nm indicates high metal chelating activity. The data obtained from Figure **2** reveal that the metal chelating effects of the compounds **4a-e** were concentration-dependent. The metal chelating effect of the compounds **4a-e** and references decreased in order of **BHT > BHA > 4a > 4e > 4c > 4d > α-tocopherol > 4b**, which were 66.9, 64.0, 60.6, 59.9, 59.4, 58.9, 58.6, 57.9 (%), at the highest concentration, respectively.

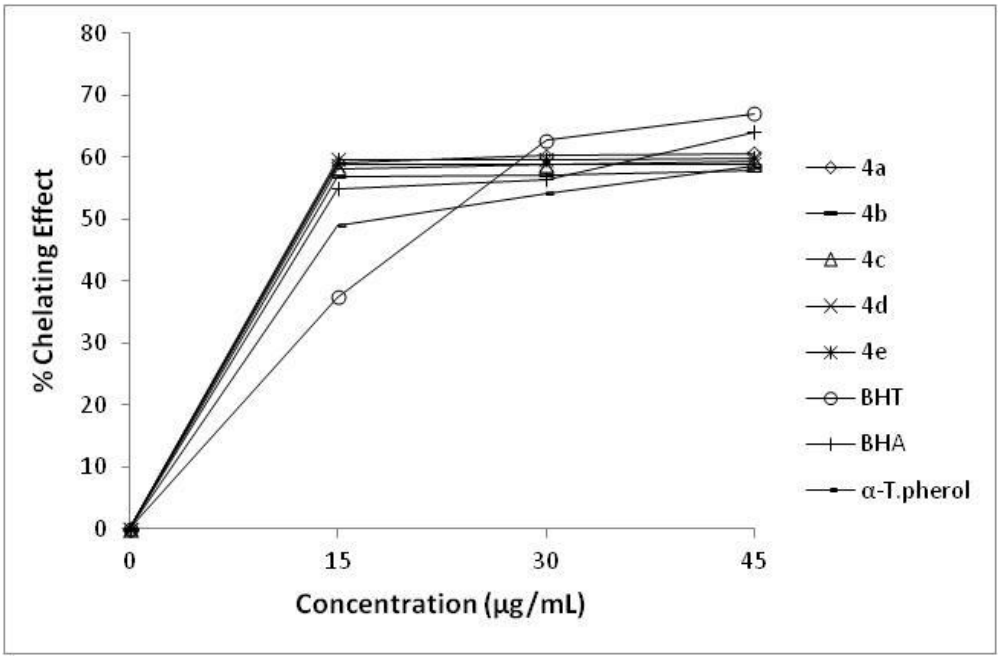


Figure 2. Metal chelating effect of different amount of the compounds 4a-e, BHT and α-tocopherol on ferrous ions.

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A STUDY ON THEORETICAL AND EXPERIMENTICAL SPECTROSCOPIC PROPERTIES 1-METHYL-3-BENZYL-4-(3-ETHOXY-4-METHOXYBENZYLIDENAMINO)-4,5-DIHYDRO-1H-1,2,4-TRIAZOL-5-ONE

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Abstract: In this study, theoretical spectral values of 1-methyl-3-benzyl-4-(3-ethoxy-4-methoxybenzylidenamino)-4,5-dihydro-*1H*-1,2,4-triazol-5-one were calculated. These values were compared with experimental values and obtained conclusions were evaluated. For this purpose, firstly, 1-methyl-3-benzyl-4-(3-ethoxy-4-methoxybenzylidenamino)-4,5-dihydro-1*H*-1,2,4-triazol-5-one has been optimized using B3LYP/6-311G(d,p) and HF/6-311G(d,p) basis sets. ^{1}H-NMR and ^{13}C-NMR spectral values according to GIAO method were calculated using Gaussian G09W program package in gas phase and in DMSO solvent. Theoretical and experimental values were plotted according to δ exp=a. δ calc. + b, Eq. a and b constants regression coefficients with a standard error values were found using the Sigma plot program. Theoretically calculated IR values of this compound were calculated in gas phase by using of 6-311G(d,p) basis sets of B3LYP and HF methods. The identification of calculated IR values were used veda4f program. UV-vis values were calculated in ethanol. In addition, bond angles, bond lengths, dipole moments, the highest occupied molecular orbital-lowest unoccupied molecular orbital (HOMO-LUMO) energy, mulliken charges and total energy of the molecule were calculated with both methods. The calculated and experimental results were exhibited a very good agreement.

Keywords: 1,2,4-triazol-5-on, Gaussian 09W, GIAO, B3LYP, HF, 6-311G(d,p) basic set

Introduction

Quantum chemical calculation methods have been widely used to predict as theoretical the structural, spectroscopic (IR, ^{1}H-NMR, ^{13}C-NMR and UV spectroscopic parameters) of molecular systems. The quantum chemical calculation methods provide support for experimental structural and spectroscopic studies. Therefore, molecular geometry, vibrational spectra, ^{13}C and ^{1}H NMR chemical shifts, electronic properties and atomic charges of the corresponding molecule have been studied by using DFT/B3LYP/6–311G(d,p) and HF/6–311G(d,p) levels (Frisch et al., 2009; Wolinski, Hilton & Pulay, 1990). The literature concerning the 1,2,4-triazole is rich and the papers published cover such subjects as vibrational properties, density functional theory (DFT) and Hartree-Fock (HF) calculations Literature survey have revealed that the DFT and HF have a great accuracy in reproducing the experimental values in geometry, vibrational frequency, NMR chemical shifts etc. (Yüksek et al., 2005a; 2005b; Yüksek et al., 2005).

Computational Details

The optimized molecular structures, vibrational frequencies, ^{1}H and ^{13}C NMR chemical shifts, UV–vis spectroscopic parameters, atomic charges and frontier molecule orbitals of the compound **2**, were calculated by using DFT/B3LYP and HF methods with 6–311G(d, p) basis set. In this study, all calculations were carried out with the Gauss–View molecular visualization program and Gaussian 09W program package on personal computer (Frisch et al., 2009; Wolinski, Hilton & Pulay, 1990).

For the vibrational computations, molecular structures of the compound **2** were calculated by using Becke–3–Lee Yang Parr (B3LYP) (Becke, 1993; Lee, Yang & Parr, 1988) density functional methods with 6–311G(d, p) basis set in ground state. The positive values of all calculated vibrational wavenumbers show that the optimized

molecular structures are stable. Therefore, the calculated vibrational wavenumbers were scaled with 0.9614 ranges from 1700 to 4000 cm^{-1} for B3LYP/6–311G(d, p) and HF/6–311G(d, p) level (Scott & Radom, 1996). The veda4f program, was used in defining IR data, which were calculated theoretically (Jamroz, 2004).
For the NMR calculations, the optimized molecular geometries of the compound were obtained at 6–311G(d, p) basis level in DMSO solvent by using GIAO method. Then, ^{1}H and ^{13}C NMR chemical shifts for the compound were calculated at B3LYP/6–31G(d) and HF levels in solvent by using gauge invariant atomic orbital (GIAO) method (Ditchfield, 1974; London, 1937; Wolinski, Hilton & Pulay, 1990). The UV–vis spectroscopic calculations of the mentioned molecule were performed by using TD–SCF/B3LYP and TD–SCF/HF method in ethanol solvent (Vlcek &Zalis, 2007). In additional, HOMO and LUMO energy values and energy gaps for the compound were calculated by using B3LYP and HF methods with 6–311G(d, p) basis set. Finally, mulliken atomic charges of the molecule under investigation were calculated by B3LYP and HF method at the same level (Özdemir et al., 2013).

Results and Discussion

Molecular Structure

The optimized molecular structures and chemical structure of the compound were given in Figure **1**. Similarly, the optimized molecular geometric parameters such as bond angles bond and lenghts of the compound by using B3LYP/6–311G(d, p) and HF/6–311G(d, p) levels are listed in Table **1** and Table **2** (Özdemir et al., 2013).

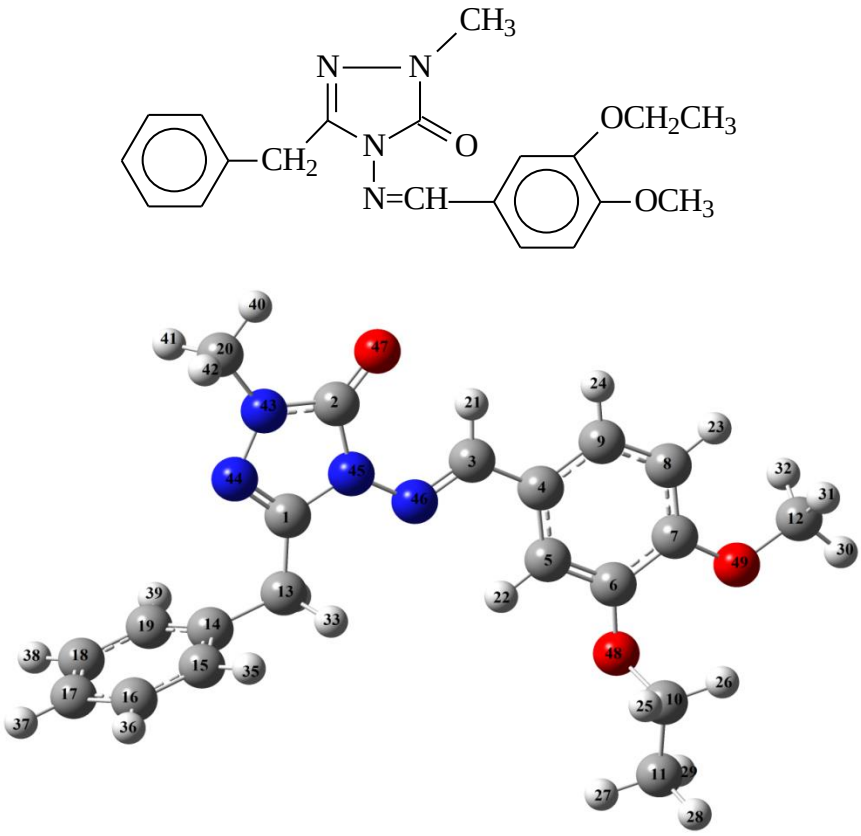


Figure 1. The chemical structure (top) and optimized molecular structure (bottom) of compound with DFT/B3LYP/6–311G(d, p) level.

Table1. The calculated bond angles of the compound

	Bond Angles	B3LYP	HF		Bond Angles	B3LYP	HF
1	C(1)-N(44)-N(43)	105.34	105.66	36	N(45)-C(1)-C(13)	122.34	122.03
2	C(1)-N(45)-N(46)	121.41	121.23	37	N(45)-N(46)-C(3)	118.95	119.86
3	C(1)-N(45)-C(2)	108.00	107.83	38	N(46)-C(3)-H(21)	121.79	122.19
4	C(1)-C(13)-H(33)	108.16	107.88	39	N(46)-C(3)-C(4)	120.57	120.71
5	C(1)-C(13)-H(34)	108.15	107.87	40	H(21)-C(3)-C(4)	117.64	117.10
6	C(1)-C(13)-C(14)	113.70	113.79	41	C(3)-C(4)-C(5)	122.61	122.49
7	H(33)-C(13)-C(14)	110.56	110.55	42	C(3)-C(4)-C(9)	118.93	118.92

8	H(34)-C(13)-C(14)	110.54	110.54	43	C(4)-C(5)-H(22)	120.16	120.28
9	C(13)-C(14)-C(15)	120.60	120.63	44	C(4)-C(5)-C(6)	121.31	121.10
10	C(13)-C(14)-C(19)	120.69	120.61	45	H(22)-C(5)-C(6)	118.52	118.62
11	C(14)-C(15)-H(35)	119.50	119.67	46	C(5)-C(6)-O(48)	119.26	119.92
12	C(14)-C(15)-C(16)	120.76	120.72	47	C(5)-C(6)-C(7)	119.71	119.96
13	H(35)-C(15)-C(16)	119.74	119.61	48	O(48)-C(6)-C(7)	120.94	120.08
14	C(15)-C(16)-H(36)	119.82	119.78	49	C(6)-C(7)-O(49)	115.94	115.96
15	C(15)-C(16)-C(17)	120.07	120.12	50	C(6)-C(7)-C(8)	119.28	119.22
16	H(36)-C(16)-C(17)	120.11	120.10	51	O(49)-C(7)-C(8)	124.78	124.82
17	C(16)-C(17)-H(37)	120.20	120.21	52	C(7)-C(8)-H(23)	120.44	120.75
18	C(16)-C(17)-C(18)	119.62	119.57	53	C(7)-C(8)-C(9)	120.23	120.13
19	H(37)-C(17)-C(18)	120.18	120.22	54	H(23)-C(8)-C(9)	119.32	119.12
20	C(17)-C(18)-H(38)	120.09	120.11	55	C(8)-C(9)-H(24)	119.31	118.97
21	C(17)-C(18)-C(19)	120.11	120.12	56	C(8)-C(9)-C(4)	121.00	121.02
22	H(38)-C(18)-C(19)	119.80	119.78	57	H(24)-C(9)-C(4)	119.69	120.02
23	C(18)-C(19)-H(39)	119.76	119.61	58	C(9)-C(4)-C(5)	118.46	118.58
24	C(18)-C(19)-C(14)	120.72	120.72	59	C(6)-O(48)-C(10)	116.47	116.45
25	H(39)-C(18)-C(14)	119.52	119.68	60	O(48)-C(10)-H(25)	108.87	109.16
26	N(44)-N(43)-C(20)	121.07	120.80	61	O(48)-C(10)-H(26)	109.68	109.72
27	N(43)-C(20)-H(40)	107.26	107.75	62	H(25)-C(10)-C(11)	111.11	110.89
28	N(43)-C(20)-H(41)	110.41	110.23	63	H(26)-C(10)-C(11)	111.06	110.77
29	N(43)-C(20)-H(42)	110.42	110.23	64	C(10)-C(11)-H(27)	110.69	110.57
30	C(20)-N(43)-C(2)	125.47	126.36	65	C(10)-C(11)-H(28)	110.23	110.17
31	N(44)-C(1)-C(13)	125.34	126.88	66	C(10)-C(11)-H(29)	110.38	110.30
32	N(43)-C(2)-N(45)	101.94	102.58	67	C(7)-O(49)-C(12)	118.54	119.87
33	N(43)-C(2)-O(47)	129.45	129.19	68	O(49)-C(12)-H(30)	111.28	111.27
34	O(47)-C(2)-N(45)	128.62	128.22	69	O(49)-C(12)-H(31)	111.48	111.42
35	C(2)-N(45)-N(46)	130.60	130.94	70	O(49)-C(12)-H(32)	105.75	106.12

Table 2. The calculated bond lengths of the compound

	Bond Lenghts (A^0)	**B3LYP**	**HF**		**Bond Lenghts (A^0)**	**B3LYP**	**HF**
1	C(1)-N(44)	1.2957	1.2659	25	N(45)-C(2)	1.4168	1.3865
2	C(1)-N(45)	1.3870	1.3777	26	N(45)-N(46)	1.3720	1.3655
3	C(1)-C(13)	1.4982	1.4989	27	N(46)-C(3)	1.2863	1.2586
4	C(13)-H(33)	1.0950	1.0846	28	C(3)-H(21)	1.0869	1.0752
5	C(13)-H(34)	1.0944	1.0845	29	C(3)-C(4)	1.4608	1.4717
6	C(13)-C(14)	1.5127	1.5122	30	C(4)-C(5)	1.4064	1.3992
7	C(14)-C(15)	1.3966	1.3873	31	C(4)-C(9)	1.3963	1.3783
8	C(14)-C(19)	1.3969	1.3872	32	C(5)-H(22)	1.0823	1.0730
9	C(15)-H(35)	1.0852	1.0763	33	C(5)-C(6)	1.3814	1.3686
10	C(15)-C(16)	1.3928	1.3841	34	C(6)-O(48)	1.3699	1.3540
11	C(16)-H(36)	1.0844	1.0756	35	C(6)-C(7)	1.4180	1.4077
12	C(16)-C(17)	1.3929	1.3844	36	C(7)-O(49)	1.3590	1.3410
13	C(17)-H(37)	1.0842	1.0754	37	C(7)-C(8)	1.3948	1.3802
14	C(17)-C(18)	1.3932	1.3842	38	C(8)-H(23)	1.0815	1.0721
15	C(18)-H(38)	1.0844	1.0756	39	C(8)-C(9)	1.3936	1.3912
16	C(18)-C(19)	1.3924	1.3843	40	C(9)-H(24)	1.0845	1.0757
17	C(19)-H(39)	1.0851	1.0763	41	O(48)-C(10)	1.4414	1.4149
18	N(44)-N(43)	1.3805	1.3700	42	C(10)-C(11)	1.0931	1.5128
19	N(43)-C(20)	1.4454	1.4397	43	C(10)-H(25)	1.0972	1.0842
20	C(20)-H(40)	1.0894	1.0800	44	C(10)-H(26)	1.5156	1.0877
21	C(20)-H(41)	1.0922	1.0834	45	C(11)-H(27)	1.0921	1.0844
22	C(20)-H(42)	1.0922	1.0834	46	C(11)-H(28)	1.0922	1.0862
23	N(43)-C(2)	1.3695	1.3449	47	C(11)-H(29)	1.0933	1.0847
24	C(2)-O(47)	1.2202	1.2001				

NMR Spectral Analysis

In nuclear magnetic resonance (NMR) spectroscopy, the isotropic chemical shift analysis allows us to identify relative ionic species and to calculate reliable magnetic properties which provide the accurate predictions of molecular geometries (Rani et al., 2010; Subramanian, Sundaraganesan & Jayabharathi, 2010; Wade, 2006). In

this framework, the optimized molecular geometry of the compound was obtained by using B3LYP and HF methods with 6–311G(d, p) basis level in DMSO solvent. By considering the optimized molecular geometry of the compound**.** the ^{1}H and ^{13}C NMR chemical shift values were calculated at the same level by using Gauge-Independent Atomic Orbital (GIAO) method. Theoretical and experimental (Yüksek et al., 2005) values were plotted according to δ exp=a. δ calc.+ b, Eq. a and b constants regression coefficients with a standard error values were found using the SigmaPlot program. The correlation graphics are given Figure **2** and the linear correlation data of the compound by considering the results are given in Table **3** (Özdemir et al., 2013).

Table 3. The calculated and experimental ^{13}C and ^{1}H NMR isotropic chemical shifts of the compound (with respect to TMS, all values in ppm).

No	Experimental	DFT/631d/DMSO	Fark/DMSO	HF/631d/DMSO	Fark/DMSO
C1	148,40	169,12	-20,72	160,27	-11,87
C2	149,72	171,09	-21,37	160,59	-10,87
C3	153,88	170,75	-16,87	162,30	-8,42
C4	125,95	148,91	-22,96	133,20	-7,25
C5	111,64	139,33	-27,69	131,62	-19,98
C6	144,82	171,98	-27,16	154,71	-9,89
C7	152,05	180,50	-28,45	165,36	-13,31
C8	109,27	130,94	-21,67	117,51	-8,24
C9	126,94	151,29	-24,35	142,19	-15,25
C10	63,81	87,64	-23,83	67,31	-3,50
C11	14,81	33,16	-18,35	21,43	-6,62
C12	55,74	72,43	-16,69	54,17	1,57
C13	31,25	53,06	-21,81	35,73	-4,48
C14	135,90	157,88	-21,98	145,45	-9,55
C15	128,95	151,87	-22,92	140,80	-11,85
C16	128,65	149,85	-21,20	139,10	-10,45
C17	123,56	148,51	-24,95	137,53	-13,97
C18	128,65	149,78	-21,13	139,14	-10,49
C19	128,95	152,14	-23,19	140,76	-11,81
C20	32,12	47,38	-15,26	33,27	-1,15
H21	9,55	10,82	-1,27	10,05	-0,50
H22	7,58	8,73	-1,15	8,61	-1,03
H23	7,08	7,61	-0,53	7,21	-0,13
H24	7,20	8,05	-0,85	7,96	-0,76
H25	4,11	4,22	-0,11	3,46	0,65
H26	4,11	5,28	-1,17	3,94	0,17
H27	1,42	1,86	-0,44	1,35	0,07
H28	1,42	2,13	-0,71	1,72	-0,30
H29	1,42	2,13	-0,71	1,73	-0,31
H30	3,87	4,36	-0,49	3,66	0,21
H31	3,87	4,46	-0,59	3,78	0,09
H32	3,87	4,86	-0,99	4,21	-0,34
H33	4,11	4,74	-0,63	4,14	-0,03
H34	4,11	4,75	-0,64	4,15	-0,04
H35	7,35	8,23	-0,88	7,97	-0,62
H36	7,50	8,30	-0,80	8,01	-0,51
H37	7,30	8,24	-0,94	7,94	-0,64
H38	7,50	8,31	-0,81	8,01	-0,51
H39	7,35	8,24	-0,89	7,97	-0,62
H40	3,42	3,58	-0,16	3,03	0,39
H41	3,42	3,60	-0,18	3,03	0,39
H42	3,42	4,36	-0,94	3,78	-0,36

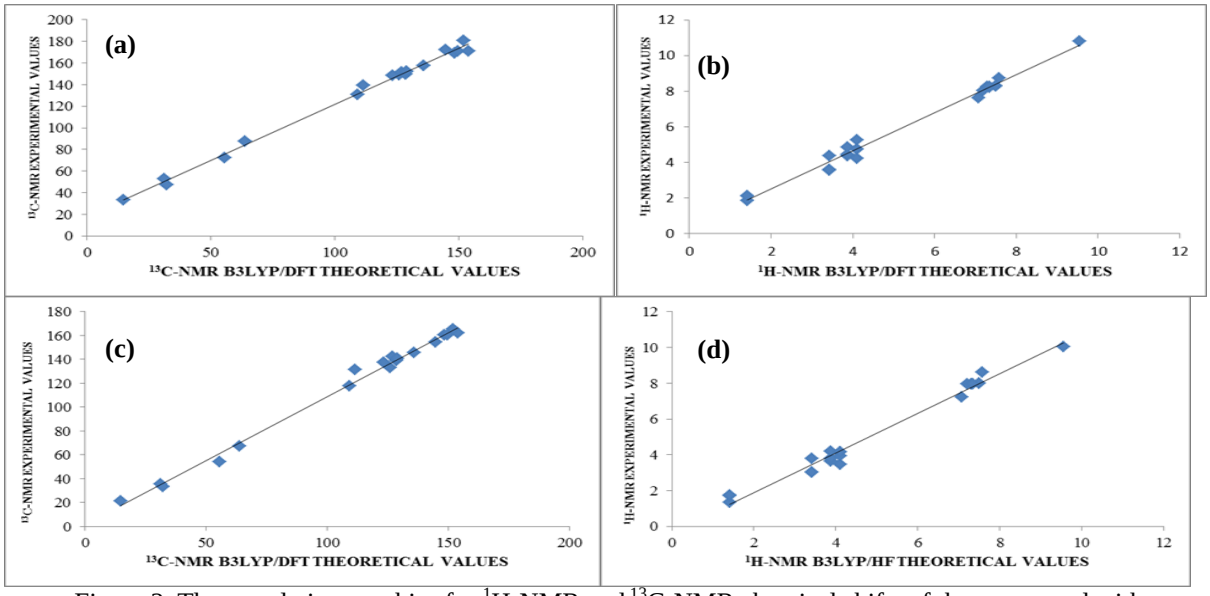


Figure 2. The correlation graphics for ^{1}H-NMR and ^{13}C-NMR chemical shifts of the compound with DFT/B3LYP/6–311G(d, p) (a, c) and HF/B3LYP/6–311G(d, p) (b, d) levels.

Analysis of vibrational modes

Investigation of vibrational wavenumbers of the chemical compounds plays a primary role in the spectral analysis. In spectroscopic field, the vibrational spectra of substituted benzene derivatives have been greatly investigated by various spectroscopic, since the single substitution can have a tendency to put greater changes in vibrational wavenumbers of benzene (Tereci et al., 2012; Pir et al., 2013a; 2013b). The number of potentially active fundamentals of non-linear molecule which have N atoms is equal to (3N-6) apart from three translational and three rotational degrees of freedom. The 1-methyl-3-benzyl-4-(3-ethoxy-4-methoxybenzylidenamino)-4,5-dihydro-1*H*-1,2,4-triazol-5-one molecule has 49 atoms and therefore the normal vibration numbers are 141. The experimental (Yüksek et al., 2005) and calculated vibrational frequencies of the compound were summarized in Table **4**. Furthermore, the simulated spectra by using B3LYP/6–311G(d, p) and HF/6–311G(d, p) levels of the compound under investigation were given in Figure **3** (Özdemir et al., 2013).

Table 4. The calculated frequencies values of the compound

Selected Vibration Types	Exp.	scaled DFT	scaled HF
τ HCCC (19), τ OCNN (54), τ COCC (19)	712	731	765
ν CC (28), τ HCCC (87)	756	768	799
τ HCCC (39)		797	839
τ HCCC (91)		855	909
τ COCC (35)		1012	1187
ν OC (42), ν CC (18), δ COC (24)		1287	1358
ν OC (49), δ OCC (32)		1362	1423
ν CN (76), δ CNC (10)		1467	1538
ν CN (19), ν CC (45)		1585	1678
ν NC (52)	1576	1642	1765
ν NC (58)	1624	1667	1792
ν OC (67), ν NC (14)		1772	1864
ν OC (85)	1703	1826	1897
ν CH (54)		2907	2860
ν CH(62)		2930	2886
ν CH (41)		3067	3012

ν, gerilme; δ, bükülme; δ_s, makaslama; ρ, sallanma; γ, düzlem dışı bükülme τ, dönme

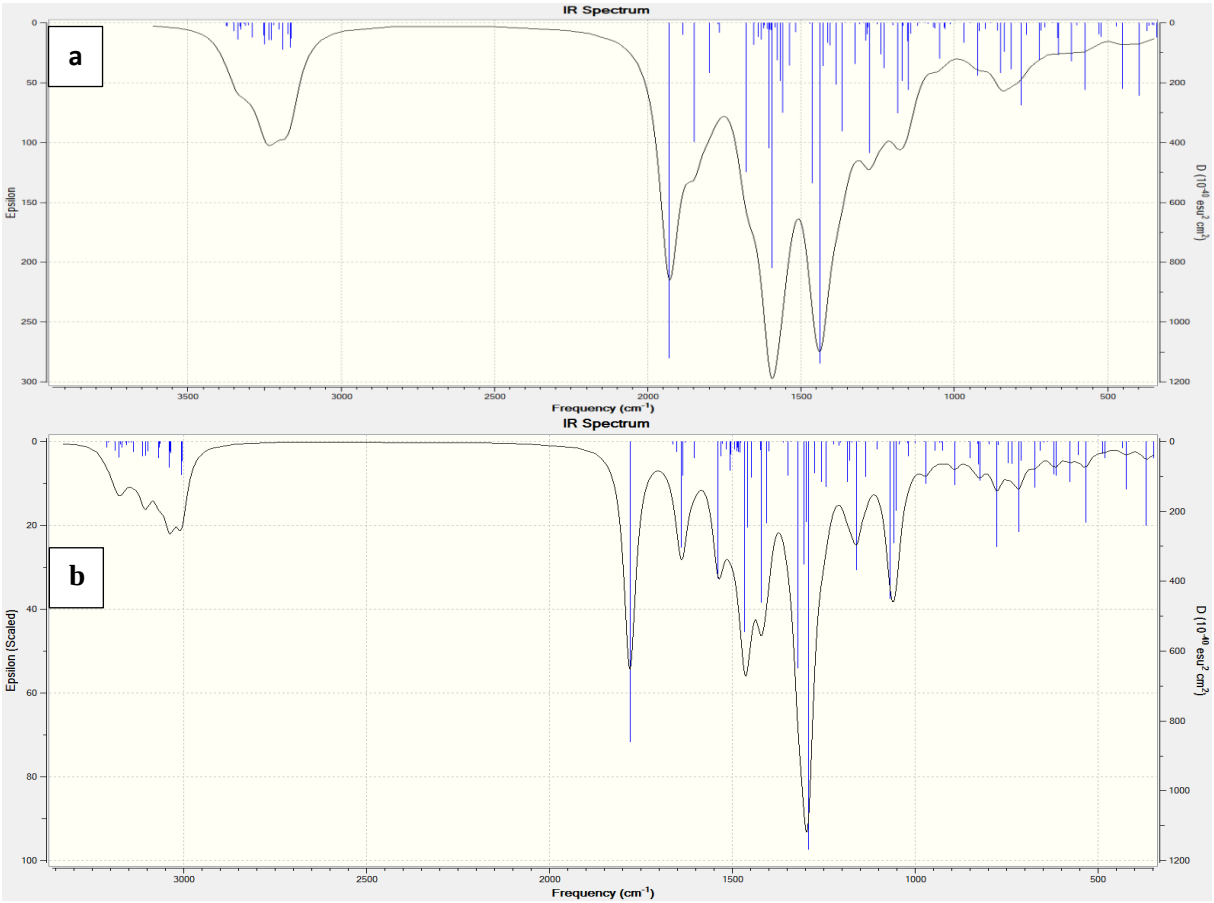


Figure 3. IR spectra of simulated (a and b) with DFT/B3LYP/6–311G(d,p) and HF/B3LYP/6–311G(d, p) levels of the compound

UV–visible Spectroscopy and HOMO–LUMO Analyses

The theoretical absorption wavelengths of the compound in ethanol solvent are given in Table **5** and the graphics of this UV-vis are given in Figure 4. The excitation energies, oscillator strengths (*f*) and absorption wavelengths (λ) of UV–vis absorption spectroscopy of the compound have been calculated by using TD–SCF/B3LYP and TD–SCF/HF methods.

It is well known that the highest occupied molecular orbital (HOMO) which implies the outermost orbital filled by electrons and behaves as an electron donor and lowest unoccupied molecular orbital (LUMO) which can be thought as the first empty innermost orbital unfilled by electron and behaves as an electron acceptor are called as the frontier molecule orbitals (FMOs). Therefore the energy of the HOMO is directly related to the ionization potential and represents the ability of electron giving. But, LUMO energy is directly related to the electron affinity and represents the ability of electron accepting. The formed energy gap between HOMO and LUMO indicates the molecular chemical stability and is a critical parameter to determine molecular electrical transport properties (Silverstein, Bassler & Morrill, 1991). In our study, HOMO, LUMO values and 3D plots of this HOMOs and LUMOs are given in Figures **5** (Özdemir et al., 2013).

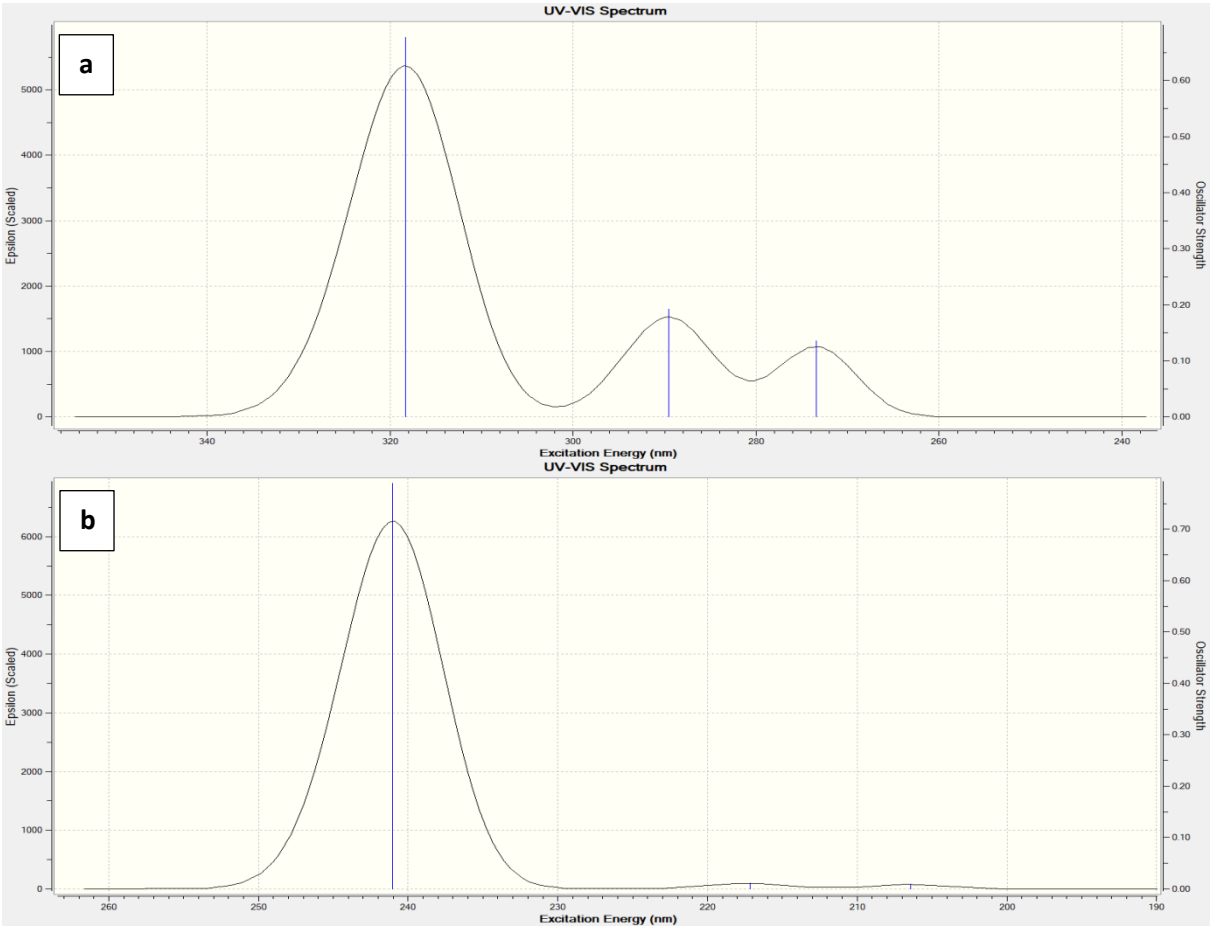
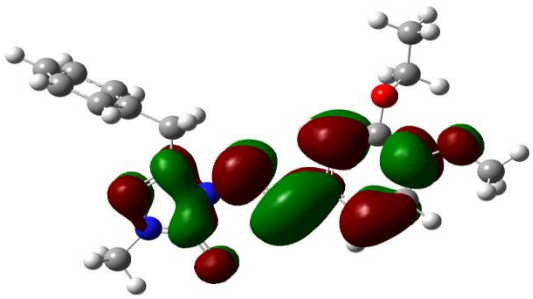


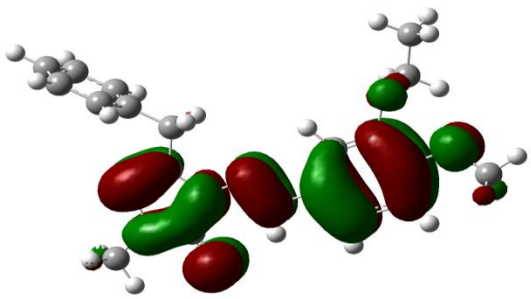
Figure 4. UV-Visible spectra (a and b) simulated with DFT/B3LYP/6–311G(d, p) and HF/B3LYP/6–311G(d, p) levels of the compound

Tablo 5. The experimental and calculated UV-vis values with B3LYP/6–311G(d, p) and HF/6–311G(d, p) level of the compound in ethanol

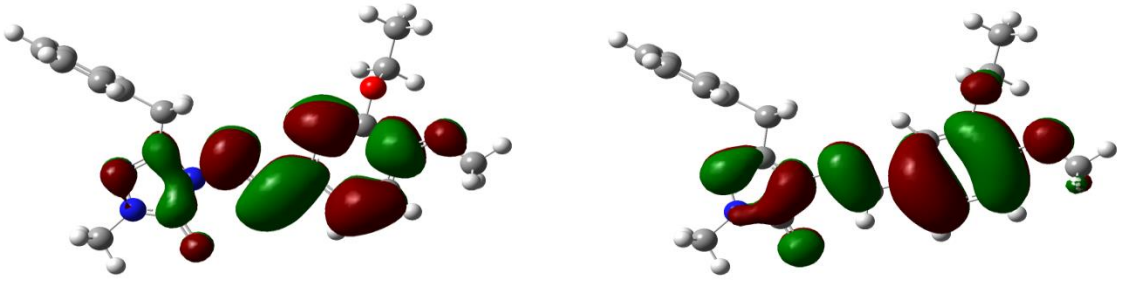
λ (nm) Exp/DFT/HF	**Excitation energy (eV) DFT/HF**	***f* (oscillator strength) DFT/HF**
323.00/318.36/241.03	3.8945/5.1439	0.6769/0.7900
215.00/289.57/217.14	4.2817/5.7098	0.1924/0.0117
/273.42/206.43	4.5345/6.0061	0.1354/0.0098



ELUMO (B3LYP) : -0.05535 Hatree



E_{HOMO} (B3LYP) : -0.21312 Hatree



E_{LUMO} (HF) : 0.09085 Hatree E_{HOMO} (B3LYP) : -0.30016 Hatree

Figure 5. The calculated HOMO-LUMO energies of the compound according to DFT/B3LYP/6–311G(d, p) and HF /6–311G(d, p) levels

Mulliken's Atomic Charges

The Mulliken atomic charges at the HF/6-31 G(d) and B3LYP/6-31 G(d) level of compound **2** in gas phase are given in Table 6 (Mulliken, 1955). The electronegative N43, N44, N45, N46, O47, O48 and O49 atoms of the compound have negative atomic charge values. The Mulliken atomic charges (B3LYP/HF) of the mentioned atoms were calculated as -0.333/-0.436, -0.213/-0.274, -0.372/-0.477, -0.216/-0.281, -0.409/-0.551, -0.375/-0.499 and -0.345/-0.461 a.u., respectively. The C1, C2, C3, C6 and C7 carbon atoms bounded to the mentioned electronegative atoms in the molecule under study have positive atomic charge values. The values of the positive charges of the mentioned carbon atoms were found as 0.355/0.470, 0.570/0.768, 0.131/0.242, 0.144/0.230 and 0.177/0.258 a.u., respectively (Özdemir et al., 2013). Therefore the C1 atom surrounded with two electronegative N44 and N45 atoms and the C2 atom surrounded with the electronegative N43, N45 and O47 atoms have the highest positive charge values. Because the carbon atoms π bonding have more positive charge density compared to ones having only σ bonding. In other words, the charge density of the carbon atoms with sp^2 hybrids is greater than those of the carbon atoms with sp^3 hybrids. Therefore the title molecule shows strong delocalization energy. In the the compound the atomic charges of all hydrogen atoms have positive values (Özdemir et al., 2013).

Table 6. Mulliken atomic charges of the compound

	DFT	HF		DFT	HF		DFT	HF
C1	0.355	0.470	**C18**	-0.093	-0.078	**H34**	0.146	0.145
C2	0.570	0.768	**C19**	-0.047	-0.079	**H35**	0.083	0.085
C3	0.131	0.242	**C20**	-0.124	-0.032	**H36**	0.092	0.097
C4	-0.163	-0.189	**H21**	0.139	0.163	**H37**	0.093	0.097
C5	-0.012	-0.042	**H22**	0.104	0.116	**H38**	0.093	0.097
C6	0.144	0.230	**H23**	0.109	0.113	**H39**	0.083	0.086
C7	0.177	0.258	**H24**	0.095	0.098	**H40**	0.126	0.107
C8	-0.117	-0.125	**H25**	0.093	0.071	**H41**	0.126	0.108
C9	-0.060	-0.075	**H26**	0.113	0.091	**H42**	0.133	0.125
C10	-0.014	0.083	**H27**	0.103	0.084	**N43**	-0.333	-0.436
C11	-0.347	-0.256	**H28**	0.114	0.097	**N44**	-0.213	-0.274
C12	-0.134	-0.031	**H29**	0.116	0.101	**N45**	-0.372	-0.477
C13	-0.182	-0.133	**H30**	0.114	0.090	**N46**	-0.216	-0.281
C14	-0.096	-0.095	**H31**	0.117	0.094	**O47**	-0.409	-0.551
C15	-0.053	-0.078	**H32**	0.133	0.116	**O48**	-0.375	-0.499
C16	-0.092	-0.078	**H33**	0.144	0.143	**O49**	-0.345	-0.461
C17	-0.089	-0.106						

Total Energy

The energetic behavior of title molecule was investigated in vacum. Total energy values of title molecule were calculated by using B3LYP/6-311G(d, p) and HF/6-311G(d, p) level. The calculated total energy values are given in Table **7**.

Table 7. The total energy of the of the compound

Energy	B3LYP	HF
(a.u.)	-1220.32	-1212.79

Conclusion

The vibrational frequencies, ^{1}H and ^{13}C-NMR chemicals shifts, UV–vis spectroscopies, HOMO and LUMO analyses of 1-methyl-3-benzyl-4-(3-ethoxy-4-methoxybenzylidenamino)-4,5-dihydro-1*H*-1,2,4-triazol-5-one molecule have been calculated by using DFT/B3LYP and HF methods. By considering the results of experimental works it can be easily stated that the vibrational frequencies and ^{13}C and ^{1}H NMR chemical shifts spectroscopic parameters obtained theoretically are in a very good agreement with the experimental data.

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SPECTROSCOPIC AND CALCULATED THERMODYNAMIC PROPERTIES OF 3-METHYL-4-[3-METHOXY-4-(4-METHYLSULFONYLOXY)-BENZYLIDENAMINO]-4,5-DIHYDRO-1*H*-1,2,4-TRIAZOL-5-ONE

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Abstract: In this study, 3-methyl-4-[3-methoxy-4-(4-methylbenzenesulfonyloxy)-benzylidenamino]-4,5-dihydro-1*H*-1,2,4-triazol-5-one was optimized by using the B3LYP/6-31G(d) and HF/6-31G(d) basis sets. ^{1}H-NMR and ^{13}C-NMR isotropic shift values were calculated by the method of GIAO using the program package Gaussian G09W. Experimental and theoretical values were inserted into the grafic according to equatation of δ exp=a+b. δ calc. The standard error values were found via SigmaPlot program with regression coefficient of a and b constants. IR absorption frequencies of this compound were calculated by two methods. The veda4f program was used in defining IR data which were calculated theoretically. Furthermore, thermodynamic parameters, geometric properties (bond angles, bond lengths and dihedral angles), electronic properties (total energy, dipole moment), the highest occupied molecular orbital (HOMO) and the lowest unoccupied molecular orbital (LUMO), Mulliken atomic charges and molecular electrostatic potential (MEP) of 3-methyl-4-[3-methoxy-4-(4-methylbenzenesulfonyloxy)-benzylidenamino]-4,5-dihydro-1*H*-1,2,4-triazol-5-one have been investigated by using Gaussian 09W program. The structural data of this compound have been calculated by using 6-31G(d) basis set with density functional method (DFT/B3LYP) and Hartree-Fock method (HF).

Keywords: 4,5-Dihidro-1*H*-1,2,4-triazol-5-one, GIAO, B3LYP, HF, 6-31G(d).

Introduction

Vibrational frequencies, UV–Vis spectroscopic parameters, atomic charges and frontier molecule orbitals (HOMO and LUMO) of the title compound have been calculated by using DFT/B3LYP and HF method with 6-31G(d) basis set. All quantum chemical calculations were carried out by using Gaussian 09W (Frisch et al., 2009; Wolinski, Hilton & Pulay, 1990) program package and the GaussView molecular visualization program (Frisch, Nielson & Holder, 2003). The molecular structure and vibrational calculations of this compound was computed by using Becke-3-Lee Yang Parr (B3LYP) (Becke, 1993; Lee, Yang & Parr, 1988) density functional method with 6-31G(d) basis set in ground state. IR absorption frequencies of molecule were calculated by two methods. Then, they were compared with experimental data (Medetalibeyoğlu & Yüksek, 2009), which are shown to be accurate. Infrared spectrum was composed by using the data obtained from both methods. The veda4f program was used in defining IR data which were calculated theoretically. The assignments of fundamental vibrational modes of the title molecule were performed on the basis of total energy distribution (TED) analysis by using veda4f program (Jamróz, 2004).

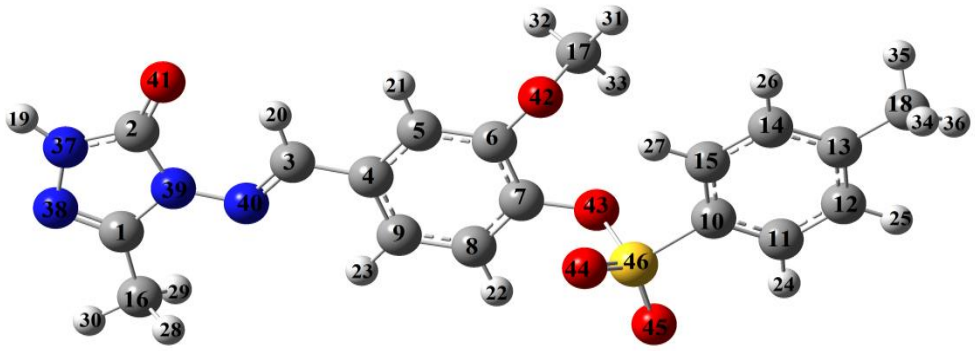


Figure 1. Optimized molecular structure of 3-methyl-4-[3-methoxy-4-(4-methylbenzenesulfonyloxy)-benzylidenamino]-4,5-dihydro-1*H*-1,2,4-triazol-5-one with DFT/B3LYP/6-31G(d) level

Methods

The molecular structure of the title compound in the ground state (in vacuo) was computed by performing both Hartree-Fock (HF) and the density functional theory (DFT) by a hydrid functional B3LYP functional (Becke's three parameter hybrid functional using the LYP correlation functional) methods (Becke, 1993; Lee, Yang & Parr, 1988) at 6-31G(d) level.

Results and Findings

Molecular Structure

The optimized molecular geometric parameters (bond angles and bond lengths) of the molecule by using B3LYP/6-31G(d) and HF/6-31G(d) levels were listed in Table **1**.

Table 1. The calculated bond angles and bond lengths of the molecule

Bond Angles	B3LYP	HF	Bond Lenghts	B3LYP	HF
C1-N39-N40	121.13	121.02	C1-N38	1.30	1.27
C1-N38-N37	104.52	104.91	C1-N39	1.38	1.38
C1-N39-C2	108.39	108.17	C1-C16	1.49	1.49
C1-C16-H28	111.04	111.60	C16-H28	1.09	1.08
C1-C16-H29	111.06	111.60	C16-H29	1.09	1.08
C1-C16-H30	108.66	108.60	C16-H30	1.09	1.08
H28-C16-H29	107.35	107.87	N39-C2	1.42	1.39
H28-C16-H30	109.35	109.58	C2-O41	1.22	1.20
H29-C16-H30	109.36	109.58	N37-C2	1.37	1.35
N39-C1-N38	111.41	111.27	N37-H19	1.00	0.99
N38-N37-H19	120.25	120.78	N37-N38	1.38	1.37
N38-N37-C2	114.58	113.81	N39-N40	1.37	1.36
N38-C1-C16	125.16	125.46	N40-C3	1.29	1.26
H19-N37-C2	125.17	125.42	C3-H20	1.09	1.07
N37-C2-N39	101.10	104.85	C3-C4	1.47	1.47
N37-C2-O41	130.01	129.52	C4-C5	1.40	1.39
O41-C2-N39	128.90	128.63	C4-C9	1.40	1.39
C2-N39-N40	130.48	130.81	C5-H21	1.08	1.08
N39-N40-C3	118.80	119.87	C5-C6	1.39	1.38
N40-C3-H20	122.08	122.45	C6-O42	1.37	1.35
N40-C3-C4	120.04	120.21	C6-C7	1.40	1.38
H20-C3-C4	117.88	117.34	C7-O43	1.39	1.38
C3-C4-C5	118.27	118.12	C7-C8	1.39	1.38
C3-C4-C9	122.55	122.44	C8-H22	1.09	1.07
C4-C5-H21	120.70	120.85	C8-C9	1.39	1.38
C4-C5-C6	120.94	120.89	C9-H23	1.08	1.07
C5-C6-O42	119.86	120.42	O42-C17	1.43	1.41

C6-O42-C17	114.50	115.53	C17-H31	1.09	1.08
O42-C17-H31	106.16	106.54	C17-H32	1.09	1.08
O42-C17-H32	110.69	110.74	C17-H33	1.09	1.08
O42-C17-H33	111.33	111.03	O43-S46	1.69	1.61
H31-C17-H32	109.42	109.40	S46-O44	1.46	1.42
H31-C17-H33	109.56	109.56	S46-O45	1.46	1.42
H32-C17-H33	109.61	109.51	S46-C10	1.75	1.75
C5-C6-C7	118.97	118.64	C10-C11	1.39	1.38
O42-C6-C7	121.13	120.93	C10-C16	1.39	1.39
C6-C7-O43	118.74	118.24	C11-H24	1.08	1.07
C6-C7-C8	120.72	121.35	C11-C12	1.39	1.38
O43-C7-C8	120.49	120.37	C12-H25	1.09	1.08
C7-C8-H22	118.73	119.10	C12-C13	1.40	1.38
C7-C8-C9	119.94	119.60	C13-C18	1.51	1.51
H22-C8-C9	121.33	121.31	C18-H34	1.10	1.09
C8-C9-C4	120.26	120.08	C18-H35	1.09	1.08
H23-C9-C4	119.20	119.74	C18-H36	1.09	1.08
C9-C4-C5	119.17	119.45	C13-C14	1.41	1.40
C7-O43-S46	117.38	119.88	C14-H26	1.09	1.08
O43-S46-O44	107.77	107.95	C14-C15	1.39	1.38
O43-S46-O45	106.87	107.41	C15-H27	1.08	1.07
O44-S46-O45	121.22	120.07	C15-C10	1.39	1.39
O43-S46-C10	98.68	99.24			
O44-S46-C10	110.39	110.36			
O45-S46-C10	109.46	109.71			
S46-C10-C11	119.26	119.73			
S46-C10-C15	119.14	119.07			
C10-C11-H24	119.95	120.09			
C10-C15-H27	120.20	120.10			
C10-C11-C12	118.76	119.05			
H24-C11-C12	121.30	120.86			
C11-C12-H25	119.28	119.21			
C11-C12-C13	121.19	120.95			
H25-C12-C13	119.54	119.83			
C12-C13-C14	118.55	118.81			
C13-C18-H34	110.92	110.67			
C13-C18-H35	111.40	110.99			
C13-C18-H36	111.55	111.43			
H34-C18-H35	107.08	107.53			
H34-C18-H36	107.56	107.95			
H35-C18-H36	108.14	108.12			
C12-C13-C18	121.00	121.13			
C18-C13-C14	120.45	120.06			
C13-C14-H26	119.44	119.61			
C13-C14-C15	121.28	121.02			
H26-C14-C15	119.28	119.37			
C14-C15-C10	118.64	118.98			
H27-C15-C10	120.20	120.10			
C15-C10-C11	121.58	121.19			

Vibrational Frequencies

The 3-methyl-4-[3-methoxy-4-(4-methylbenzenesulfonyloxy)-benzylidenamino]-4,5-dihydro-1*H*-1,2,4-triazol-5-one have 46 atoms and the number of the normal vibrations were 132. The selected and experimental vibrational frequencies (Medetalibeyoğlu & Yüksek, 2009), the calculated IR intensities and assignments of vibrational frequencies for title compound were summarized in Table **2** and Figure **2**.

Table 2. The selected frequencies values of the molecule

Selected Vibration Types	Exper.	Scaled DFT	Scaled Hf
ν SO	1147	1114	1113
ν OC	1278	1237	1198
ν SO	1381	1391	1441
ν C=C	1570	1593	1620
ν C=N	1595	1614	1704
ν C=O	1686	1753	1762
ν =CH	3056	3091	3039
ν NH	3186	3540	3519

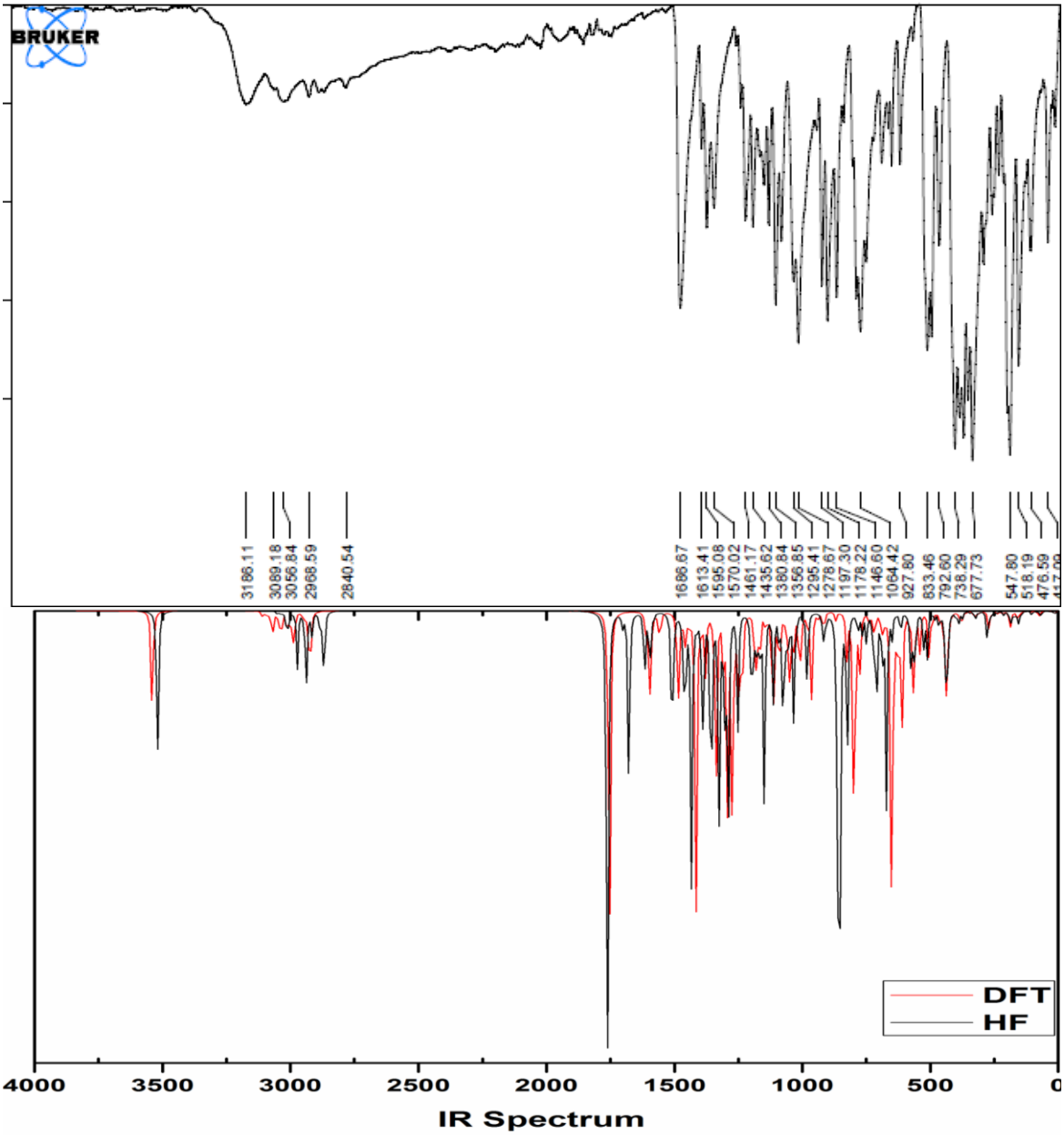


Figure 2. IR spectrum simulated DFT/HF 6-31G(d) level of the molecule.

NMR Spectral Analysis

In nuclear magnetic resonance (NMR) spectroscopy, the isotropic chemical shift analysis allows us to identify relative ionic species and to calculate reliable magnetic properties which provide the accurate predictions of molecular geometries (Rani et al., 2010; Subramanian, Sundaraganesan, & Jayabharathi, 2010; Wade, 2006). In this framework, the optimized molecular geometry of the molecule was obtained by using B3LYP and HF

methods with 6-31G(d) basis level in DMSO solvent. By considering the optimized molecular geometry of the title compound the ^{1}H and ^{13}C NMR chemical shift values were calculated at the same level by using Gauge-Independent Atomic Orbital (GIAO) method. Theoretical and experimental values (Medetalibeyoğlu & Yüksek, 2009) were plotted according to δ exp=a. δ calc.+ b, Eq. a and b constants regression coefficients with a standard error values were found using the SigmaPlot program.

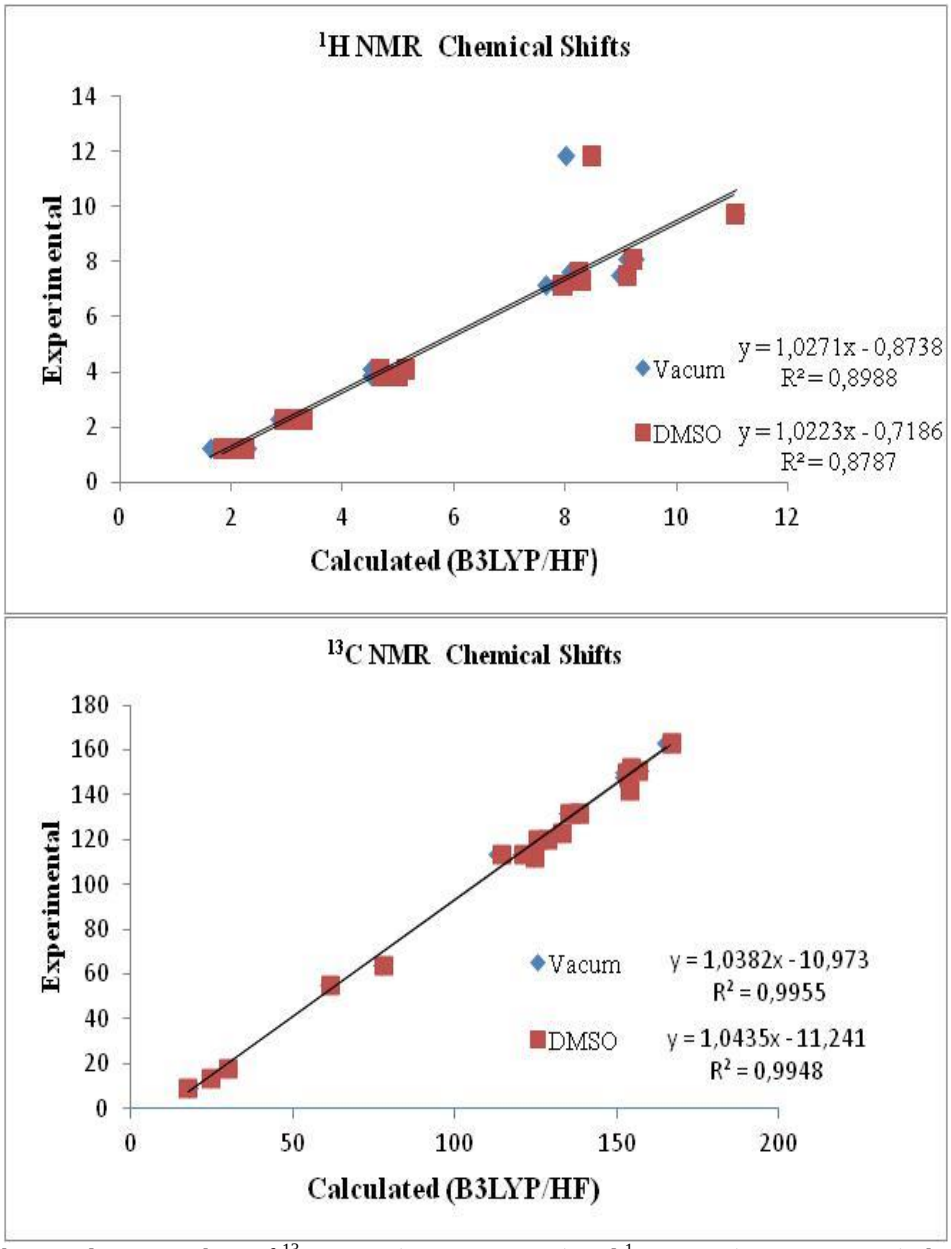


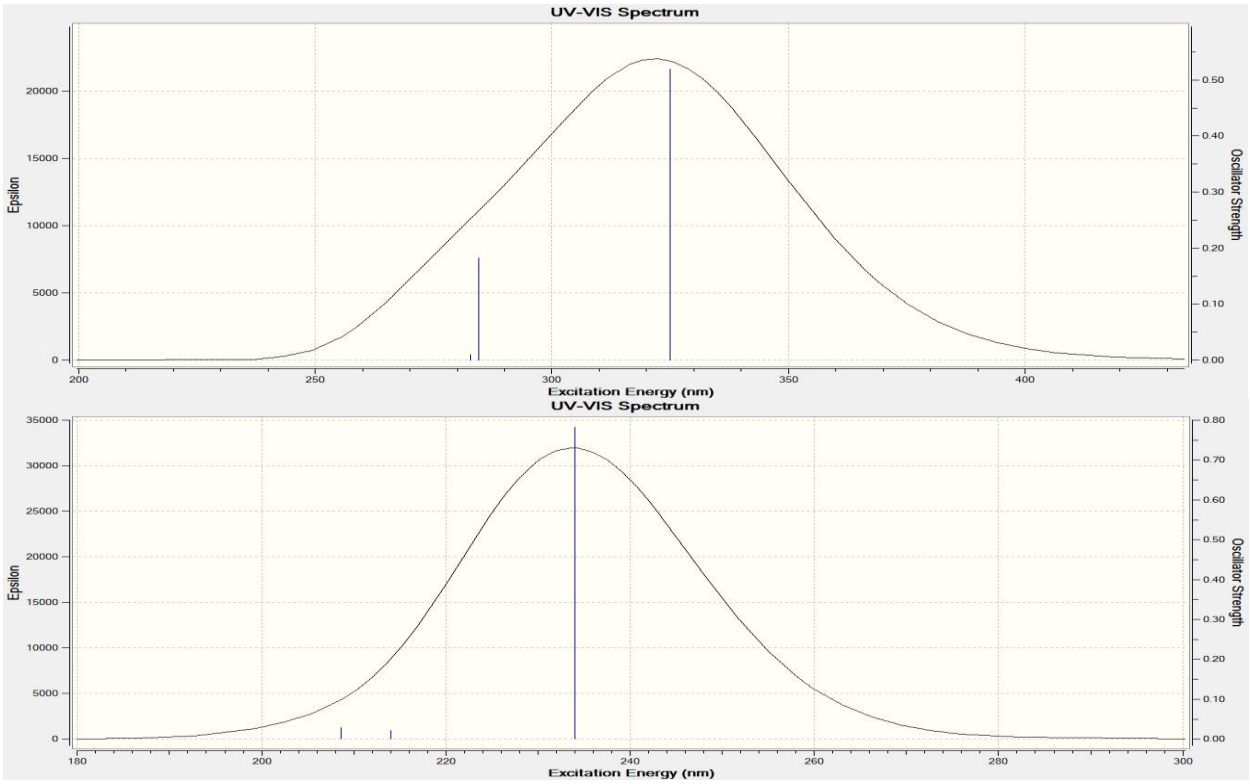
Figure 3. The correlation graphics of ^{13}C-NMR (Vacum/DMSO) and ^{1}H-NMR (Vacum/DMSO) chemical shift values of the molecule

Atomic Charges , Dipole Moments, UV-Vis Values, Total Energy and Molecular Electrostatic Potential (MEP)

Theoretical Mulliken atomic charges, UV-Vis values, dipole moments, HOMO-LUMO energies, electronic properties and molecular electrostatic potential (MEP) of 3-methyl-4-[3-methoxy-4-(4-methylbenzenesulfonyloxy)-benzylidenamino]-4,5-dihydro-1*H*-1,2,4-triazol-5-one have been given in Tables **3, 4** and **5** and Figures **4, 5** and **6**.

Table 3. Mulliken atomic charges of the molecule

	B3LYP	HF		B3LYP	HF
C1	0,54	0,61	**H24**	0,19	0,27
C2	0,82	1,06	**H25**	0,14	0,21
C3	0,03	0,09	**H26**	0,14	0,21
C4	0,14	-0,02	**H27**	0,20	0,27
C5	-0,25	-0,27	**H28**	0,18	0,21
C6	0,34	0,39	**H29**	0,18	0,21
C7	0,32	0,35	**H30**	0,19	0,20
C8	-0,16	-0,21	**H31**	0,17	0,18
C9	-0,17	-0,20	**H32**	0,16	0,18
C10	-0,17	-0,34	**H33**	0,15	0,16
C11	-0,14	-0,16	**H34**	0,16	0,18
C12	-0,18	-0,24	**H35**	0,18	0,19
C13	0,18	0,06	**H36**	0,16	0,18
C14	-0,18	-0,23	**N37**	-0,52	-0,66
C15	-0,13	-0,16	**N38**	-0,32	-0,34
C16	-0,51	-0,52	**N39**	-0,41	-0,62
C17	-0,22	-0,18	**N40**	-0,31	-0,31
C18	-0,53	-0,51	**O41**	-0,54	-0,66
H19	0,36	0,42	**O42**	-0,53	-0,67
H20	0,21	0,29	**O43**	-0,63	-0,78
H21	0,15	0,24	**O44**	-0,51	-0,66
H22	0,17	0,26	**O45**	-0,50	-0,65
H23	0,16	0,24	**S46**	1,25	1,69



λ (nm)B3LYP/HF	Excitadion Energy(eV) B3LYP/HF	*f* (oscillator values) B3LYP/HF
325.01/233.99	3.8148/5.2986	0.5190/0.7821
284.55/214.02	4.3571/5.7931	0.1819/0.0217
282.76/208.68	4.3847/5.9413	0.0096/0.0287

Figure 4. The calculated absorption wavelength (λ), excitation energies and oscillator strengths (*f*) of the molecule

Table 4. The calculated dipole moment values of the molecule

Dipol Moment (Debye) Total Energy (a.u.)	**B3LYP/6-31G(d)**	**HF/6-31G(d)**
μ_x	2.3768	-4.0373
μ_y	-0.5886	-2.1157
μ_z	-4.9225	-2.9442
μ_{Toplam}	5.4979	5.4263
Energy (a.u)	1689.96	1681.61

Table 5. Electronic properties of the molecule

	B3LYP/6-31G(d)	**HF/6-31G(d)**
EHOMO (eV)	-0.21997	-0.31860
ELUMO (eV)	-0.06396	0.07906
ΔE= ELUMO- EHOMO (eV)	0.28393	0.3977
□□(eV)	0.21997	0.31860
□□eV)	0.06396	-0.0791
□□(eV)	0.14196	0.11977
□□(eV)	0.07801	0.1988
S (eV^{-1})	6.4098	2.51417

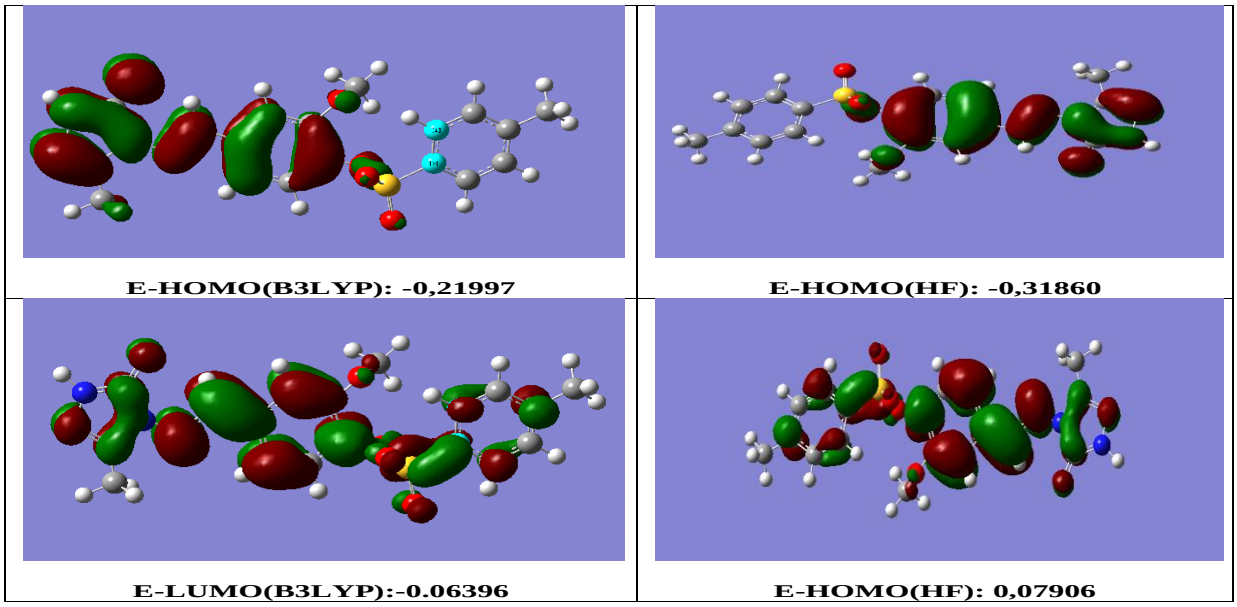


Figure 5. The calculated HOMO-LUMO energies of the molecule according to DFT/6-31G(d) and HF/6-31G(d) levels

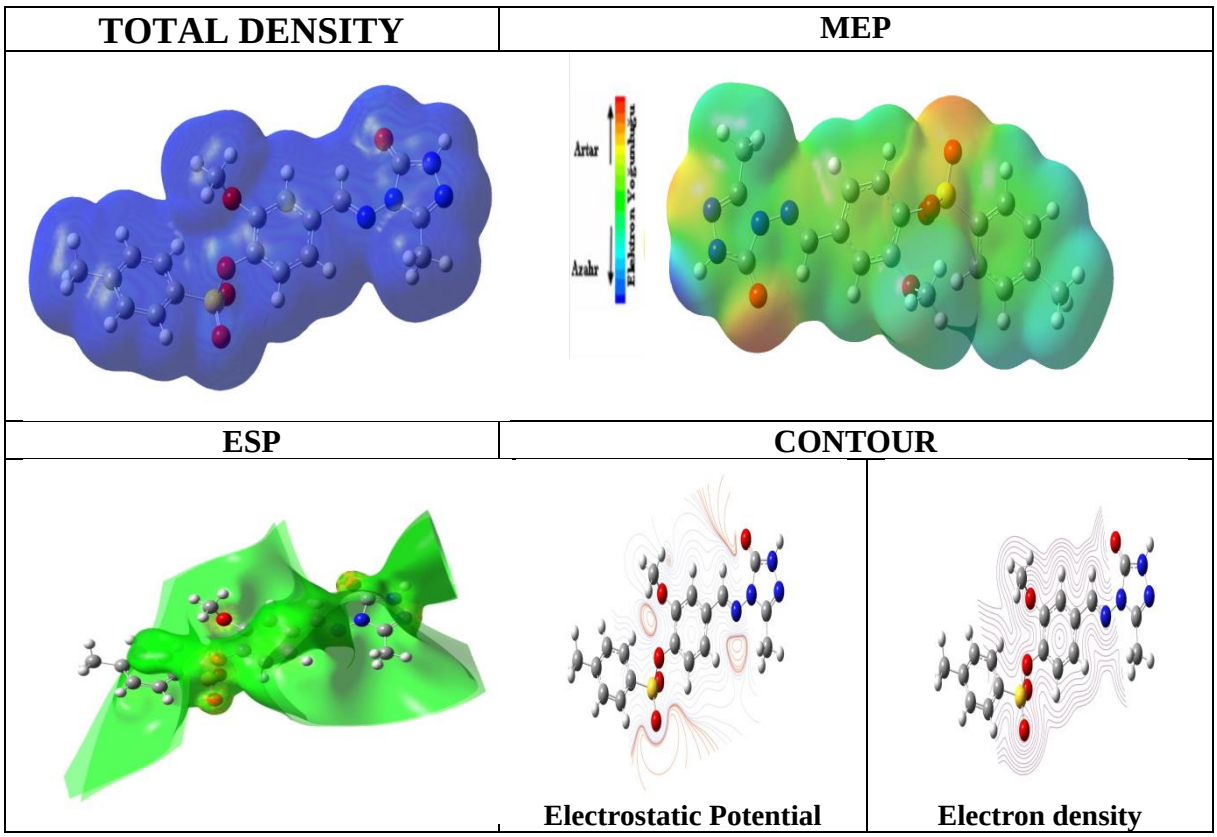


Figure 6. The calculated molecular surfaces for the molecule according to DFT/ 6-31G(d) and HF/6-31G(d) levels

Conclusion

In this study, vibrational frequencies, ^{1}H and ^{13}C NMR chemicals shifts, UV–vis values HOMO and LUMO energies and atomic charges and molecular electrostatic potential (MEP) of 3-methyl-4-[3-methoxy-4-(4-methylbenzenesulfonyloxy)-benzylidenamino]-4,5-dihydro-1*H*-1,2,4-triazol-5-one have been calculated by using DFT/B3LYP and HF methods. The vibrational frequencies, ^{13}C and ^{1}H NMR chemical shifts and UV–vis values obtained theoretically were in a very good agreement with the experimental data.

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COMPARISON OF THEORETICAL AND EXPERIMENTAL PROPERTIES OF 3-METHYL-4-[2-(4-NITROBENZOXY)-3-ETHOXY-BENZYLIDENEAMINO]-4,5-DIHYDRO-1*H*-1,2,4-TRIAZOL-5-ONE

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Abstract: In this study, 3-methyl-4-[2-(4-nitrobenzoxy)-3-ethoxy-benzylideneamino]-4,5-dihydro-1*H*-1,2,4-triazol-5-one was optimized by using the B3LYP/6-31G(d,p) and HF/6-31G(d,p) basis sets. Afterwards, ^{1}H-NMR and ^{13}C-NMR isotropic shift values were calculated by the method of GIAO using the program package Gaussian G09W. Experimental and theoretical values were inserted into the graphic according to equitation of δ exp=a+b. δ calc. The standard error values were found via SigmaPlot program with regression coefficient of a and b constants. IR absorption frequencies of analyzed molecule were calculated by two methods. Then, they were compared with experimental data, which are shown to be accurate. Infrared spectrum was composed by using the data obtained from both methods. The veda4f program was used in defining IR data which were calculated theoretically. Furthermore, molecule's theoretical bond lengths, UV-Vis values, dipole moments, Mulliken atomic charges, HOMO-LUMO energies, total energy were calculated with both methods.

Keywords: Gaussian09W, theoretical, HOMO-LUMO, 1,2,4-triazol-5-one.

Introduction

3-Methyl-4-[2-(4-nitrobenzoxy)-3-ethoxy-benzylidenamino]-4,5-dihydro-1*H*-1,2,4-triazol-5-one (Yüksek et al., 2015) was optimized by using the B3LYP/6-31G (d,p) and HF/6-31G (d,p) basis set (Frisch et al., 2009; Wolinski, Hilton & Pulay, 1990). Vibrational frequencies, UV–Vis spectroscopic parameters, atomic charges and frontier molecule orbitals (HOMO and LUMO) of the title compound have been calculated by using DFT/B3LYP and HF method with 6-31G(d,p) basis set from the optimized molecular structure. All quantum chemical calculations were carried out by using Gaussian 09W (Frisch et al., 2009; Wolinski, Hilton & Pulay, 1990) program package and the GaussView molecular visualization program (Frisch, Nielson & Holder, 2003). The molecular structure and vibrational calculations of the molecule was computed by using Becke-3-Lee Yang Parr (B3LYP) (Becke, 1993; Lee, Yang & Parr, 1988) density functional method with 6-31G(d,p) basis set in ground state. IR absorption frequencies of analyzed molecule were calculated by two methods. Then, they were compared with experimental data (Yüksek et al., 2015) which are shown to be accurate. Infrared spectrum was composed by using the data obtained from both methods. The assignments of fundamental vibrational modes of the title molecule were performed on the basis of total energy distribution (TED) analysis by using veda4f program (Jamróz, 2004).

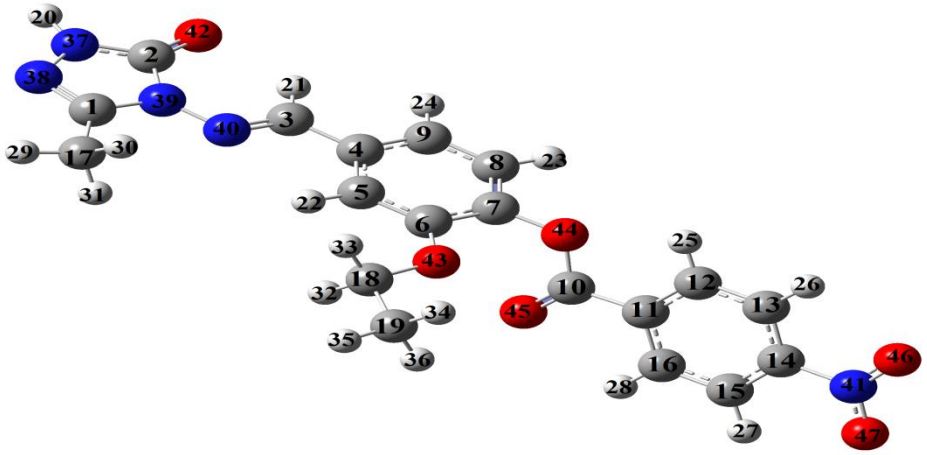

Figure 1. Optimized molecular structure of 3-methyl-4-[2-(4-nitrobenzoxy)-3-ethoxy-benzylideneamino]-4,5-dihydro-1*H*-1,2,4-triazol-5-one with DFT/B3LYP/6-31G(d,p) level.

Methods

The molecular structure of the title compound in the ground state (in vacuo) was computed by performing both Hartree-Fock (HF) and the density functional theory (DFT) by a hydrid functional B3LYP functional (Becke's three parameter hybrid functional using the LYP correlation functional) methods at 6-31G(d,p) level.

Results and Findings

Molecular Structure

The optimized molecular geometric parameters (bond angles and bond lengths) of the molecule by using B3LYP/6-31G(d,p) and HF/6-31G(d,p) levels were listed in Table **1**.

Table 1.The calculated bond angles and bond lengths of the molecule

Bond Angles	B3LYP	HF	Bond lenghts	B3LYP	HF
C(1)-N(39)-N(40)	121.21	121.10	C(1)-N(38)	1.30	1.27
C(1)-N(38)-N(37)	104.53	104.95	C(1)-N(39)	1.39	1.38
C(1)-N(39)-C(2)	108.36	108.11	C(1)-C(17)	1.49	1.49
C(1)-C(17)-H(29)	110.98	110.54	C(17)-H(29)	1.09	1.08
C(1)-C(17)-H(30)	108.64	108.54	C(17)-H(30)	1.09	1.08
C(1)-C(17)-H(31)	110.97	110.53	C(17)-H(31)	1.09	1.08
H(29)-C(17)-H(30)	109.40	109.64	N(39)-C(2)	1.41	1.39
H(29)-C(17)-H(31)	109.41	109.64	C(2)-O(42)	1.22	1.20
H(30)-C(17)-H(31)	107.41	107.95	N(37)-C(2)	1.37	1.34
N(38)-C(1)-N(39)	111.44	111.29	N(37)-H(20)	1.00	0.99
N(38)-N(37)-H(20)	120.43	120.99	N(37)-N(38)	1.38	1.37
N(38)-N(37)-C(2)	114.51	113.72	N(39)-N(40)	1.37	1.37
N(38)-C(1)-C(17)	125.13	125.40	N(40)-C(3)	1.29	1.26
H(20)-N(37)-C(2)	125.06	125.29	C(3)-H(21)	1.09	1.07
N(37)-C(2)-N(39)	101.17	101.93	C(3)-C(4)	1.46	1.47
N(37)-C(2)-O(42)	129.99	129.47	C(4)-C(5)	1.40	1.40
O(42)-C(2)-N(39)	128.84	128.60	C(4)-C(9)	1.40	1.38
C(2)-N(39)-N(40)	130.43	130.78	C(5)-H(22)	1.09	1.07
N(39)-N(40)-C(3)	118.75	119.79	C(5)-C(6)	1.39	1.38
N(40)-C(3)-H(21)	122.08	122.39	C(6)-O(43)	1.36	1.34
N(40)-C(3)-C(4)	120.10	120.35	C(6)-C(7)	1.41	1.40
H(21)-C(3)-C(4)	117.83	117.26	C(7)-O(44)	1.39	1.38
C(3)-C(4)-C(5)	121.71	121.58	C(7)-C(8)	1.38	1.37
C(3)-C(4)-C(9)	118.45	118.29	C(8)-H(23)	1.08	1.07
C(4)-C(5)-H(22)	118.37	118.72	C(8)-C(9)	1.40	1.39
C(4)-C(5)-C(6)	120.47	120.28	C(9)-H(24)	1.09	1.07
C(5)-C(6)-O(43)	125.55	125.50	O(44)-C(10)	1.37	1.33
C(6)-O(43)-C(18)	118.59	120.12	C(10)-O(45)	1.21	1.18

O(43)-C(18)-C(19)	107.46	107.48	C(10)-C(11)	1.50	1.50
O(43)-C(18)-H(32)	109.60	109.73	C(11)-C(12)	1.40	1.39
O(43)-C(18)-H(33)	109.49	109.61	C(11)-C(16)	1.40	1.39
H(32)-C(18)-H(33)	108.05	108.33	C(12)-H(25)	1.08	1.07
H(32)-C(18)-C(19)	111.08	110.76	C(12)-C(13)	1.39	1.38
H(33)-C(18)-C(19)	111.16	110.92	C(13)-H(26)	1.08	1.07
C(18)-C(19)-H(34)	110.72	110.55	C(13)-C(14)	1.39	1.38
C(18)-C(19)-H(35)	110.60	110.43	C(14)-N(41)	1.48	1.46
C(18)-C(19)-H(36)	109.95	110.02	N(41)-O(46)	1.23	1.19
H(34)-C(19)-H(35)	108.46	108.58	N(41)-O(47)	1.23	1.19
H(34)-C(19)-H(36)	108.51	108.56	C(14)-C(15)	1.39	1.38
H(35)-C(19)-H(36)	108.54	108.64	C(15)-H(27)	1.08	1.07
C(5)-C(6)-O(43)	125.55	119.04	C(15)-C(16)	1.38	1.38
C(5)-C(6)-C(7)	118.63	118.67	C(16)-H(28)	1.08	1.07
O(43)-C(6)-C(7)	115.82	115.83			
O(44)-C(7)-C(8)	119.10	119.45			
C(6)-C(7)-C(8)	121.30	121.43			
C(7)-C(8)-H(23)	118.84	119.12			
C(7)-C(8)-C(9)	119.77	119.68			
H(23)-C(8)-C(9)	121.40	121.20			
C(8)-C(9)-H(24)	120.05	119.78			
C(8)-C(9)-C(4)	119.99	119.81			
H(24)-C(9)-C(4)	119.96	120.41			
C(9)-C(4)-C(5)	119.84	120.13			
C(7)-O(44)-C(10)	117.97	118.98			
O(44)-C(10)-O(45)	124.03	124.09			
O(44)-C(10)-C(11)	111.41	112.02			
O(45)-C(10)-C(11)	124.55	123.87			
C(10)-C(11)-C(16)	117.37	117.55			
C(10)-C(11)-C(12)	122.46	122.03			
C(11)-C(12)-H(25)	119.72	120.09			
C(11)-C(12)-C(13)	120.04	119.95			
H(25)-C(12)-C(13)	120.24	119.96			
C(12)-C(13)-H(26)	121.86	121.36			
H(26)-C(13)-C(14)	119.50	120.11			
C(12)-C(13)-C(14)	118.64	118.53			
C(13)-C(14)-N(41)	118.78	118.70			
C(14)-N(41)-O(46)	117.59	117.59			
C(14)-N(41)-O(47)	117.56	117.57			
O(46)-N(41)-O(47)	124.85	124.84			
N(41)-C(14)-C(15)	118.81	118.73			
C(14)-C(15)-H(27)	119.58	120.16			
H(27)-C(15)-C(16)	121.98	121.48			
C(15)-C(16)-H(28)	121.00	120.59			
C(15)-C(16)-C(11)	120.30	120.18			
H(28)-C(16)-C(11)	118.70	119.24			
C(16)-C(11)-C(12)	120.17	120.42			

Vibrational Frequencies

The 3-methyl-4-[2-(4-nitrobenzoxy)-3-ethoxy-benzylideneamino]-4,5-dihydro-1*H*-1,2,4-triazol-5-one have 47 atoms and the number of the normal vibrations were 135. The observed and calculated vibrational frequencies, the calculated IR intensities and assignments of vibrational frequencies for title compound were summarized in Table 2.

Table 2. The calculated frequencies values of the molecule

Vibration Frequencies	Scaled DFT	Scaled HF
τ COCC(26)	13	13
τ NCCC(37), τ CNNC(11), τ COCC(11)	16	14
τ CCCO(12), τ CCCC(10)	18	16
τ CCCC(11), τ COCC(19)	23	21
δ NCC(10), τ COCC(13), τ ONCC(16)	45	32
δ NCC(20), δ CCC(20)	50	45
δ COC(14), τ NCNN(19)	57	49
τ ONCC(63), τ COCC(13)	61	59
τ CCOC(29), τ CCCC(17)	70	65
τ COCC(19), τ CCCC(17), τ NCCC(10)	87	86

δ CCC(12), τ CNNC(19), τ NCNN(14)	94	95
τ COCC(49)	101	105
δ COC(24), δ CNN(12)	120	115
τ CNNC(12), τ COCC(10)	121	154
τ CNNC(27), τ HCCN(14)	153	160
τ HCCN(46), τ CNNC(16)	154	165
τ NCCC(18), τ CNNC(23)	177	168
δ CNN(13), δ CCC(15), δCCO(12)	192	183
δ NCC(14), τ CCCO(15)	211	197
τ NCCC(11), τ NCNN(16), τ CCCC(15)	223	214
δ CCN(10), τ CCCC(11)	233	242
δ CCN(16), τ NCCC(12), τ CCCC(17)	245	254
τ HCOC(46), τ HCCO(17)	251	267
δ NCC(15), τ CNNC(21), τ HNNC(11)	281	297
τ CNNC(10), τ HNNC(11)	281	302
δ CCO(13)	299	313
τ NCNN(19), τ NNCN(13)	312	332
δ COC(11), δ CCO(28)	335	340
δ CNN(17), δ CCN(17), δ OCN(13)	344	377
δ COC(11)	400	386
δ CCC(16), δ NNC(10), δ OCN(11)	404	399
τ CCCC(12), τ HCCC(23)	405	407
δ CCC(10), τ CCCO(13)	408	420
τ HNNC(51), τ ONNC(12)	440	444
τ CCCC(21), τ NCCC(24)	450	448
τ CCCC(18), τ OCCC(22), τ HCCC(13)	460	485
ν CC(12), ν NC(15), δ OCO(10), δ ONC(17), δ ONO(11)	493	520
δ ONC(39), δ NCC(12)	520	542
δ CCO(20), δ COC(11), δ OCN(10)	532	560
δ COC(14), δCCC(14)	556	579
δ CCC(18)	578	593
δ OCN(27), δ CNN(11)	582	603
τ OCCC(19), τ CCCC(16)	611	626
ν CC(13)	615	628
ν CC(11), δ CCC(34)	617	639
τ HNNC(13), τ NNCN(31)	633	652
τ CCCC(16), τ CCCO(16), τ OCOC(16)	649	701
δ OCO(10), τ CCCC(14), τ HCCC(14)	679	723
τ ONNC(79)	694	745
τ HCCC(18), τ OCOC(26), τ OCON(45)	696	754
δ CCC(17), δ ONO(12)	705	767
δ CCC(10)	733	781
τ OCOC(29), τ OCON(25), τ NCCC(12), τ CCCC(10)	752	788
ν CC(10), νNC(15), δ CNN(25), δ NNC(10)	776	793
ν OC(10), τ HCCC(18)	782	807
τ HCCC(40)	789	830
τ HCOC(37)	802	835
δ NNC(11), δ NCC(11), δ CCC(10)	810	848
δ ONO(17), τ HCCC(40)	829	874
δ ONO(12), τ HCCC(58)	830	880
τ HCCC(44)	850	896
τ HCCC(37)	858	917
τ HCCC(69)	862	950
ν OC(20), τ HCCO(12)	888	983
τ HCCC(51)	909	987
δ NNC(11), δ HCH(13), τ HCCC(30), τ HCCN(37)	959	989
τ HCCC(54)	959	997
τ HCCC(61)	968	1005
τ HCNN(90)	976	1030
ν CC(18), δ HCC(13)	977	1038
δ CCC(25), δ HCC(16)	993	1040
ν OC(37), ν CC(33)	1028	1051

δ HCH(20), τ HCCN(57)	1030	1065
ν CC(10), ν NC(12), δ NNC(13)	1038	1069
ν OC(16)	1054	1075
ν NN(32), HNN(12), τ HCCN(15)	1067	1092
ν NC(24), ν CC(18), δ HCC(10)	1083	1096
ν CC(10), δ HCC(59)	1086	1117
ν CC(11), δ CCO(11), δ HCC(12), τ HCCO(16)	1096	1125
ν CC(13), δ HCC(38)	1108	1148
δ HCC(22), τ HCOC(18)	1142	1153
ν CC(18), ν OC(15)	1145	1159
ν CC(10), δ HCC(67)	1152	1170
ν OC(31), δ HCC(10)	1175	1179
ν NC(14), δ HCC(11)	1189	1183
ν CC(31)	1231	1204
δ HCC(42)	1244	1215
ν OC(10), ν NN(11), δ NCN(11)	1253	1259
δ HCC(63), τ HCOC(12)	1257	1265
δ HCC(47)	1270	1271
δ HCC(40)	1272	1276
ν CC(21)	1311	1289
ν CC(24)	1325	1301
ν NC(23), δ HNN(22), δ HCN(17)	1338	1311
ν ON(78), δ ONO(12)	1345	1363
δ HNN(46), δ HCH(21)	1346	1374
δ HCH(49), τ HCOC(16)	1355	1389
δ HCH(56), δ HCN(18)	1378	1395
δ HCH(20), τ HCOC(18)	1383	1404
ν CC(15), δ HCC(31)	1391	1411
ν NC(14), δ HCH(18), δ HCN(16)	1408	1419
ν CC(16)	1416	1438
δ HCH(78), τ HCCN(21)	1428	1440
δ HCH(38), τ HCOC(10)	1441	1449
δ HCH(47), τ HCCN(18)	1443	1450
δ HCH(60), τ HCCO(12)	1457	1462
ν CC(18), δ HCC(56)	1471	1463
δ HCH(29)	1476	1464
δ HCC(30)	1493	1474
ν ON(48), ν CC(30)	1558	1494
ν CC(17)	1573	1520
ν NC(13), ν CC(11), δ HCC(10)	1583	1523
ν CC(21), δ HCC(18)	1592	1591
ν NC(42)	1600	1607
ν ON(45), ν CC(30)	1607	1628
ν NC(53)	1614	1632
ν OC(73), ν NC(12)	1754	1690
ν OC(88)	1757	1714
ν CH(52)	2901	1774
ν CH(32)	2942	1855
ν CH(42)	2943	2861
ν CH(91)	2944	2862
ν CH(99)	3002	2873
ν CH(46)	3015	2889
ν CH(58)	3022	2899
ν CH(91)	3045	2920
ν CH(30)	3055	2936
ν CH(48)	3077	2948
ν CH(43)	3095	2950
ν CH(40)	3104	3037
ν CH(45)	3112	3053
ν CH(26)	3119	3055
ν CH(60)	3125	3056
ν CH(70)	3126	2903

ν NH(100)	3556	3552

ν, stretching; δ, bending; δs, scissoring; ρ, rocking; γ, out-of-plane bending; τ, torsion

NMR Spectral Analysis

In nuclear magnetic resonance (NMR) spectroscopy, the isotropic chemical shift analysis allows us to identify relative ionic species and to calculate reliable magnetic properties which provide the accurate predictions of molecular geometries (Rani et al., 2010; Subramanian, Sundaraganesan, & Jayabharathi, 2010; Wade, 2006). In this framework, the optimized molecular geometry of title compound was obtained by using B3LYP and HF methods with 6-31G(d,p) basis level in DMSO solvent. By considering the optimized molecular geometry of the title compound the ^{1}H and ^{13}C NMR chemical shift values were calculated at the same level by using Gauge-Independent Atomic Orbital (GIAO) method. Theoretical and experimental values were plotted according to δ exp=a. δ calc.+ b, Eq. a and b constants regression coefficients with a standard error values were found using the SigmaPlot program.

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Table 3. The calculated and experimental ^{13}C and ^{1}H NMR isotropic chemical shift values of the molecule

No	Experim.	DFT/Vacum	DFT/DMSO	HF/Vacum	DFT/DMSO
C1	144,05	148,45	150,31	142,77	145,22
C2	148,36	152,13	152,89	145,70	146,48
C3	151,08	153,84	154,50	147,97	148,73
C4	127,41	138,58	138,37	130,23	130,13
C5	116,36	110,90	111,25	103,42	103,77
C6	150,78	154,78	154,62	145,73	145,28
C7	138,82	147,46	147,19	135,94	135,38
C8	118,38	126,47	126,85	120,72	121,12
C9	126,94	128,73	129,25	120,56	121,31
C10	162,46	164,37	165,70	153,68	155,23
C11	133,44	139,52	139,82	132,84	133,03
C12	131,29	136,43	135,33	127,35	129,11
C13	124,17	127,67	128,69	121,71	122,27
C14	150,41	154,37	155,27	144,17	144,62
C15	124,17	127,86	128,25	121,82	122,48
C16	131,29	134,33	136,79	129,01	128,15
C17	10,85	20,93	20,77	10,51	10,42
C18	64,39	71,03	71,43	52,99	53,28
C19	14,34	23,58	23,37	13,10	12,95
H20	11,79	8,01	8,46	7,27	7,66
H21	9,91	11,11	11,05	10,33	10,29
H22	7,58	8,57	8,72	8,28	8,46
H23	7,43	8,04	8,24	7,89	8,13
H24	7,36	7,90	8,06	7,71	7,94
H25	8,43	9,33	9,49	9,11	9,28
H26	8,43	9,38	9,49	9,31	9,44
H27	8,43	9,39	9,48	9,33	9,43
H28	8,43	9,40	9,43	9,23	9,26
H29	2,12	3,15	3,30	2,40	2,82

H30	2,12	3,17	3,30	2,63	2,81
H31	2,12	2,89	2,95	2,47	2,51
H32	4,11	4,91	5,08	4,06	4,26
H33	4,11	4,86	4,96	3,90	4,02
H34	1,20	2,26	2,18	1,70	1,64
H35	1,20	2,20	2,17	1,68	1,58
H36	1,20	1,88	2,07	1,27	1,47

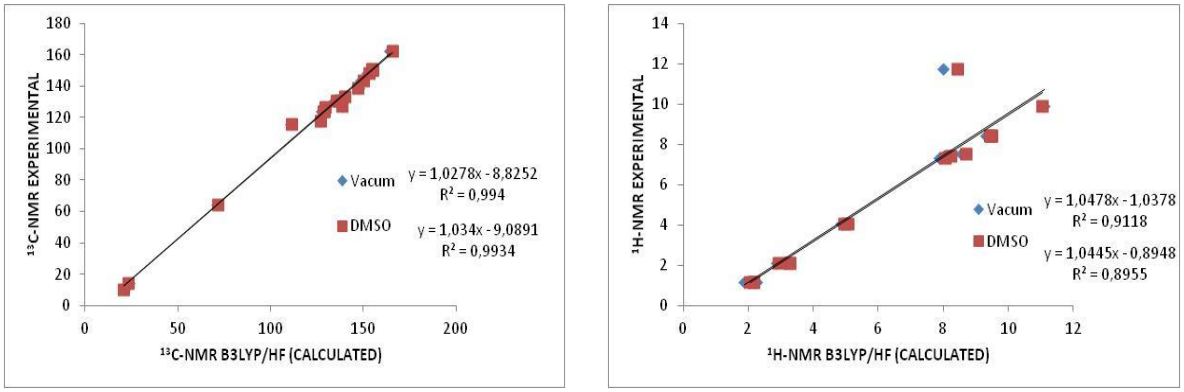


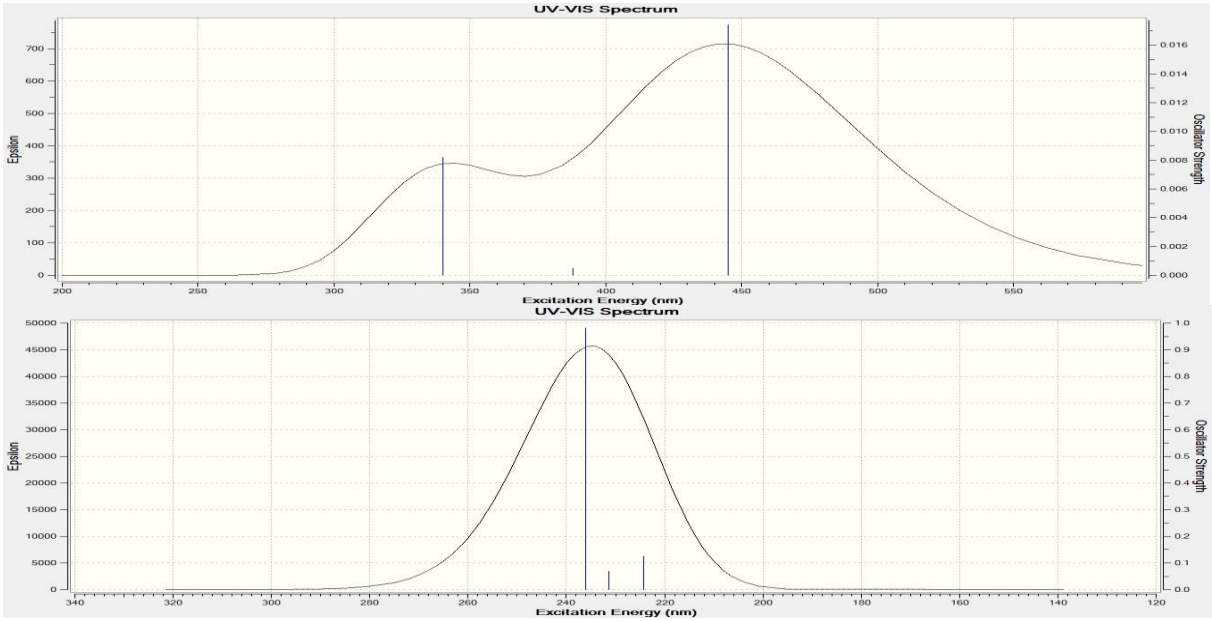
Figure 3. The correlation graphics of 13C-NMR (Vacum, DMSO), 1H-NMR (Vacum, DMSO) chemical shift values of 3-methyl-4-[2-(4-nitrobenzoxy)-3-ethoxy-benzylideneamino]-4,5-dihydro-1H-1,2,4-triazol-5-one.

Atomic Charges and Dipole Moments

Theoretical UV-Vis values, dipole moments, Mulliken atomic charges, HOMO-LUMO energies and total energy of 3-methyl-4-[2-(4-nitrobenzoxy)-3-ethoxy-benzylideneamino]-4,5-dihydro-1*H*-1,2,4-triazol-5-one have been given in Tables **4, 5** and **6** and Figures **3**, **4**.

Table 4. Mulliken atomic charges of the molecule

	B3LYP	**HF**		**B3LYP**	**HF**
C1	0.52	0.59	**H25**	0.13	0.21
C2	0.82	1.05	**H26**	0.14	0.22
C3	0.12	0.18	**H27**	0.15	0.23
C4	0.09	-0.07	**H28**	0.14	0.21
C5	-0.16	-0.18	**H29**	0.14	0.16
C6	0.38	0.43	**H30**	0.14	0.15
C7	0.29	0.34	**H31**	0.14	0.15
C8	-0.11	-0.15	**H32**	0.11	0.11
C9	-0.15	-0.17	**H33**	0.11	0.12
C10	0.62	0.88	**H34**	0.13	0.13
C11	0.03	-0.18	**H35**	0.13	0.14
C12	-0.11	-0.12	**H36**	0.11	0.12
C13	-0.10	-0.12	**N37**	-0.44	-0.57
C14	0.25	0.14	**N38**	-0.33	-0.35
C15	-0.10	-0.12	**N39**	-0.41	-0.62
C16	-0.11	-0.12	**N40**	-0.33	-0.33
C17	-0.36	-0.36	**N41**	0.39	0.53
C18	0.06	0.09	**O42**	-0.54	-0.66
C19	-0.34	-0.35	**O43**	-0.54	-0.69
H20	0.30	0.34	**O44**	-0.55	-0.71
H21	0.16	0.23	**O45**	-0.46	-0.55
H22	0.11	0.19	**O46**	-0.39	-0.47
H23	0.11	0.18	**O47**	-0.39	-0.47
H24	0.10	0.17			



λ (nm)B3LYP/HF	excitation Energy(eV) B3LYP/HF	*f* (oscillator values) B3LYP/HF
442.82/236.07	2.7873/5.2521	0.0174/0.9814
387.90/231.32	3.1963/5.3598	0.0005/0.0699
339.97/224.35	3.6469/5.5264	0.0082/0.1247

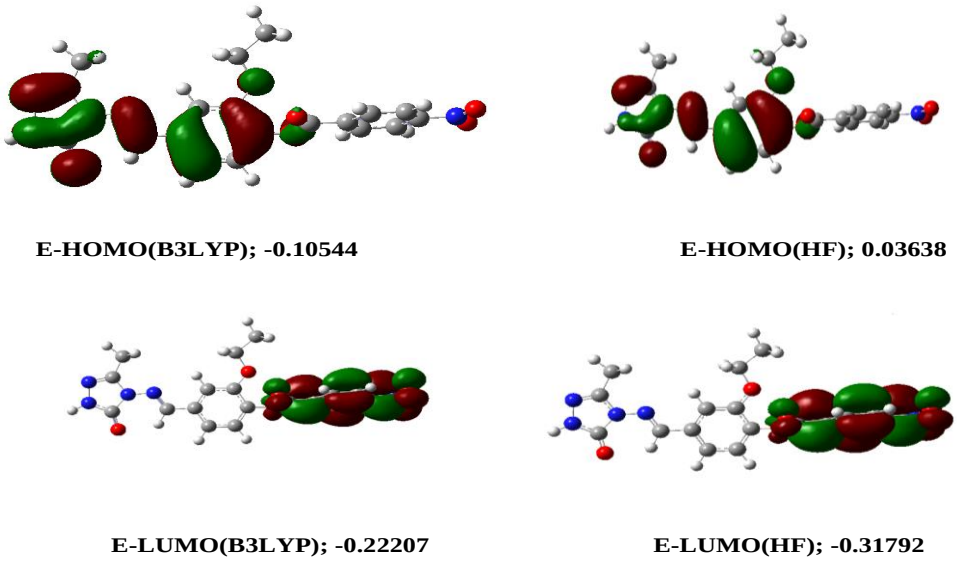
Figure 2. The absorption wavelength (λ), excitation energies and oscillator strengths (*f*) of the molecule.

Table 5. The calculated dipole moment values of the molecule

Dipole Moment	B3LYP (a.u.)	HF (a.u.)
μ_x	-4.6582	-2.7728
μ_y	0.3996	1.4394
μ_z	3.3802	2.3999
μ_{Toplam}	5.7692	3.9395

Table 6. The total energy of the of the molecule

Energy	B3LYP	HF
(a.u.)	-1459.272	-1450.712



E-HOMO(B3LYP); -0.10544 **E-HOMO(HF); 0.03638**

E-LUMO(B3LYP); -0.22207 **E-LUMO(HF); -0.31792**

Figure 3. The calculated HOMO-LUMO energies of the molecule according to B3LYP/HF 6-31G(d,p) levels

Conclusion

In this study, vibrational frequencies, ^{1}H and ^{13}C NMR chemicals shifts, UV–vis values, HOMO and LUMO energies and atomic charges of 3-methyl-4-[2-(4-nitrobenzoxy)-3-ethoxy-benzylideneamino]-4,5-dihydro-1*H*-1,2,4-triazol-5-one have been calculated by using DFT/B3LYP and HF methods. The vibrational frequencies, ^{1}H and ^{13}C NMR chemical shift values obtained theoretically were in a very good agreement with the experimental data.

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SYNTHESIS, CHARACTERIZATION AND ANTIOXIDANT ACTIVITIES OF NEW 1-(2,6-DIMETHYLMORPHOLINE-4-YL-METHYL)-3-ALKYL(ARYL)-4-[4-(DIMETHYLAMINO)-BENZYLIDENAMINO]-4,5-DIHYDRO-1*H*-1,2,4-TRIAZOL-5-ONES

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Abstract: In this paper, seven new 1-(2,6-dimethylmorpholine-4-yl-methyl)-3-alkyl(aryl)-4-[4-(dimethylamino)-benzylidenamino]-4,5-dihydro-1*H*-1,2,4-triazol-5-ones (2) were obtained by the reactions of 3-alkyl(aryl)-4-[4-(dimethylamino)-benzylidenamino]-4,5-dihydro-1*H*-1,2,4-triazol-5-ones (1) with formaldehyde and 2,6-dimethylmorpholine. The novel synthesized compounds were identified by IR, ^{1}H NMR and ^{13}C NMR spectral data. Besides, the newly synthesized compounds were analyzed for their *in vitro* potential antioxidant capacities in three different assays. All of the compounds demonstrated significant activity for metal chelating effect.

Keywords: 1,2,4-Triazol-5-one, mannich base, syntheses, antioxidant activity

Introduction

Mannich bases have applications the field medicinal chemistry, the product synthetic polymers, the petroleum industry, as products used in water treatment, cosmetics, the dyes industry, etc (Tramontini & Angiolini, 1994). Moreover, Mannich bases have some biological activities such as anticancer (Savariz et al., 2010), antibacterial (Maddila & Jonnalagadda, 2012), anti-inflammatory (Liu, Yu, Li, Pang, & Zhao, 2013), anti-HIV (Sriram, Yogeeswari, Dinakaran, & Sowmya, 2008), analgesic (Nithinchandra, Kalluraya, Aamir, & Shabaraya, 2012), antiviral (Chen et al., 2010), antifungal (Ozkan-Daguyan, Sahin, & Koksal, 2013), antitumor (Pati et al., 2008), antidepressant (Köksal & Bilge, 2007) and antioxidant activities (Hamama, Zoorob, Gouda, & Afsah, 2011).

Antioxidants are extensively studied for their capacity to protect organism and cell from damage that is induced by the oxidative stress. A great deal of research has been devoted to the study of different types of natural and synthetic antioxidant. A large number of heterocyclic compounds, containing the 1,2,4-triazole ring, are associated with diverse biological properties such as antioxidant, anti-inflammatory, antimicrobial and antiviral activity. External chemicals and internal metabolic processes in human body or in food system might produce highly reactive free radicals, especially oxygen derived radicals, which are capable of oxidizing biomolecules by resulting in cell death and tissue damage. Oxidative damages play a significantly pathological role in human diseases. Cancer, emphysema, cirrhosis, atherosclerosis and arthritis have all been correlated with oxidative damage. Also, excessive generation of reactive oxygen species (ROS) induced by various stimuli and which exceeds the antioxidant ability of the organism leads to variety of pathophysiological processes like inflammation, diabetes, genotoxicity and cancer (McClements & Decker, 2000).

Triazoles are heterocyclic compounds that contain three nitrogen atoms. 1,2,4-Triazole and 4,5-dihydro-1*H*-1,2,4-triazol-5-one derivatives are reported to possess a broad spectrum of biological activities such as analgesic, antibacterial, antioxidant and antiparasitic properties (Aktas-Yokus, Yuksek, Gursoy-Kol, & Alpay-Karaoglu, 2015; Chidananda et al., 2012). Considering about the development of new hetero moieties by combining potential biological active scaffolds, an attempt was made here to obtain 1,2,4-triazoles bearing morpholine ring and to evaluate their antioxidant activity.

In this regard, seven new 1-(2,6-dimethylmorpholine-4-yl-methyl)-3-alkyl(aryl)-4-[4-(dimethylamino)-benzylidenamino]-4,5-dihydro-1*H*-1,2,4-triazol-5-ones (2) were synthesized and investigated by using different antioxidant methodologies like; reducing power, 1,1-diphenyl-2-picryl-hydrazyl (DPPH) free radical scavenging activity and iron binding effect.

Methods

Chemicals and Apparatus

Chemical reagents used in this paper were bought from Merck AG, Aldrich and Fluka. Melting points were recorded in open glass capillaries using a Stuart SMP30 melting point apparatus and were not corrected. The infrared spectra were recorded on an Alpha-P Bruker FT-IR Spectrometer. ^{1}H and ^{13}C NMR spectra were determined in deuterated dimethyl sulfoxide with TMS as internal standard using a Bruker Ultrashield Plus Biospin spectrophotometer at 400 MHz and 100 MHz, respectively.

Synthesis of Compounds 2: The General Procedure

3-Alkyl(Aryl)-4-[4-(dimethylamino)-benzylidenamino]-4,5-dihydro-1*H*-1,2,4-triazol-5-ones (**1**) were obtained according to the literature (Bahçeci et al., 2002). Then, to solution of this compound (**1**) (5 mmol) in absolute ethanol was added 2,6-dimethylmorpholine (6 mmol). The reaction mixture was refluxed for 4 hours. The mixture was left at room temperature for overnight. After cooling the mixture in the refrigerator, the solid formed was obtained by filtration, washed with cold ethanol and recrystallized from ethanol.

Physical data of the new compounds are presented in Table **1**. IR, ^{1}H-NMR and ^{13}C-NMR spectral data are given in Tables **2**, **3** and **4**, respectively.

Table 1. Physical data of the compounds 2

Compound No	R	Yield (%)	m.p. (°C)
2a	CH_3	62	134
2b	CH_2CH_3	46	136
2c	$CH_2C_6H_5$	54	143
2d	$CH_2C_6H_4.CH_3$ (*p*-)	63	174
2e	$CH_2C_6H_4.OCH_3$ (*p*-)	66	136
2f	$CH_2C_6H_4.Cl$ (*p*-)	64	166
2g	C_6H_5	62	142

Table 2. IR data of the compounds 2 (cm^{-1})

Compound No	$\nu_{C=O}$	$\nu_{C=N}$	$\nu_{1,4\text{-disubstituted benzenoid ring}}$	$\nu_{monosubstituted\ benzenoid\ ring}$
2a	1694	1591	814	-
2b	1689	1590	822	-
2c	1703	1680, 1590	816	767 and 705
2d	1703	1609, 1590	814	-
2e	1704	1608, 1588	815	-
2f	1702	1609, 1587	811	-
2g	1696	1613, 1586	814	769 and 694

Table 3. ^{1}H-NMR data of the compounds 2 (DMSO-d_6, δ/ppm)

Comp. No	$2CH_3$	CH_2	CH_3	CH_3CH_3	CH_2	$N(CH_3)_2$	2CH	CH_2Ph	NCH_2N	Aromatic H	N=CH
2a	1.03 (d, *J*=6.00Hz)	1.98-2.03 (m)	2.27 (s)	-	2.75 (d, *J*=11.20Hz)	2.99 (s)	3.50-3.55 (m)	-	4,53 (s)	6.77 (d, 2H, *J*=8.80Hz); 7.64 (d, 2H, *J*=8.80Hz)	9.41 (s)
2b	1.03 (d, *J*=6.40Hz)	2.00 (t, *J*=10.80Hz)	1.22 (t, *J*=7.20Hz)	2.68 (q, *J*=7.20Hz)	2.76 (d, *J*=11.20Hz)	2.99 (s)	3.51-3.54 (m)	-	4.53 (s)	6.78 (d, 2H, *J*=8.80Hz); 7.64 (d, 2H, *J*=8.80 Hz)	9.40 (s)
2c	1.03 (d, *J*=6.00Hz)	2.02 (t, *J*=11.20Hz)	-	-	2.77 (d, *J*=10.80Hz)	3.00 (s)	3.51-3.54 (m)	4.04 (s)	4.56 (s)	6.76 (d, 2H, *J*=8.80Hz); 7.21-7.32 (m, 5H); 7.60 (d, 2H, *J*=8.80Hz)	9.37 (s)
2d	1.03 (d, *J*=6.00Hz)	1.99 (t, *J*=10.80Hz)	2.24 (s)	-	2.77 (d, *J*=10.80Hz)	2.98 (s)	3.51-3.54 (m)	3.98 (s)	4.57(s)	6.77 (d, 2H, *J*=8.80Hz); 7.10 (d, 2H, *J*=8.00Hz); 7.20 (d, 2H, *J*=8.00Hz); 7.61 (d, 2H, *J*=9.20Hz)	9.37 (s)
2e	1.03 (d, *J*=6.00Hz)	1.99 (t, *J*=10.80Hz)	3.70 (s)	-	2.76 (d, *J*=10.40Hz)	3.00 (s)	3.51-3.55 (m)	3.97 (s)	4.55 (s)	6.77 (d, 2H, *J*=8.80Hz); 6.86 (d, 2H, *J*=8.80Hz); 7.23 (d, 2H, *J*=8.80Hz); 7.62 (d, 2H, *J*=8.80Hz)	9.37 (s)
2f	1.03 (d, *J*=6.40Hz)	2.02 (t, *J*=10.40Hz)	-	-	2.76 (d, *J*=10.80Hz)	3.00 (s)	3.46-3.52 (m)	4.06 (s)	4.55 (s)	6.77 (d, 2H, *J*=8.80Hz); 7.33-7.39 (m, 4H); 7.60 (d, 2H, *J*=8.80Hz)	9.38 (s)
2g	1.04 (d, *J*=6.40Hz)	2.12 (t, *J*=10.80Hz)	-	-	2.83 (d, *J*=11.20Hz)	3.01 (s)	3.54-3.58 (m)	-	4.69 (s)	6.78 (d, 2H, *J*=9.20Hz); 7.50-7.54 (m, 3H); 7.63-7.65 (m, 2H); 7.92 (d, 2H, *J*=9.20Hz)	9.30 (s)

Table 4. ^{13}C-NMR data of the compounds 2 (DMSO-d_6, δ/ppm)

Comp. No	N=CH	Triazole C_5	Triazole C_3	Aromatic C	Aliphatic C
2a	152.50	150.51	142.92	155.97; 129.32 (2C); 120.16; 111.63 (2C)	71.03 (CHOCH); 65.54 (NCH_2N); 55.65 (CH_2NCH_2); 38.97 ($N(CH_3)_2$); 18.92 ($2CH_3$); 11.03 (CH_3)
2b	152.52	150.65	146.71	156.00; 129.29 (2C); 120.19; 111.66 (2C)	71.03 (CHOCH); 65.61 (NCH_2N); 55.68 (CH_2NCH_2); 38.97 ($N(CH_3)_2$); 18.93 ($2CH_3$); 18.51 (CH_2CH_3); 10.12 (CH_2CH_3)
2c	152.50	150.52	144.79	155.61; 135.83; 129.81 (2C); 128.71 (2C); 128.41 (2C); 126.72; 120.13; 111.66 (2C)	71.01 (CHOCH); 65.67 (NCH_2N); 55.71 (CH_2NCH_2); 38.97 ($N(CH_3)_2$); 30.96(CH_2Ph); 18.92 ($2CH_3$)
2d	152.50	150.51	144.94	155.55; 135.81; 132.70; 129.31 (2C); 128.96 (2C); 128.56 (2C); 120.15; 111.66 (2C)	71.01 (CHOCH); 65.65 (NCH_2N); 55.71 (CH_2NCH_2); 38.97 ($N(CH_3)_2$); 30.55(CH_2Ph); 20.56 ($PhCH_3$); 18.93 ($2CH_3$)
2e	152.50	150.52	145.10	158.12; 155.56; 129.77 (2C); 129.32 (2C); 127.60; 120.17; 113.88 (2C); 111.67 (2C)	71.01 (CHOCH); 65.42 (NCH_2N); 55.71 (CH_2NCH_2); 55.03 (OCH_3); 38.98 ($N(CH_3)_2$); 30.11(CH_2Ph); 18.92 ($2CH_3$)
2f	152.50	150.53	144.47	155.64; 134.61; 131.44; 130.63; 129.34 (2C); 129.21 (2C); 128.31 (2C); 111.65 (2C)	71.01 (CHOCH); 65.89 (NCH_2N); 55.68 (CH_2NCH_2); 38.95 ($N(CH_3)_2$); 30.31(CH_2Ph); 18.92 ($2CH_3$)
2g	152.68	150.79	143.02	159.01; 132.36; 129.87 (2C); 129.47 (2C); 127.89 (2C); 126.51 (2C); 119.89; 111.69 (2C)	71.07 (CHOCH); 66.10 (NCH_2N); 55.63 (CH_2NCH_2); 38.96 ($N(CH_3)_2$); 18.92 ($2CH_3$)

Antioxidant Activity

Chemicals

Butylated hydroxytoluene (BHT), ferrous chloride, DPPH., α-tocopherol, 3- butylated hydroxyanisole (BHA), (2-pyridyl)-5,6-bis(phenylsulfonic acid)-1,2,4-triazine (ferrozine) and trichloroacetic acid (TCA) were obtained from E. Merck or Sigma.

Reducing Power

The reducing power of the compounds **2a-g** was determined using the method of Oyaizu (1986). Different concentrations of the samples (50-250 µg/mL) in DMSO (1 mL) were mixed with phosphate buffer (2.5 mL, 0.2 M, pH = 6.6) and potassium ferricyanide (2.5 mL, 1%). The mixture was incubated at 50°C for 20 min. after which a portion (2.5 mL) of trichloroacetic acid (10%) was added to the mixture, which was then centrifuged for 10 min at 1000 x g. The upper layer of solution (2.5 mL) was mixed with distilled water (2.5 mL) and $FeCl_3$ (0.5 mL, 0.1%), and then the absorbance at 700 nm was measured in a spectrophometer. Higher absorbance of the reaction mixture indicated greater reducing power.

Free Radical Scavenging Activity

Free radical scavenging effect of the compounds **2a-g** was estimated by DPPH·, by the method of Blois (1958). Briefly, 0.1 mM solution of DPPH· in ethanol was prepared, and this solution (1 mL) was added to sample solutions in DMSO (3 mL) at different concentrations (50-250 µg/mL). The mixture was shaken vigorously and allowed to stand at room temperature for 30 min. Then the absorbance was measured at 517 nm in a spectrophometer. Lower absorbance of the reaction mixture indicated higher free radical scavenging activity.

The $DPPH^{\cdot}$ concentration (mM) in the reaction medium was calculated from the following calibration curve and determined by linear regression (R: 0.997):

$$\text{Absorbance} = 0.0003 \times DPPH^{\cdot} - 0.0174$$

The capability to scavenge the DPPH radical was calculated using the following equation:

$$\text{DPPH. scavenging effect (\%)} = (A_0 - A_1/A_0) \times 100$$

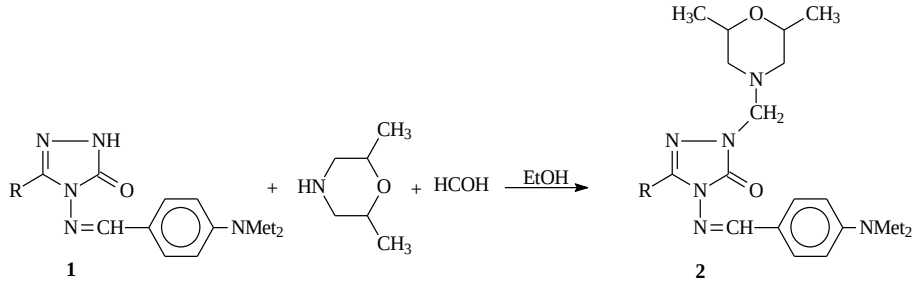
where A_0 is the absorbance of the control reaction and A_1 is the absorbance in the presence of the samples or standards.

Metal Chelating Activity

The chelating of ferrous ions by the compounds **2a-g** and references was measured according to the method of Dinis et al. (1994). Briefly, the synthesized compounds (30–60 μg/mL) were added to a 2 mM solution of $FeCl_2.4H_2O$ (0.05 mL). The reaction was initiated by the addition of 5 mM ferrozine (0.2 mL), and then the mixture was shaken vigorously and left standing at room temperature for 10 min. After the mixture had reached equilibrium, the absorbance of the solution was measured at 562 nm in a spectrophotometer. All tests and analyses were run in triplicate and averaged. The percentage of inhibition of ferrozine–Fe^{2+} complex formation was given by the formula: % inhibition = $(A_0 - A_1 / A_0) \times 100$, where A_0 is the absorbance of the control, and A_1 is the absorbance in the presence of the samples or standards. The control did not contain compound or standard.

Results and Findings

In the current paper, seven new 1-(2,6-dimethylmorpholine-4-yl-methyl)-3-alkyl(aryl)-4-[4-(dimethylamino)-benzylidenamino]-4,5-dihydro-1*H*-1,2,4-triazol-5-ones (**2a-g**) were synthesized. The starting compounds **1a-g** were prepared as explained in the literature (Bahçeci et al., 2002). Compounds **2a-g** were obtained by the reactions of 3-alkyl(aryl)-4-[4-(dimethylamino)-benzylidenamino]-4,5-dihydro-1H-1,2,4-triazol-5-ones (1) with formaldehyde and 2,6-dimethylmorpholine (**Scheme 1**). The novel 1-(2,6-dimethylmorpholine-4-yl-methyl)-3-alkyl(aryl)-4-[4-(dimethylamino)-benzylidenamino]-4,5-dihydro-1*H*-1,2,4-triazol-5-ones (**2a-g**) were characterized with IR, ^{1}H NMR and ^{13}C NMR and spectral data.



1, 2	R
a	CH_3
b	CH_2CH_3
c	$CH_2C_6H_5$
d	$CH_2C_6H_4.CH_3$ (*p*-)
e	$CH_2C_6H_4.OCH_3$ (*p*-)
f	$CH_2C_6H_4.Cl$ (*p*-)
g	C_6H_5

Scheme 1

Antioxidant Activity

The antioxidant capacities of seven newly synthesized compounds **2a-g** were determined. Different processes have been used to identify antioxidant capacities. The processes used in the paper are clarified below:

Reducing Power

The reducing power of the compounds **2** was determined. The reducing capacity of a compound may serve as a significant indicator of its potential antioxidant activity. The presence of reductants such as antioxidants substances in the antioxidant samples causes the reduction of the Fe^{3+} / ferricyanide complex to the ferrous form. Therefore, the Fe^{2+} can be monitored by measuring the formation of Perl's Prussian blue at 700 nm (Chung, Chang, Chao, Lin, & Chou, 2002). The antioxidant activity of putative antioxidant has been attributed to various mechanisms such as prevention chain initiation, binding of transition metal ion catalyst, decomposition of peroxides, prevention of continued hydrogen abstraction, reductive capacity and radical scavenging (Yildirim,

Mavi, & Kara, 2001). In the paper, all of the concentrations of the compounds showed lower absorbance than reference antioxidants as seen in Figure **1**. Hereby, any reductive activities were not observed.

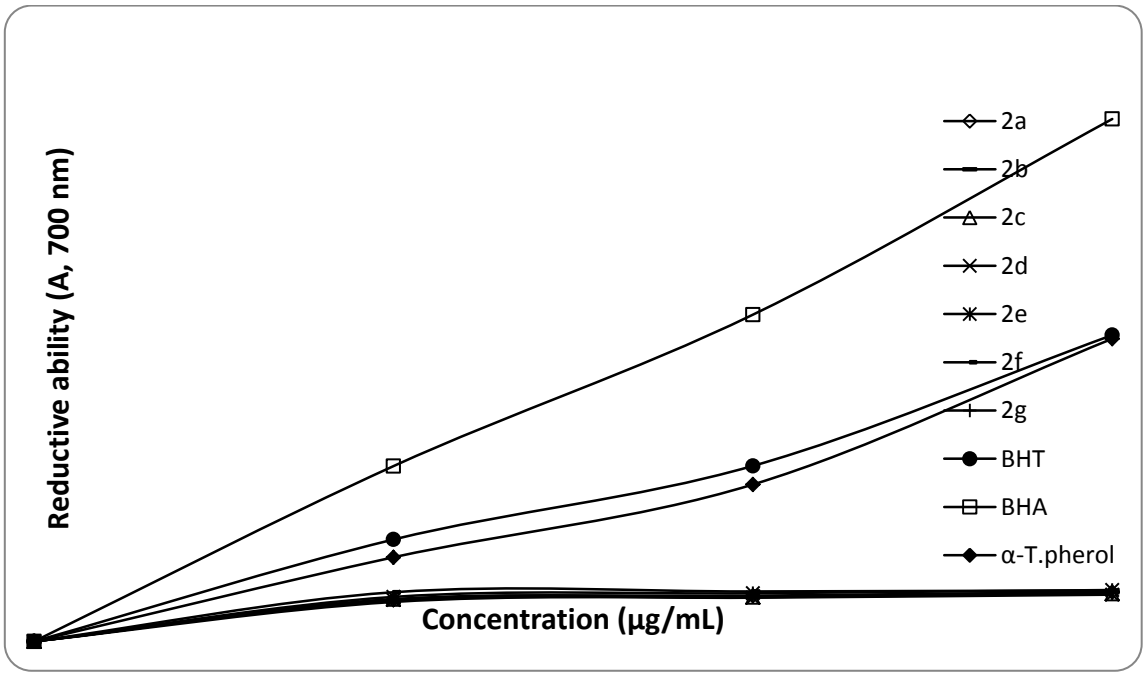


Figure 1. Total reductive potential of different concentrations of compounds 2a-g, BHT, BHA and α-tocopherol

DPPH Radical Scavenging Activity

Free radical scavenging effect of the compounds **2** was estimated by DPPH radical model. The effect of antioxidants on DPPH radical scavenging was thought to be due to their hydrogen donating ability (Baumann, Wurn, & Bruchlausen, 1979). DPPH is a stable free radical and accepts an electron or hydrogen radical to become a stable diamagnetic molecule (Soares, Dinis, Cunha, & Almeida, 1997). The reduction capability of DPPH radicals was determined by decrease in its absorbance at 517 nm induced by antioxidants. In the study, antiradical capacities of the compounds **2a-g** and reference antioxidants for instance α-tocopherol, BHA and BHT were detected by using DPPH$^{\cdot}$ method. Scavenging effect values of compounds **2** with BHT, BHA and α-tocopherol at different concentrations are given in Figure **2**. All of the compounds tested with this method exhibited very low DPPH free radical scavenging activity in a concentration-dependent manner. In other words the newly synthesized compounds did not show any ability like a radical scavenger.

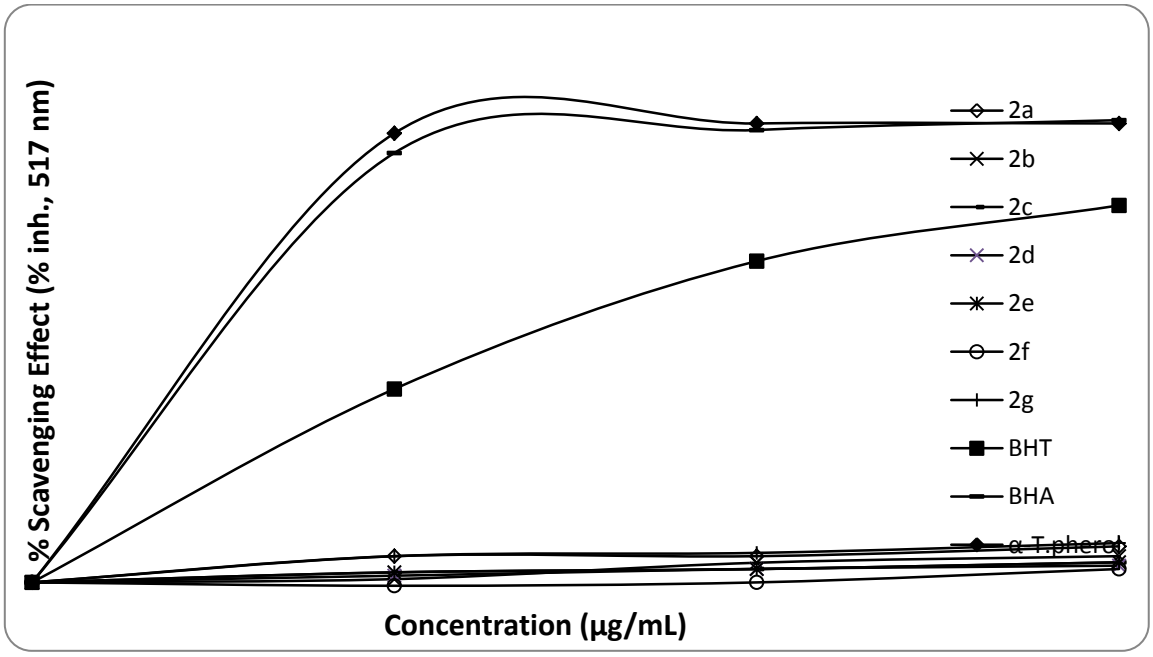


Figure 2. Scavenging effect of compounds 2a-g, BHT, BHA and α-tocopherol at different concentrations

Iron Binding Capacity

The chelating of ferrous ions by the compounds **2** and references was measured. Ferrozine can quantitatively form complexes with Fe^{2+}. In the presence of chelating agents, the complex formation is disrupted with the result that the red colour of the complex is decreased. Measurement of colour reduction therefore allows estimation of the chelating activity of the coexisting chelator (Yamaguchi, Ariga, Yoshimura, & Nakazawa, 2000). The transition metals ions play an important role as catalysts of oxidative process, leading to formation of hydroxyl radicals and hydroperoxide decomposition reaction via Fenton chemistry (Halliwell, 1996). The production of these radicals may lead to lipid peroxidation, protein modification and DNA damage. Chelating agents are effective as secondary antioxidants because they potentially inhibit the metal-dependent processes thereby stabilizing the oxidized form of the metal ion (Finefrock, Bush, & Doraiswamy, 2003). Iron binding activities of the compounds **2**, α-tocopherol and EDTA are shown in Figure **3**. In the current paper, high iron binding capacity of synthesized compounds would be beneficial in retarding metal-chelating oxidation. The data acquired from Figure **3** disclose that the metal chelating effects of the compounds **2** were significant and concentration-dependent. The metal chelating effect of the compounds and references decreased in order of EDTA > 2a > 2b > 2g > 2c ≈ 2f > 2d ≈ 2f > α-tocopherol, which were 85.4, 84.5, 84.0, 83.6, 82.9, 81.5, 60.3 (%), at the highest concentration, respectively.

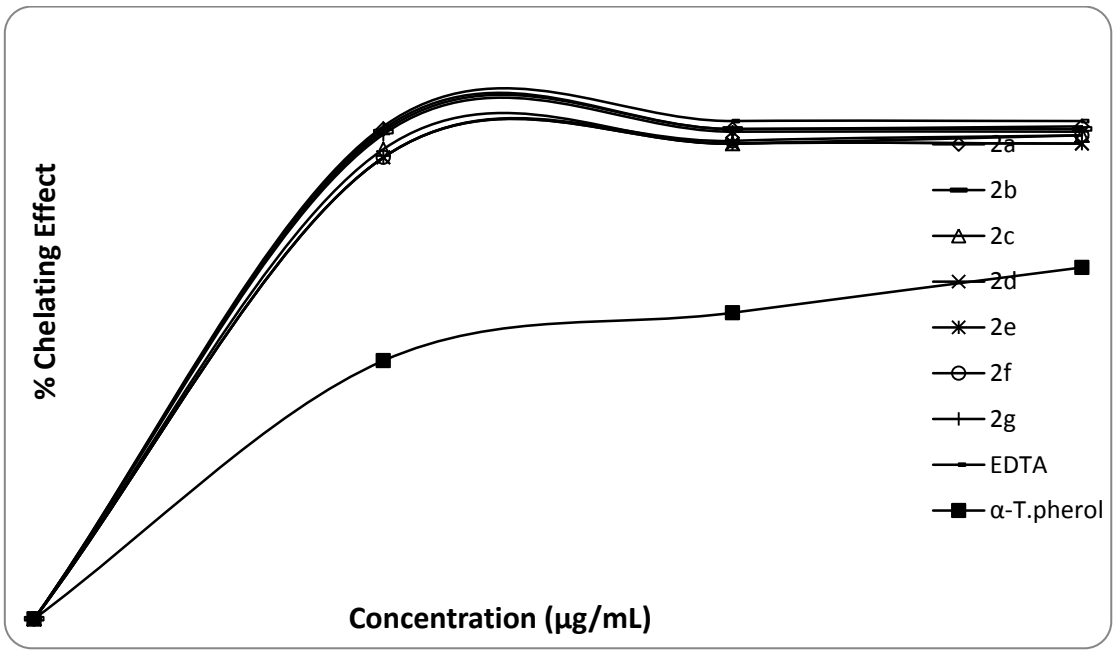


Figure 3. Metal chelating effect of different amount of the compounds 2a-g, EDTA and α-tocopherol on ferrous ions

Conclusion

New 4,5-dihydro-1*H*-1,2,4-triazol-5-one derivatives were obtained and evaluated for their in-vitro antioxidant capacity. All of the compounds demonstrate a marked ability for metal chelating activity. The data reported with regard to the observed metal chelating activities of the studied compounds could prevent redox cycling. The results may also give several advices for the improvement of new triazole-based therapeutic target.

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SYNTHESIS AND ANTIOXIDANT ACTIVITIES OF NEW 1-ACETYL-3-ALKYL(ARYL)-4-(3-ETHOXY-4-BENZENESULFONYLOXY)-BENZYLIDENAMINO-4,5-DIHYDRO-1*H*-1,2,4-TRIAZOL-5-ONES

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Abstract: In this paper, five new 1-acetyl-3-alkyl(aryl)-4-(3-ethoxy-4-benzenesulfonyl-oxy)benzylidenamino-4,5-dihydro-1*H*-1,2,4-triazol-5-ones (**2**) were synthesized by the reactions of 3-alkyl(aryl)-4-(3-ethoxy-4-benzenesulfonyloxy)benzylidenamino-4,5-dihydro-1*H*-1,2,4-triazol-5-ones (**1**) with acetic anhydride. The structures of five new compounds are established from the spectral data. Moreover, the antioxidant properties of the compounds **2** were studied and evaluated using different three antioxidant assays; including reducing power, free radical scavenging and metal chelating activity. All of the compounds showed good metal chelating activities at the lowest concentration.

Keywords: 1,2,4-triazol-5-one, schiff base, syntheses, acetylation, antioxidant activity

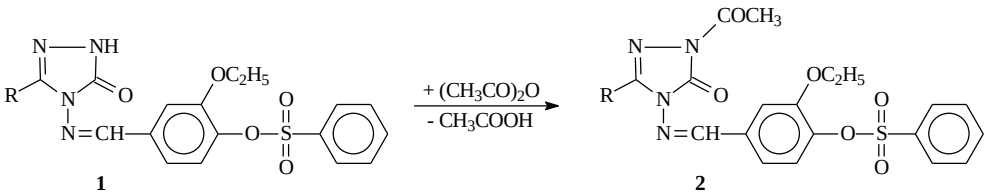
Introduction

In the last two decades there has been an explosive interest in the role of reactive oxygen species (ROS) and of reactive nitrogen species (RNS) in food, drugs, and even living system. Therefore, scientists in various disciplines have become more interested in naturally-occurring antioxidant and also related synthetic derivatives that could provide active components to prevent or reduce the impact of oxidative stress (Hussain et al., 2003).

Exogenous chemicals and endogenous metabolic processes in human body or in food system might produce highly reactive free radicals, especially oxygen derived radicals. At high concentrations, they can be important mediators of damage to cell structures, including lipids and membranes, proteins, and nucleic acids. Oxidative damages from ROS accumulate during the life cycle and radical-related damage to biomolecules has been proposed to play a key role in the development of age-dependent diseases and other conditions (McClements & Decker, 2000).

1,2,4-Triazole and 4,5-dihydro-1*H*-1,2,4-triazol-5-one derivatives have been found to have a broad spectrum of biological activities (Bayrak, Demirbas, Karaoglu, & Demirbas, 2009; Gürsoy-Kol & Ayazoglu, 2014; Kahveci, Özil, Menteşe, Bekircan, & Buruk, 2008; Yüksek et al., 2013). In addition, several articles about the synthesis of some N-arylidenamino-4,5-dihydro-1*H*-1,2,4-triazol-5-one derivatives have been published (Gürsoy-Kol & Ayazoglu, 2014; Yüksek et al., 2013). The acetylation of 4,5-dihydro-1*H*-1,2,4-triazol-5-one derivatives have also been reported (Gürsoy-Kol & Ayazoglu, 2014; Yüksek et al., 2013).

In this regard, five new 1-acetyl-3-alkyl(aryl)-4-(3-ethoxy-4-benzenesulfonyloxy)benzylidenamino-4,5-dihydro-1*H*-1,2,4-triazol-5-ones (**2**) were synthesized by the reactions of 3-alkyl(aryl)-4-(3-ethoxy-4-benzenesulfonyloxy)benzylidenamino-4,5-dihydro-1*H*-1,2,4-triazol-5-ones (**1**) with acetic anhydride (Scheme 1). In addition, due to a wide range of applications to find their possible antioxidant activity, the newly synthesized compounds were investigated by using different antioxidant methodologies: 1,1-diphenyl-2-picrylhydrazyl (DPPH.) free-radical scavenging, reducing power and metal chelating activities.



1, 2	R
a	CH_3
b	CH_2CH_3
c	$CH_2C_6H_5$
d	$CH_2C_6H_4.CH_3$ (*p*-)
e	$CH_2C_6H_4.Cl$ (*p*-)

Scheme 1: Synthesis route compounds 2

Methods

Chemicals and Apparatus

Chemical reagents and all solvents used in this paper were bought from Merck AG, Aldrich and Fluka. Melting points were recorded in open glass capillaries using a Stuart SMP30 melting point apparatus and were not corrected. The infrared spectra were recorded on an Alpha-P Bruker FT-IR Spectrometer. ^{1}H and ^{13}C NMR spectra were determined in deuterated dimethyl sulfoxide with TMS as internal standard using a Bruker Ultrashield Plus Biospin spectrophotometer at 400 MHz and 100 MHz, respectively.
The starting compounds **1** were prepared as described in the literature (Yüksek, Özdemir & Gürsoy-Kol, 2017).

General Method for the Preparation of 1-Acetyl-3-alkyl(aryl)-4-(3-ethoxy-4-benzenesulfonyl-oxy)benzylidenamino-4,5-dihydro-1*H*-1,2,4-triazol-5-ones (2)

The corresponding compound **1** (0.01 mol) was refluxed with acetic anhydride (15 mL) for 0.5 h. After addition of absolute ethanol (50 mL), the mixture was refluxed for 1 h. more. Evaporation of the resulting solution at 40-45 °C in vacuo and several recrystallizations of the residue from EtOH gave pure compounds **2** as colorless crystals.

1-Acetyl-3-methyl-4-(3-ethoxy-4-benzenesulfonyl-oxy)benzylidenamino-4,5-dihydro-1H-1,2,4-triazol-5-one (2a)
Yield 91%, m.p. 206°C. IR: 1761, 1692 (C=O), 1620, 1578 (C=N), 1379 and 1170 (SO_2), 753 and 689 (monosubstituted benzenoid ring) cm^{-1}. ^{1}H NMR (DMSO-d_6): δ 1.10 (t, 3H, OCH_2CH_3, *J*=6.80 Hz), 2.34 (s, 3H, CH_3), 2.49 (s, 3H, $COCH_3$, *J*=6.80 Hz), 3.84 (q, 2H, OCH_2CH_3, *J*=6.80 Hz), 7.32 (d, 1H, ArH, *J*=8.00 Hz), 7.49 (dd, 1H, ArH, *J*=8.40 Hz, 2.00Hz), 7.52 (m, 1H, ArH), 7.65-7.69 (m, 2H, ArH), 7.81-7.85 (m, 3H, ArH), 9.56 (s, 1H, N=CH). ^{13}C NMR (DMSO-d_6): δ 11.16 (CH_3), 14.03 ($OCH_2\underline{C}H_3$), 23.39 ($CO\underline{C}H_3$), 64.10 ($O\underline{C}H_2CH_3$), [113.00, 120.43, 124.36, 128.14 (2C), 129.50 (2C), 133.23, 134.88, 135.10, 139.85, 150.93] (arom-C), 146.67 (triazole C_3), 147.77 (triazole C_5), 154.47 (N=CH), 165.97 ($\underline{C}OCH_3$). MS: m/z 445 (M+1, 4), 444 (M^+, 3), 115 (100).

1-Acetyl-3-ethyl-4-(3-ethoxy-4-benzenesulfonyl-oxy)benzylidenamino-4,5-dihydro-1H-1,2,4-triazol-5-one (2b)
Yield 97%, m.p. 156°C. IR: 1763, 1690 (C=O), 1619, 1577 (C=N), 1367 and 1181 (SO_2), 751 and 691 (monosubstituted benzenoid ring) cm^{-1}. ^{1}H NMR (DMSO-d_6): δ 1.10 (t, 3H, OCH_2CH_3, *J*=6.80 Hz), 1.24 (t, 3H, CH_2CH_3, *J*=7.20 Hz), 2.50 (s, 3H, $COCH_3$), 2.75 (q, 2H, CH_2CH_3, *J*=7.20 Hz), 3.84 (q, 2H, OCH_2CH_3, *J*=7.20 Hz), 7.32 (d, 1H, ArH, *J*=8.40 Hz), 7.48-7.51 (m, 2H, ArH), 7.65-7.69 (m, 2H, ArH), 7.81-7.86 (m, 3H, ArH), 9.55 (s, 1H, N=CH). ^{13}C NMR (DMSO-d_6): δ 9.40 ($CH_2\underline{C}H_3$), 14.02 ($OCH_2\underline{C}H_3$), 18.52 ($\underline{C}H_2CH_3$), 23.41 ($CO\underline{C}H_3$), 64.09 ($O\underline{C}H_2CH_3$), [113.03, 120.32, 124.39, 128.13 (2C), 129.50 (2C), 133.25, 134.87, 135.12, 139.85, 150.93] (arom-C), 148.00 (triazole C_3), 150.16 (triazole C_5), 154.49 (N=CH), 165.97 ($\underline{C}OCH_3$). MS: m/z 459 (M+1, 30), 458 (M^+, 8), 115 (100).

1-Acetyl-3-benzyl-4-(3-ethoxy-4-benzenesulfonyl-oxy)benzylidenamino-4,5-dihydro-1H-1,2,4-triazol-5-one (2c)
Yield 90%, m.p. 135°C. IR: 1726, 1706 (C=O), 1606, 1577 (C=N), 1368 and 1196 (SO_2), 777 and 692 (monosubstituted benzenoid ring) cm^{-1}. ^{1}H NMR (DMSO-d_6): δ 1.12 (t, 3H, OCH_2CH_3, *J*=7.20 Hz), 2.49 (s, 3H, $COCH_3$), 3.79 (q, 2H, OCH_2CH_3, *J*=7.20 Hz), 4.14 (s, 2H, CH_2Ph), 7.25-7.43 (m, 8H, ArH), 7.65-7.69 (m, 2H, ArH), 7.81-7.85 (m, 3H, ArH), 9.52 (s, 1H, N=CH). ^{13}C NMR (DMSO-d_6): δ 14.01 ($OCH_2\underline{C}H_3$), 23.48 ($CO\underline{C}H_3$), 31.10 (CH_2Ph), 64.05 ($O\underline{C}H_2CH_3$), [112.12, 121.01, 124.34, 126.93, 128.13 (2C), 128.48 (2C), 128.84 (2C), 129.49 (2C), 133.21, 134.72, 134.87, 135.10, 139.85, 150.87] (arom-C), 147.93 (triazole C_3), 148.16 (triazole C_5), 153.77 (N=CH), 165.95 ($\underline{C}OCH_3$). MS: m/z 521 (M+1, 5), 115 (100).

1-Acetyl-3-p-methylbenzyl-4-(3-ethoxy-4-benzenesulfonyl-oxy)benzylidenamino-4,5-dihydro-1H-1,2,4-triazol-5-one (2d)

Yield 83%, m.p. 176°C. IR: 1754, 1722 (C=O), 1602, 1577 (C=N), 1369 and 1196 (SO_2), 781 (1,4-disubstituted benzenoid ring), 756 and 687 (monosubstituted benzenoid ring) cm^{-1}. ^1H NMR (DMSO-d_6): δ 1.12 (t, 3H, OCH_2CH_3, *J*=7.20 Hz), 2.25 (s, 3H, $PhCH_3$), 2.50 (s, 3H, $COCH_3$), 3.80 (q, 2H, OCH_2CH_3, *J*=6.80 Hz), 4.08 (s, 2H, CH_2Ph), 7.11 (d, 2H, ArH, *J*=7.60 Hz), 7.23 (d, 2H, ArH, *J*=8.00 Hz), 7.30 (d, 1H, ArH, *J*=8.40 Hz), 7.39-7.43 (m, 2H, ArH), 7.65-7.69 (m, 2H, ArH), 7.81-7.85 (m, 3H, ArH), 9.52 (s, 1H, N=CH). ^{13}C NMR (DMSO-d_6): δ 14.02 ($OCH_2\underline{C}H_3$), 20.58 ($PhCH_3$), 23.47 ($CO\underline{C}H_3$), 30.72 (CH_2Ph), 64.04 ($O\underline{C}H_2CH_3$), [112.11, 121.03, 124.34, 128.14 (2C), 128.51 (2C), 128.71 (2C), 129.49 (2C), 131.57, 133.22, 134.87, 135.12, 136.03, 139.85, 150.87] (arom-C), 147.92 (triazole C_3), 148.29 (triazole C_5), 153.75 (N=CH), 165.96 ($\underline{C}OCH_3$). MS: m/z 536 (M+2, 8), 535 (M+1, 14), 444 (M^+, 3), 115 (100).

1-Acetyl-3-p-chlorobenzyl-4-(3-ethoxy-4-benzenesulfonyl-oxy)benzylidenamino-4,5-dihydro-1H-1,2,4-triazol-5-one (2e)

Yield 85%, m.p. 145°C. IR: 1726 (C=O), 1600, 1576 (C=N), 1369 and 1181 (SO_2), 849 (1,4-disubstituted benzenoid ring), 761 and 692 (monosubstituted benzenoid ring) cm^{-1}. ^1H NMR (DMSO-d_6): δ 1.11 (t, 3H, OCH_2CH_3, *J*=6.80 Hz), 2.50 (s, 3H, $COCH_3$), 3.79 (q, 2H, OCH_2CH_3, *J*=6.80 Hz), 4.16 (s, 2H, CH_2Ph), 7.29 (d, 1H, ArH, *J*=8.40 Hz), 7.36-7.43 (m, 6H, ArH), 7.67 (t, 2H, ArH, *J*=8.00 Hz), 7.81-7.85 (m, 3H, ArH), 9.53 (s, 1H, N=CH). ^{13}C NMR (DMSO-d_6): δ 14.02 ($OCH_2\underline{C}H_3$), 23.46 ($CO\underline{C}H_3$), 30.43 (CH_2Ph), 64.05 ($O\underline{C}H_2CH_3$), [112.15, 121.01, 124.34, 128.14 (2C), 128.40 (2C), 129.49 (2C), 130.76 (2C), 131.63, 133.17, 133.75, 134.87, 135.09, 139.87, 150.88] (arom-C), 147.84 (triazole C_3), 147.92 (triazole C_5), 153.85 (N=CH), 165.93 ($\underline{C}OCH_3$). MS: m/z 557 (M+2, 4), 556 (M+1, 3), 555 (M^+, 2), 115 (100).

Antioxidant Activity

Chemicals

Butylated hydroxytoluene (BHT), ferrous chloride, DPPH., α-tocopherol, 3- butylated hydroxyanisole (BHA), (2-pyridyl)-5,6-bis(phenylsulfonic acid)-1,2,4-triazine (ferrozine) and trichloroacetic acid (TCA) were obtained from E. Merck or Sigma.

Reducing Power

The reducing power of the compounds **2a-e** was determined using the method of Oyaizu (1986). Different concentrations of the samples (50-250 μg/mL) in DMSO (1 mL) were mixed with phosphate buffer (2.5 mL, 0.2 M, pH = 6.6) and potassium ferricyanide (2.5 mL, 1%). The mixture was incubated at 50°C for 20 min. after which a portion (2.5 mL) of trichloroacetic acid (10%) was added to the mixture, which was then centrifuged for 10 min at 1000 x g. The upper layer of solution (2.5 mL) was mixed with distilled water (2.5 mL) and $FeCl_3$ (0.5 mL, 0.1%), and then the absorbance at 700 nm was measured in a spectrophometer. Higher absorbance of the reaction mixture indicated greater reducing power.

Free Radical Scavenging Activity

Free radical scavenging effect of the compounds **2a-e** was estimated by $DPPH^{\cdot}$, by the method of Blois (1958). Briefly, 0.1 mM solution of $DPPH^{\cdot}$ in ethanol was prepared, and this solution (1 mL) was added to sample solutions in DMSO (3 mL) at different concentrations (50-250 μg/mL). The mixture was shaken vigorously and allowed to stand at room temperature for 30 min. Then the absorbance was measured at 517 nm in a spectrophometer. Lower absorbance of the reaction mixture indicated higher free radical scavenging activity. The $DPPH^{\cdot}$ concentration (mM) in the reaction medium was calculated from the following calibration curve and determined by linear regression (R: 0.997):

$$\text{Absorbance} = 0.0003 \times DPPH^{\cdot} - 0.0174$$

The capability to scavenge the DPPH radical was calculated using the following equation:

$$\text{DPPH. scavenging effect (\%)} = (A_0 - A_1/A_0) \times 100$$

where A_0 is the absorbance of the control reaction and A_1 is the absorbance in the presence of the samples or standards.

Metal Chelating Activity

The chelating of ferrous ions by the compounds **2a-e** and references was measured according to the method of Dinis et al. (1994). Briefly, the synthesized compounds (30–60 μg/mL) were added to a 2 mM solution of $FeCl_2.4H_2O$ (0.05 mL). The reaction was initiated by the addition of 5 mM ferrozine (0.2 mL), and then the mixture was shaken vigorously and left standing at room temperature for 10 min. After the mixture had reached equilibrium, the absorbance of the solution was measured at 562 nm in a spectrophotometer. All tests and analyses were run in triplicate and averaged. The percentage of inhibition of ferrozine–Fe^{2+} complex formation was given by the formula: % inhibition = $(A_0 - A_1 / A_0) \times 100$, where A_0 is the absorbance of the control, and A_1 is the absorbance in the presence of the samples or standards. The control did not contain compound or standard.

Results and Findings

In the current paper, five new 1-acetyl-3-alkyl(aryl)-4-(3-ethoxy-4-benzenesulfonyloxy)benzylidenamino-4,5-dihydro-1*H*-1,2,4-triazol-5-ones (**2a-e**) were characterized with IR, ^{1}H NMR, ^{13}C NMR and MS spectral data.

Antioxidant activity

The antioxidant capacities of five newly synthesized compounds **2a-e** were determined. Different processes have been used to identify antioxidant capacities. The processes used in the paper are clarified below:

Reducing Power

The reducing power of the compounds **2** was determined. The reducing capacity of a compound may serve as a significant indicator of its potential antioxidant activity. The presence of reductants such as antioxidants substances in the antioxidant samples causes the reduction of the Fe^{3+} / ferricyanide complex to the ferrous form. Therefore, the Fe^{2+} can be monitored by measuring the formation of Perl's Prussian blue at 700 nm (Chung, Chang, Chao, Lin, & Chou, 2002). The antioxidant activity of putative antioxidant has been attributed to various mechanisms such as prevention chain initiation, binding of transition metal ion catalyst, decomposition of peroxides, prevention of continued hydrogen abstraction, reductive capacity and radical scavenging (Yildirim, Mavi, & Kara, 2001). In the paper, all of the concentrations of the compounds showed lower absorbance than reference antioxidants. Hereby, any reductive activities were not observed.

DPPH Radical Scavenging Activity

Free radical scavenging effect of the compounds **2** was estimated by DPPH radical model. The effect of antioxidants on DPPH radical scavenging was thought to be due to their hydrogen donating ability (Baumann, Wurn, & Bruchlausen, 1979). DPPH is a stable free radical and accepts an electron or hydrogen radical to become a stable diamagnetic molecule (Soares, Dinis, Cunha, & Almeida, 1997). The reduction capability of DPPH radicals was determined by decrease in its absorbance at 517 nm induced by antioxidants. In the study, antiradical capacities of the compounds **2a-e** and reference antioxidants for instance α-tocopherol, BHA and BHT were detected by using $DPPH^{\cdot}$ method. All of the compounds tested with this method did not show any ability like a radical scavenger.

Iron Binding Capacity

The chelating of ferrous ions by the compounds **2** and references was measured. Ferrozine can quantitatively form complexes with Fe^{2+}. In the presence of chelating agents, the complex formation is disrupted with the result that the red colour of the complex is decreased. Measurement of colour reduction therefore allows estimation of the chelating activity of the coexisting chelator (Yamaguchi, Ariga, Yoshimura, & Nakazawa, 2000). The transition metals ions play an important role as catalysts of oxidative process, leading to formation of hydroxyl radicals and hydroperoxide decomposition reaction via Fenton chemistry (Halliwell, 1996). The production of these radicals may lead to lipid peroxidation, protein modification and DNA damage. Chelating agents are effective as secondary antioxidants because they potentially inhibit the metal-dependent processes thereby stabilizing the oxidized form of the metal ion (Finefrock, Bush, & Doraiswamy, 2003). Iron binding activities of

the compounds **2**, α-tocopherol and EDTA are shown in Figure **1**. In the current paper, high iron binding capacity of synthesized compounds would be beneficial in retarding metal-chelating oxidation. The data acquired from Figure **1** disclose that the metal chelating effects of the compounds **2** were not concentration-dependent. The metal chelating effect of the compounds and references decreased in order of EDTA > 2e > 2b > 2a > 2d > 2c > α-tocopherol, which were 85.7, 65.2, 61.2, 56.3, 52.7, 47.8, 37.9 (%), at the lowest concentration, respectively.

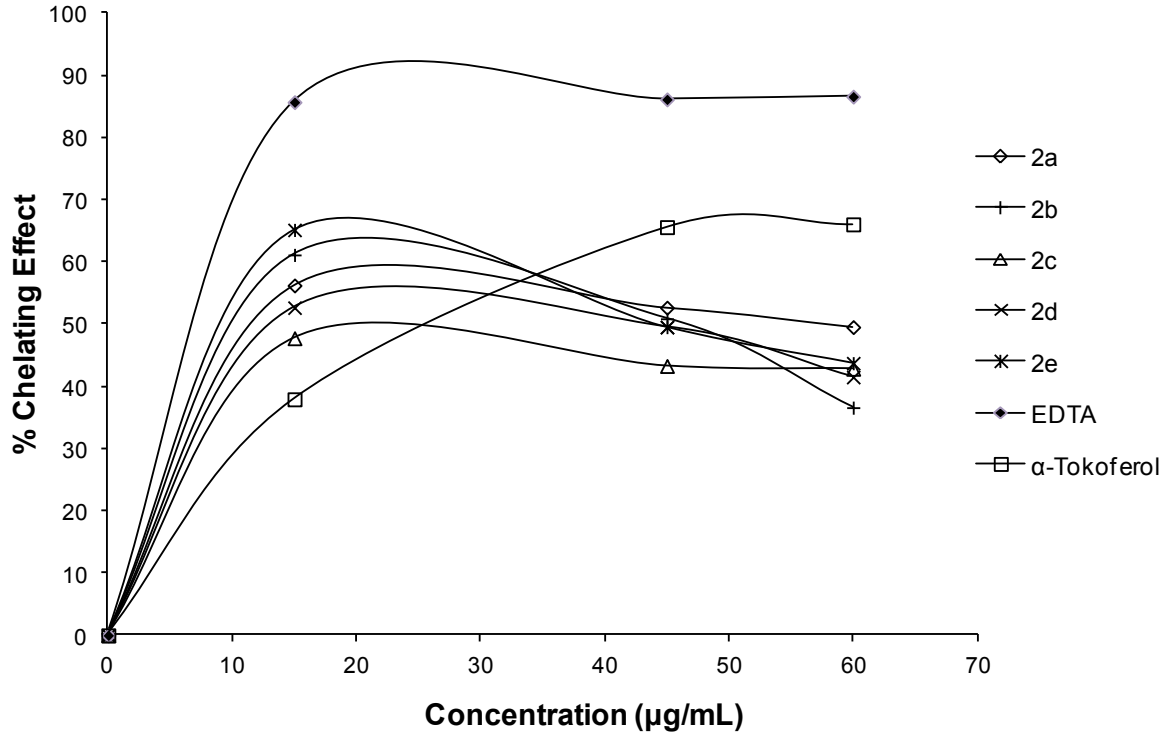


Figure 1. Metal chelating effect of different amount of the compounds 2, BHT, BHA and α-tocopherol on ferrous Ions

Conclusion

New 4,5-dihydro-1*H*-1,2,4-triazol-5-one derivatives were obtained and evaluated for their in-vitro antioxidant capacity. All of the compounds showed good metal chelating activities at the lowest concentration.

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AUTOMATICALLY ASSIGNMENT OF BUSINESS PROCESSES MANAGEMENT IN CRITICAL FINANCIAL SYSTEMS

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Abstract: In critical financial systems, business process management (BPM) is very important. BPM tools that are purchased or developed are used for this. These tools, which solve many problems between users and customers, generally have the same characteristics. In this study, an automatic assignment model was developed in order to increase the efficiency, accelerate the processes and move the customer satisfaction to the upper levels. In order to increase the accuracy of the analysis results, the one-year manual transaction data before integration was compared with the one-year automatic transaction data after the model integration. The error rate and the execution time of the system are analyzed in order to see the effects of the developed model. This model is based on both parameters of customer and process. For determining and scoring the significance of these two parameters, the AHP technique and the RFM analysis are used. With the help of this analysis, the transactions performed by the customers are evaluated in terms of the up-to-date, frequency and amount and the score is calculated. These two methods determine and prioritize the most important processes and customers. This model, where exemptions are managed and detailed reports can be obtained, provides great benefits in terms of customer satisfaction, number of staff employed, process performance and provides great competence for BPM tools.

Keywords: AHP technique, automatic assignment, BPM, business process management, RFM analysis

Introduction

Business process management is a very important place in customer-focused banks. The main goal is to ensure that processes are completed quickly and customer satisfaction is kept at a high level. To this end, the banks prefer or develop their own business process management tool.

The main purpose of this work is to develop an automatic assignment model. It has been seen that process management is performed manually in business process management tools. However, the advantages of automating this process are too great to ignore. On one of the vehicles examined, the system was automated. The developed system and its derivation are explained in this study. In this developed model, the customer has worked on a special grouping and scoring mechanism, a prioritization structure between users and processes, different types of automatic assign according to working style. A sample process is shown in figure 1.

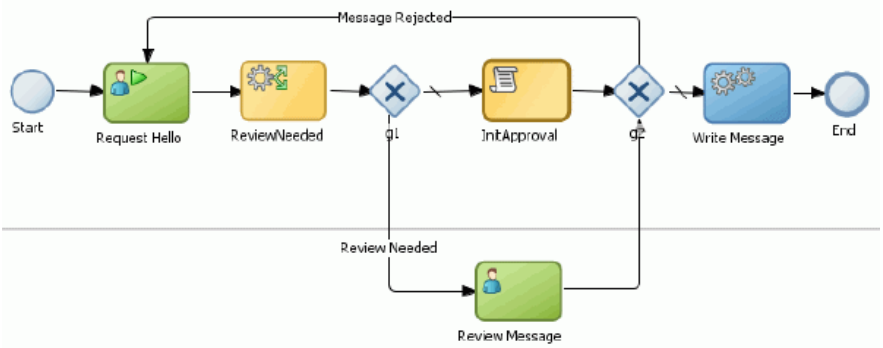


Figure 1. Sample process

Methods

In business process management, it is the most common method of having jobs to be assigned by manual management. In many applications, after a process is completed, the structures that automatically bring the next process to hand are created. Manual assignment of jobs is usually done through a manager. It is expected that the

managers who will do this work will have the competencies such as the definition of work, the definition and follow-up of personnel. Of course, in the absence of backups of these managers, a number of tasks are involved, and inconsistencies in job assignments are only one of the biggest problems of the manual system.

It may not always be possible to expect all managers to have these competencies. Whenever you want to add a new feature to the system, hanging on to the capabilities of the administrators, telling the developed features to them and expecting them to perform this task smoothly is often negatively and difficult to establish an enhanceable system.

The automatic assignment of the process takes place at this point and many probing solutions are emerging. Target groups will be set up for the processes by establishing certain teams and considering the situation of users. For processes, scores will be calculated by AHP technique and RFM analysis and a certain order of importance will be determined. Different forms of assignment will be used to ensure a fair share of work for employees.

Scoring with RFM Analysis

RFM analysis is one of the most well-known and applied segmentation methods in marketing, especially in direct marketing. In the Customer Punishment Pool analysis, "Customer Punishment Pool Score" was obtained by using RFM Analysis technique. Recency states how many days ago the customer's project fell into the punishment pool. Frequency refers to how many projects of the customer fall into the punishment pool. Monetary corresponds to the proportion of the customer's expected profits from the projects in the punishment pool and the amount of profits from the customer's projects to the total corporation.There are times when the projects arrive at the punishment pool, how many projects the customer has in the punishment pool, and the upper and lower values of the snow rate inputs. The determined upper and lower values will be calculated from the yearly maintenance.

Binned field: Recency

Bins will be created using the values shown in the table

Bin	Lower	Upper
1	> 225	<= 427
2	> 152	<= 225
3	> 77	<= 152
4	> 29	<= 77
5	>= 0	<= 29

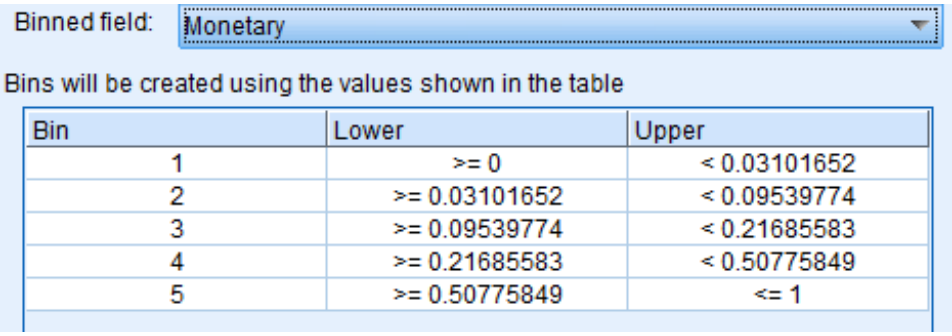
Figure 2. Recency

Binned field: Frequency

Bins will be created using the values shown in the table

Bin	Lower	Upper
1	>= 1	< 2
2	>= 2	< 3
3	>= 3	< 4
4	>= 4	< 5
5	>= 5	<= 14

Figure 3. Frequency



Bin	Lower	Upper
1	>= 0	< 0.03101652
2	>= 0.03101652	< 0.09539774
3	>= 0.09539774	< 0.21685583
4	>= 0.21685583	< 0.50775849
5	>= 0.50775849	<= 1

Figure 4. Monetary

In RFM analysis, there is a weight over total of each layer. Weights for each item are determined as shown in figure 5, based on the process information. According to this, it is decided that the weight of the monetary floor is 60%, the weight of the frequency floor is 25% and the weight of the recency floor is 15%.

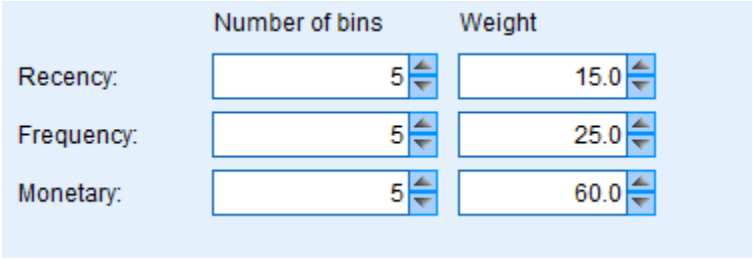


Figure 5. RFM breakdown numbers and weights

The resulting RFM Score was excluded from the 600 for the worst-rated customers to get a lower score.

$$RFMScore\ (Adjusted) = 600 - RFM\ Score$$

The customers in the resulting punishment pool of RFM analysis are divided into 3 classes. There are also customers who have not been involved in any project at the punishment pool, and this type of customer has been accepted as 'A' segment.

Table 1. Punishment Pool Breaks

Class	**RFM Score**
A	Dont Fall Into the Punishment Pool
B	385 ≤ RFMScore(Adjusted) ≤ 500
C	285 ≤ RFMScore(Adjusted) < 385
D	100 ≤ RFMScore(Adjusted) < 285

Scoring with AHP Technique

Score variables and weights of the projects were analyzed and conclusions were determined. The AHP technique has been used to determine the hierarchy of the determined variables. Analytic Hierarchy Process (AHP) is a quantitative method for ordering and selecting decision alternatives according to multiple criteria. The "Standard Preference Table" was used by experts to establish a reasonable basis for comparing the two variables.

Table 2. Standard Preference Table

AHP Scale of Importance for comparison pair	Numeric Rating	Reciprocal (decimal)
Extreme Importance	9	1/9 (0.111)
Very strong to extremely	8	1/8 (0.125)
Very strong Importance	7	1/7 (0.143)
Strongly to to very strong	6	1/6(0.167)
Strong Importance	5	1/5(0.200)
Moderately to Strong	4	1/4(0.250)
Moderate Importance	3	1/3(0.333)
Equally to Moderately	2	1/2(0.500)
Equal Importance	1	1 (1.000)

Criteria are divided into two main parts as customer and process criteria. The weight of these two main parts was determined by the participation of the relevant group managers, managers and directors. Accordingly, it has been decided that the weight of the customer main criteria will be 60% and the weight of the process main criteria will be 40%.

Table 3. Comparison of Customer and Process Criteria

	Customer	Process
Customer	1	1.5
Process	0.667	1
COL.TOTAL	1.667	2.5

CTQ'S	Normalized Score Customer	Normalized Score Process	Cumulative Normalized Score or Row Sum	Normalized Percentage or Percent Ratio Scale Priority
Customer	0.6	0.6	1.2	60%
Process	0.4	0.4	0.8	40%
COL.TOTAL	1	1	2	100%

All these criteria and values were scored. Based on the results of the AHP technique, a scoring chart was created.

Table 4. Scoring chart

VARIABLES	SCORE
PROCESS	
ProjectSuffixFlag	
WithSuffix	28
Without Suffix	3
CampaignFlag	
WithCampaign	12
WithoutCampaign	3
CUSTOMER	
ProjectVolume	
5	15
4	7
3	4
2	2
1	1
PunishmentScore	
A	15
B	6
C	3
D	1
Customer Efficiency	
5	15
4	7
3	4
2	2
1	1
CustomerSegment	
5	15
4	8
3	5
2	3
1	2
0	1

Results and Findings

With the automatic assignment model, the operations performed manually are performed automatically. The usefulness of this model is analyzed by comparing the manual management with the automatic assignment model. Some parameters are needed for this. The count of the processes performed, the duration of processes and the count of the processes performed incorrectly are at the top of the parameters required for comparison. Therefore, according to these parameters evaluations will be done. For data analysis, the data of manual processes performed during 2015 and the data of automatic processes performed during 2016 were used.

Comparison of Process Number

Process numbers can vary greatly from process to process. However, the number of transactions in March 2015 and the number of transactions in March 2016 are similar. The graph of sample process is as shown in figure 6.

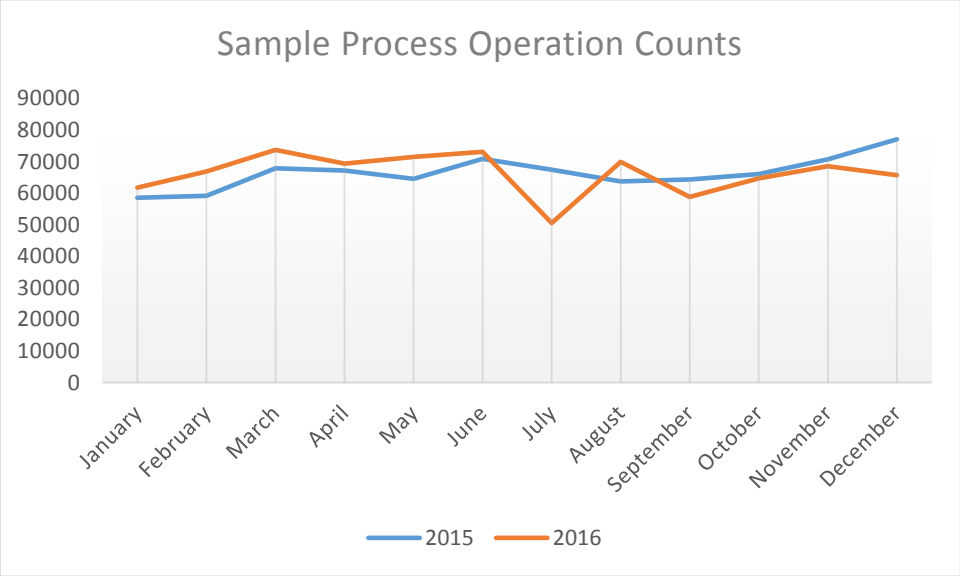


Figure 6. Sample process operation counts

Comparison of Process Time and Error Rate

The automatic assign model takes care of the business by constantly listening to the process pool and checking the status of the users. It is expected that the waiting time in the pool will decrease. In addition, in this model, assignments are performed by checking the competencies assigned to operations and the competencies of users. Therefore, the error rate is expected to decrease. Scatter Plots have been used for this comparison to be best understood. Figure 3 shows the ratio of the number of erroneous transactions to the total number of transactions in the x-axis. On the y-axis, the execution times of the operations are specified.

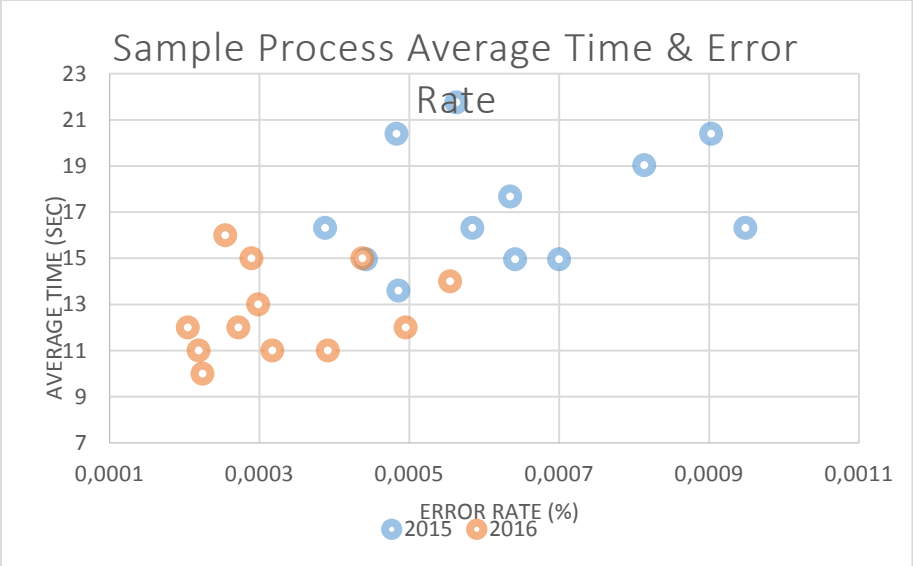


Figure 7. Sample process average time & error rate

Each point in the figure 7 represents a month of a year. It is facilitated to recognize the change between the years 2015-2016 on the same table. In the scatter plot used, the points approaching the center point are the months in which the processing time decreases and the error rate decreases. When the graph is analyzed in general, it can clearly be seen that the processes of 2015 (manual processes) are scattered and distant to the central point and the processes of 2016 (processes by using the automatic assignment model) are much closer to the central and central point.

Conclusion

The basic requirements for the development of automatic assignment have been taken into consideration. In this system, which is developed to carry customer satisfaction to the upper levels, to reduce manpower and to gain both financial gain and time, it has been benefited from AHP Technique and RFM Analysis to score customers. Following the scoring of the customers, an ordering was made among the processes based on the other parameters of the process. With the help of adjustments between a number of systematic constructs and users, the system has been transformed into a parametric structure.

Increased customer satisfaction with speed achieved through automatic assignment. Time has been gained by the removal of human power. With the wasted human power being assessed in different tasks as needed, there was no need for new personnel and the material gain was obtained. In addition to these, the model is generated automatically by the system and reports can be generated and analyzed instantly.

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DESIGN AND IMPLEMENTATION OF A CONTENT DELIVERY ARCHITECTURE FOR MUSEUMS

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Abstract: There is not enough interest to museums located in almost every region of Turkey. In order to increase the attraction of the museums, it is necessary to make activities to orient people and to make the museums more attractive place to visit. Unfortunately, these activities, which can be realized very easily with the help of technology, cannot be implemented to museums due to technological infrastructure inadequacy. In this paper, we aimed to develop a system that will interactively distribute and access media data about artifacts in museums. The system consists of a local server, tablets located next to the works, a mobile program installed on the visitor's mobile phones, and a cloud server to manage whole system. Mobile application on tablets will provide written and visual media support about museums and artifacts to visitors. The artifacts in the museum are kept both on the cloud and on the local server. The information about artifacts is kept both on the cloud and on the local server. However, considering the number of museums, it is not enough to manage the data traffic with only the cloud. With proxy servers to be used, we aimed to reduce network traffic and to move intensive data traffic to local networks in the museum. Proxy servers are used as buffer servers in many studies. Thanks to this feature, system performance and efficiency will be increased by caching.

Keywords: Museum, cloud, mobile application, web service

Introduction

The unique treasures and works of art inherited by several civilizations throughout history are carefully preserved in museums and exhibition areas in several parts of our country and introduced to visitors in an intact form.

Along with the development of technology, cloud and interactive design applications designed to manage and access information from a single point have been used in museums as well as several fields. Nowadays, many prestigious museums are aiming to increase the number of their visitors and their quality of visits by using these technologies.

Although the museums abroad have more tendencies to use technology; most of the current museums in Turkey do not use technology except for a few technology supported museums established recently. This study aims to develop a technological platform for all museums in Turkey to become more interactive and more attractive places. As a result of the literature review conducted, several studies that introduce the use of mobile and computer technologies in museums and exhibition areas are presented.

Ceipidor et al. (2013), aimed to design a multimedia mobile guide system for visitors of "Wolfsoniana Museum of Genoa" in their study. This system in which NFC and QR code technologies are used focused on offering a good user experience. This system was limited to functioning as an electronic guide.

Kovavisaruch et al. (2015), aimed to enable the museums to work in coordination with each other by the use of a comprehensive application to be developed. In the trial version of the application, information about "Science Museum, Information Technology Museum, and Chaosamphraya National Museum" is included. The disadvantages of the application were its inflexibility for changes and the need for memory use to a great extent.
Çayırezmez et al. (2013), developed a museum application by using RFID technology. The tracking and monitoring of works of art inventories were carried out by using RFID technologies. The wardrobe, shelves, boxes and drawers with smart technology related to RFID caused to additional expenses for the system to work.
Bruns and Bimber (2010), aimed to develop a mobile guide for museums by using relational multi-image classification. In this application, users catch frames using simple remote close camera movements via their mobile devices. Then, other images close to the caught frames were selected and classified. One of the limitations of the study was the lack of use of developed image classification.

Jing et al. (2011), developed a prototype of a mobile interactive museum guide consisting of an ultra-mobile computer equipped with a web camera. Users were generally satisfied during the trials, but the low speed of the system was mentioned as a feature of the system that needs to be developed.

Alletto et al. (2016), focused on a wearable device that combines image recognition and localization skills to provide the cultural content of the automatically monitored works of art for users.
Weiss et al. (2010) suggested an active service to users by using RFID and WLAN connections and perceiving profiles of visitors nearby in their studies. The major limitation of this study is that localization detection cannot be done if the visitor doesn't read a RFID.

In this article, a system that aims to increase the number of visitors to museums and the quality of visits by making the museums a more interactive place and enables to access and manage information from a single point is introduced. Thanks to the system that has cloud based server/client, information about each work of art in a museum is registered to a local server of that museum and synchronized with a cloud based system outside of the museum. The information about the works of art in the cloud is transferred to mobile devices of users by using web service technologies. Moreover, the same information is offered to users in an interactive and multi-language form via the tablets with the works of art. This system developed for museums offers the chance to manage several museums dynamically rather one museum thanks to its cloud support. Moreover, content synchronization is also possible between the local servers in the museums and the cloud. With this implemented system aiming to provide quick and accurate information to visitors of museums, it is provided to utilize our museums effectively.

System Architecture

Along with the technological developments, mobile applications that help us access information easily and cloud technologies aiming the management of information from a single point have been used actively in several fields. The system that offers the chance to control information about works of art from a single point and improve the quality of visits in museums and exhibition areas by using mobile and cloud technologies is implemented in three modules (Figure 1).

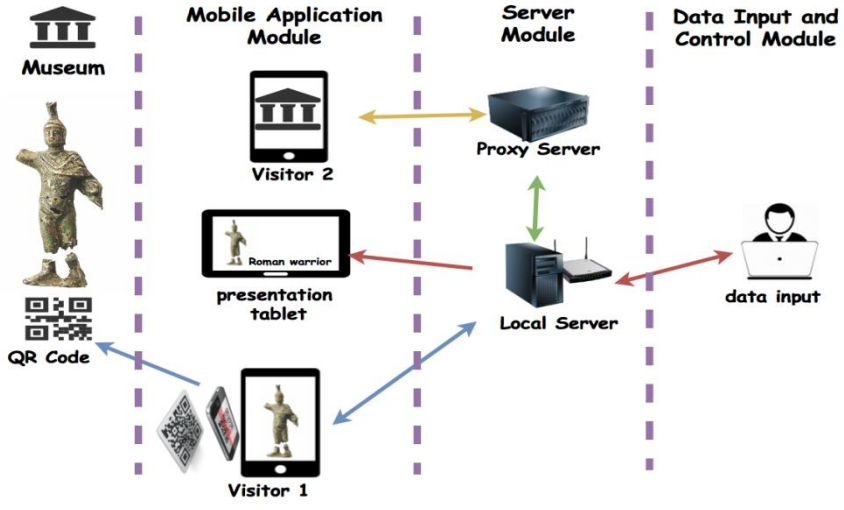

Figure 1. System architecture

Mobile Software Module

Mobile Software Module, consisting of mobile devices of visitors and mobile software running in the mobile devices with the works of art exhibited in the museums, gives interactive information about the works of art in the museum and enables the visitors to access information about museums and the works of art registered in the system. The up-to-date information about works of art was conveyed to visitors using mobile devices by the use of web service technologies (restful). The users can preferably view all museums, the museums they visited previously and the museum they are currently vising.

Data Input and Control Module

Thanks to the data input module consisting of software running on local and central servers, the museum personnel can access and control the information about works of art from a central location. In this module, after the user signs in the system, it is possible to load general information about museums and written and visual information about works of art and make data input to announce events.

Server Module

It consists of a Cloud Server that provides access to contents of museums from different locations and a Local Server that provides high bandwidth and continuous access to information about works of art in the museum. According to scenario of use in the museums, the server structure of the system is designed considering the following conditions:

- The system can be used both online and via the local network in the museum.
- Servers of different museums can be run from different locations.
- The system should have the network infrastructure that enables visitors to watch museum introduction videos.
- The introduction service provided to visitors should be uninterrupted. It should not be affected by problems such as internet connection cut off and low speed internet.
- Visitors should be able to access the whole system via the local network without using internet.

Application

The users can preferably view all museums, the museums they visited previously and the museum they are currently visiting. For this operation, the QR code of the works of art are read and transferred to the local server to search for information about them. The server evaluates the search and conveys detailed media information about the works of art to the users quickly and accurately. Furthermore, users can download the information obtained by server and these media to their mobile devices. Along with this, the history screen displaying information about previously visited museums and a museum screen enabling the users to obtain information about works of art before and after the visit are provided to the users. This information was supplied to visitors in an interactive and multi-language form via the tablets with the works of art.

The system is designed to work with the two server groups on the Internet (cloud) and in the museum (local). The mission of the cloud server group is to provide the online use of the system on the Internet and to broadcast contents of museums from different locations (or from different Internet Service Providers). The mission of local server group is to provide high bandwidth and continuous access to information about works of art in the museum. The structure of local servers in the museum and servers in the cloud are presented in Figure 2.
Three different server software ("DNS Server", "Web Service Server "and "Proxy Server") are used in the system in the museum. "Web Service Server" enables the visitors and tablets to access information about the museum (video, presentations, documents etc.) via HTTP web services. The "DNS Server" and "Proxy Server" are used to connect to other museums.

In order to share the content of the museum on the internet, at least one server that is independent from the local server is used. In this server, a literal copy of "Web Service Server" software and data are stored. The cloud system is formed by adding the internet servers of museums to the system as subdomains.

According to the scenario of use of the system, the up-to-date data is always stored in the local server. Therefore, synchronization is done as mirroring from the local server to the cloud server. Static files (videos, images of works of art etc.) and database are updated during the synchronization.

In order to enable the mobile programs to access the content independently from the platform, the software system is designed in a way that makes it possible to share the whole content provided to users on the HTTP web services. A subdomain name is given to each museum in order to enable the software to access the content in a standard way. The naming template used in the web services in the project is as the following:

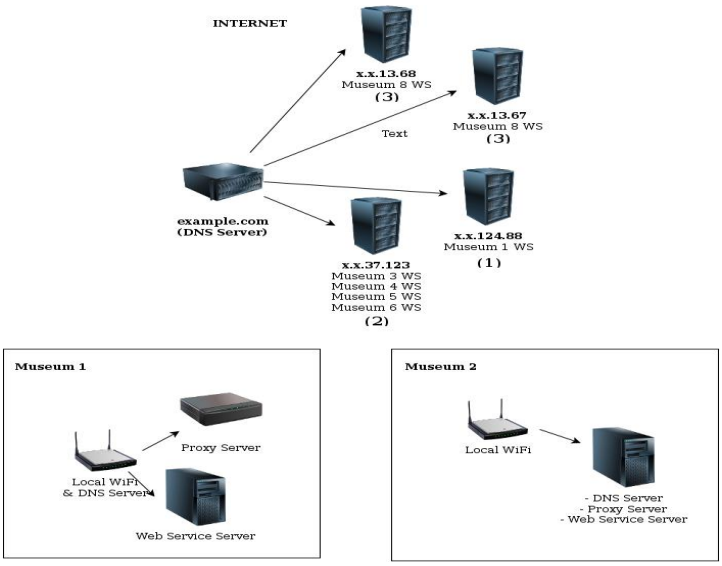

Figure 2. The structure of the local server and the cloud

The system has three states of use:
1. Online access
2. Connection to the local museum on the local network of museum
3. Connection to the other museums on the local network of museum

The web service runs on the same URL in three scenarios of use. The connection to domain name is directed to a close server via DNS settings in the location of the users. Connection scenarios and connection direction rules are presented in Figure 3.

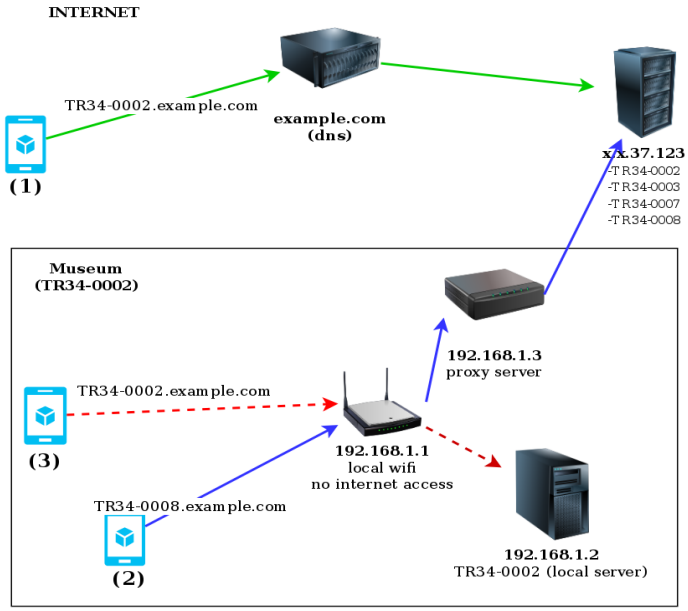

Figure 3. The connection scenarios and connection routing rules

1st State: This connection type is shown with the line number (1) in the Figure 4. In this scenario, the user accesses to the server of museum available on the internet via any internet connection. The DNS settings and direction infrastructure of the system work in way that makes it possible for the user to access to the content of all museums without requiring any settings.

2nd State: This type of connection is shown with the line number (2) in the Figure 4. This state takes place when the users connect to the local server in the museum with their own mobile devices. Users trying to access internet pages or web services of the museum via WIFI are directed to the local server in the museum without disconnecting from the internet.

The local server in the museum has the following advantages over the internet server:
• Visitors of the museum can access to detailed information, video and image contents of the works of art in the museum without using their mobile internet on their phones.
• Even if the online infrastructure of the system collapses because of a reason, the visitors inside the museum can still access to the contents without any problems.
• Users in crowded museums can access to media which needs high bandwidth easily without causing any online traffic.
• The museums that do not have internet service can utilize only the local version of the system.
3rd State: This state is shown with line number (3) in the Figure 4. This state takes place when the users connect to local server in the museum with their own mobile devices. Users trying to access internet pages or web services of the museum via WIFI, can access to other museums via the proxy server in the museum without disconnecting from internet.

The use of local proxy server provides the following advantages over the use of internet server:
• Visitors of the museum can access to the content of all museums in the system without using their mobile internet on their phones.
• Since the museums do not need to share internet service with the visitors, problems such as committing internet crimes over the shared WIFI will not be faced.
• Since cache system will be used on the proxy server, the media that visitors frequently access will be accessed by causing less internet traffic.

Conclusion

In this study, a smart system that provides information about the works of art in museums and exhibition areas is developed by using cloud architecture. By the use of cloud and local server architecture developed, the system can be used online and the contents of museums can be accessed quickly from different locations. By the use of local servers connected to the cloud server, a distributed architecture is obtained. With this architecture, users were provided with high bandwidth and infrastructure for continuous access to information. The data traffic that will emerge on the cloud server is balanced by the local server. Moreover, visitors can access to information about the works of art in an interactive and multi-language form via the tablets with the works of art. Thanks to the quick and accurate transfer of information about the works of art via the system developed, visitors can utilize from museums more efficiently.

Acknowledgments

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SYNTHESIS AND ANTIOXIDANT STUDIES OF SOME NEW [2-METHOXY-6-(3-ALKYL/ARYL-4,5-DIHYDRO-1*H*-1,2,4-TRIAZOL-5-ONE-4-YL)-AZOMETHINPHENYL] PHENYLACETATES

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Abstract: In this study, 3-alkyl(aryl)-4-amino-4,5-dihydro-1*H*-1,2,4-triazol-5-ones (2) reacted with 2-phenylacetoxy-3-methoxybenzaldehyde (3) to synthesize corresponding some new [2-methoxy-6-(3-alkyl/aryl-4,5-dihydro-1H-1,2,4-triazol-5-one-4-yl)-azomethinphenyl] phenylacetates (4). The newly synthesized compounds were characterized using by IR, ^{1}H-NMR, ^{13}C-NMR and UV spectral data. In addition, the synthesized compounds were analyzed for their in vitro potential antioxidant activities in three different methods.

Keywords: 4,5-Dihydro-1*H*-1,2,4-triazol-5-one, schiff base, antioxidant activity

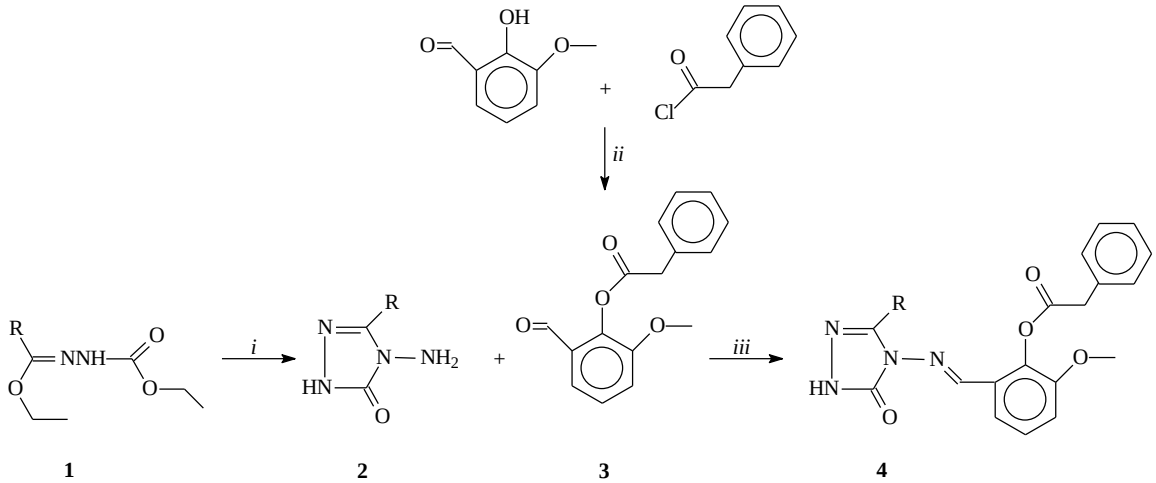
Introduction

In the last two decades there has been an explosive interest in the role of reactive oxygen species (ROS) and of reactive nitrogen species (RNS) in food, drugs, and even living system. Therefore, scientists in various disciplines have become more interested in naturally-occurring antioxidant and also related synthetic derivatives that could provide active components to prevent or reduce the impact of oxidative stress (Hussain et al., 2003).

Exogenous chemicals and endogenous metabolic processes in human body or in food system might produce highly reactive free radicals, especially oxygen derived radicals. At high concentrations, they can be important mediators of damage to cell structures, including lipids and membranes, proteins, and nucleic acids. Oxidative damages from ROS accumulate during the life cycle and radical-related damage to biomolecules has been proposed to play a key role in the development of age-dependent diseases and other conditions (McClements & Decker, 2000).

1,2,4-Triazole and 4,5-dihydro-1*H*-1,2,4-triazol-5-one derivatives have been found to have a broad spectrum of biological activities (Aktas-Yokus, Yuksek, Gursoy-Kol, & Alpay-Karaoglu, 2015; Bayrak, Demirbas, Karaoglu, & Demirbas, 2009; Chidananda et al., 2012; Gürsoy-Kol & Ayazoglu, 2014; Kahveci, Özil, Menteşe, Bekircan, & Buruk, 2008; Saadeh, Mosleh, Al-Bakri, & Mubarak, 2010; Yuksek et al., 1997). In addition, several articles about the synthesis of some N-arylidenamino-4,5-dihydro-1*H*-1,2,4-triazol-5-one derivatives have been published (Aktas-Yokus et al., 2015; Gürsoy-Kol & Ayazoglu, 2014; Yuksek et al., 1997).

In the present paper, the antioxidant activities of seven novel [2-methoxy-6-(3-alkyl/aryl-4,5-dihydro-1H-1,2,4-triazol-5-one-4-yl)-azomethinphenyl] phenylacetates (**4a-g**), which were synthesized by the reactions of 3-alkyl-4-amino-4,5-dihydro-1H-1,2,4-triazol-5-ones (**3a-g**) with 2-phenylacetoxy-3-methoxybenzaldehyde (**3**) were investigated. 2-Hydroxy-3-methoxy-benzaldehyde reacted with phenylacetyl chloride to afford 2-phenylacetoxy-3-methoxybenzaldehyde by using triethylamine (Scheme **1**).



1 **2** **3** **4**

i) $N_2H_4.H_2O$, reflux, 6 h; ii) Et_3N, AcOEt, 0-5°C; iii) AcOH, reflux, 1 h
a) R = CH_3, b) R = CH_2CH_3, c) R = $CH_2CH_2CH_3$, d) R = $CH_2C_6H_5$,
e) R = $CH_2C_6H_4CH_3$ (p-), f) R = $CH_2C_6H_4Cl$ (p-), g) R = C_6H_5
Scheme 1. Synthesis route compounds 2, 4

Methods

Chemical reagents and all solvents used in this study were purchased from Merck AG, Aldrich and Fluka. Melting points which were uncorrect were determined in open glass capillaries using an Electrothermal 9100 digital melting point apparatus. The IR spectra were obtained on a Perkin-Elmer Instruments Spectrum One FT-IR spectrometer. ^{1}H and ^{13}C NMR spectra were recorded in deuterated dimethyl sulfoxide with TMS as internal standard using a Bruker Ultrashield spectrometer at 200 MHz and 50 MHz, respectively. UV absorption spectra were measured in 10 mm quartz cells between 200 and 400 nm using a Schimadzu-1201 UV/VIS spectrometer. Extinction coefficients (ε) are expressed in $L \cdot mol^{-1} \cdot cm^{-1}$.

The starting compounds **2a-g** were prepared from the reactions of the corresponding ester ethoxycarbonylhydrazones (**1a-g**) with an aqueous solution of hydrazine hydrate as described in the literature (Ikizler & Un, 1979; Ikizler & Yüksek, 1993).

General Procedure for the Synthesis of [2-Methoxy-6-(3-alkyl/aryl-4,5-dihydro-1H-1,2,4-triazol-5-one-4-yl)-azomethinphenyl] phenylacetates (4a-g)
2-Hydroxy-3-methoxybenzaldehyde (0.01 mol) dissolved in ethyl acetate (30 mL) was treated with phenylacetyl chloride (0.01 mol), and to this solution was added triethylamine (0.01 mol) in 10 mL of ethyl acetate slowly with stirring at 0-5 ◦C. Stirring was continued for 2 h; then the mixture was refluxed for 4 h and filtered. The filtrate was evaporated in vacuo and the crude product was washed with water and recrystallized from ethanol to afford compound **3**. mp 97 °C; IR (υ, cm^{-1}): 2847 and 2773 (CHO), 1766, 1681 (C=O), 1252 (COO), 763 and 701 (monosubstituted benzenoid ring). ^{1}H NMR (DMSO-d_6): δ 3.82 (s, 3H, OCH_3), 4.10 (s, 2H, CH_2Ph), 7.43-7.50 (m, 8H, ArH), 10.09 (s, 1H, CHO). ^{13}C NMR (DMSO-d_6): δ 45.37 (CH_2), 58.96 (OCH_3), [119.8, 121.05, 127.15, 128.22 (2C), 128.40, 129.35, 129.85 (2C), 133.66, 140.68, 151.47] (arom-C), 149.50 (COO), 189.99 (CHO). The corresponding compound **2** (0.01 mol) was dissolved in acetic acid (15 mL) and treated with 2-phenylacetoxy-3-methoxybenzaldehyde (**3**) (0.01 mol). The mixture was refluxed for 2 h and then evaporated at 50-55 ℃ in vacuo. Several recrystallizations of the residue from AcOH-H_2O (1:3) gave pure compounds **4a-g** as colorless crystals.

[2-Methoxy-6-(3-methyl-4,5-dihydro-1H-1,2,4-triazol-5-one-4-yl)-azomethinphenyl] phenylacetate (4a)
Yield 90%, m.p. 194°C. IR: 3168 (NH), 1757, 1718 (C=O), 1597, 1573 (C=N), 1278 (COO), 784 and 708 (monosubstituted benzenoid ring) cm^{-1}. ^{1}H NMR (DMSO-d_6): δ 2.27 (s, 3H, CH_3), 3.78 (s, 3H, OCH_3), 4.04 (s, 2H, $COCH_2Ph$), 7.27-7.42 (m, 7H, ArH), 7.55 (d, 1H, ArH, *J*=7.83 Hz) 9.86 (s, 1H, N=CH), 11.88 (s, 1H, NH). ^{13}C NMR (DMSO-d_6): δ 11.52 (CH_3), 40.01 ($CO\underline{CH_2}Ph$), 56.58 (OCH_3), [115.77, 117.80, 127.52 (2C), 128.88 (3C), 130.03 (2C), 133.99, 139.76, 151.74] (arom-C), 144.70 (triazole C_3), 148.07 (N=CH), 151.80 (triazole C_5), 169.87 (COO). UV λ_{max} (ε): 296 (10950), 262 (9310), 224 (17670), 216 (18180) nm.

[2-Methoxy-6-(3-ethyl-4,5-dihydro-1H-1,2,4-triazol-5-one-4-yl)-azomethinphenyl] phenylacetate (4b)
Yield 89%, m.p. 189°C. IR: 3170 (NH), 1767, 1695 (C=O), 1593, 1573 (C=N), 1278 (COO), 786 and 702 (monosubstituted benzenoid ring) cm^{-1}. ^{1}H NMR (DMSO-d_6): δ 1.20 (t, 3H, CH_2CH_3, *J*=7.51 Hz), 2.67 (q, 2H,

CH_2CH_3, *J*=7.50 Hz), 3.79 (s, 3H, OCH_3), 4.04 (s, 2H, $COCH_2Ph$), 7.27-7.31 (m, 2H, ArH), 7.34-7.42 (m, 5H, ArH), 7.54 (d, 1H, ArH, *J*=7.88 Hz), 9.85 (s, 1H, N=CH), 11.92 (s, 1H, NH). ^{13}C NMR (DMSO-d_6): δ 10.49 ($CH_2\underline{CH_3}$), 18.95 ($\underline{CH_2}CH_3$), 40.03 ($CO\underline{CH_2}Ph$), 56.61 (OCH_3), [115.81, 117.71, 127.51 (2C), 127.57, 128.88 (2C), 130.02 (2C), 133.99, 139.78, 151.82] (arom-C), 148.46 (triazole C_3), 148.72 (N=CH), 151.87 (triazole C_5), 169.86 (COO). UV λ_{max} (ε): 296 (15500), 262 (13740), 228 (21750), 216 (20250) nm.

[2-Methoxy-6-(3-n-propyl-4,5-dihydro-1H-1,2,4-triazol-5-one-4-yl)-azomethinphenyl] phenylacetate (4c)
Yield 87%, m.p. 141°C. IR: 3180 (NH), 1771, 1694 (C=O), 1591, 1576 (C=N), 1279 (COO), 770 and 699 (monosubstituted benzenoid ring) cm^{-1}. ^{1}H NMR (DMSO-d_6): δ 0.95 (t, 3H, $CH_2CH_2\underline{CH_3}$, *J*=7.42 Hz), 1.68 (sext, 2H, $CH_2\underline{CH_2}CH_3$, *J*=7.40 Hz), 2.63 (t, 2H, $\underline{CH_2}CH_2CH_3$, *J*=7.47 Hz), 3.79 (s, 3H, OCH_3), 4.04 (s, 2H, $COCH_2Ph$), 7.27-7.44 (m, 7H, ArH), 7.53 (d, 1H, ArH, *J*=7.88 Hz), 9.85 (s, 1H, N=CH), 11.83 (s, 1H, NH). ^{13}C NMR (DMSO-d_6): δ 13.91 ($CH_2CH_2\underline{CH_3}$), 19.34 ($CH_2\underline{CH_2}CH_3$), 27.14 ($\underline{CH_2}CH_2CH_3$), 40.02 ($CO\underline{CH_2}Ph$), 56.57 (OCH_3), [115.76, 117.61, 127.50, 127.54, 128.87 (3C), 130.02 (2C), 133.99, 139.84, 151.84] (arom-C), 148.46 (triazole C_3), 148.72 (N=CH), 151.87 (triazole C_5), 169.86 (COO). UV λ_{max} (ε): 296 (19840), 260 (18750), 232 (23420), 214 (19650) nm.

[2-Methoxy-6-(3-benzyl-4,5-dihydro-1H-1,2,4-triazol-5-one-4-yl)-azomethinphenyl] phenylacetate (4d)
Yield 92%, m.p. 198°C. IR: 3176 (NH), 1770, 1695 (C=O), 1590, 1574 (C=N), 1282 (COO), 778 and 708 (monosubstituted benzenoid ring) cm^{-1}. ^{1}H NMR (DMSO-d_6): δ 3.78 (s, 3H, OCH_3), 4.02 (s, 2H, CH_2Ph), 4.05 (s, 2H, $COCH_2Ph$), 7.23-7.41 (m, 12H, ArH), 7.50 (d, 1H, ArH, *J*=7.81 Hz), 9.84 (s, 1H, N=CH), 12.06 (s, 1H, NH). ^{13}C NMR (DMSO-d_6): δ 31.50 (CH_2Ph), 40.03 ($CO\underline{CH_2}Ph$), 56.59 (OCH_3), [115.82, 117.50, 127.20, 127.47, 127.51, 127.55, 128.87 (2C), 128.92 (2C), 129.25 (2C), 130.02 (2C), 133.96, 136.17, 139.91, 151.75] (arom-C), 146.63 (triazole C_3), 148.44 (N=CH), 151.79 (triazole C_5), 169.86 (COO). UV λ_{max} (ε): 296 (23690), 262 (22120), 234 (24470), 216 (20530) nm.

[2-Methoxy-6-(3-p-methylbenzyl-4,5-dihydro-1H-1,2,4-triazol-5-one-4-yl)-azomethinphenyl] phenylacetate (4e)
Yield 98%, m.p. 204°C IR: 3174 (NH), 1770, 1696 (C=O), 1591, 1576 (C=N), 1282 (COO), 824 (1,4-disubstituted benzenoid ring), 770 and 698 (monosubstituted benzenoid ring) cm^{-1}. ^{1}H NMR (DMSO-d_6): δ 2.24 (s, 3H, $PhCH_3$), 3.78 (s, 3H, OCH_3), 3.99 (s, 2H, CH_2Ph), 4.02 (s, 2H, $COCH_2Ph$), 7.11 (d, 2H, ArH, *J*=7.88 Hz), 7.19 (d, 2H, ArH, *J*=7.95 Hz), 7.27-7.40 (m, 7H, ArH), 7.51 (d, 1H, ArH, *J*=7.81 Hz), 9.82 (s, 1H, N=CH), 12.04 (s, 1H, NH). ^{13}C NMR (DMSO-d_6): δ 21.06 ($PhCH_3$), 31.09 (CH_2Ph), 40.03 ($CO\underline{CH_2}Ph$), 56.60 (OCH_3), [115.83, 117.51, 127.46, 127.51, 127.57, 128.87 (2C), 129.10 (2C), 129.48 (2C), 130.02 (2C), 133.05, 133.95, 136.27, 139.88, 151.70] (arom-C), 146.77 (triazole C_3), 148.41 (N=CH), 151.79 (triazole C_5), 169.86 (COO). UV λ_{max} (ε): 296 (10630), 264 (9830), 224 (19480), 216 (19420) nm.

[2-Methoxy-6-(3-p-chlorobenzyl-4,5-dihydro-1H-1,2,4-triazol-5-one-4-yl)-azomethinphenyl] phenylacetate (4f)
Yield 76%, m.p. 194°C. IR: 3163 (NH), 1771, 1699 (C=O), 1592, 1576 (C=N), 1283 (COO), 821 (1,4-disubstituted benzenoid ring), 769 and 700 (monosubstituted benzenoid ring) cm^{-1}. ^{1}H NMR (DMSO-d_6): δ 3.78 (s, 3H, OCH_3), 4.03 (s, 2H, CH_2Ph), 4.05 (s, 2H, $COCH_2Ph$), 7.27-7.40 (m, 11H, ArH, *J*=7.88 Hz), 7.49 (d, 1H, ArH, *J*=7.00 Hz), 9.83 (s, 1H, N=CH), 12.10 (s, 1H, NH). ^{13}C NMR (DMSO-d_6): δ 30.81 (CH_2Ph), 40.03 ($CO\underline{CH_2}Ph$), 56.61 (OCH_3), [115.88, 117.52, 127.41, 127.51, 127.57, 128.87 (2C), 126.10 (2C), 129.48 (2C), 130.02 (2C), 133.05, 133.95, 135.12, 139.90, 151.70] (arom-C), 146.29 (triazole C_3), 148.55 (N=CH), 151.79 (triazole C_5), 169.85 (COO). UV λ_{max} (ε): 296 (982), 264 (8100), 224 (19420), 212 (19760) nm.

[2-Methoxy-6-(3-phenyl-4,5-dihydro-1H-1,2,4-triazol-5-one-4-yl)-azomethinphenyl] phenylacetate (4g)
Yield 93%, m.p. 198°C. IR: 3159 (NH), 1766, 1698 (C=O), 1607, 1575 (C=N), 1283 (COO), 760 and 685 (monosubstituted benzenoid ring) cm^{-1}. ^{1}H NMR (DMSO-d_6): δ 3.79 (s, 3H, OCH_3), 3.96 (s, 2H, $COCH_2Ph$), 7.28-7.40 (m, 7H, ArH), 7.47-7.54 (m, 4H, ArH), 7.89-7.92 (m, 2H, ArH), 9.81 (s, 1H, N=CH), 12.50 (s, 1H, NH). ^{13}C NMR (DMSO-d_6): δ 40.11 ($CO\underline{CH_2}Ph$), 56.09 (OCH_3), [115.49, 117.68, 126.54, 126.83, 127.01, 127.16, 128.01 (2C), 128.37 (2C), 128.50 (2C), 129.53 (2C), 130.12, 133.51, 139.34, 151.12] (arom-C), 144.53 (triazole C_3), 151.36 (N=CH), 151.40 (triazole C_5), 169.37 (COO).

Antioxidant Activity

Chemistry

Butylated hydroxytoluene (BHT) was purchased from E. Merck. Ferrous chloride, α-tocopherol, 1,1-diphenyl-2-picryl-hydrazyl ($DPPH^{\cdot}$), 3-(2-pyridyl)-5,6-bis(phenylsulfonic acid)-1,2,4-triazine (ferrozine), butylated

hydroxyanisole (BHA) and trichloracetic acid (TCA) were bought from Sigma (Sigma–Aldrich GmbH, Sternheim, Germany).

Reducing Power

The reducing power of the synthesized compounds was determined according to the method of Oyaizu (1986). Different concentrations of the samples (50-250 µg/mL) in DMSO (1 mL) were mixed with phosphate buffer (2.5 mL, 0.2 M, pH = 6.6) and potassium ferricyanide (2.5 mL, 1%). The mixture was incubated at 50°C for 20 min. after which a portion (2.5 mL) of trichloroacetic acid (10%) was added to the mixture, which was then centrifuged for 10 min at 1000 x g. The upper layer of solution (2.5 mL) was mixed with distilled water (2.5 mL) and $FeCl_3$ (0.5 mL, 0.1%), and then the absorbance at 700 nm was measured in a spectrophometer. Higher absorbance of the reaction mixture indicated greater reducing power.

Free Radical Scavenging Activity

Free radical scavenging activity of compounds was measured by DPPH·, using the method of Blois (1958). Briefly, 0.1 mM solution of DPPH· in ethanol was prepared, and this solution (1 mL) was added to sample solutions in DMSO (3 mL) at different concentrations (50-250 µg/mL). The mixture was shaken vigorously and allowed to stand at room temperature for 30 min. Then the absorbance was measured at 517 nm in a spectrophotometer. Lower absorbance of the reaction mixture indicated higher free radical scavenging activity. The DPPH· concentration (mM) in the reaction medium was calculated from the following calibration curve and determined by linear regression (R: 0.997):

$$\text{Absorbance} = 0.0003 \times \text{DPPH}^{\cdot} - 0.0174$$

The capability to scavenge the DPPH radical was calculated using the following equation:

$$\text{DPPH}^{\cdot}\ \text{scavenging effect (\%)} = (A_0 - A_1/A_0) \times 100$$

where A_0 is the absorbance of the control reaction and A_1 is the absorbance in the presence of the samples or standards.

Metal Chelating Activity

The chelation of ferrous ions by the synthesized compounds and standards were estimated by the method of Dinis et al. (1994). Shortly, the synthesized compounds (50–250 mg/mL) were added to a 2 mM solution of $FeCl_2$ (0.05 mL). The reaction was initiated by the addition of 5 mM ferrozine (0.2 mL), and then the mixture was shaken vigorously and left remaining at the room temperature for 10 min. After the mixture had reached equilibrium, the absorbance of the solution was measured at 562 nm in a spectrophotometer. All tests and analyses were carried out in triplicate and averaged. The percentage of inhibition of ferrozine–Fe^{+2} complex formation was given by the formula: Inhibition% = $(A_0 - A_1 / A_0) \times 100$, where A_0 is the absorbance of the control, and A_1 is the absorbance in the presence of the samples or standards. The control did not contain compound or standard.

Results and Findings

In this study, the structures of seven new [2-methoxy-6-(3-alkyl/aryl)-4,5-dihydro-1*H*-1,2,4-triazol-5-one-4-yl)-azomethinphenyl] phenylacetates **(4a-g)** were identified using by IR, ^{1}H-NMR, ^{13}C-NMR and UV spectral data.

Antioxidant Activity

The compounds **4a-g** were screened for their *in-vitro* antioxidant activities. Several methods are used to determine antioxidant activities. The methods used in this study are discussed below.

Reducing Power

The reducing power of the compounds **4** was determined. The reducing capacity of a compound may serve as a significant indicator of its potential antioxidant activity. The presence of reductants such as antioxidants substances in the antioxidant samples causes the reduction of the Fe^{3+} / ferricyanide complex to the ferrous form. Therefore, the Fe^{2+} can be monitored by measuring the formation of Perl's Prussian blue at 700 nm (Chung,

Chang, Chao, Lin, & Chou, 2002). The antioxidant activity of putative antioxidant has been attributed to various mechanisms such as prevention chain initiation, binding of transition metal ion catalyst, decomposition of peroxides, prevention of continued hydrogen abstraction, reductive capacity and radical scavenging (Yildirim, Mavi, & Kara, 2001).

In this study, all the amount of the compounds, except **4f**, did not show reductive activities. Compound **4f** showed higher activities than blank and its reductive ability was concentration-dependent as seen in Figure **1**. Reducing power of the compound and the standards were found as following order: BHA > BHT > α-tocopherol > **4f**.

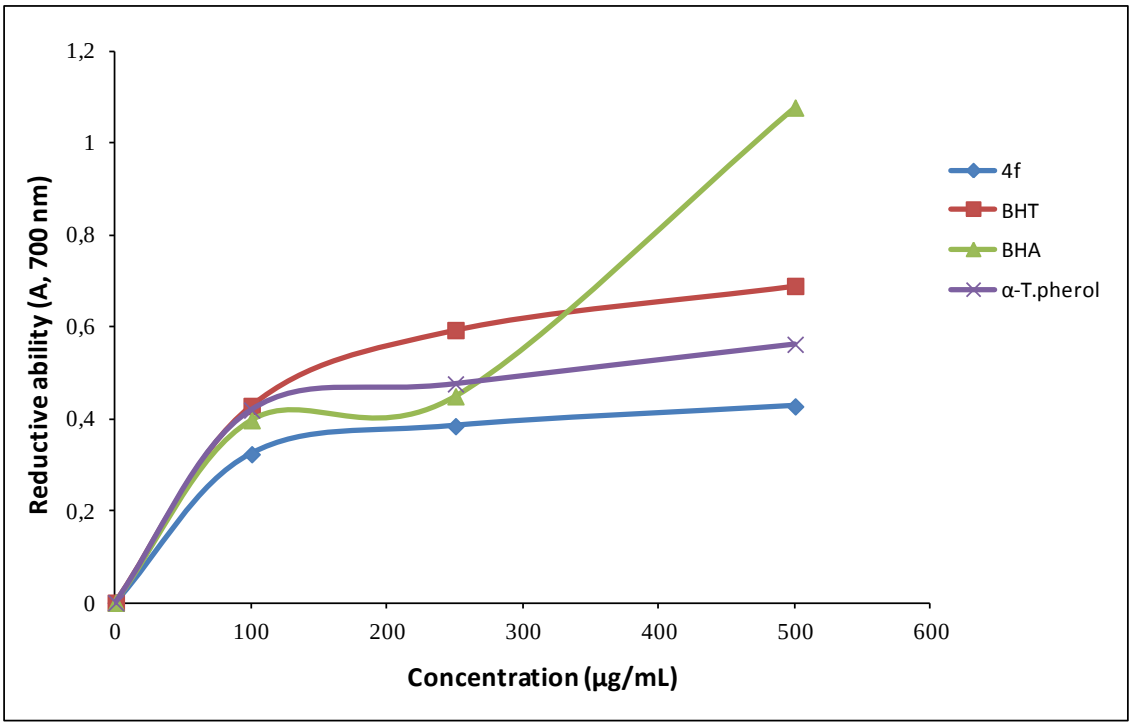


Figure 1. Total reductive potential of different concentrations of compound 4f, BHT, BHA and α-tocopherol

DPPH• Radical Scavenging Activity

Free radical scavenging effect of the compounds **4** was estimated by DPPH radical model. The effect of antioxidants on DPPH radical scavenging was thought to be due to their hydrogen donating ability (Baumann, Wurn, & Bruchlausen, 1979). DPPH is a stable free radical and accepts an electron or hydrogen radical to become a stable diamagnetic molecule (Soares, Dinis, Cunha, & Almeida, 1997). The reduction capability of DPPH radicals was determined by decrease in its absorbance at 517 nm induced by antioxidants. In the study, antiradical activities of compounds and standard antioxidants such as BHT, BHA and α-tocopherol were determined. The newly synthesized compounds showed no activity as a radical scavenger. This situation is also plotted in Figure **2** for only compound **4a**.

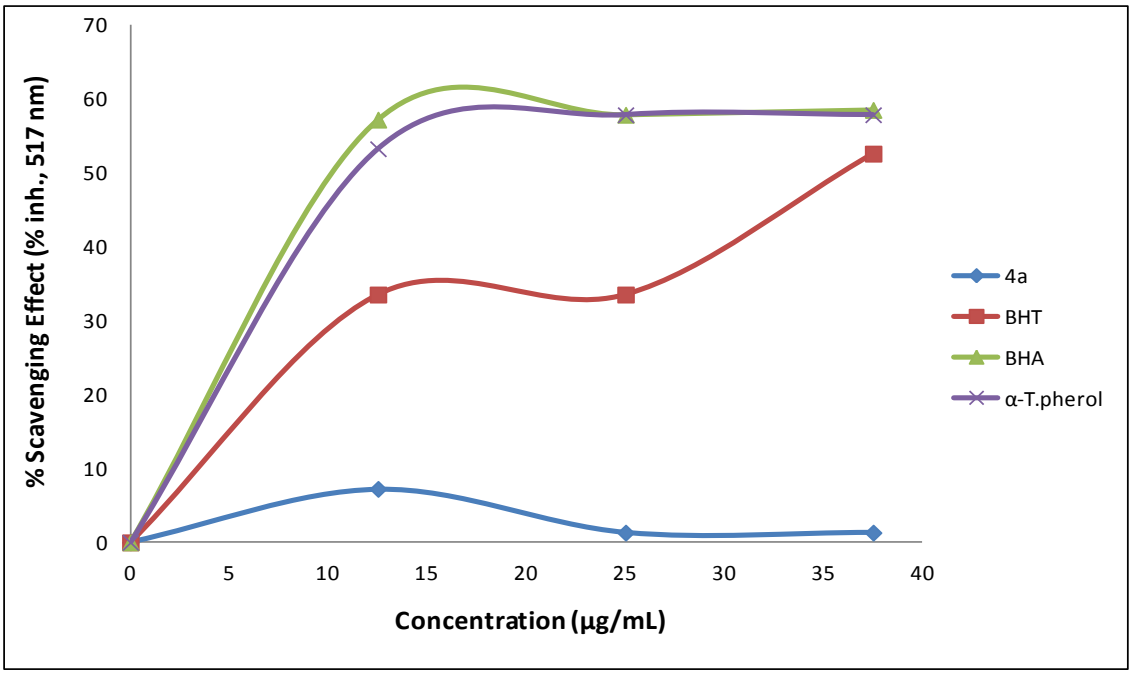


Figure 2. Scavenging effect of compound 4a, BHT, BHA and α-tocopherol at different concentrations

Iron Binding Capacity

The chelating of ferrous ions by the compounds **4** and references was measured. Ferrozine can quantitatively form complexes with Fe^{2+}. In the presence of chelating agents, the complex formation is disrupted with the result that the red colour of the complex is decreased. Measurement of colour reduction therefore allows estimation of the chelating activity of the coexisting chelator (Yamaguchi, Ariga, Yoshimura, & Nakazawa, 2000). The transition metals ions play an important role as catalysts of oxidative process, leading to formation of hydroxyl radicals and hydroperoxide decomposition reaction via Fenton chemistry (Halliwell, 1996). The production of these radicals may lead to lipid peroxidation, protein modification and DNA damage. Chelating agents are effective as secondary antioxidants because they potentially inhibit the metal-dependent processes thereby stabilizing the oxidized form of the metal ion (Finefrock, Bush, & Doraiswamy, 2003).

Ferrous ion chelating activities of the compounds, BHT, BHA and α-tocopherol are shown in Figure **3**. The data obtained from Figure **3** reveal that the compounds demonstrate a marked capacity for iron binding, suggesting that their action as peroxidation protectors may be related to their iron binding capacity. On the other hand, the metal chelating effects of the compound **4a** was concentration-dependent, the other compounds were not. The metal chelating effect of the compounds and references decreased in order of 4a > BHT > BHA > α-tocopherol, which were 80.7, 78.3, 72.6, 68.9 (%), at the highest concentration, respectively.

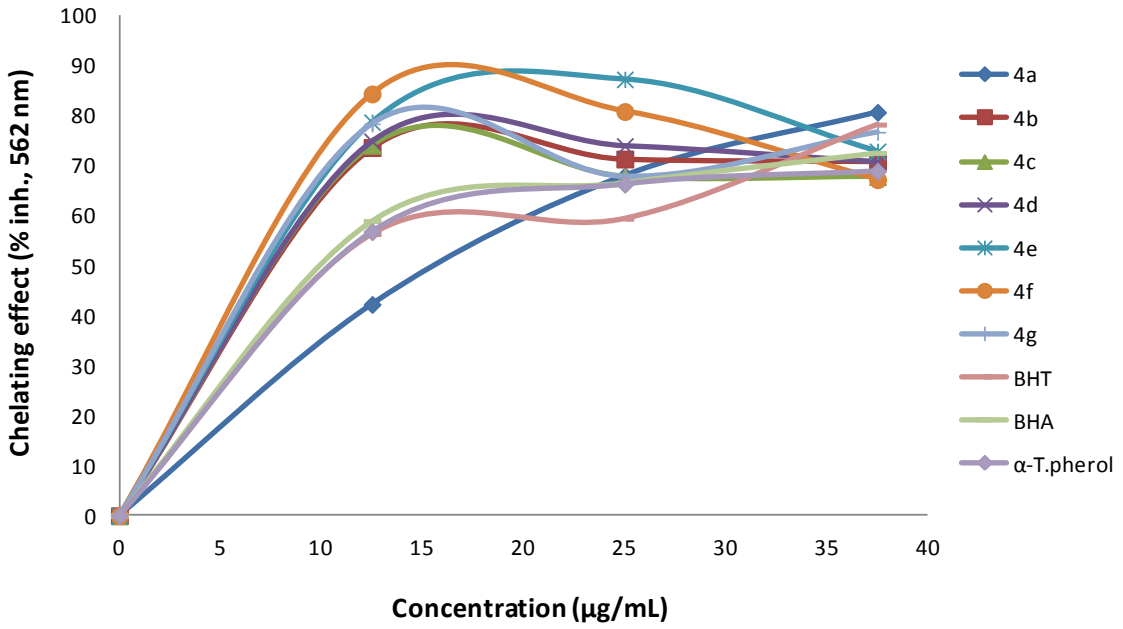


Figure 3. Metal chelating effect of different amount of the compounds 4a-g, BHT, BHA and α-tocopherol on ferrous ions

Conclusion

The synthesis and *in-vitro* antioxidant and antimicrobial evaluation of new 4,5-dihydro-1*H*-1,2,4-triazol-5-one derivatives are described. Compound **4a** demonstrates a marked capacity for iron binding activity. Design and synthesis of novel small molecules can play specifically a protective role in biological systems and in modern medicinal chemistry. These results may also provide some guidance for the development of novel triazole-based therapeutic target.

Acknowledgments

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GAUSSIAN CALCULATIONS OF 2-METHOXY-6-[(3-METHYL-4,5-DIHYDRO-1*H*-1,2,4-TRIAZOL-5-ON-4-YL)-AZOMETHIN]PHENYL FURAN-2-CARBOXYLATE

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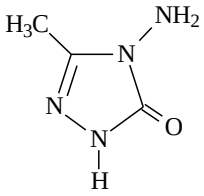
Abstract: In this study, 2-methoxy-6-[(3-methyl-4,5-dihydro-1*H*-1,2,4-triazol-5-on-4-yl)-azomethin]phenyl furan-2-carboxylate was optimized by using the B3LYP/6-311G(d,p) and HF/6-311G(d,p) basis sets. ^{1}H-NMR and ^{13}C-NMR isotropic shift values were calculated by the method of GIAO using the program package Gaussian G09W. Experimental and theoretical values were inserted into the graphic according to equitation of δ exp=a+b. δ calc. The standard error values were found via SigmaPlot program with regression coefficient of **a** and **b** constants. IR absorption frequencies of analyzed molecule were calculated by two methods. The veda4f program was used in defining IR data which were calculated theoretically. The experimental and the obtained theoretical values were compared and found by regression analysis that is accurate. Furthermore, geometric properties (bond angles and bond lengths), electronic properties (total energy, dipole moment), the highest occupied molecular orbital (HOMO) and the lowest unoccupied molecular orbital (LUMO), Mulliken atomic charges have been investigated by using Gaussian 09W program.

Keywords: 1,2,4-triazol-5-one, Gaussian 09W, 6-311G(d,p) basis set, GIAO, vibrational frequencies

Introduction

The optimized molecular structure, vibrational frequencies, UV–Vis spectroscopic parameters, atomic charges and frontier molecule orbitals (HOMO and LUMO) of the titled compound were calculated by using DFT/B3LYP and HF method with 6-311G(d,p) basis set. All quantum chemical calculations were carried out by using Gaussian 09W (Frisch et al., 2009; Wolinski, Hilton & Pulay, 1990) program package and the GaussView molecular visualization program (Frisch, Nielson & Holder, 2003). The molecular structure and vibrational calculations of the molecula were computed by using Becke-3-Lee Yang Parr (B3LYP) (Becke, 1993;Lee, Yang & Parr, 1988) density functional method with 6-311G(d,p) basis set in ground state. IR absorption frequencies of analyzed molecule were calculated by two methods. Then, they were compared with experimental data, which are shown to be accurate. Infrared spectrum was composed by using the data obtained from both methods. The assignments of fundamental vibrational modes of the title molecule were performed on the basis of total energy distribution (TED) analysis by using Veda 4f program (Jamroz, 2004). In this study, 2-methoxy-6-[(3-methyl-4,5-dihydro-1*H*-1,2,4-triazol-5-on-4-yl)-azomethin]phenyl furan-2-carboxylate **(3)** was synthesized from the reaction of 3-methyl-4-amino-4,5-dihydro-1*H*-1,2,4-triazol-5-one **(1)** with 2-methoxy-6-formylphenyl furan-2-carboxylate **(2)** (Alkan, Yüksek & Gürbüz, 2015).



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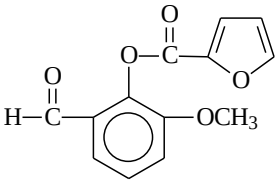

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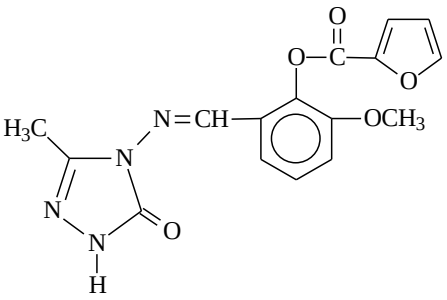


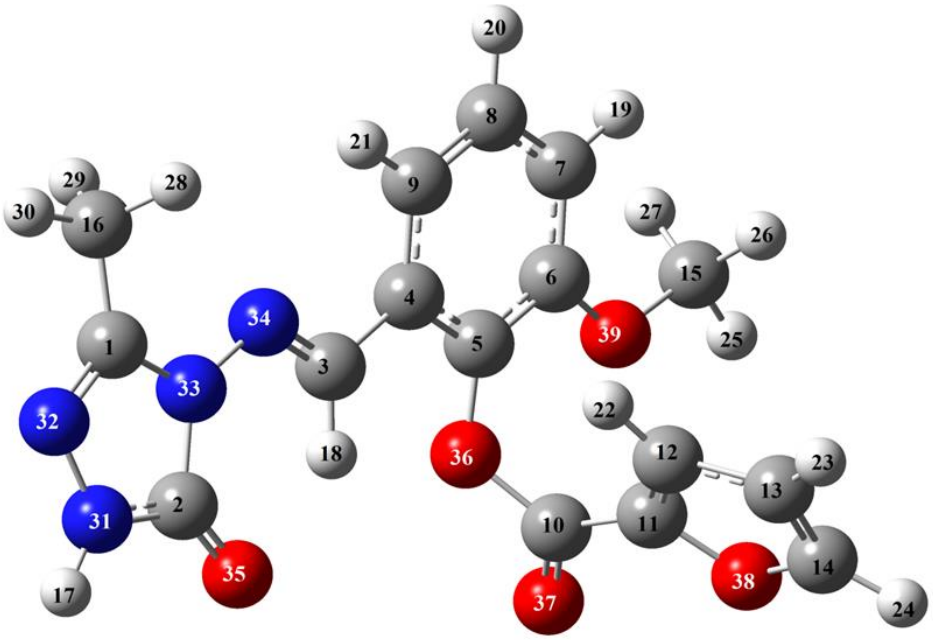
3

Methods

The molecular structure of the title compound in the ground state (in vacuo) is computed by performing both Hartree-Fock (HF) and the density functional theory (DFT) by a hydrid functional B3LYP functional (Becke's three parameter hybrid functional using the LYP correlation functional) methods (Becke, 1993; Lee, Yang & Parr, 1988) at 6-311G(d,p) level.

Results and Findings

3.1. Molecular Structure



The optimized molecular geometric parameter (bond lengths) of the molecule by using B3LYP/6–311G(d,p) and HF/6–311G(d,p) levels are listed in Table **1**.

Table 1.The calculated bond lengths of the molecule.

Bond lenghts		B3LYP	HF	Bond lenghts		B3LYP	HF
1	C(1)-N(32)	1.2956	1.2661	22	C(7)-H(19)	1.0816	1.0724
2	C(1)-N(33)	1.3891	1.3795	23	C(7)-C(8)	1.4000	1.3941
3	C(1)-C(16)	1.4851	1.4875	24	C(8)-H(20)	1.0837	1.0747
4	C(16)-H(28)	1.0893	1.0809	25	C(8)-C(9)	1.3811	1.3696
5	C(16)-H(29)	1.0927	1.0838	26	C(9)-H(21)	1.0816	1.0720
6	C(16)-H(30)	1.0925	1.0838	27	O(36)-C(10)	1.3923	1.3566
7	N(32)-N(31)	1.3805	1.3701	28	C(10)-O(37)	1.1936	1.1694
8	N(31)-H(17)	1.0058	0.9904	29	C(10)-C(11)	1.4687	1.4768

9	N(31)-C(2)	1.3690	1.3466	30	C(11)-C(12)	1.3697	1.3448
10	C(2)-O(35)	1.2145	1.1946	31	C(11)-O(38)	1.3676	1.3431
11	N(33)-C(2)	1.4218	1.3893	32	C(12)-H(22)	1.0767	1.0682
12	N(33)-N(34)	1.3684	1.3630	33	C(12)-C(13)	1.4241	1.4334
13	N(34)-C(3)	1.2861	1.2580	34	C(13)-H(23)	1.0780	1.0694
14	C(3)-H(18)	1.0842	1.0724	35	C(13)-C(14)	1.3626	1.3423
15	C(3)-C(4)	1.4666	1.4791	36	C(14)-H(24)	1.0772	1.0686
16	C(4)-C(5)	1.3995	1.3804	37	C(14)-O(38)	1.3500	1.3303
17	C(4)-C(9)	1.4078	1.3994	38	O(39)-C(15)	1.4223	1.4020
18	C(5)-O(36)	1.3792	1.3652	39	C(15)-H(25)	1.0880	1.0790
19	C(5)-C(6)	1.4101	1.4006	40	C(15)-H(26)	1.0952	1.0856
20	C(6)-O(39)	1.3575	1.3408	41	C(15)-H(27)	1.0950	1.0854
21	C(6)-C(7)	1.3911	1.3765				

Table 2.The calculated bond angles of the molecule

	Bond Angles (°)	**B3LYP**	**HF**		**Bond Angles (°)**	**B3LYP**	**HF**
1	C(1)-N(32)-N(31)	104.81	105.08	31	H(19)-C(7)-C(8)	119.79	119.61
2	C(1)-N(33)-N(34)	121.37	121.31	32	C(7)-C(8)-H(20)	119.16	119.16
3	C(1)-N(33)-C(2)	108.26	108.10	34	C(7)-C(8)-C(9)	120.77	120.72
4	C(1)-C(16)-H(28)	108.52	108.44	35	H(20)-C(8)-C(9)	120.07	120.12
5	C(1)-C(16)-H(29)	110.96	110.49	36	C(8)-C(9)-H(21)	121.23	121.01
6	C(1)-C(16)-H(30)	110.96	110.44	37	C(8)-C(9)-C(4)	120.35	120.09
7	N(32)-C(1)-N(33)	111.39	111.27	38	H(21)-C(9)-C(4)	118.42	118.89
8	N(32)-N(31)-(17)	120.45	120.97	39	C(9)-C(4)-C(5)	118.77	119.02
9	N(32)-C(1)-C(16)	125.10	125.40	40	C(5)-O(36)-C(10)	123.76	124.72
10	H(17)-N(31)-C(2)	125.12	125.29	41	O(36)-C(10)-O(37)	119.13	119.99
11	N(31)-C(2)-N(33)	101.11	101.80	42	O(36)-C(10)-C(11)	116.21	116.38
12	N(31)-C(2)-O(35)	130.20	129.73	43	O(37)-C(10)-C(11)	124.43	123.40
13	O(35)-C(2)-N(33)	128.69	128.47	44	C(10)-C(11)-C(12)	135.19	133.92
14	C(2)-N(33)-N(34)	130.34	130.37	45	C(10)-C(11)-O(38)	114.99	115.58
15	N(33)-C(1)-C(16)	123.52	123.33	46	C(11)-C(12)-C(13)	106.47	105.82
16	N(33)-N(34)-C(3)	119.01	119.49	47	C(11)-C(12)-H(22)	126.62	127.04
17	N(34)-C(3)-H(18)	122.57	122.81	48	H(22)-C(12)-C(13)	126.91	127.13
18	N(34)-C(3)-C(4)	119.21	119.23	49	C(12)-C(13)-C(14)	105.91	105.30
19	H(18)-C(3)-C(4)	118.22	117.95	50	C(12)-C(13)-H(23)	127.38	127.65
20	C(3)-C(4)-C(5)	119.06	119.23	51	H(23)-C(13)-C(14)	126.71	127.04
21	C(3)-C(4)-C(9)	122.17	121.75	52	C(13)-C(14)-O(38)	110.90	111.19
22	C(4)-C(5)-O(36)	118.82	118.74	53	C(13)-C(14)-H(24)	133.32	132.54
23	C(4)-C(5)-C(6)	120.88	121.00	54	H(24)-C(14)-O(38)	115.78	116.27
24	O(36)-C(5)-C(6)	120.03	120.06	55	C(14)-O(28)-C(11)	107.10	107.37
25	C(5)-C(6)-O(39)	115.25	115.16	56	C(6)-O(39)-C(15)	118.92	120.39
26	C(5)-C(6)-C(7)	119.27	119.20	57	O(39)-C(15)-H(25)	105.60	105.95
27	O(39)-C(6)-C(7)	125.49	125.64	58	O(39)-C(15)-H(26)	111.29	111.16
29	C(6)-C(7)-H(19)	120.27	120.44	59	O(39)-C(15)-H(27)	111.20	111.08
30	C(6)-C(7)-C(8)	119.94	119.95				

Vibrational Frequencies

The 2-methoxy-6-[(3-methyl-4,5-dihydro-1*H*-1,2,4-triazol-5-on-4-yl)-azomethin]phenyl furan-2-carboxylate molecule has 39 atoms and the number of the normal vibrations is 113. The observed and calculated vibrational frequencies, the calculated IR intensities and assignments of vibrational frequencies for title compound are summarized in Table **2**.

Table 2. The calculated frequencies values of the molecule.

	Vibration Types	**scaled DFT**	**scaled Hf**
1	τ NCNN, τ CCCC, τ NNCC	16	13
2	τ NCCC, τ NCNN, τ CNNC	29	23
3	τ NCCC, τ NCNN, τ CCCC	49	48
4	δ NNC, τ NCNN, τ CCCC,	58	60
5	δ NCC, δ CCC, δ NNC	66	67
6	τ CCCC, τ CNNC	74	72
7	δ CNN, δ NCN, τ CNNC	93	86
8	τ NCNN, τ CCCC, τ CNNC	102	98
9	τ HCCN, τ CNNC	148	155

10	τ NNCC, τ CCCC	152	163
11	τ CNNC, τ NNCC	160	171
12	δ CNN, δ NCN, δ CCC	182	177
13	τ NCCC, τ CCCC	197	183
14	δ CNN, δ NCN,	212	206
15	ν CC, δ CNN	215	216
16	τ CCCC, τ NNCC,	249	234
17	τ NNCC, τ CCCC	268	252
18	τ NCNN, τ NNCC, τ CCCC	276	265
19	τ HNNC, τ CNNC	286	282
20	τ NNCC, τ CCCC	297	291
21	ν CC, δ CNN, τ CNNC	324	296
22	δ CCC, δ CCN	336	297
23	δ CCC, τ OCCC	348	320
24	τ HOCC	353	339
25	δ CNN, δ OCN, δ OCC, δ NNC	376	382
26	τ CCCC, τ NNCC, τ OCCC	395	405
27	τ HCCC, τ CCCC	416	422
28	δ OCC, δ CCC, τ OCCC	434	430
29	δ OCN, δ OCC, δ CCC	436	439
30	τ HNNC, τ ONNC	444	440
31	ν NC, δ CNN, τ ONNC	469	471
32	δ CNN, τ ONNC	516	502
33	δ CCC, τ HCCC, τ CCCC	523	524
34	δ CCC, τ OCCC	523	537
35	τ HCCC, τ CCCC, τ OCCC	544	552
36	δ OCN, δ CNN, δ CCN	579	588
37	δ CNN, δ CCN	604	602
38	ν CC, δ NCN	611	611
39	ν CC, δ NCN, τ CNNC	625	623
40	δ CCC	635	637
41	δ NNC, τ HCCN	638	642
42	τ HNNC, τ NNCC, τ CNNC	642	659
43	τ HCCC, τ CCCC	686	697
44	τ HCCC, τ CCCC, τ OCCC	708	721
45	δ CCC, τ OCCC	712	736
46	τ ONNC	722	751
47	ν CC, ν NN, δ CCC	749	775
48	ν NN, δ CCC	766	789
49	ν NC, δ CNN	783	794
50	τ HCCC	792	814
51	τ OCCC, τ HCCC	803	821
52	ν CC, ν OC	808	826
53	τ HCCC, τ OCCC	818	848
54	ν CC, δ NCC, δ NNC	863	865
55	τ HCCC, τ CCCC	926	965
56	δ NNC, τ HCCN	934	977
57	τ HCCC, τ CCCC	942	988
58	δ HCH, δ NNC, τ HCCN	963	993
59	τ HCCN	989	997
60	δ CCC, δ HCC	993	1036
61	δ HCC, τ HCCN	1020	1042
62	δ HCH, τ HCCN	1035	1056
63	ν NC, ν NN, δ NNC	1037	1069
64	ν NN, δ HNN, τ HCCN	1069	1078
65	ν CC, δ HNN, τ HCCN	1076	1094
66	ν CC, δ HCC,	1091	1103
67	ν CC, δ HCC	1149	1119
68	δ HOC, δ HCC	1159	1156
69	ν NC, ν NN	1168	1190
70	ν CC	1211	1226
71	ν NN, δ NCN	1246	1230
72	ν OC, ν NN, δ NCN	1255	1233
73	ν CC, ν OC	1259	1268
74	ν CC, δ HCC, δ HOC	1292	1313

75	ν CC, δ HOC, δ HCC	1329	1325
76	ν NC, δ HCH, δ HCN	1339	1369
77	δ HNN, δ HCH	1351	1395
78	δ HCH, δ HCN	1378	1405
79	δ HCH, δ HCN	1391	1416
80	ν NC, δ HCH, δ HCN	1408	1427
81	ν CC, δ HCC	1423	1442
82	δ HCH, τ HCCN	1425	1442
83	δ HCH, τ HCCN	1444	1467
84	ν CC, δ HCC	1501	1525
85	ν CC	1571	1606
86	ν NC, ν CC, δ HCC	1591	1630
87	ν NC, ν CC	1601	1690
88	ν NC, ν CC	1617	1709
89	ν NC	1724	1702
90	ν OC, ν NC	1748	1771
91	ν CH	2950	2893
92	ν CH	2978	2916
93	ν CH	3002	2950
94	ν CH	3043	2981
95	ν CH	3051	3000
96	ν CH	3052	3014
97	ν CH	3064	3026
98	ν CH	3071	3035
99	ν CH	3098	3044
100	ν CH	3101	3050
101	ν NH	3767	3761
102	ν OH	3808	3800
ν, stretching; δ, bending; δs, scissoring; ρ, rocking; γ, out-of-plane bending; τ, torsion			

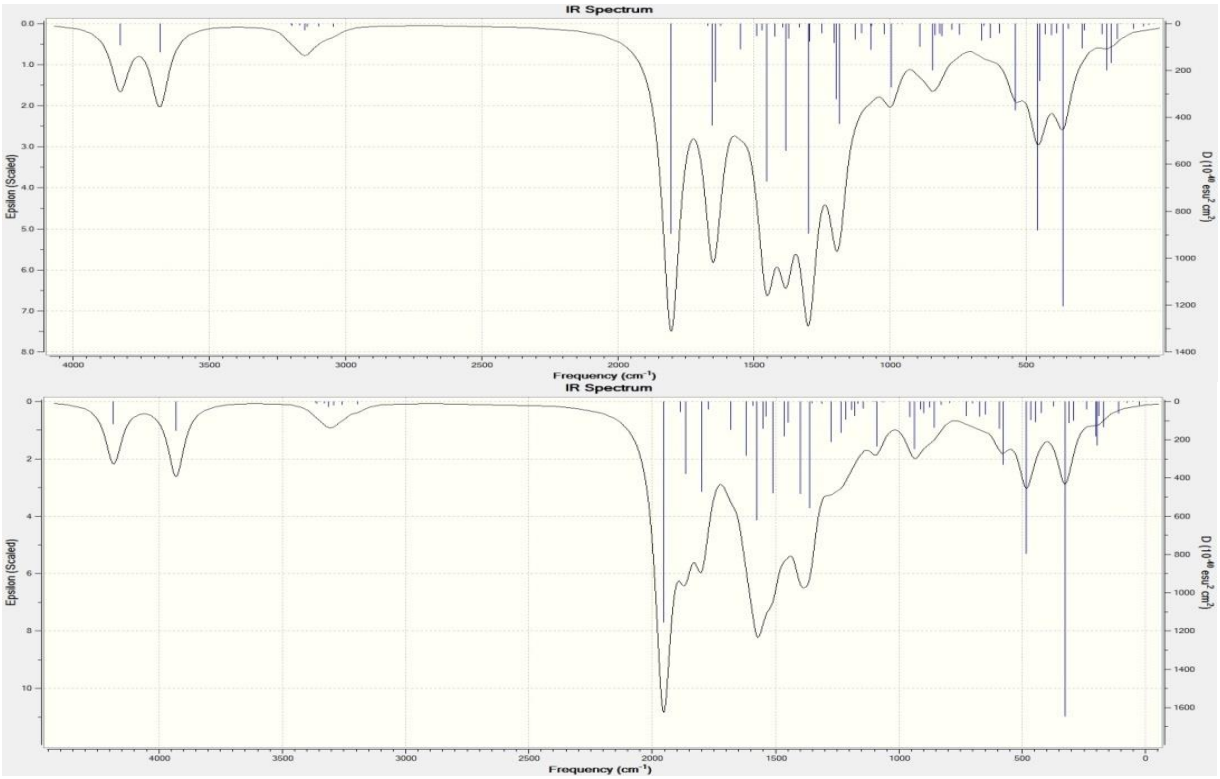


Figure 1. IR spectra simulated with DFT/B3LYP/6–311G(d,p) and HF/6–311G(d,p) levels of the molecule.

NMR Spectral Analysis

In nuclear magnetic resonance (NMR) spectroscopy, the isotropic chemical shift analysis allows us to identify relative ionic species and to calculate reliable magnetic properties which provide the accurate predictions of molecular geometries (Rani et al., 2010; Subramanian, Sundaraganesan, & Jayabharathi, 2010; Wade, 2006). In

this framework, the optimized molecular geometry of the molecule was obtained by using B3LYP and HF methods with 6–311G(d,p) basis level in DMSO solvent. By considering the optimized molecular geometry of the title compound the ^{1}H and ^{13}C NMR chemical shift values were calculated at the same level by using Gauge-Independent Atomic Orbital (GIAO) method. Theoretical and experimental (Alkan, Yüksek & Gürbüz, 2015) values were plotted according to δ exp=a. δ calc.+ b, Eq. a and b constants regression coefficients with a standard error values were found using the SigmaPlot program.

Table 3. The calculated and experimental ^{13}C and ^{1}H NMR isotropic chemical shifts of the molecule.

No	Experim.	DFT/631d/DMSO	Diff./DMSO	HF/631d/DMSO	Diff/DMSO
C1		132,05	-132,05	158,90	-158,90
C2		134,26	-134,26	159,91	-159,91
C3		131,37	-131,37	158,41	-158,41
C4		108,05	-108,05	134,79	-134,79
C5		123,71	-123,71	151,26	-151,26
C6		128,08	-128,08	156,76	-156,76
C7		98,20	-98,20	122,53	-122,53
C8		107,56	-107,56	136,57	-136,57
C9		100,13	-100,13	126,96	-126,96
C10		138,33	-138,33	162,37	-162,37
C11		122,34	-122,34	146,77	-146,77
C12		105,24	-105,24	131,65	-131,65
C13		91,29	-91,29	116,52	-116,52
C14		132,19	-132,19	156,77	-156,77
C15		34,43	-34,43	53,98	-53,98
C16		11,09	-11,09	18,41	-18,41
H17	11,77	6,14	5,63	7,20	4,57
H18	9,81	10,28	-0,47	10,39	-0,58
H19	7,40	6,38	1,02	7,28	0,12
H20	7,50	7,06	0,44	7,87	-0,37
H21	8,09	7,85	0,24	8,45	-0,36
H22	7,32	5,88	1,44	6,79	0,53
H23	6,78	5,85	0,93	6,54	0,24
H24	7,56	7,51	0,05	7,90	-0,34
H25	3,77	2,71	1,06	3,38	0,39
H26	3,77	2,94	0,83	3,61	0,16
H27	3,77	3,59	0,18	4,01	-0,24
H28	2,07	1,66	0,41	2,47	-0,40
H29	2,07	1,97	0,10	2,64	-0,57
H30	2,07	2,03	0,04	2,79	-0,72

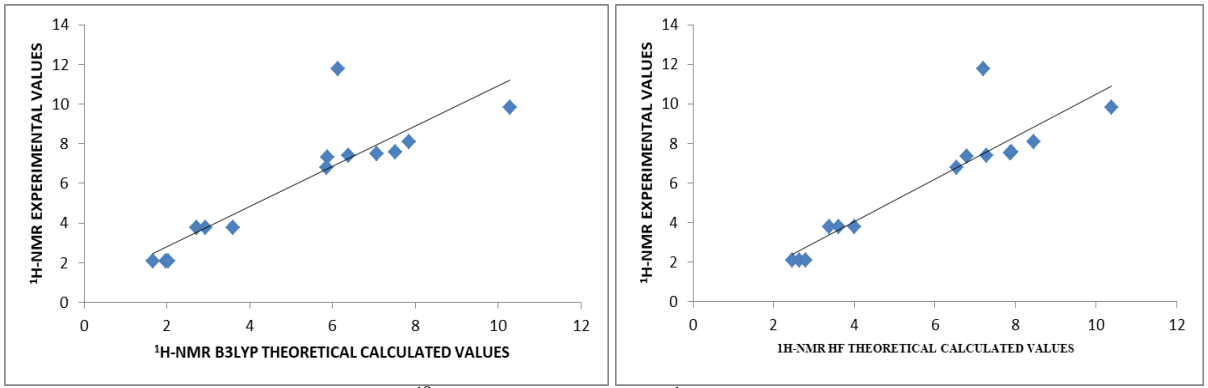


Figure 1. The correlation graphics for ^{13}C-NMR (DMSO) and ^{1}H-NMR (DMSO) chemical shifts of the molecule

Mulliken's Atomic Charges

The Mulliken atomic charges at the HF/6-311G(d,p) and B3LYP/6-31 G(d,p) level of compound **3** in gas phase are given in Table **5** (Mulliken, 1955). The carbon atoms π bonding have more positive charge density compared to ones having only σ bonding. In other words, the charge density of the carbon atoms with sp^2 hybrids is greater than those of the carbon atoms with sp^3 hybrids. Therefore the title molecule shows strong delocalization energy. In the compound **3** the atomic charges of all hydrogen atoms have positive values.

Table 4. Mulliken atomic charges of the molecule

	B3LYP	HF		B3LYP	HF		B3LYP	HF
C1	0.295	0.397	**C14**	0.086	0.148	**H27**	0.116	0.094
C2	0.532	0.722	**C15**	-0.130	-0.026	**H28**	0.132	0.122
C3	0.156	0.267	**C16**	-0.245	-0.183	**H29**	0.132	0.123
C4	-0.175	-0.201	**H17**	0.251	0.261	**H30**	0.133	0.128
C5	0.100	0.165	**H18**	0.156	0.182	**N31**	-0.313	-0.379
C6	0.239	0.340	**H19**	0.111	0.117	**N32**	-0.218	-0.283
C7	-0.103	-0.123	**H20**	0.098	0.104	**N33**	-0.364	-0.469
C8	-0.092	-0.076	**H21**	0.101	0.112	**N34**	-0.209	-0.266
C9	-0.030	-0.058	**H22**	0.127	0.130	**O35**	-0.379	-0.520
C10	0.404	0.592	**H23**	0.110	0.114	**O36**	-0.341	-0,481
C11	0.047	0.107	**H24**	0.121	0.121	**O37**	-0.272	-0.380
C12	-0.080	-0.101	**H25**	0.113	0.092	**O38**	-0.222	-0,324
C13	-0.168	-0.199	**H26**	0.142	0.127	**O39**	-0.361	-0.494

Table 5. The calculated dipole moment values of the molecule

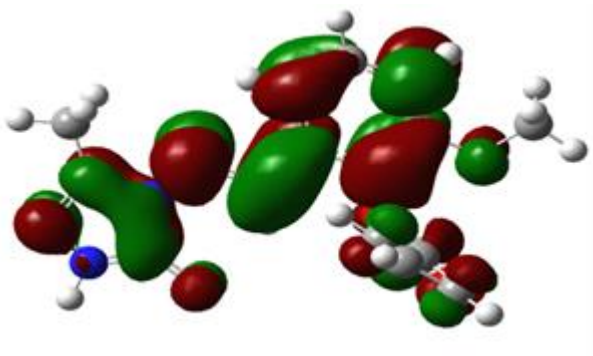
Dipole Moment	B3LYP (a.u.)	HF (a.u.)
μx	-1.1595	-1.5989
μy	1.7920	4.9692
μz	5.2799	5.8202
μToplam	5.6950	7.8182

Table 6. The total energy of the of titled compound.

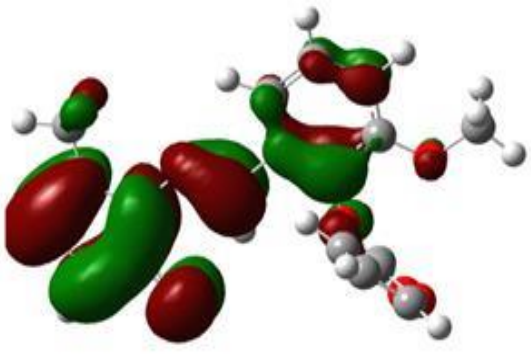
Energy	**B3LYP**	**HF**
Kcal/mol	-7614.81	-7570.00

HOMO–LUMO Analyses

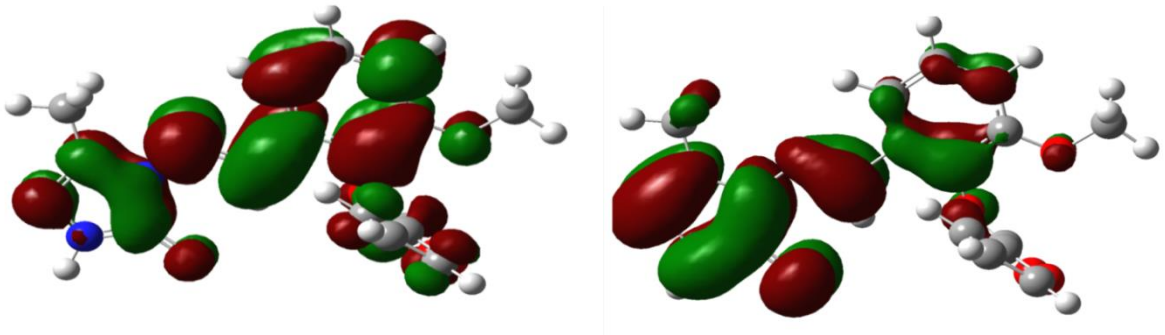
It is well known that the highest occupied molecular orbital (HOMO) which implies the outermost orbital filled by electrons and behaves as an electron donor and lowest unoccupied molecular orbital (LUMO) which can be thought as the first empty innermost orbital unfilled by electron and behaves as an electron acceptor are called as the frontier molecule orbitals (FMOs). Therefore the energy of the HOMO is directly related to the ionization potential and represents the ability of electron giving. But, LUMO energy is directly related to the electron affinity and represents the ability of electron accepting. The formed energy gap between HOMO and LUMO indicates the molecular chemical stability and is a critical parameter to determine molecular electrical transport properties (Silverstein, Bassler & Morrilli 1991)



E_{LUMO} (B3LYP) : -473.12 KJ/mol



E_{HOMO} (B3LYP) : -736.95 KJ/mol



E_{LUMO} (B3LYP) : -528.62 KJ/mol E_{HOMO} (B3LYP) : -811.28 KJ/mol

Figure 3. The calculated HOMO-LUMO energies of the molecule according to DFT/B3LYP/6–31G(d) and HF/B3LYP/6–311G(d,p) levels

Conclusion

The vibrational frequencies, ^{13}C NMR chemicals shifts, HOMO and LUMO analyses and atomic charges of 2-methoxy-6-[(3-methyl-4,5-dihydro-1*H*-1,2,4-triazol-5-on-4-yl)-azomethin]phenyl furan-2-carboxylate (**3**) synthesized for the first time have been calculated by using DFT/B3LYP and HF methods. By considering the results of experimental works it can be easily stated that the ^{1}H NMR chemical shifts spectroscopic parameters obtained theoretically are in a very good agreement with the experimental data.

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TURKISH BANKNOTE RECOGNITION APPLICATION FOR VISUALLY IMPAIRED

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Abstract: Visually impaired people have some problems regarding identify Turkish banknotes. In this manner, we present a mobile application which uses a convolutional neural network model to classify Turkish Banknotes. Image dataset is created to train a convolutional neural network. In order to make the images easier to process digitally, some preliminary operations are performed. Inception v3 model retrained with these preprocessed banknote images. Optimized graph of the model is exported and used in a mobile application which takes video input and makes inference based on this input.

Keywords: Convolutional neural network, image processing, classification, retraining

Introduction

Recently, recognizing paper currencies and classifying denominations have been a popular research area for image processing and machine learning disciplines. It used to be the focus of only the image processing field until machine learning techniques are developed and started challenging image processing. Nowadays, machine learning outperforms image processing in classification tasks. Identifying a paper currency from an image is a classification problem.

Recognizing denominations have some different use cases, although, the techniques are similar. Generally, currency classification is used for automated teller machines to detect denominations or to check whether the banknote is counterfeit or not. In this research, our focus is to create a mobile application which will help visually impaired people to classify paper currencies. This could be achieved either image processing or machine learning algorithms.

Image processing is a technique that uses computer algorithms to transform pixel data which is usually stored as red, green, blue values. This technique allows digital transformation of images in a way which is more understandable by the computers. Blurring, gray scaling or binarizing images are popular image processing methods.

This research began with a plan to use image processing to identify denominations. Literature of image processing for banknote classification is reviewed. There are some popular image feature extraction methods like Scale-invariant feature transform (SIFT) (Lowe, 2004) or Speeded up robust features (SURF). (Herbert Bay, 2008) These algorithms are useful to extract some features of the objects in images. These features could be used to compare image similarities. Scale invariance is a very important feature which allows computers detect image's interesting points and it can help to detect objects even if they are scaled differently. These algorithms could be helpful to compare target image of the banknote with the labeled image dataset.

In order to understand how image classification algorithms are compared to each other, literature review is performed. Since 2010, there is a yearly contest where different teams can compete each other with a given image dataset. This contest is called ILSVRC (ImageNet Large-Scale Visual Recognition Challenge). This challenge has a dataset which has over 14 million labeled images. There are 21841 categories. (Summary and Statistics, 2010) Competitors are evaluated based on their top 5 predictions. In ILSVRC-2012 competition, AlexNet which is a neural network model had an outstanding success in this contest. This model achieved a winning top-5 test error rate of 15.3%, compared to 26.2% achieved by the second-best entry. (Alex Krizhevsky, 2012). In 2013, all winning entries were based on Deep Learning and in 2015 multiple Convolutional Neural Network (CNN) based algorithms surpassed the human recognition rate of 95%. (Mallick, 2016). Current development shows that convolutional neural networks are a very promising solution for image classification tasks. In the consideration of current developments in this area, the planned way of this research is changed from image processing algorithms to convolutional neural networks.

Methods

Convolutional Neural Network (CNN) is a type of Feed-Forward Neural Network. In image classification field, CNN proved its efficiency multiple times in ILSVRC. CNN also has a very important feature which is called translation invariance. This allows it to recognize an object in an image even if its position in the image differs. This prevents creating a large dataset to increase positions awareness of the network. Instead of teaching every possible position of an object with large train data, convolutions learn with divide and conquer strategy. It breaks the image into overlapping tiles and feeds them to small neural networks. This is useful for image classification tasks where the area of interest in the image may locate anywhere since images will be created with mobile phone cameras. Therefore, CNN will be used in this study.

This research consists of these steps: creating a dataset, retraining a model, exporting model graph and using in it a mobile application to make inferences.

Creating a Dataset

Images are photographed with a mobile phone camera. Six different denominations of Turkish Currency are photographed in different positions and both indoor and outdoor. Both sides of the banknotes are given same proportion in the dataset. As a result, 1530 images are collected in this data set. All images are resized to 400x400 pixels. All images are classified with respect to denominations. 150 images which are not included in train dataset is used as a test data set. %80 of data set will be used in training, 10% for validation while training, 10% for tests.

Using separate images for test data set is very critical to prevent the problem which known as overfitting. Overfitting is a problem where model performs good on its training data but failing on a new data which model haven't seen before.

Retraining a Model

Basically, there are two ways of training a model: training from scratch or retraining an already trained model (transfer learning). In this experiment, transfer learning is used in order to reduce the training time.

Transfer learning is a technique that shortcuts a lot of this work by taking a fully-trained model for a set of categories like ImageNet, and retrains from the existing weights for new classes. (How to Retrain Inception's Final Layer for New Categories , 2016). This retrained model has the ability to transfer this learning to different task with different labels. (Donahue, 2013). Training a fully-trained model from scratch takes much longer time than transfer learning.

Inception v3 is a model which is pre-trained on ILSVRC-2012-CLS image classification dataset. This model's benchmark results on the ILSVRC 2012 validation set, shows significant gains over the state of the art: 21.2% top-1 and 5.6% top-5 error for single frame evaluation using a network with a computational cost of 5 billion multiply-adds per inference and with using less than 25 million parameters. (Christian Szegedy, 2015)
To perform transfer learning, this model is retrained to classify six types of Turkish Banknotes. This training run through 4,000 training steps. At each step, ten images randomly chosen, feeds their bottlenecks into the final layer.

Tensorflow explains performance measures as: "A true measure of the performance of the network is to measure its performance on a data set not contained in the training data -- this is measured by the validation accuracy. If the train accuracy is high but the validation accuracy remains low, that means the network is overfitting and memorizing features in the training images that aren't helpful more generally. Cross entropy is a loss function which gives a glimpse into how well the learning process is progressing." (How to Retrain Inception's Final Layer for New Categories , 2016)

To measure performance, cross entropy and validation accuracy are watched during the training. At 1000. Step model's cross entropy is 0.119908 and validation accuracy is 97.0%. At 2000. step, cross entropy is 0.085739 and validation accuracy is 96.0%. At the final step, cross entropy = 0.035461 and validation accuracy is 97.0%.

Exporting Model Graph to Mobile Application

Trained graph of a model exported as Protocol Buffer binary file and classes are exported as a text file. An iOS app is developed to parse these exported files via Protocol Buffer and Tensorflow libraries. This app takes video input and scaled it to 400x400 pixels and feed it to model. Then model makes an inference and speaks the denomination if confidence is over 0.8. This threshold value is selected via trial and error.

Results and Findings

Train accuracy of the model is 100.0% at the end of the 4000 steps of training. This performance measure may ignore overfitting, therefore, validation accuracy and cross entropy are more reliable performance measures. This training performs significantly good respecting to accuracy and cross-entropy as well. Thanks to cross entropy, network learn relatively fast before reaching 1000 steps.

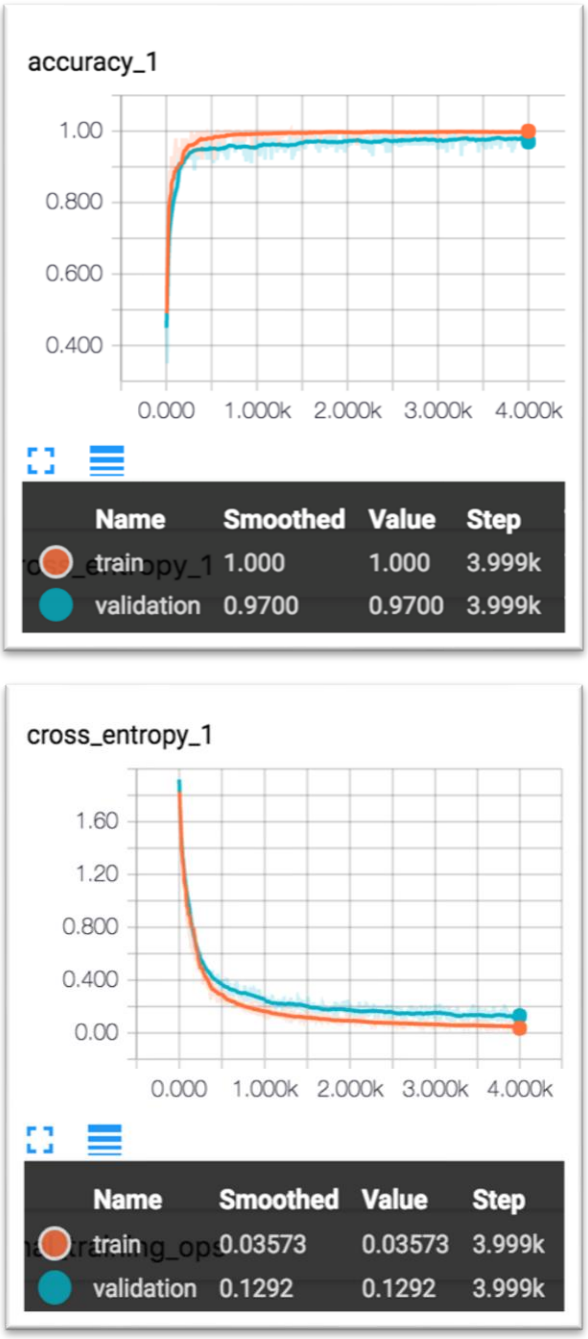

Figure 1. Accuracy and cross entropy

Conclusion

The author described the study, "Turkish Banknote Recognition Application for Visually Impaired". The main problem of this research is to help visually impaired people to identify and classify the banknotes. This research proposed the technique of that supervised retraining a pre-trained convolutional neural network to make inferences. It has been concluded that via retraining a model for 6 classes, 0.035461 cross entropy, and 97.0%. validation accuracy can be achieved.

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SYNTHESIS OF SOME NEW 1-(MORPHOLINE-4-YL-METHYL)-3-ALKYL(ARYL)-4-(4-ETHYLBENZYLIDENAMINO)-4,5-DIHYDRO-1*H*-1,2,4-TRIAZOL-5-ONES

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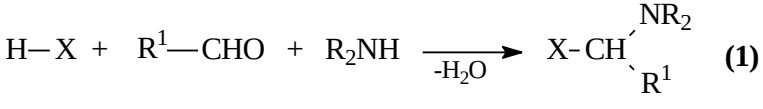
Abstract: In this study, 3-alkyl(aryl)-4-(4-ethylbenzylidenamino)-4,5-dihydro-1*H*-1,2,4-triazol-5-ones reacted with formaldehyde and morpholine to afford 1-(morpholine-4-yl-methyl)-3-alkyl(aryl)-4-(4-ethylbenzylidenamino)-4,5-dihydro-1*H*-1,2,4-triazol-5-ones. Thus, five new Mannich bases (3-ethyl-4-(4-ethylbenzylidenamino)-4,5-dihydro-1*H*-1,2,4-triazol-5-one, 3-benzyl-4-(4-ethylbenzylidenamino)-4,5-dihydro-1*H*-1,2,4-triazol-5-one, 3-(*p*-methylbenzyl)-4-(4-ethylbenzylidenamino)-4,5-dihydro-1*H*-1,2,4-triazol-5-one, 3-(*p*-chlorobenzyl)-4-(4-ethylbenzylidenamino)-4,5-dihydro-1*H*-1,2,4-triazol-5-one and 3-phenyl-4-(4-ethyl-benzylidenamino)-4,5-dihydro-1*H*-1,2,4-triazol-5-one) were synthesized. The structures of these compounds were established from, IR, ^{1}H NMR and ^{13}C NMR spectral data.

Keywords: Mannich base, synthesis, 4,5-dihydro-1*H*-1,2,4-triazol-5-one

Introduction

4,5-Dihydro-1*H*-1,2,4-triazol-5-one and 1,2,4-triazole derivatives were reported to exhibit various biological activities such as antifungal, antimicrobial, hypoglycemic, antihypertensive, analgesic, antiviral, anti-inflammatory, antitumor, antioxidant and anti-HIV properties (Uzgören-Baran et.al., 2012; Chidananda et.al., 2012; Henen et.al., 2012; Demirbaş, Uğurluoğlu., 2004; Li et.al., 2013; Ali et.al., 2011; Yüksek et.al., 1997; Yüksek et.al., 2013; Aktaş-Yokuş et.al., 2015). Compounds containing the 4,5-dihydro-1*H*-1,2,4-triazol-5-one constituted important substrate class for the Mannich reaction due to an active hydrogen atom bound to the nitrogen (Roman, 2015). Mannich bases containing the triazole derivatives have applications the field medicinal chemistry, the product synthetic polymers, the petroleum industry, as products used in water treatment, cosmetics, the dyes industry, etc (Tramontini & Angiolini, 1994). In addition, Mannich bases have biological activity such as anticancer (Savariz et.al., 2010; Chen et.al., 2012) antibacterial (Bandgar et.al., 2010; El-Emam et.al., 2013; Maddila & Jonnalagadda, 2012), antimycobacterial (Das et.al., 2010; Sriram et.al., 2005; Ceylan et.al., 2013), anti-inflammatory (Liu et.al., 2013; Bandgar et.al., 2010; Köksal et.al., 2005), analgesic (Nithinchandra et.al., 2012; Manjunatha et.al., 2010), antifungal (Ozkan-Dagliyan et.al., 2013; Frank et.al., 2013), antitumor (Pati et.al., 2008; Pau et.al., 2009), antiviral (Jia et.al., 2009a; Jia et.al., 2009b; Chen et.al., 2010), antidepressant (Koksal & Sirri Bilge, 2007; Dyubchenko et.al., 2006), antiulcer (Kodhati et.al., 2013; Koksal & Sirri Bilge, 2007), anticonvulsant (Byrtus et.al., 2011; Rajasekaran et.al., 2013), antimalaria (Görlitzer et.al., 2004a; Görlitzer et.al., 2004b; Görlitzer et.al., 2004c), antioxidant activities (Görlitzer et.al., 2007; Hamama et.al., 2011). Mannich reaction is a three-component condensation reaction involving an active hydrogen containing compound, formaldehyde and a secondary amine (Karthikeyan et.al., 2006). Mannich reactions (Scheme **1**) are also known as aminoalkylation reactions. Although primary amines (RNH_2) may be employed as amine reagents in aminomethylations or aminoalkylations, secondary aliphatic amines (R_2NH) are the most commonly encountered as amine reagents in the Mannich reaction. Formaldehyde is used to a great extent as aldehyde component in the Mannich reaction (Roman, 2015).



(1)

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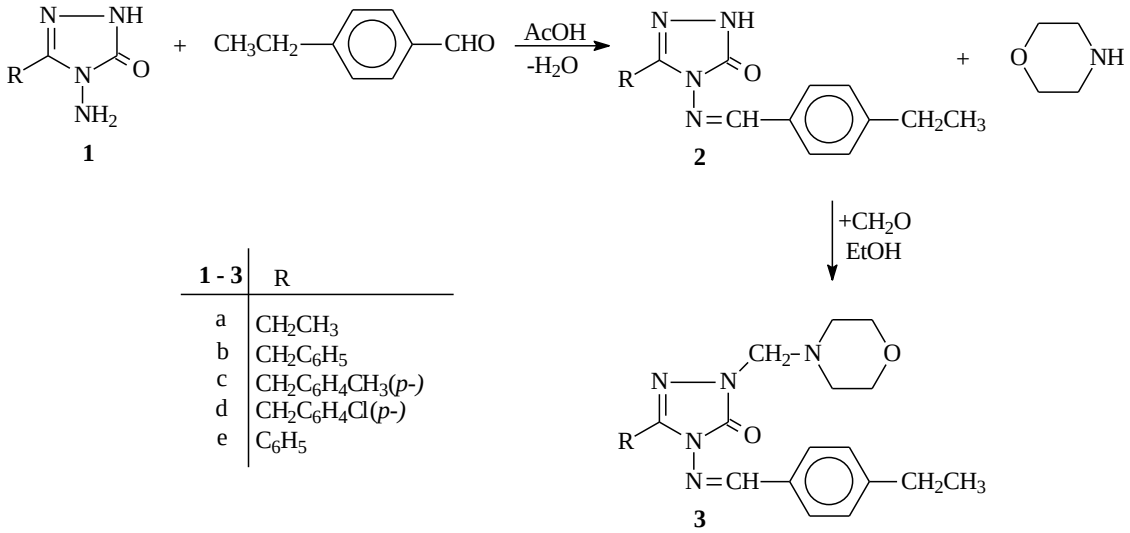
Scheme 1. General representation of the Mannich reaction

In the present paper, synthesis of a series of Mannich bases was investigated. Firstly, 3-alkyl(aryl)-4-(4-ethylbenzylidenamino)-4,5-dihydro-1*H*-1,2,4-triazol-5-ones (**2a-e**) were obtained by the reactions of compounds **1** with 4-ethylbenzaldehyde as described in the literature (Kemer, 2007). Then, the compounds **2** reacted with formaldehyde and morpholine to afford new 1-(morpholine-4-yl-methyl)-3-alkyl(aryl)-4-(4-ethylbenzylidenamino)-4,5-dihydro-1*H*-1,2,4-triazol-5-ones (**3a-e**) (Scheme **2**).



Scheme 2

Materials and Methods

Chemicals and Apparatus

Chemical reagents and all solvents used in this study were purchased from Merck AG, Aldrich and Fluka. Melting points were taken using an WRS-2A Microprocessor Melting-point Apparatus in an open capillary tubes. ^{1}H- and ^{13}C-NMR spectra were recorded in deuterated dimethyl sulfoxide with TMS as internal standard on a Bruker spectrometer at 400 MHz and 100 MHz, respectively. The IR spectra were registered on a Alpha-P Bruker FT-IR Spectrometer.

General Procedure for the Synthesis of 1-(morpholine-4-yl-methyl)-3-alkyl(aryl)-4-(4-ethlybenzyliden-amino)-4,5-dihydro-1*H*-1,2,4-triazol-5-ones (3a-e):
3-alkyl(aryl)-4-(4-ethylbenzylidenamino)-4,5-dihydro-1*H*-1,2,4-triazole-5-one (**2**) (5 mmol) was dissolved absolute ethanol and to this solution were added formaldehyde (% 37, 10 mmol) and morpholine (6 mmol). The reaction mixture was refluxed for 4 hours and filtered. The mixture was left at room temperature for 1 overnight and after cooling of the mixture in the -18 ^{0}C refrigeratör. The solid formed was obtained by filtration, washed with cold ethanol and recrystalised from ethanol.

Physical data of the new compounds are presented in Table **1**. IR, ^{1}H-NMR and ^{13}C-NMR spectral data are given in Tables **2**, **3** and **4**, respectively.

Table 1. Physical data of the compounds 3a-e

Compound No	R	Yield (%)	m.p. (°C) (Crystallized from)
3a	CH_2CH_3	66	108 (Ethanol)
3b	$CH_2C_6H_5$	64	148 (Ethanol)
3c	$CH_2C_6H_4.CH_3$ (*p*-)	70	152 (Ethanol)
3d	$CH_2C_6H_4.Cl$ (*p*-)	66	148 (Ethanol)
3e	C_6H_5	75	155 (Ethanol)

Table 2. IR data of the compounds 3a-e (cm^{-1})

Compound No	$\nu_{C=O}$	$\nu_{C=N}$	$\nu_{1,4\text{-disubstituted benzenoid ring}}$	$\nu_{monosubstituted\ benzenoid\ ring}$
3a	1702	1601	892	-
3b	1702	1602	829	-
3c	1707	1601	834	765 and 710
3d	1702	1600	802	-

3e	1693	1602	830, 801	-

Table 3. ^{1}H-NMR data of the compounds 3a-e (DMSO-d_6, δ/ppm)

Comp.No	CH_3	$CH_2\underline{CH_3}$	CH_2	CH_2NCH_2	CH_2OCH_2	CH_2Ph	$\underline{CH_2}CH_3$	NCH_2N	Aromatic H	N=CH
3a	-	1.20-1,22 (t,*J*=8.00 Hz)	2.63-2.74(m,4H)	2.58 (m)	3.56(m,4H)	-	4,10 (q, *J*=7.20 Hz)	4,54 (s)	7.34 (d,2H,*J*=8.0 Hz); 7.74 (d,2H,*J*=8.0 Hz	9.67 (s)
3b	-	1.12(t,*J*=8.00 Hz)	2.66 (q, *J*=8.0Hz)	2.59 (m)	3.57(m,4H)	4.09(s)	-	4.57 (s)	7.23-7.24(m,1H); 7.30-7.35(m,6H); 7.71(d,2H)	9.61 (s)
3c	2.24(s)	1.20 (t,*J*=8.00 Hz)	2.66(q, *J*=8.0Hz)	2.59 (m)	3.56(m,4H)	4.03(s)	4.10 (q, *J*=7.20 Hz)	4.57 (s)	7.12(d,2H,*J*=8.00Hz); 7.22(d,2H,*J*=8.00Hz); 7.34(d,2H,*J*=8.00Hz); 7.72(d,2H,*J*=8.00Hz)	9.62 (s)
3d	-	1.20 (t,*J*=8.00 Hz)	2.66(q, *J*=8.0Hz)	2.58 (m)	3.56(m,4H)	4.10(s)	-	4.56(s)	7.34(d,2H,*J*=8.00Hz); 7.37(d,2H,*J*=8.00Hz); 7.39(d,2H,*J*=8.00Hz); 7.71 (d,2H,*J*=8.00Hz)	9.63 (s)
3e	-	1.20(t,*J*=8.00 Hz)	2.63-2.69(m,6H)	2.63-2.69 (m)	3.59(m,4H)	-	-	4.69 (s)	7.35(d,2H,*J*=8.00Hz); 7.53-7.55(m,3H); 7.73(d,2H,*J*=8.00 Hz) 7.91-7.92(m,2H)	9.59 (s)

Table 4. ^{13}C-NMR data of the compounds 3a-e (DMSO-d_6, δ/ppm)

Comp.No	Triazole C_5	N=CH	Triazole C_3	Aromatic C	Aliphatic C
3a	150.89	154.83	147.26	128.27(2C); 128.89(2C); 131.41; 148.28	10.49(CH_3); 15.70($PhCH_2\underline{CH_3}$); 18,91($\underline{CH_2}CH_3$); 28.64($Ph\underline{CH_2}CH_3$); 50.45(CH_2NCH_2); 66.39 (CH_2OCH_2); 66.51(NCH_2N)
3b	150.77	154.66	145.39	127.26(C);128.33(2C); 128.92(2C); 128.97(2C); 129.18(2C); 131.35;136.14;148.33	15.70($CH_2\underline{CH_3}$); 28.63 ($\underline{CH_2}CH_3$); 31.40(Ph CH_2); 50.46 (CH_2NCH_2); 66.51(CH_2OCH_2+NCH_2N)
3c	150.77	154.63	145.55	128.33(2C);128.92(2C); 129.06(2C); 129.53(2C); 131.36; 132.99; 136.34; 148.32	15.70($CH_2\underline{CH_3}$); 21.05($PhCH_3$); 28.64 ($\underline{CH_2}CH_3$); 30.99($\underline{CH_2}Ph$); 50.46(CH_2NCH_2); 66.46 (NCH_2N); 66.51(CH_2OCH_2)
3d	150.76	154.75	145.08	128.36(2C); 128.91(4C); 131.13(2C); 131.30; 131.97; 135.10; 148.37	15.69($CH_2\underline{CH_3}$); 28.64 ($\underline{CH_2}CH_3$); 30.74(CH_2Ph); 50.44 (CH_2NCH_2); 66.51(CH_2OCH_2+NCH_2N)
3e	150.97	157.83	143.66	126.68; 128.53(4C); 129.01(4C); 130.75; 131.20; 148.62	15.70($CH_2\underline{CH_3}$); 28.68($\underline{CH_2}CH_3$); 50.43 (CH_2NCH_2); 66.54(CH_2OCH_2); 66.88(NCH_2N)

Results and Dıscussıon

This study reports the successful synthesis and characterization of five new Mannich bases. The structures of new 1-(morpholine-4-yl-methyl)-3-alkyl(aryl)-4-(4-ethylbenzylidenamino)-4,5-dihydro-1*H*-1,2,4-triazol-5-ones (**3a-e**) were identified using IR, ^{1}H-NMR, ^{13}C-NMR spectral data.

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COMPARATION OF THEORETICAL PROPERTIES OF 3-METHYL-4-(3-BENZOXY-4-METHOXYBENZYLIDENAMINO)-4,5-DIHYDRO-1*H*-1,2,4-TRIAZOL-5-ONE MOLECULE

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Abstract: 3-Methyl-4-(3-benzoxy-4-methoxybenzylidenamino)-4,5-dihydro-1*H*-1,2,4-triazol-5-one molecule was described in the literature. This molecule was optimized by using the B3LYP/ HF 6-31G (d,p) and B3LYP/ HF 6-311G (d,p) basis sets. This optimized structures used to calculation of the different theoretical properties of the compound. ^{1}H-NMR and ^{13}C-NMR isotropic shift values were calculated by the method of GIAO using the program package Gaussian G09W. Experimental and theoretical values were inserted into the graphic according to equitation of δ exp=a+b. δ calc. The standard error values were found via SigmaPlot program with regression coefficient of **a** and **b** constants. The veda4f program was used in defining IR data. IR absorption frequencies were compared with experimental data. Infrared spectrums were composed by using the data calculated. Additionally, bond lengths, dipole moments, the HOMO-LUMO energy, Mulliken charges by using the B3LYP/ HF 6-31G (d,p) and B3LYP/ HF 6-311G (d,p) basis sets of this compound were theoretically calculated. Finally, theoretical properties of the compound according to two different basis sets were compared.

Keywords: GIAO, 631G (d,p) and 6311G (d,p), mulliken charge, B3LYP, HF

Introduction

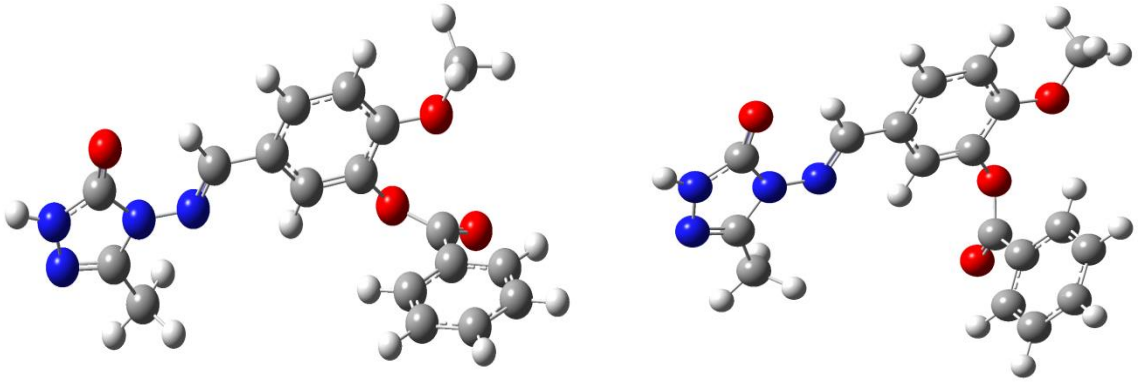
Schiff base compounds are used as starting materials in the synthesis of important drugs, such as antibiotics and antiallergic, antiphlogistic, and antitumor substances (Barton &Ollis, 1979; Ingold, 1969; Layer, 1963). On the industrial scale, they have a wide range of applications, such as dyes and pigments (Taggi et.al., 2002). Schiff bases have been employed as ligands for the complexation of metal ions (Aydogan et.al., 2001) . Schiff bases are also becoming increasingly important in the dye and plastic industries as well as for the liquidecrystal technology and mechanistic investigation of drugs used in pharmacology, biochemistry and physiology (Casaszar et.al., 1985, Sheikhshoaie & Sharif, 2006). In the past years, by increasing development of computational chemistry, theoretically properties of Schiff bases were investigated. Quantum chemical calculation methods have widely been used to theoretically predict the structural, spectroscopic, thermodynamic and electronic properties of molecular systems. The quantum chemical calculation methods provide support for experimental structural and spectroscopic studies (Yüksek et.al., 2005a; Yüksek et.al., 2005b; Yüksek et.al., 2008a; Yüksek et.al., 2008b; Gökçe ve ark., 2013; Gökçe ve ark., 2014) . Experimental data of 3-methyl-4-(3-benzoxy-4-methoxybenzylidenamino)-4,5-dihydro-1*H*-1,2,4-triazol-5-one molecule were described in the literature (Bahçeci et.al., 2016). In the present paper, theoretical values of compound were calculated theoretically on the computer. Molecule was optimized by using the B3LYP/HF 631G (d,p) and B3LYP/HF 6311G (d,p) basis sets (Frisch et al., 2009; Wolinski, Hilton & Pulay, 1990). Starting from this optimized structure with ^{1}H-NMR and ^{13}C-NMR spectral data (Table **1**) and IR spectral values according to GIAO (Wolinski et al., 1990) method was calculated using the method of Gaussian G09W program package in gas phase. Theoretically and experimentally values (Bahçeci et.al., 2016) were plotted according to exp =a +b. δ calc Eq. a and b constants regression coefficients with a standard error values were found using the SigmaPlot program (Table **2**). The correlation graphs for chemical shifts drawn with ^{1}H-NMR, ^{13}C-NMR and ^{1}H-NMR(DMSO), ^{13}C-NMR(DMSO) spectral data of the molecule (Fig. **3**) Theoretically calculated IR data are multiplied with appropriate adjustment factors (Merrick et.al., 2007) and the data obtained according to HF and DFT method are formed using theoretical infrared spectrum (Fig. **4, 5**). The identification of calculated IR data was used in veda4f program (Jamróz, 2004) (Table **3**). Additionally, bond lengths (Table **4**), Mulliken charges (Mulliken, 1955) (Table **5**), the HOMO (the highest occupied molecular orbitals)-LUMO (lowest unoccupied

molecular orbitals) energy (Fig. **5, 6**) and dipole moments (Table **6**) of this compound was found by using two basis sets.

Methods

The quantum chemical calculations were carried out with Density Functional Theory (DFT) and Hartree-Fock (HF) methods using 631G (d,p) and 6311G (d,p) basis set at the Gaussian 09W program package on a computing system (Frisch et al., 2009). Firstly, the compound was optimized by using the B3LYP/HF 631G (d,p) and B3LYP/HF 6311G (d,p) basis sets (Frisch et al., 2009; Wolinski, Hilton & Pulay, 1990). Thus, the most stable geometrical comformer of compound was obtained. Then, ^{1}H-NMR and ^{13}C-NMR isotropic shift values were calculated with method of GIAO (Wolinski et al., 1990). The veda4f program was used in defining IR data (Jamróz, 2004). Otherwise, bond lengths, dipole moments, the HOMO-LUMO energy, and Mulliken charges (Mulliken, 1955) of compound were calculated theoretically on the computer. Theoretical properties of the compound according to two different basis sets were compared.

Theoretical Calculations



1 **2**

Figure 2. The optimized structure of the molecule with DFT/B3LYP/631G(d,p) (**1**) and DFT/B3LYP/6311G(d,p) (**2**) levels

Table 1. The calculated and experimental ^{13}C and ^{1}H-NMR DMSO(B3LYP/HF 631G(d,p)/6311G(d,p))isotropic chemical shifts of the molecule (δ/ppm)

No	Exp.	B3LYP/631 G	B3LYP/6311 G	Differ./ B3LYP631 G	Differ./ B3LYP6311 G	HF/631 G	HF/6311 G	Differ./ HF631G	Differ./HF631 1G
C1	144.73	150,21	167,65	-5,48	-22,92	145,35	159,01	-0,62	-14,28
C2	151.75	152,93	171,12	-1,18	-19,37	146,61	160,48	5,14	-8,73
C3	153.21	154,04	169,98	-0,83	-16,77	149,16	161,98	4,05	-8,77
C4	126.93	132,34	148,86	-5,41	-21,93	119,97	132,70	6,96	-5,77
C5	121.42	119,70	135,69	1,72	-14,27	119,35	132,74	2,07	-11,32
C6	140.25	149,20	168,43	-8,95	-28,18	132,22	146,77	8,03	-6,52
C7	154.01	154,78	177,10	-0,77	-23,09	149,66	164,23	4,35	-10,22
C8	113.20	116,34	132,34	-3,14	-19,14	105,68	117,28	7,52	-4,08
C9	128.72	134,40	151,54	-5,68	-22,82	131,71	145,16	-2,99	-16,44
C10	164.39	170,95	189,63	-6,56	-25,24	157,13	170,48	7,26	-6,09
C11	130.13	134,83	151,17	-4,70	-21,04	123,04	135,96	7,09	-5,83
C12	130.33	132,19	154,55	-1,86	-24,22	129,48	143,58	0,85	-13,25
C13	129.46	130,38	150,53	-0,92	-21,07	122,67	136,76	6,79	-7,30
C14	134.59	136,22	156,22	-1,63	-21,63	133,00	147,48	1,59	-12,89

C15	129.46	132,05	149,67	-2,59	-20,21	122,78	136,90	6,68	-7,44
C16	130.33	135,65	151,51	-5,32	-21,18	130,37	144,03	-0,04	-13,70
C17	56.93	61,07	73,18	-4,14	-16,25	46,25	54,59	10,68	2,34
C18	11.53	20,84	29,86	-9,31	-18,33	10,40	18,37	1,13	-6,84
H19	11.80	8,45	7,93	3,35	3,87	7,62	7,18	4,18	4,62
H20	9.65	11,02	10,61	-1,37	-0,96	10,27	10,06	-0,62	-0,41
H21	7.76	9,09	8,21	-1,33	-0,45	8,90	8,76	-1,14	-1,00
H22	7.28	7,69	7,72	-0,41	-0,44	7,60	7,33	-0,32	-0,05
H23	7.74	8,14	7,96	-0,40	-0,22	8,32	8,19	-0,58	-0,45
H24	8.13	8,50	8,96	-0,37	-0,83	9,15	9,01	-1,02	-0,88
H25	7.60	8,15	8,38	-0,55	-0,78	8,22	8,08	-0,62	-0,48
H26	7.61	8,51	8,40	-0,90	-0,79	8,54	8,40	-0,93	-0,79
H27	7.72	8,52	8,10	-0,80	-0,38	8,23	8,09	-0,51	-0,37
H28	8.13	9,05	8,39	-0,92	-0,26	9,10	8,91	-0,97	-0,78
H29	3.83	4,17	4,69	-0,34	-0,86	4,31	3,65	-0,48	0,18
H30	3.83	4,80	5,05	-0,97	-1,22	3,84	4,08	-0,01	-0,25
H31	3.83	4,49	4,50	-0,66	-0,67	4,02	3,86	-0,19	-0,03
H32	2.24	3,32	3,02	-1,08	-0,78	2,71	2,66	-0,47	-0,42
H33	2.24	3,33	2,96	-1,09	-0,72	2,75	2,62	-0,51	-0,38
H34	2.24	2,95	2,72	-0,71	-0,48	2,43	2,39	-0,19	-0,15

The relation between R^2 values of the compound

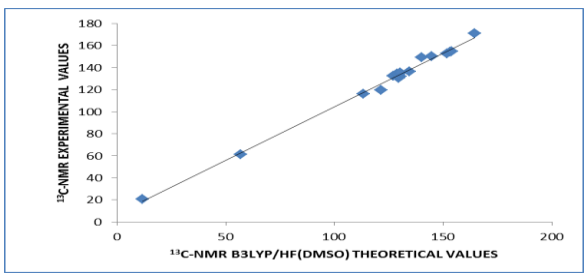
The optimized R^2 values of the compound with B3LYP/HF 631G(1) level: B3LYP/631G(d,p) (DMSO): ^{13}C: 0.9934, ^{1}H: 0.8617; HF/631G(d,p) (DMSO): ^{13}C: 0.9898, ^{1}H: 0.8220.

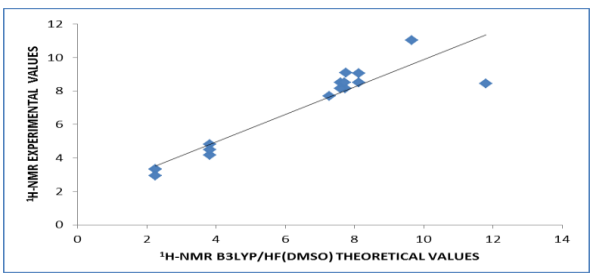
The optimized R^2 values of the compound with B3LYP/HF 6311G(2) level: B3LYP/6311G(d,p) (DMSO): ^{13}C: 0.9936, ^{1}H: 0.8437; HF/6311G(d,p) (DMSO): ^{13}C: 0.9885, ^{1}H: 0.8009.

There is such a relationship between R^2-values of the compound. Found standard error rate and a, b constants regression values were calculated according to formula exp =a +b. δ calc Eq. These values for compound were shown in the table **2**. Theoretical and experimental carbon and proton chemical shifts ratios between according to a, b ve R^2 values, linear a correlation were observed.

Table 2. The correlation data for chemical shifts of the molecule

	^{13}C (DMSO)				^{1}H(DMSO)			
2	**R^2**	**S. error**	**a**	**b**	**R^2**	**S. error**	**a**	**b**
DFT/631G	0.9934	2.9357	1.0244	-6.8507	0.8617	1.1174	1.0485	0.8687
HF/631G	0.9898	3.7732	0.9869	5.8241	0.8220	1.2678	0.9617	0.0200
	^{13}C (DMSO)				**^{1}H(DMSO)**			
2	**R^2**	**S. error**	**a**	**b**	**R^2**	**S. error**	**a**	**b**
DFT/6311G	0.9936	2.9800	0.9547	-14.369	0.8437	1.1880	1.0751	0.8786
HF/6311G	0.9885	4.0078	0.9416	0.9226	0.8009	1.3410	0.9589	0.1621





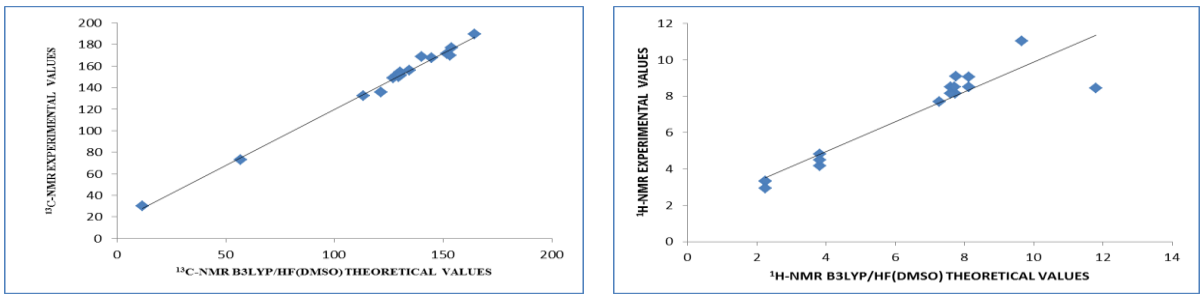


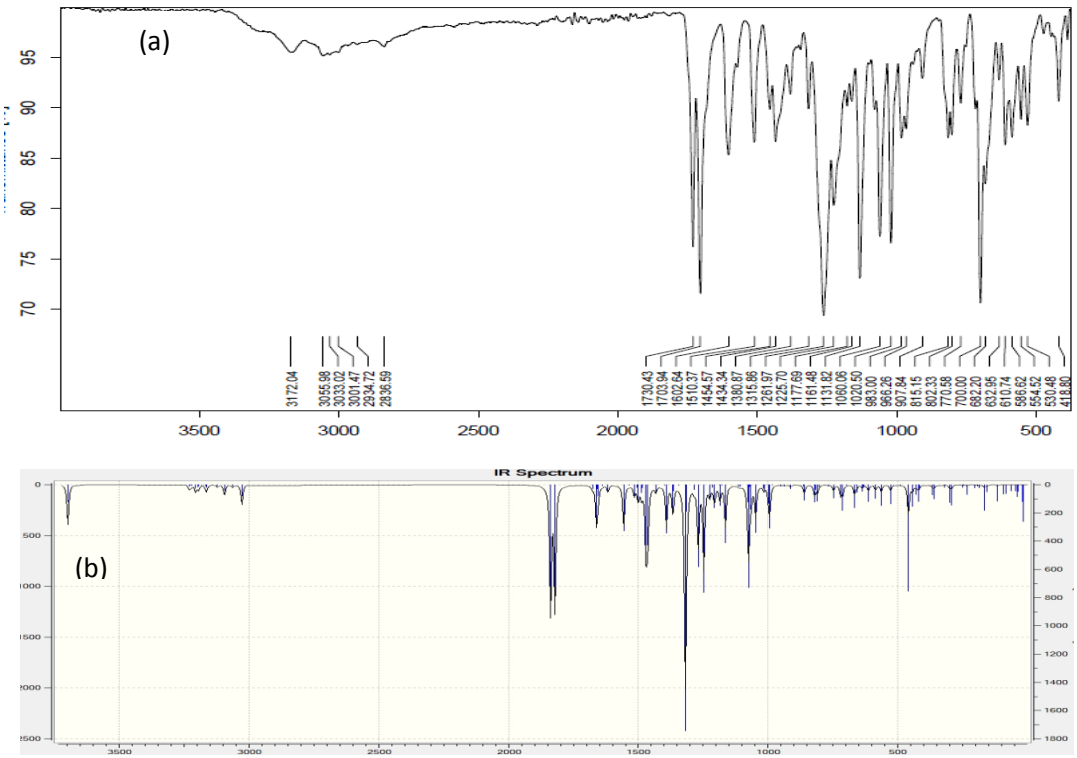
Figure 3. The correlation graphs for B3LYP/HF 631G(d,p)/6311G(d,p) chemical shifts of the molecule.

The Vibration Frequency of the Compound

Theoretically IR values were calculated with the veda4f program and scalar values were obtained. Theoretically calculated IR data are multiplied with appropriate adjustment factors respectively 0.9617, 0.8992, 0.9688, 0.9059 for DFT/631G(d,p), HF/631G(d,p) and DFT/6311G(d,p), HF/6311G(d,p) basis sets. The negative frequency in the data was not found. This result shows that the structure of compound was shown to be stable. IR spectrums were drawn with obtained values according to HF and DFT method. Theoretical IR values were compared with experimental IR counterparts. The result of this compare were found corresponding with each other of values. Experimental carbonyl peak (C=O) was found in 1704, 1730 cm^{-1} and theoretical (C=O) peak was found in 1768 cm^{-1} for 631G(d,p), 1762 cm^{-1} for 6311G(d,p).

Table 3. The calculated frequencies values of the molecule optimized with 1 and 2 levels

Vibration Types (1)	Experimental	Skalalı dft(1)	Skalalı hf(1)	Skalalı dft(2)	Skalalı hf(2)
τ HCCC(16)	700	692	724	682	684
τ HCCC(11)	771	779	809	797	826
τ HCOC(27)	1262	1268	1277	1179	1197
ν NC(54)	1603	1591	1625	1613	1710
ν OC(90)	1730, 1704	1768	1809	1762	1809
ν NH(100)	3172	3557	3556	3566	3561



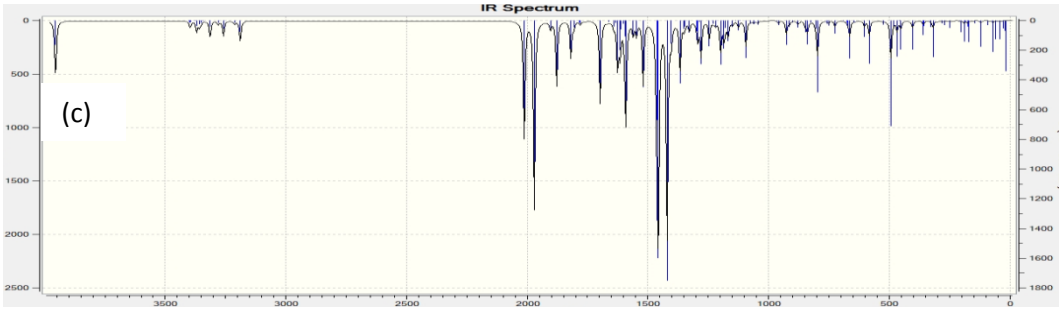


Figure 4. Experimental(a) and theoretical IR spectrums and simulated with DFT/B3LYP/631G(d,p)(b) and HF/B3LYP/631G(d,p)(c) levels of the molecule

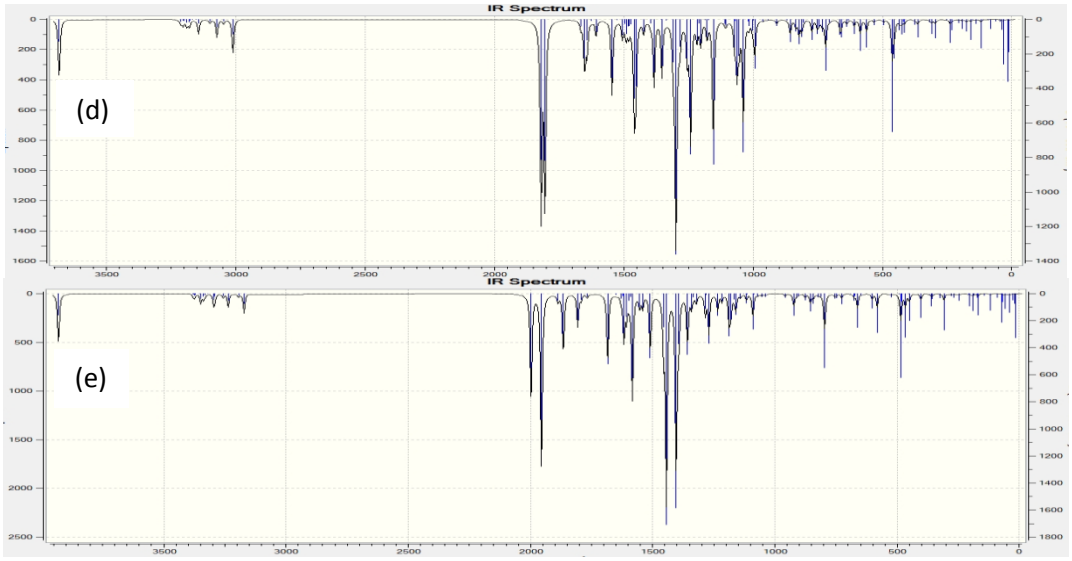
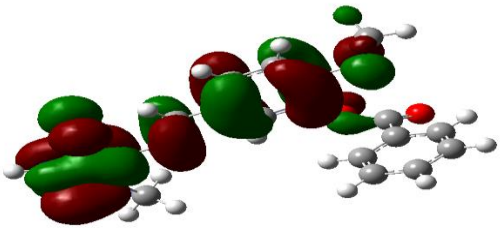


Figure 5. Theoretical IR spectrums and simulated with DFT/B3LYP/6311G(d,p)(d) and HF/B3LYP/6311G(d,p)(e) levels of the molecule

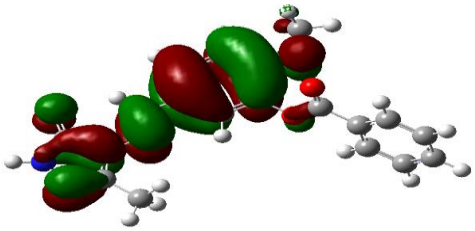
Table 4. The calculated bond lengths B3LYP/HF 631G(d,p) and B3LYP/HF 6311G(d,p) of the molecule.

	Bond Lengths	DFT/631G	HF/631G		Bond Lengths	DFT/631G	HF/631G
1	C(1)-N(35)	1.300	1.269	**24**	O(40)-C(10)	1.386	1.341
2	C(1)-N(37)	1.388	1.378	**25**	C(10)-O(42)	1.204	1.185
3	C(1)-C(18)	1.486	1.488	**26**	C(10)-C(11)	1.493	1.488
4	N(35)-N(36)	1.382	1.371	**27**	C(11)-C(12)	1.401	1.389
5	N(36)-H(19)	1.006	0.990	**28**	C(11)-C(16)	1.402	1.390
6	N(36)-C(2)	1.370	1.346	**29**	C(12)-H(24)	1.083	1.072
7	C(2)-O(39)	1.223	1.203	**30**	C(12)-C(13)	1.394	1.384
8	C(2)-N(37)	1.417	1.385	**31**	C(13)-H(25)	1.085	1.075
9	N(37)-N(38)	1.373	1.367	**32**	C(13)-C(14)	1.395	1.384
10	N(38)-C(3)	1.290	1.260	**33**	C(14)-H(26)	1.086	1.075
11	C(3)-H(20)	1.088	1.075	**34**	C(14)-C(15)	1.397	1.386
12	C(3)-C(4)	1.461	1.470	**35**	C(15)-H(27)	1.085	1.075
13	C(4)-C(5)	1.408	1.399	**36**	C(15)-C(16)	1.391	1.382
14	C(4)-C(9)	1.399	1.380	**37**	C(16)-H(28)	1.084	1.073
15	C(5)-H(21)	1.083	1.072	**38**	C(7)-O(41)	1.356	1.337
16	C(5)-C(6)	1.382	1.364	**39**	O(41)-C(17)	1.422	1.402
17	C(6)-O(40)	1.382	1.375	**40**	C(17)-H(29)	1.096	1.085
18	C(6)-C(7)	1.415	1.401	**41**	C(17)-H(30)	1.089	1.084
19	C(7)-O(41)	1.356	1.337	**42**	C(17)-H(31)	1.096	1.079
20	C(7)-C(8)	1.396	1.381	**43**	C(18)-H(32)	1.094	1.083
21	C(8)-H(22)	1.083	1.072	**44**	C(18)-H(33)	1.094	1.083
22	C(8)-C(9)	1.395	1.390	**45**	C(18)-H(34)	1.090	1.080
23	C(9)-H(23)	1.086	1.076				
	Bond Lengths	**DFT/6311G**	**HF/6311G**		**Bond Lengths**	**DFT/6311G**	**HF/6311G**
1	C(1)-N(35)	1.296	1.266	**24**	O(40)-C(10)	1.388	1.340
2	C(1)-N(37)	1.388	1.378	**25**	C(10)-O(42)	1.197	1.178
3	C(1)-C(18)	1.485	1.487	**26**	C(10)-C(11)	1.491	1.489
4	N(35)-N(36)	1.380	1.370	**27**	C(11)-C(12)	1.399	1.388
5	N(36)-H(19)	1.005	0.990	**28**	C(11)-C(16)	1.399	1.389
6	N(36)-C(2)	1.368	1.346	**29**	C(12)-H(24)	1.082	1.072
7	C(2)-O(39)	1.216	1.196	**30**	C(12)-C(13)	1.389	1.383
8	C(2)-N(37)	1.419	1.387	**31**	C(13)-H(25)	1.083	1.074
9	N(37)-N(38)	1.370	1.365	**32**	C(13)-C(14)	1.394	1.384
10	N(38)-C(3)	1.285	1.258	**33**	C(14)-H(26)	1.084	1.075
11	C(3)-H(20)	1.086	1.075	**34**	C(14)-C(15)	1.393	1.386
12	C(3)-C(4)	1.461	1.471	**35**	C(15)-H(27)	1.083	1.074
13	C(4)-C(5)	1.406	1.399	**36**	C(15)-C(16)	1.391	1.381
14	C(4)-C(9)	1.395	1.378	**37**	C(16)-H(28)	1.082	1.073

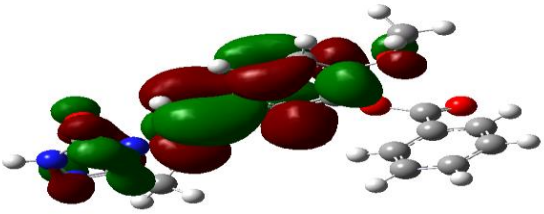
15	C(5)-H(21)	1.082	1.072	**38**	C(7)-O(41)	1.355	1.335
16	C(5)-C(6)	1.379	1.362	**39**	O(41)-C(17)	1.423	1.402
17	C(6)-O(40)	1.380	1.374	**40**	C(17)-H(29)	1.095	1.079
18	C(6)-C(7)	1.413	1.401	**41**	C(17)-H(30)	1.088	1.085
19	C(7)-O(41)	1.355	1.335	**42**	C(17)-H(31)	1.094	1.085
20	C(7)-C(8)	1.394	1.380	**43**	C(18)-H(32)	1.092	1.083
21	C(8)-H(22)	1.081	1.071	**44**	C(18)-H(33)	1.092	1.083
22	C(8)-C(9)	1.393	1.390	**45**	C(18)-H(34)	1.089	1.080
23	C(9)-H(23)	1.084	1.075				



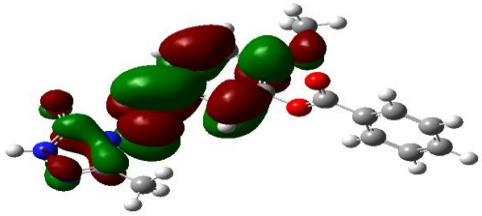
E_{HOMO} (B3LYP) : -0.21409 Hatree



E_{HOMO} (HF) : -0.30218 Hatree

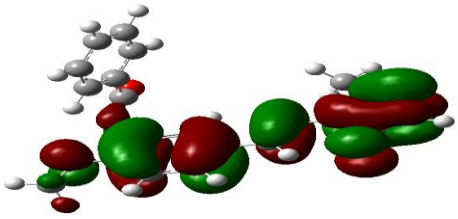


E_{LUMO} (B3LYP) : -0.05666 Hatree

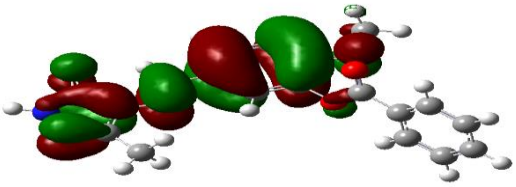


E_{LUMO} (HF) : 0.09319 Hatree

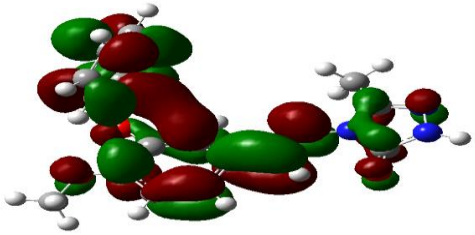
Figure 6. HOMO-LUMO energy calculated with DFT/B3LYP/631G(d,p) and HF/B3LYP/631G(d,p) levels of the molecule



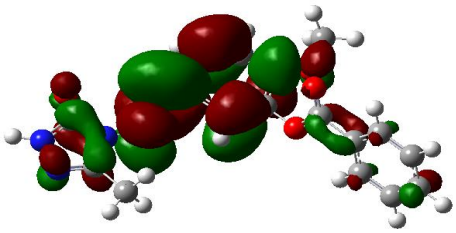
E_{HOMO} (B3LYP) : -0.22090 Hatree



E_{HOMO} (HF) : -0.30611 Hatree



E_{LUMO} (B3LYP) : -0.06669 Hatree



E_{LUMO} (HF) : 0.08729 Hatree

Figure 7. HOMO-LUMO energy calculated with DFT/B3LYP/6311G(d,p) and HF/B3LYP/6311G(d,p) levels of the molecule

Table 5. The calculated Mulliken charges data B3LYP/HF 631G(d,p)/ 6311G(d,p) of the molecule

	DFT/631G	HF/631G		DFT/631G	HF/631G		DFT/6311G	HF/6311G		DFT/6311G	HF/6311G
C1	0.522	0.592	**H22**	0.098	0.167	**C1**	0.294	0.396	**H22**	0.111	0.115
C2	0.816	1.051	**H23**	0.100	0.171	**C2**	0.535	0.729	**H23**	0.098	0.101
C3	0.111	0.187	**H24**	0.106	0.190	**C3**	0.135	0.245	**H24**	0.111	0.119
C4	0.081	-0.106	**H25**	0.096	0.157	**C4**	-0.169	-0.199	**H25**	0.103	0.104
C5	-0.144	-0.111	**H26**	0.094	0.158	**C5**	0.016	-0.015	**H26**	0.103	0.105
C6	0.284	0.341	**H27**	0.095	0.158	**C6**	0.098	0.250	**H27**	0.099	0.105
C7	0.370	0.430	**H28**	0.116	0.196	**C7**	0.198	0.291	**H28**	0.124	0.124
C8	-0.142	-0.217	**H29**	0.121	0.117	**C8**	-0.120	-0.130	**H29**	0.114	0.119
C9	-0.136	-0.137	**H30**	0.137	0.126	**C9**	-0.050	-0.063	**H30**	0.138	0.100
C10	0.556	0.862	**H31**	0.121	0.148	**C10**	0.387	0.697	**H31**	0.120	0.091
C11	0.034	-0.191	**H32**	0.144	0.160	**C11**	-0.213	-0.293	**H32**	0.132	0.122
C12	-0.096	-0.102	**H33**	0.141	0.154	**C12**	-0.023	-0.034	**H33**	0.133	0.124
C13	-0.095	-0.165	**H34**	0.141	0.156	**C13**	-0.098	-0.092	**H34**	0.136	0.127
C14	-0.075	-0.128	**N35**	-0.335	-0.567	**C14**	-0.071	-0.077	**N35**	-0.220	-0.286
C15	-0.096	-0.164	**N36**	-0.435	-0.352	**C15**	-0.105	-0.091	**N36**	-0.312	-0.380
C16	-0.088	-0.105	**N37**	-0.411	-0.618	**C16**	-0.021	-0.035	**N37**	-0.365	-0.469
C17	-0.084	-0.034	**N38**	-0.327	-0.334	**C17**	-0.138	-0.031	**N38**	-0.215	-0.277
C18	-0.360	-0.359	**O39**	-0.542	-0.659	**C18**	-0.244	-0.182	**O39**	-0.392	-0.532

C19	0.288	0.339	**O40**	-0.528	-0.710	**C19**	0.250	0.259	**O40**	-0.322	-0.503
C20	0.157	0.227	**O41**	-0.524	-0.662	**C20**	0.140	0.164	**O41**	-0.277	-0.446
H21	0.121	0.197	**O42**	-0.432	-0.562	**H21**	0.117	0.116	**O42**	-0.338	-0.466

Table 6. The calculated dipole moments data B3LYP/HF 631G(d,p)/ 6311G(d,p) of the molecule

	Dft/631G	**Dft/6311G**	**Hf/631G**	**Hf/6311G**
μ_x	-0.9451	-0.9097	-1.6273	-1.6055
μ_y	4.1544	4.1733	5.9378	5.8610
μ_z	-0.1641	-0.1783	0.3787	0.2856
μ_{Toplam}	4.2637	4.2750	6.1684	6.0836

Results and Discussion

In this work, geometrical parameters and spectroscopic parameters such as IR, ^{1}H-NMR and ^{13}C-NMR spectra of molecule are calculated by Density Functional Theory (DFT) and Hartree-Fock (HF) methods with the 631G(d, p) and 6311G(d, p) two different basis sets. Obtained spectroscopic parameters are compared with experimental data. Furthermore, calculated theoretical data with the 631G(d, p) and 6311G(d, p) basis sets are compared with each other. The chemical shifts in the calculations ^{1}H-NMR and ^{13}C-NMR and IR vibrational frequencies are found to be compatible with the experimental data. Theoretical and experimental carbon and proton chemical shifts ratios between according to a, b ve R^2 values, a linear correlation were observed. Furthermore, IR vibrational frequencies experimental carbonyl peak (C=O) was found in 1706 cm^{-1} and theoretical (C=O) peak was found in 1768 cm^{-1} for 631G(d,p),1762 cm^{-1} for 6311G(d,p). The negative frequency in the IR data was not found. This result shows that the structure of compound was shown to be stable. In addition, bond lengths, dipole moments, the HOMO-LUMO energy and Mulliken charges are calculated theoretically by using the B3LYP/HF 631G (d,p) and 6311G (d,p) basis sets.

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POST-CONFLICT, TRANSITIONAL AND FAILED STATES

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Abstract: Post-conflict, transitional and failed states are the concepts which are used to describe states, and have been used widely by many academic researchers as synonyms; post-conflict and transitional concepts, in particular. Thus, this paper aims to present the differences between the concepts of post-conflict, transitional, and failed states. This paper argues that although these concepts have similar characteristics and are used as synonyms, there are several differences between them, and they do not have the same meaning.

The finding of this paper is that the concepts of post-conflict and transition could be described as stages or phases which a state may pass through before it will become a stable state, depending on the factors that may affect them. There are some factors which may have a crucial impact on the final shape of the state, such as the political history of the state, the reasons for it changing its shape, war or changing the political system, for instance. In addition, this paper has described all of these states by providing their characteristics and conditions, and finally providing examples for every one of these states.

In conclusion, this paper presents the important differences between the concepts of post-conflict, transitional and failed states by providing the features, conditions and examples of each one of these states.

***Keywords**:* State, conflict, post-conflict, transition, failure, collapsed state

Introduction

The concepts of post-conflict, transitional and failed state are the controversial concepts which are used to describe the state formation in its different aspects. Even though these concepts share some similar characteristics, it is difficult to differentiate between them. This might be due to the distinctive features and conditions which they have.

Therefore, this paper identifies the concepts of the post-conflict, transitional and failed states not only by analysing the characteristics and conditions of these states, but also by providing the most common definitions of these concepts. Thereafter, with the purpose of analysing the contextual framework of post-conflict, transitional and failed states, it might be necessary to start with the definitions of the modern state in both institutional and functional terms and definitions of armed conflict. By doing this, the differences between failure and collapse of state may become clear, and the differences between the concepts of post-conflict, transitional and failed state will be distinguished as well.

Research Methods

A doctrinal legal research methodology that involves analysis of secondary sources will be employed in this research. Secondary sources will primarily consist of academic texts and journal articles, as well as contemporary media and industry-specific commentary. It is from such sources that information will be generated and used for the study. Such sources will be procured from libraries, books, journals, relevant websites and documentation centres.

This paper is based on a global literature review of the topics related to the concepts of post-conflict, transitional and failed states. As a study dependent on using secondary resources, no ethical approval was required. The aim was to carry out an exploratory analysis of approaches, themes and findings of recent writing relating to post-conflict, transitional and failed state concepts. Published studies from recent years were sought using the following search terms: state, post-conflict, post-war, peace-building, transition, fragile, Arab Uprising, failed state, government, transitional governments, sovereignty, security, welfare, collapse and other concepts that related to the concepts of the post-conflict, transitional and failed states.

Identification of the Concepts of Post-conflict, Transitional and Failed States

In order to identify the concepts of post-conflict, transitional and failed states, it seems to be crucial to start by providing a brief definition of a state, a conflict, and then the impacts of conflict on the formation of a state. The reason behind this is an attempt to present a full understanding and identification of these concepts of state. Moreover, another reason is that armed conflict or war has been considered important for several reasons that may influence the stability of state and lead it to become a post-conflict, transitional or even failed state. Therefore, by doing this, the distinction between these concepts may become clear; post-conflict and transitional states in particular.

The concept of state will now be defined, which is analytical as well as normative. A state can be defined as 'Groups of people which have acquired international recognition as an independent country and which have a population, a common language and a defined and distinct territory[1]'. In the same regard, Farley defined a state as 'Sovereign states which have three absolute prerogatives: independence, equality and unanimity. Independence means a state is completely free to organize any system of government, proclaim an official religion of its choice, and structure its economy as it sees fit'[2].Further, the state can be defined in accordance with their responsibilities, which is that a state has the ability to deliver the basic services and security to its citizens and ensure the protection of human rights[3]. That means the state may be defined as a sovereign state, which has a legitimate government controlling a specified territory and is recognised internally and internationally, and also has an ability to protect the human rights of its citizens and deliver basic services and security to them.

After providing a brief definition of the state, let us now turn to the definition of an armed conflict or war. According to the UNEP, an armed conflict is a dispute involving the use of armed force between two or more parties, and according to international humanitarian law, there are two distinctive kinds of armed conflicts, namely international armed conflict and non-international armed conflict[4]. Moreover, the same report has defined a civil war as a non-international armed conflict in which a war occurs between factions, organised groups or regions of the same country[5]. In another report of UNEP, conflict has been defined as 'a dispute or incompatibility caused by the actual or perceived opposition of needs, values and interests. In political terms, conflict refers to wars or other struggles that involve the use of force'[6].

Moreover, the concept of conflict can be defined as clashing or engaging in a fight, a confrontation between one or more parties aspiring towards incompatible or competitive means or ends[7]. In regard to terms and concepts of peace and conflict, the war concept is defined as 'a mutually recognised, hostile exchange of actions among two or more parties (such as between or within nation-states) conducted by conventional military forces, paramilitary forces, or guerrillas to achieve respective policy objectives'[8].However, some of these different conflicts are country-wide such as in Iraq, Rwanda and Libya, whereas others such as Sudan are localised in specific parts of a country.

An armed conflict is also defined by the Uppsala Conflict Data Project as a contested incompatibility that concerns government or territory or both, where the use of armed force between two parties results in at least 25 battle-related deaths. Of these two parties, at least one is the government of a state. A state is defined here as an internationally recognized sovereign government controlling a specified territory, or a non-recognized government whose sovereignty is not disputed by another internationally recognized sovereign government previously controlling the same territory[9].

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[1] Duhaime's Law Dictionary, [online] < http://www.duhaime.org/LegalDictionary/S/State.aspx> accessed 12/04/2017

2 See Lawrence T. Farley, *Plebiscites and Sovereignty: The Crisis of Political Illegitimacy* (Westview Special Studies in International Relations)(Boulder, Colo. : Westview Press ; London, Eng. : Mansell Pub., c1986)

[3] See Christopher E. Millar, *A Glossary of Terms and Concepts in Peace and Conflict Studies* (2nd edn, University for Peace 2005) p35

4 See UNEP, 'Protecting the environment during armed conflict, An inventory and analysis of international law' (UNEP, November 2009) <www.un.org/zh/events/environmentconflictday/pdfs/int_law.pdf> accessed 01/03/2016.

5 ibid

6 See UNEP, 'From Conflict to Peacebuilding The Role of Natural Resources and the Environment' (UNEP, February 2009) <www.unep.org/pdf/pcdmb_policy_01.pdf> accessed 13/03/2016.

[7] See Christopher E. Millar, *A Glossary of Terms and Concepts in Peace and Conflict Studies* (2nd edn, University for Peace 2005)22

[8] Ibid 79

[9] See Gleditsch, Nils Petter and others, 'Armed conflict 1946-2001: A new dataset' (2002) 39(5) J Peace Res 615

In the period 1949-2001, there were 225 armed conflicts[10], and recently this number has increased more and more, after 2011, for example, when the Arab Uprising was conducted in Arabic countries such in Syria, Yemen and Libya. These conflicts could be defined as revolutionary wars, which are episodes of violent conflict between governments and politically organised groups (political challengers) that seek to overthrow the central government, to replace its leaders, or to seize power in one region. Conflicts here most likely include substantial use of violence by one or both parties[11].However, states during and after armed conflicts likely face challenges related to a lack of the resources crucial to sustain the basic institutions of governance, and provision of public services to their residents is most likely to be affected by armed conflict and civil wars[12].It is important to note that most recent conflicts are internal or intra-state conflicts; in other words, most protected political crises that may lead to armed conflicts are occurring within rather than between states[13]. In this regard, Peter Wallensteen identifies three general forms of conflict: interstate, internal, and state-formation conflicts. Interstate conflicts are disputes between nation-states or violations of the state system of alliances. The international community, however, has become increasingly concerned with the rise in frequency and intensity of internal conflicts, which are contributing to the expanding nature, sophistication, and, at times, legitimisation of interventionist policies. Examples of internal and state-formation conflicts include civil and ethnic wars, anti-colonial struggles, secessionist and autonomous movements, territorial conflicts, and battles over control of government. Recently, attention has also focused on 'global conflicts', where non-state groups combat international and regional organisations[14].

As mentioned above, the reason for providing the definition of notions of state and conflict, and armed conflict in particular, is an attempt to be responsible for fully understanding the point of view of concepts of post-conflict, transitional and failed states. However, when the war or conflict comes to an end, it opens the door for the peace stage to start, which raises questions about the concepts of post-conflict, transitional and failed states which will be discussed in the next section.

Post-Conflict State

It is worth noting that there is substantial literature on working with the post-conflict concept which has provided definitions for the concept of a post-conflict state; however, researchers have defined this concept based on the sight of a very complex and context-determined post-conflict period. In this regard, post-conflict could be defined as a process in which warfare is absent, but it is not exactly a presence of peace[15]. However, a post-conflict situation may not be identified easily, because this process is different based on the kind of war. In the big international wars, post-conflict – defined as a negotiated cessation of hostilities –and/or peace talks followed by a peace treaty mark possible 'ends' to conflict. But in internal wars, this situation may be difficult to apply, as a result of the continuing hostilities within the state even after the peace agreement was signed and the parties of the war agreed to establish the peace[16]. In other words, in post-conflict situations, not only has the violence been reduced and conflict become less violent, but also the features of peace may become more

[10] Ibid 615

[11] See Mony G. Marshall and others, 'PITF- STATE FAILURE PROBLEM SET: International Wars and Failures of Governance, 1955-2014' political instability (formerly, state failure) Task Force (PITF) 6 May 2015 [online]<https://www.revolvy.com> accessed 25/02/2016. P.5

[12] See Chirtopher S. Chivvis and Jeffrey Martini, Libya *After Qaddafi, Lessons And Implication For The Future* (1st edn, RAND Corporation 2014) p.53

[13] See Mark Duffield, 'Post- Modern Conflict: Warlords, Post- Adjustment States And Private Protection' (1998) 1 Civil Wars <http://www.tandfonline.com/loi/fciv20> accessed 5 April 2017 p.66

[14] See Peter Wallensteen, *Understanding Conflict Resolution* (3rdedn, London, Sage Publications 2002) p.15

[15] See Lakhdar Brahimi, 'State Building in Crisis and Post-conflict Countries, at the 7th Global Forum on Reinventing Government Building Trust in Government 26-29 June 2007' (2007) 6 <www.unpan1.up.org> accessed 02/04/2016 p.3

[16] See Graham Brown, Arnim Langer and Frances Stewart, 'A Typology of Post-Conflict Environments' (September 2011) 1 Centre for Research on Peace and Development (CRPD) <https://lirias.kuleuven.be/handle/123456789/330374> accessed 29 February 2016 P.4

recognised in this period[17].In this context, Larry Diamond defined the post-conflict states as the states which emerge, or in some cases try to emerge, from a period of external or more commonly civil war; such states are Lebanon, Nicaragua and Liberia[18]. Similarly, another researcher has described post-conflict as a country or area where conflict ceases and has become active and post-conflict government is recognised by a political transformation[19]. However, Sophie Witter has classified post-conflict states as fragile states because they share many characteristics[20]. Therefore, a post-conflict situation can be described as a stage when the state has passed from conflict to peace.

But what main characteristics of the post-conflict state can be analysed from the above definitions? Prior to that, it is important to realise that the characteristics of a state which has suffered from conflict are likely affected by the characteristics of the conflict itself such as a kind of war; international or inter-state war. Such wars happened in Arabic countries in 2011, a duration of war; for example, the civil war in Libya in 2011 lasted nine months, whereas ongoing war which also started in 2011in Syria is still continuing today; a geographical location of state, international intervention and the economic system[21]. All of these factors can be a potential in determining the features of the state after the end of conflict and have significant influence on post-conflict and transitional stages of the progress of state transformation to meet the conditions of a stable state.

In this context, starting with the post-conflict state which as defined above is a country when conflict ceases to be active; in this situation, the conflict becomes more or less violent, more or less manifest or latent, but rarely stops at all[22].In spite of this fact, empirical experience with various post-conflict situations in different parts of the world shows that the crimes and privatized violence record high levels and the polarization of domestic politics have been increased during these periods[23]. According to Sophie, about 40% of countries collapse back into conflict, particularly developing countries, which are most likely to relapse into conflict again[24].

In addition, the post-conflict state is characterised by weakening state authority and capacity. This weakness influences other aspects of reformation of the state, however, there are a series of enabling conditions and potential obstacles which may face a state during this period which make post-conflict policy-making more or less difficult in different countries. Such obstacles which affect the security situation in the post-conflict environment are capacity, inclusivity, form or degree of the government and available international resources[25]. In this regard, even though the post-conflict states in most cases have a new government after the overthrow of the previous government and its leaders, the new one may deal with the problems in respect of legitimacy in order to become recognised by the internal and international community. As mentioned previously, the key dilemma that appears in the post-conflict state is related to lack of security, which leads to the collapse of the

[17]See Shary Charlotte Henriette Pattipeilohy and Hanafi Rais, 'Typology And Causes Of Post Conflict Violence In Aceh (2005-2012)' (2015) 3 Journal of Global Peace and Conflict <https://dx.doi.org/10.15640/jgpc.v3n1a3 > accessed 13 April 2017 P.38

[18]See Larry Diamond, 'Promoting Democracy In Post-Conflict And Failed States, Lessons And Challenges' (2006) 2 Taiwan Journal of Democracy <http://http://www.tfd.org.tw/export/sites/tfd/files/publication/journal/dj0202/05.pdf> accessed 13 April 2017 P.94

[19]See Sophie Witter, 'Health Financing In Fragile And Post-Conflict States: What Do We Know And What Are The Gaps?' (2012) 75 Social Science & Medicine <http://www.sciencedirect.com/science/article/pii/S0277953612006752> accessed 10 April 2017 P.2370

[20]Ibid p.2371, and See Patrick Tom, *Liberal Peace and Post-Conflict Peace building in Africa* (1st edn, Palgrave Macmillan 2017) p.23

[21]See Graham Brown, Arnim Langer and Frances Stewart, 'A Typology of Post-Conflict Environments' (September 2011) 1 Centre for Research on Peace and Development (CRPD) <https://lirias.kuleuven.be/handle/123456789/330374> accessed 29 February 2016 P.6

[22]See Roy Licklider, 'The consequences of Negotiated Settlements in Civil Wars, 1945-1993' (2015) 89 (3) American Political Science Review

[23]See Larry Diamond, 'Promoting Democracy In Post-Conflict And Failed States, Lessons And Challenges' (2006) 2 Taiwan Journal of Democracy <http://http://www.tfd.org.tw/export/sites/tfd/files/publication/journal/dj0202/05.pdf> accessed 13 April 2017 P.95

[24]See Sophie Witter, 'Health Financing In Fragile And Post-Conflict States: What Do We Know And What Are The Gaps?' (2012) 75 Social Science & Medicine <http://www.sciencedirect.com/science/article/pii/S0277953612006752> accessed 10 April 2017 P.2370

[25]See Graham Brown, Arnim Langer and Frances Stewart, 'A Typology of Post-Conflict Environments' (September 2011) 1 Centre for Research on Peace and Development (CRPD) <https://lirias.kuleuven.be/handle/123456789/330374> accessed 29 February 2016 P.4

systems and institutions within the state that assist to establish a stable society function[26].Due to the lack of security, the government cannot deliver most core functions to its citizens and there is a notable lack in its capacity to manage the resources of the country, protect the rights of its people and deliver basic services to them[27].

Overall, the post-conflict concept could be described as a state in which war comes to an end and it has an opportunity to establish the peace, with several obstacles which may face the state during this progress. This situation might be due to the influences of war on the formation of the state, which weakens the state in respect of its functions and institutions, thus many of the post-conflict states are described as fragile states because they do not have an effective, legitimate government that has the capacity to deliver core services and basic security to its citizens. However, in some instances, in the post-conflict state when active conflict ceases, there is a political transformation to a recognised post-conflict government. This government deals with the issues related to peacetime in order to pass through the next phase, which is a political transitional stage when the state may become more stable as will be illustrated later.

Transitional State

The transition concept is often related to the political aspect of the re-formation of the state and establishing a new regime. In this context, the political transition could be defined as the interval between the demise of one political regime and installation of a new (emergent) political regime. It is a process where new rules are being shaped during an interregnum managed by a provisional regime[28]. The political transitions may also be known as the transition paradigm which has conceptualised a normative theoretical framework based on the fundamental assumption that any state which shifts away from authoritarianism is a state in transition to democracy. The setting up of the new democratic regime is presumed to follow a precise political path; the breakdown of the authoritarian regime, the emergence of a democratic opposition, negotiations between the relevant social and political actors, the enactment of a new constitution, followed by elections and the establishment of a new democratic structure[29]. That means the transitional political change not only refers to removing one government from power and replacing it with another, but also refers to changing the regimes of political structure and function[30]. Such regimes are the range of institutions, infrastructure, actors, procedures, values, ideas and languages[31]. However, evaluating a political transition period, it appears that its outcomes depend on temporal distance (structural factors) and temporally proximate factors (external factors), and these factors may affect the process of the transition and influence the choices and decisions of the political actors which, at the end, could affect the shape of the state[32]. Such factors include the economic situation, the history, the institutional legacies, the ethnic characteristics of population and the socio-cultural dimension[33].The transitional period has played a crucial role in the transit from the one period to the next one, particularly to establish the peace after the conflict. That is because of its impacts on the shape of the state. Hence, according to UNEP, the state, in the transitional period, usually has weak governance institutions and experiences, and this may lead to an institutional vacuum, as a result[34].

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[26] See Lakhdar Brahimi, 'State Building in Crisis and Post-conflict Countries, at the 7th Global Forum on Reinventing Government Building Trust in Government 26-29 June 2007' (2007) 6 <www.unpan1.up.org> accessed 02/04/2016 p.3

[27] See Sophie Witter, 'Health Financing In Fragile And Post-Conflict States: What Do We Know And What Are The Gaps?' (2012) 75 Social Science & Medicine <http://www.sciencedirect.com/science/article/pii/S0277953612006752> accessed 10 April 2017 P.2371

[28] See Yossi Shain, Linz J. Juan and Berat Lynn , *Between States: Interim Governments in Democratic Transitions* (Cambridge University Press, 1995)

[29] See Marina Rafti, *A Perilous Path to Democracy: Political Transition and Authoritarian Consolidation in Rwanda*.(Institute of Development Policy and Management, University of Antwerp, 2008) p 8

30 See Imad El-Anis and Ashraf Hamed, 'Libya after the civil war: Regime Change and Democratisation' (2013)2(3) Journal of Conflict: Transformation& Security, 174-193. P177

31 See Stephen Krasner, *International Regimes*, (London, Cornell University Press,1983) p21

[32] See Marina Rafti, *A Perilous Path to Democracy: Political Transition and Authoritarian Consolidation in Rwanda*.(Institute of Development Policy and Management, University of Antwerp, 2008) p 10

[33] See Larry Diamond, 'Promoting Democracy In Post-Conflict And Failed States, Lessons And Challenges' (2006) 2 Taiwan Journal of Democracy <http://http://www.tfd.org.tw/export/sites/tfd/files/publication/journal/dj0202/05.pdf> accessed 13 April 2017 P.73

[34] See UNEP, 'From Conflict to Peacebuilding The Role of Natural Resources and the Environment' (UNEP, February 2009) <www.unep.org/pdf/pcdmb_policy_01.pdf> accessed 13/03/2016. p19

It is important to note that a war could be considered as the most important reason for establishing a transitional state, yet there are other reasons which may lead a country to transit from one regime to another, such as the secession of part of the state to create a new state, as happened in the Soviet Union, or a change in the form of the state, as an adjustment to the political system of the republic into a mass, as happened in Libya in 1977[35], and the revolutions, as happened in the Arab Spring in 2011[36], including Libya. Furthermore, the most important and difficult one as mentioned above is transition from conflict to peace, whether internal or external war, because of the chaos that permeated all sectors in the country after the end of war.

Even though transitional states share common and similar features, these features differ from country to country and situation to situation, because the states have been influenced by their particular circumstances. For example, low-income countries such Rwanda have faced difficulties more than others[37], as well as the countries which have natural resources such Libya also perhaps facing different difficulties, according to UNEP[38]. In addition, states, after the end of war, seem to be non-functional states because of the weakness of the government during a chaotic conflict period[39]. Moreover, a transitional period is a complex process and may take different periods; some states take a short time such as Sir Lanka, while others may take a long time, such as Northern Ireland[40].It is recognised that the period after the end of conflict is complex and context-determined and could be divided into different stages; emergency and stabilisation (0-11 months post-conflict); transition and recovery (12-47 months after the cessation of war); peace and development (4-10 years)[41]. Furthermore, although in most cases of a transition period the state may be characterised by establishing a new regime, the old regime in some instances may remain and influence the new one, such as in Libya, in which the old regime and its legacy cast a long shadow on the transitional period[42].Other features of the transitional state could be understood from the definition from the 'transition paradigm' that is used to describe any country in which there is a shift away from an authoritarian regime being a country in transition to democracy[43]. This paradigm points to three phases on the path to establish and build a democracy in the transitional states; opening, breakthrough and consolidation. In the first phase, the political transition starts and coincides with a reformist move which is supported by the authority of the government. The next phase is the breakthrough stage, in which is recognised the establishment of a new democratic government that coincides with the collapse of the old regime, and conducts national elections and enacts a new constitution. The last phase is consolidation, in which the democracy is shaped and materialises through the implementation of state reforms, the holding of periodic elections and the promising of civil society[44].It is important to note that the transition period in many aspects could be considered as a temporary phase which may lead either to democracy or, in some instances, a return to the pre-transitory state, or even lead the state to become a failed state. However, from the contemporary cases such as the Arab Uprising, including Libya, there has been neither a democratic transition nor a return to authoritarian pre-transitory politics[45].

Failed State

As mentioned earlier, the state passes through the transitional stage and sometimes it cannot reach this stage successfully, so it may fail at the end of the path to peace. The state in this situation is called a failed state. In spite of the fact that there are several definitions of failed state, the academic researchers tend to describe failed

35 See Hafizullah Emadi. 'Libya: The Road to Regime Change' (2012) 14(2) Global Dialogue. p 128

36 See Lisa Anderson. 'Demystifying the Arab spring' (2011) 90(3) Foreign Affairs. p2

37 See Graham Brown, Arnim Langer and Frances Stewart, 'A Typology of Post-Conflict Environments' (September 2011) 1 Centre for Research on Peace and Development (CRPD) <https://lirias.kuleuven.be/handle/123456789/330374> accessed 29 February 2016 P.4

38 See UNEP, 'From Conflict to Peacebuilding The Role of Natural Resources and the Environment' (UNEP, February 2009) <www.unep.org/pdf/pcdmb_policy_01.pdf> accessed 13/03/2016. P21

39 See Cerwyn Moore, *Contemporary violence: postmodern war in Kosovo and Chechnya* (Oxford University Press, 2010)

40 See Graham Brown, Arnim Langer and Frances Stewart, 'A Typology of Post-Conflict Environments' (September 2011) 1 Centre for Research on Peace and Development (CRPD) <https://lirias.kuleuven.be/handle/123456789/330374> accessed 29 February 2016 P.4

41 See Sophie Witter, 'Health Financing In Fragile And Post-Conflict States: What Do We Know And What Are The Gaps?' (2012) 75 Social Science & Medicine <http://www.sciencedirect.com/science/article/pii/S0277953612006752> accessed 10 April 2017 P.2371

42 SeeMieczystaw P. Boduszyński and Duncan Pickard, 'Libya Starts From Scratch' (2013) 24 Journal of Democracy. P86

43 See Thomas Carothers, 'The end of the transition paradigm' (2002) 13(1) Journal of democracy 5. P6

44 See Ingrid Nifosi, 'A NEW CONCEPTUAL FRAMEWORK FOR POLITICAL TRANSITION: A CASE-STUDY ON RWANDA' (1994) 20 Résumé. P73

45 See Joshua Stacher, 'Fragmenting states, new regimes: militarized state violence and transition in the Middle East' (2015) 22(2) Democratization 259. P260

states than define them. In this regard, Potter considered a state as a failed state when it has a weak government, which loses its ability to deliver the basic political, economic, social, and other crucial requirements to its citizens[46]. That means he linked the failure of the state and its sovereignties or responsibilities towards its citizens. Similarly, Barma linked the failure of a state with the significant functions of the modern state, and he reported that a state fails when it becomes unable to impose its sovereignty on its citizens and territory, as well as losing its capacity to protect its national boundaries[47].

In the context of the characteristics of the failed states, the countries in this period have shared some common features in general, however, in some situations the failed states have special features which make them different from others in relation to the reason that leads to failure.
In recent years, there has been a notable rise in the number of political problems, which may lead to a rise in the number of countries which may be described as failed or collapsed states[48]. Further, the main common characteristics of the failed states are; having a weak government or in some cases having more than one non-functional government; losing control over the borders of the country; decreasing levels of GDP per capita; increasing corruption levels; declining levels of life expectancy due to a weak health system and a rise in violence and extreme poverty; rising crime levels; limitation in the educational system[49].

The other characteristics of the failed state are that governments in this stage of the state, are usually described as weak governments which could not enforce the laws even though it may have the possibility of imposing some bans[50]. As a result of this weakness of the governance authorities as mentioned above, the state has witnessed an appearance of unofficial forms. These local forms have taken place spontaneously to offer private protection to the government, as well as legal and illegal enterprises[51].

Moreover, Rolf argued that a state becomes failed in functional terms when it fails to provide three substantial functions; welfare, representation, and security. He described the failed state as the state which has become unable to maintain its most core functions or is unable to continue to provide its functions[52]. Accordingly, the term ‘failed state’ refers not only to the inability of the state to deliver basic services and security to its citizens, but also refers to its unwillingness to meet such responsibilities[53]. The reasons for the failure of states are important because of the effects of them on the shape of the country as a result. However, there are many debates about these reasons and their results on the failure of a state at the end. It is important to realise that the political conflict or the political division could be considered as an important reason for the failure of the state. That is because the authority inside the state is divided between two or more governments, a situation which results from the weakness of the governance institutions and in some instances leads the country to return to conflict again. Thus, the governments lose their authority to control overall the territory of the country. This situation could be illustrated by the situation of Somalia, which is the most famous example of a failed state in modern history. In addition to this reason, there are other reasons which can lead to a state being failed, such as corruption, war, history of the state and international intervention. However, in many cases a state does not fail solely for one reason, but it fails because of multiple reasons, when many factors combine together, leading to the failure of a state. In this regard, Haiti is an example of a state which failed because of its history and this country is now considered a real example of a failed state[54].In this regard, there are other concepts related to a failure of the state, such as a collapsed state which will be illustrated later.

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[46] See Donald w. Potter, 'State responsibility, sovereignty, and failed states' (University of Adelaide, Australasian Political Studies Association Conference. Adelaide2004) p4

[47] See Rolf Schwarz, 'Post-conflict peacebuilding: the challenges of security, welfare and representation' (2005) 36(4) Secur Dialogue 429. P431

[48] See Monty Marshall, Gurr Robert and Harff Barbara, 'Political Instability Task Force: Internal Wars and Failures of Governance, 1955-2006' (2001) [online]<http://globalpolicy.gmu.edu/pitf/pitfcode.htm> accessed 22/02/2016.

[49] See Donald w. Potter, 'State responsibility, sovereignty, and failed states' (University of Adelaide, Australasian Political Studies Association Conference. Adelaide2004) p3

[50] See Sandra F. Juireman, *where there is no government: Enforcing property rights in common law Africa* (Oxford University Press, 2011) p34

[51] Ibid p35

[52] See Rolf Schwarz, 'Post-conflict peacebuilding: the challenges of security, welfare and representation' (2005) 36(4) Secur Dialogue 429. P430

[53] See Christopher E. Millar, *A Glossary of Terms and Concepts in Peace and Conflict Studies* (2nd edn, University for Peace 2005) p34

[54] See Charles T., Call, 'The fallacy of the ‘Failed State’' (2008) 29(8) Third World Quarterly 1491.

The Distinction Between State Collapse and Functional State Failure

As mentioned early, a failed state could be defined as a state which has a weak government that loses its authority to control its country and becomes unable or unwilling to deliver basic services to its citizens. However, there are few countries which could be described as failed states in recent years, and these states should be distanced from collapsed states. To distinguish between these concepts, it may be necessary to mention the relation between these concepts and the nature of the modern states in institutional and functional terms. Taking this into account, states fail when they are no longer willing or able to carry out their functions or bear responsibilities for their citizens. Such responsibilities of the state include delivering political goods and security, health, education and economic systems, law and order, and legitimate governance. As a result, the failure to deliver these basic services leads a state to become a failed state, or in some cases become a collapsed state, which is an extreme version of a failed state where there is a total vacuum of authority[55]. In this context, other researchers defined the state collapse as being when order breaks down completely and a war of all against all emerges, and they distinguish between state collapse and functional state failure, which is a kind of de-formation in which the state fails to provide crucial functions to its citizens[56]. The collapsed state refers to a situation where national structures or institutions that are meant to implement its responsibilities have disappeared, dissolved or lost their ability to act[57].

Differences Between the Concepts of Post-conflict, Transitional and Failed States

In spite of the fact that the concepts of post-conflict, transitional and failed states share similar characteristics and conditions, and in some cases it may be difficult to distinguish between them– post-conflict and transitional states in particular – the evaluation of these concepts appears that there are some differences between each other, and other concepts relate to them such as state collapse and state functional failure. These concepts could be described as stages that the country passes through in its path to peace, when the war comes to an end. The state which has been affected by conflict has become a post-conflict state and then a transitional state, and finally some of these transitional states meet the conditions of the stable states, whereas others fail to meet these conditions and become a failed state or even a collapsed state. However, it is important to note that as mentioned above, not all of the transitional states are affected by conflict and were post-conflict states before; that is because some of them are described as transitional states due to changing their political system and replacing the old regime with a new regime. In other words, the reason for the transit from one political shape to another, or reformation of the shape of the state and establishing a new political system, is not always the conflict, but can be for other reasons such as the secession of part of the state to establish a new one, such as in the Soviet Union, or changing the political system within the country such as in Libya in 1977, when the form of state was changed from the republic system to a mass (Jamahiriya) system. Let us return now to the differences between the post-conflict, transitional and failed states. The most important distinction among these states is the degree of effectiveness of the government[58]. In other words, the main characteristic which could be used to distinguish between the concepts of post-conflict, transitional and failed states is the legitimacy and effectiveness of the government in these periods because of other issues such as security and welfare, which rely on the degree and power of the government. In other words, when the government is unable or unwilling to take on its responsibilities or deliver basic services, such as security, to its citizens, it will lose part or even all of its authority to control its territory, and as a result, other problems such as violence and corruption will spread within this country. Also, the non-government actors will appear in this situation and this will impact negatively on the function and authority of the government and lead it to become more non-functional and ineffective.

In this regard, the post-conflict state usually has a new government after the overthrow of the previous government and its leaders, and the new one may need to deal with the problems in respect of legitimacy in order to become recognised by the internal and international community. As mentioned previously, the key dilemma that appears in the post-conflict state is related to lack of security, which leads to the weakness of the systems

[55] See Donald w. Potter, 'State responsibility, sovereignty, and failed states' (University of Adelaide, Australasian Political Studies Association Conference. Adelaide2004) p3,4

[56] See Rolf Schwarz, 'Post-conflict peacebuilding: the challenges of security, welfare and representation' (2005) 36(4) Secur Dialogue 429. P430

[57] See Christopher E. Millar, *A Glossary of Terms and Concepts in Peace and Conflict Studies* (2nd edn, University for Peace 2005) p34

[58] See Larry Diamond, 'Promoting Democracy In Post-Conflict And Failed States, Lessons And Challenges' (2006) 2 Taiwan Journal of Democracy <http://http://www.tfd.org.tw/export/sites/tfd/files/publication/journal/dj0202/05.pdf> accessed 13 April 2017 P.95

and institutions within the state that assist in establishing a stable society's functions[59].Due to the lack of security, the government cannot deliver most core functions to its citizens and there is a notable lack in its capacity to manage the resources of the country, protect the rights of its people and deliver basic services to them[60]. In the same regard of the government, even though the state in the transitional period also has weak governance, institutions and experience, and thus, this may lead to an institutional vacuum[61], this government is more recognised by the international and internal community which will support this government to work on the ground and enable it to function effectively[62]. That means even though the governments in both periods of post-conflict and transition are usually fragile due to the lack of security and political experience, the government in most cases of the transitional period is more functional, more recognised and more legitimate. On the contrary, a failed state has a weak government or even a non-functional government which loses its ability to deliver the basic political, economic, social, and other crucial requirements to its citizens[63]. The government in this situation loses its authority to control overall the territory of the country and as a result becomes unrecognised by the international and internal community.

Conclusion

This paper starts with identification of the concepts of the post-conflict, transitional and failed states and provides the characteristics and conditions of each one of these states in order to distinguish the differences between them. However, prior to this, the definitions of the armed conflict and state itself haven been provided in order to introduce the target concepts and in an attempt to present a full understanding and identification for these concepts of states. The post-conflict, transitional and failed states are the concepts convergent in meaning, and sometimes it could be difficult to differentiate between them to describe the status of the state. Accordingly, by analysing the conceptual framework of the post-conflict, transitional and failed state, it appears that these concepts could be referred to the sequent stages of the state which affected by the armed conflict and the state in each stage has different features and conditions. It also appears that there are other concepts which may have a close meaning in these concepts, such as state collapse and failure functional states. However, the main point that could be used to distinguish between the post-conflict, transitional and failed states is the degree of legitimacy of their government. In this respect, in all of these periods there is a new government which has been established and a new regime has been replaced the old one. Hence, the governments of these states are likely weak and ineffective functional governments. Additionally, the weakest and most ineffective one is the government of the failed state, which could be described as a non-functional government, and post-conflict government is also weaker but is not in the same level of the failed state because it may have some power to control its country and deliver basic services and goods to its citizens. Further, even though the governments of the transitional state are also weak and in many cases face several problems related to legitimacy and security, they are likely more effective and functional and more recognised by the international and internal community. Finally, It is important to note there is a difference between the concept of the failed state or failure of a functional state and the concept of a collapsed state. States fail when they are no longer able or even willing to carry out their functions or bear responsibilities for their citizens, while a collapsed state refers to a state where is a total vacuum of authority, and where national structures or institutions that are meant to implement responsibilities of states have disappeared, dissolved or states lost their ability to act.

[59] See Lakhdar Brahimi, 'State Building in Crisis and Post-conflict Countries, at the 7th Global Forum on Reinventing Government Building Trust in Government 26-29 June 2007' (2007) 6 <www.unpan1.up.org> accessed 02/04/2016 p.3

[60] See Sophie Witter, 'Health Financing In Fragile And Post-Conflict States: What Do We Know And What Are The Gaps?' (2012) 75 Social Science & Medicine <http://www.sciencedirect.com/science/article/pii/S0277953612006752> accessed 10 April 2017 P.2371

[61] See UNEP, 'From Conflict to Peacebuilding The Role of Natural Resources and the Environment' (UNEP, February 2009) <www.unep.org/pdf/pcdmb_policy_01.pdf> accessed 13/03/2016. p19

[62] See Joshua Stacher, 'Fragmenting states, new regimes: militarized state violence and transition in the Middle East' (2015) 22(2) Democratization 259. P262

[63] See Donald w. Potter, 'State responsibility, sovereignty, and failed states' (University of Adelaide, Australasian Political Studies Association Conference. Adelaide2004) p4

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COMPACT TRI-BAND PARALLEL COUPLED SIR BASED Y-SHAPED BANDPASS FILTER FOR WiMAX AND WLAN APPLICATIONS

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Abstract: In this study, a new compact tri-band bandpass filter was introduced. The filter utilized three operating bands centered at 1.8 GHz, 3.6 GHz, and 5 GHz with return loss of -33.8 dB, -26.9 dB, and -18.1 dB respectively. These bands are widely used for worldwide interoperability for microwave access (WiMAX) and wireless local area network (WLAN) applications. Y-shaped step impedance resonator structure is used to resonate at the designed frequencies. The operation mechanism of the filter can be analyzed by an even- and odd-mode transmission line theory as the structure is an even symmetrical around electrical or magnetic wall. The resonator structure is parallel coupled with a pair of 50 Ω input/output ports. The coupling structures can realize at least two transmission zeros around each of the operating band by proper inter-coupling between the feeding and the filter resonator. The filter is designed on substrate of 10.8 dielectric constant and 1.27 mm thickness. The filter is analyzed and optimized using the full wave Electromagnetic simulator. Five transmission zeros are exist at 0.1, 1.38, 2.3, 4.66, and 6.8 GHz with transmission loss of -44.2, -57.9, -44.3, -67.9, and -38.4 dB respectively. These zeros provide a good out of the band spurs rejection. The center frequency of the designed bands can be easily refined by the filter dimensions. The overall dimension of the filter is $0.42\lambda_g \times 0.46\lambda_g$ (where λ_g is the guided wavelength at the lower frequency band of 1.8 GHz) corresponding to 27.3 mm x 30 mm.

Keywords: SIR resonator, microstrip bandpass filter, WLAN applications, WiMAX, tri-band filter

Introduction

The recent development of modern communication systems increase the demand for circuits containing filters, oscillators, amplifiers, and antennas etc., operate in a wide variety of frequency bands. This opens the way toward the design and developments of multi-frequency band miniaturized components with reduced size, weight, complexity, and cost.

Multi-band filters have become very popular in innovative designs research for modern wireless systems application. These systems include the Global Positioning System (GPS), Worldwide Interoperability for Microwave Access (WiMAX), and wireless local area networks (WLANs).
Planar resonators are commonly used in modern filter design. They are designed using the microstrip structure. These microstrip planar filters have been implemented using different types of resonator structures. From literature, the resonator may be designed with inter-digital coupling structure (Ge and Jin, 2015), loop resonator (Jackson and Jayanthy, 2014**),** stepped impedance resonator (SIR) (Abdalla and Smith, 2010; Zhu, Ahmed , and Abbosh , 2015), ring resonator (Chang, 1996), meandered lines (Hong and Lancaster, 1996), square-ring-loaded resonator (Chen et al., 2011; Doan, Che, and Feng, 2012) and dual and multilayer filters with apertures on the ground plane (Luo, Ma, and Li, 2011; Hong and Lancaster, 1999).

Multi-band filters are designed and implemented for the purpose of filter miniaturization. Resonator mostly used for multi-bands are split-ring resonators (Geschke, Jokanovic, and Meyer, 2011), square-ring-loaded resonator (Chen et al, 2011) and step impedance resonators.

The stepped impedance resonator filters (SIRs) are used to realize high performance bandpass filters. The resonant frequencies of a SIR can be tuned by adjusting the impedance ratios of the transmission line sections. Dual and triple band bandpass filter using tri-section SIR filter are described in (Packiaraj, Ramesh, and Kalghatgi, 2006; Lin and Chu, 2007).

In this paper, a tri-band microstrip bandpass filter with a Y-shaped SIR resonator. The SIR resonator consists of three section of transmission line with different impedance ratios. The structure is parallel coupled to the input/output ports. The overall structure of the filter provides three transmission bands applicable for GSM, LTE, WiMAX and WLANs. The designed filter is analyzed and simulated using the full wave Electromagnetic Simulator.

Proposed Y-Shaped Sir Based Resonator Analysis

The transmission line model of the proposed Y-shaped SIR resonator is shown in Fig.1. The resonator structure is symmetrical along the electrical or magnetic wall. The even-odd method can be used to simplify the analysis of the equivalent circuit as shown in Fig.2. The characteristic impedances Z_1, Z_2, and Z_3 are corresponding to the electrical lengths θ_1, θ_2 and θ_3 of the transmission line sections respectively.

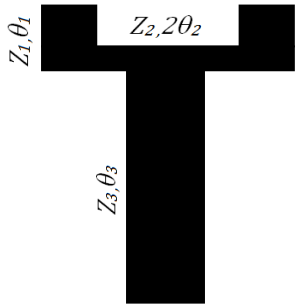

Figure 1. Transmission Line Configuration Of Y-Shaped SIR Resonator

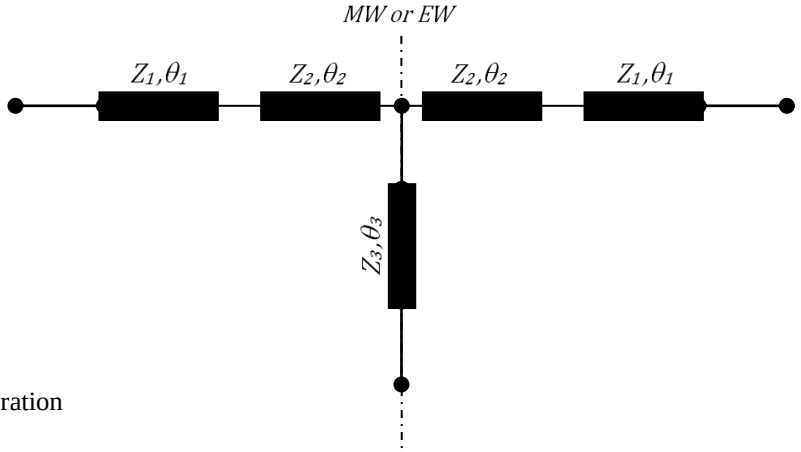

Figure 2. The Equivalent Circuit Of Y-Shaped Resonator

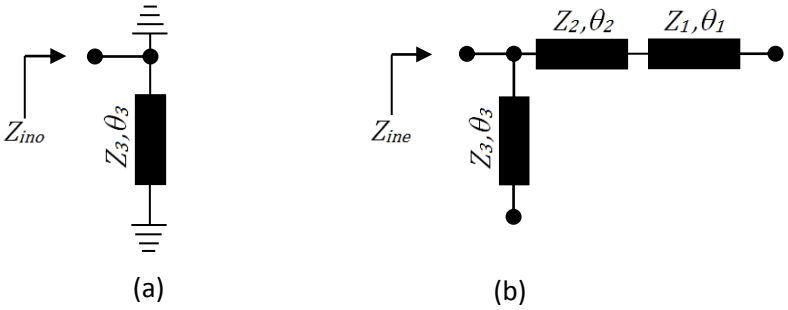

Figure 3. Equivalent Circuits For Analysis (a) Odd Mode (b) Even Mode

The input admittance of the odd mode section of Fig. 3(a) gives:

$$Y_{in} = -jY_2 \frac{Y_1 - Y_2 \tan\theta_1 \tan\theta_2}{Y_2 \tan\theta_1 + Y_1 \tan\theta_2} \quad (1)$$

$$Y_{ino} = -jY_3 \cot\theta_3 \quad (2)$$

When Y_{ino} enforced to zero, then

$$Y_3 \cot\theta_3 = 0 \quad (3)$$

The input admittance of the even section of Fig. 3(b) gives:

$$Y_{ine} = jY_3 \tan\theta_3 + Y_2 \frac{jY_1 \tan\theta_1 + jY_2 \tan\theta_2}{Y_2 - Y_1 \tan\theta_1 \tan\theta_2} \quad (4)$$

Similarly, when $Y_{ine} = 0$, the even mode analysis leads to:

$$Y_1Y_2 \tan\theta_1 + Y_2^2 \tan\theta_2 + Y_2Y_3 \tan\theta_3 - Y_1Y_3 \tan\theta_1 \tan\theta_2 \tan\theta_3 = 0 \quad (5)$$

The transmission zeros of the circuit in Fig. 1 can be calculated by equating Y_{ino} and Y_{ine} in (3) and (5) that leads to:

$$Y_1Y_2 \tan\theta_1 + Y_2^2 \tan\theta_2 + Y_2Y_3 \tan\theta_3 - Y_1Y_3 \tan\theta_1 \tan\theta_2 \tan\theta_3 - Y_3 \cot\theta_3 = 0 \quad (6)$$

$$R_{Z3} \tan\theta_1 + R_{Z2} \tan\theta_2 - R_{Z1} \tan\theta_1 \tan\theta_2 \tan\theta_3 + (1 - Z_2Z_3 \cot\theta_3) = 0 \quad (7)$$

Where $R_{Z1}=\frac{Z_2}{Z_1}$, $R_{Z2}=\frac{Z_3}{Z_2}$, $R_{Z3}=\frac{Z_3}{Z_1}$ defines the impedance ratios of the three sections of the SIR resonator.

From (7) it seems clear that the locations of transmission zeros depend on the transmission line impedances Z_1, Z_2, Z_3, and the corresponding electrical lengths θ_1, θ_2 and θ_3 respectively. By proper selection of these parameters, transmissions zeros can be found and located by using full wave Electromagnetic Simulators.

Proposed Design of Sir Based Y-Shaped Tri-Band Filter

The proposed filter structure is shown in Fig.4. The resonator is a single Y-shaped SIR resonator consist of three transmission line sections with different impedances Z_1, Z_2, Z_3 and lengths L_1, L_2, and L_3 respectively. These lengths are in correspondence to the electrical lengths θ_1, θ_2, and θ_3 respectively. The resonator and the 50 Ω feeding ports are parallel coupled through two coupling plates. The resonator structure and the amount of coupling will excite different modes in the resonator. The resonant frequencies are located according to the resonator dimensions and the coupling structure.

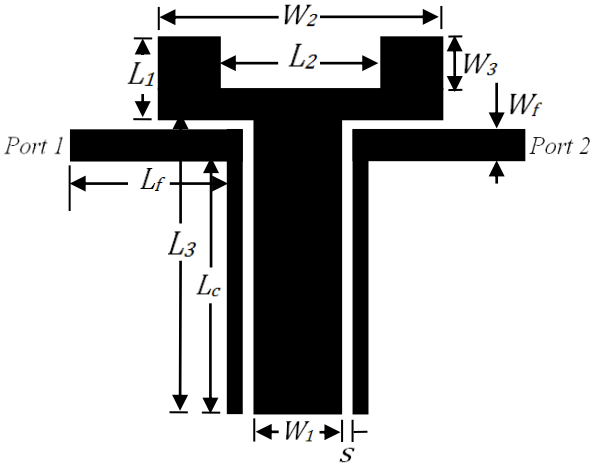

Figure 4. Proposed Filter Configuration Based On Y-Shaped SIR Resonator.

Table 1. Equivalent Circuit Parameters

Design parameter	Designed value	Units
Z_1	30.2	Ohm
Z_2	37	Ohm
Z_3	21.18	Ohm
θ_1	0.325	rad
θ_2	0.909	Rad
θ_3	1.221	Rad

The substrate used in the design of the filter is Rogers RO3210 with relative dielectric constant of 10.8 and thickness of 1.27 mm. Based on the circuit analysis given in the previous section, a tri-band BPF shown in Fig. 4 is constructed in the full-wave simulator. The related circuit parameters at the center frequency of 1.8 GHz are listed in Table 1.

Simulation and Results

The structure of the filter is optimized using the Electromagnetic Simulator. The final dimensions in (mm) are: L_1=4.8, L_2=13.4, L_3=18, L_c=16.8, L_f=10.9, W_1=4.7, W_2=19, W_3=2.8, W_f=1.1, S=0.2. Fig.5 shows the simulated frequency response of the filter. The frequency response has three transmission bands located at 1.8, 3.6 and 5 GHz with a return loss of -33.8, -26.9 and -18.1 dB respectively. Five transmission zeroes are clearly observed at 0.1, 1.38, 2.3, 4.66 and 6.84 GHz with a return loss of -44.2, -57.9, -44.3, 67.9 and -38.4 dB respectively. The response of the transmission loss (S_{21}) has skirt shape around the transmission bands. These provide good out of the band spurs rejection. The transmission bands are highly needed for wireless communication and can be re-tuned through the selection of dimension parameters.

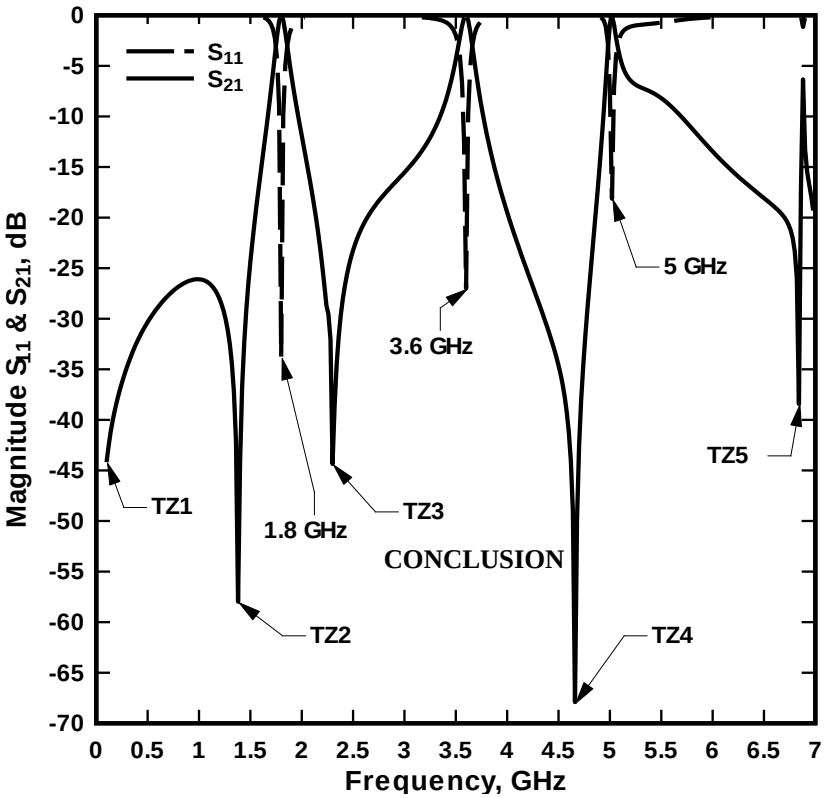

Figure 5. Frequency Response Of The Filter: Return Loss (Slotted) Line And Insertion Loss (Solid) Line

Tri-band bandpass filter based on Y-shaped SIR resonator has been presented and analyzed. Even and odd modes of the resonator structure are analyzed and the transmission zeros and pass bands are allocated using the full wave Electromagnetic simulator. The results of modeling and simulating a tri-band filter show the creation of five transmission zeros caused in a skirt shape response around each of the three bands. The filter was compact size, simple shape and low profile with tri-band operation suitable for many wireless applications.

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ACTUAL PROBLEMS OF ENSURING THE DURABILITY OF BUILDING CONSTRUCTIONS

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Abstract: Based on mathematical models there were synthesized engineering calculation method and developed a computer program to determine the time of completion of the initial stage of the cement concrete corrosion of the second type.

Keywords: Corrosion, building constructions, concrete, mass transfer, mathematical modeling methods

Introduction

Currently 75% of residential and industrial buildingsare subject to the aggressive actions of the external environment.Therefore, the study of corrosion processes of building structures is topical from a scientific and practical point of view.

Solution of problems of concrete and reinforced concrete objects durability is impossible without a clear understanding concerning the mechanism of processes, experimental data characterizing the influence of various factors on the kinetics and dynamics of corrosion mass transfer.The laws of mass transfer is general for the whole variety of natural phenomena, give the possibility of rational design of building structures in accordance with the exploitation regime, optimal material selection,evaluation of thestructurestate [1]. Methods of mathematical modeling in the study of concrete corrosion process have not yet been widely used in practice, although their benefits are obvious [2].

Methods and Results

On the basis of theoretical and experimental research it is necessary to work out the mathematical model mass transfer in the process of corrosion of the second type of cement concrete in a closed system "liquid-reservoir", to carry out its analysis at the level of phenomenological equations that allows to calculate the concentration of a portable component ("free calcium hydroxide") in thickness of structures at any time, its content in the liquid phase and the average thickness and volume structures and ultimately, to determine the completion time of the initial stage of cement concretecorrosion of the second type.

As the model corrosive aqueous solutions, acting on the cement concrete we investigated 2% $MgCl_2$ and 0,001% HCl.

Corrosion of the second type becomes much more complicated, there can be allocated six consistently interrelated stages of corrosion destruction: chemical interaction of aggressive substance dissolved in the pores of the concrete "free calcium hydroxide" on the surface of the concrete; diffusion of "free calcium hydroxide" through the porous structure of concrete to the reaction surface till the moment of reaching a concentration of decomposition of highly basic compounds; promotion of the reaction front zone "free of calcium hydroxide" into the concrete with the appearance of the reaction product; penetrating of the aggressive component from the solution into the porous structure of concrete through a layer of the reaction product; highly basic chemical decomposition reaction of cement stone with forming soluble compounds or amorphous products; diffusion of soluble reaction products to the interface "liquid - concrete" and mass transfer into liquid medium [3].

At a certain stage of corrosion development there occurs the moment when the concentration of the carried component on the border with aggressive environment becomes zero.The task of the mass transfer from diffusion-kinetic controlled external, internal diffusion and chemical kinetics is to transfer into mass transfer problem controlled by only the internal diffusion and chemical kinetics. The general solution of the problem of

mass conductivity controlled within the diffuse resistance and chemical kinetics has the form obtained by Laplace transform method.

Conclusion

On the basis of the mathematical model the engineering calculation method was synthesized and developed a computer program to determine the time of completion of the initial stage of cement concrete corrosion of the second kind. Experimentally and theoretically was showed that for the cement concrete the duration of the initial period of corrosion of the second type by the impact of 2% aqueous solution of $MgCl_2$ may be about 2.8 years and under the influence of 0.0001% aqueous solution of HCl is nearly 2,4 years since the construction start-up into exploitation before reaching the saturation concentration "of free calcium hydroxide", composing 1,1kg/m^3 (counting on CaO) in the pores of the concrete, at which begins the decomposition of highly basic compounds of the cement stone.

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SIGNIFICANCE MULTIVARIATE CORRELATION (SMC) STATISTIC OF OCCIPITAL (OZ) ELECTROPHYSIOLOGICAL SIGNAL CORRELATED WITH OUR FEELINGS AS WHAT SEE IS LIKE WHEN WE SEE

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Abstract: We move from the features of the occipital (Oz) electrophysiological signal characterized in (Pereira 2015) towards the instantaneous amplitude and frequency of event-related changes correlated with a contrast in access and in our feelings as what see is like when we see (i. e., phenomenology). From previous calculations we obtained results related to empirical mode decomposition (EMD) with post processing (Xie et al. 2014) and Hilbert-Huang Transform (HHT), calculation of the variance inflation factor (VIF), partial least squares regression (PLSR) and the minimal root mean squared error of prediction (RMSEP). These are previous results, here we present the significance multivariate correlation (sMC) statistic of these results.

Keywords: Electroencephalography, occipital, vision, consciousness and feelings, empirical mode decomposition (EMD), Hilbert-Huang Transform (HHT), variance inflation factor (VIF), partial least squares regression (PLSR), the minimal root mean squared error of prediction (RMSEP), partial least squares regression (PLSR), significance multivariate correlation (sMC) statistic

Introduction

The relevant computation to the effect of the occipital correlates of the distinction between access and phenomenology (Pereira 2015) is the computation of the high degree of visibility 4-5 assigned by the participants in both experiments to the correctly identified stimuli (and what there are more in the second experiment is more incorrect answers than in the first experiment), because to distinguish electrophysiologically the access from phenomenology we need that access and phenomenology will be cognitively consciousness of something and we need that access be the same for all participants in the two experiments [1: 337-339].

Notwithstanding, as evoked signal, the change in ERPs phase (frequency is the change in phase over time) is instantaneous, that is, the frequency will transiently be infinite: a transient peak in frequency (positive or negative), if any, is instantaneous in EEG averaging or filtering that the ERPs required and the underlying structure of the ERPs in the frequency domain cannot be accounted, for example, by the Wavelet Transform (WT) or the Fast Fourier Transform (FFT) analysis, because they require that frequency is derived by convolution (frequency are pre-defined and constant over time) rather than by differentiation (without predefining frequency and accounted that frequency may vary over time).

Methodology

Now, we move from the features of the occipital (Oz) electrophysiological signal (such as the amplitude and latency of peaks) of the (Pereira 2015) towards the decomposition of amplitude and to the instantaneous frequency resulting from this decomposition: the instantaneous amplitude and the instantaneous frequency of occipital (Oz) event-related changes correlated with a contrast in access and with a contrast in phenomenology.

Despite that the Wavelet or the Fourier Transform are the methods most widely used for analysing the linear (proportionality or additivity) and stationary (the signal, and so the time series representing this signal, has the same mean and variance throughout) properties of the EEG signal, the EEG signal have nonlinear (nonproportionality or nonadditivity) and non stationary (signal's statistical characteristics change with time) properties.

However, one suitable method for analyse the instantaneous change in event-related brain potentials (ERPs) phase and accounted for a transient peak in frequency (positive or negative), if any, in the underlying structure of the ERPs is the Empirical Mode Decomposition (EMD) with post processing (Xie et al. 2014), Ensemble Empirical Mode Decomposition (postEEMD).

The Wavelet or the Fourier Transform analyse the signal in time-frequency-energy (Wavelet) and in frequency-energy (Fourier) domain without discrete feature extraction (Wavelet, with continuous feature extraction) or without discrete or continuous feature extraction (Fourier).
However, the Hilbert-Huang Transform (HHT) analyse the signal in time-frequency-energy domain for feature extraction.

For example, either the Fourier functions or the EMD functions are oscillations with zero mean derived from the decomposition of a signal (for example, ERPs) that when summed together reconstitute the original signal.
However, whereas the Fourier functions are called harmonic functions meaning that they amplitude and frequency are constant over time, the EMD functions are called Intrinsic Mode Functions (IMFs) meaning that they amplitude and frequency may vary over time.

Once the Intrinsic Mode Functions have been extracted and post processing (Xie et al. 2014), the Hilbert-Huang Transform can be used to display the underlying structure in the amplitude and frequency domain of the grand average occipital electrical activity characterized in (Pereira 2015).

Data

Given the occipital (Oz) electrophysiological signal recording in (Pereira 2015) with a duration of 1150 ms, defined as 150 ms before the stimulus (baseline) and 1000 ms after its occurrence, there are 8 ERPs correlated with combined target-mask presentations and with isolated presentations of square or diamond and of mask or pseudo-mask.

The Empirical Mode Decomposition (EMD) with post processing (Xie et al. 2014) resulted in 56 occipital variables (7 postIMFs by each of the 8 ERPs) in amplitude domain and resulted in 56 occipital variables in frequency domain with 460 observations each: 230 observations (the EEG records duration of 1150 ms) by each of two experiments.

Results

Given the calculated minimal value that we can use to measure with less error of prediction (namely, 23 variables in Oz instantaneous amplitude and 40 variables in Oz instantaneous frequency) the propagation of the remaining values around the variability between the two experiments (Pereira 2015), which variables are important for the variability between the two experiments (Pereira 2015) are assessed by significance multivariate correlation (sMC) statistic (Afanador et al. 2016), (Thanh et al. 2014) of the partial least squares regression (PLSR) (Mevick et al. 2007) results, cross-validated using 10 random segments (setting 59 as the seed).

In other words, which variables are important for the variability between the two experiments (Pereira 2015) are assessed by comparing the ratios between the variable-wise Mean Squared Errors (MSE) and the mean squared of its residuals to an F-test with 1 and N - 2 degrees of freedom (the cut-off is based on the F-test, because appeared that the cut-off based on the mean was influencing negatively the predictions): the variables that exceed the F-test threshold are selected.

If we set 59 as the seed, the significance multivariate correlation (sMC) statistic, with a correction of 1st order auto-correlation in the residuals, "out-of-bag" (OOB) validation and with 1000 cross-validation bootstrap samples, selected the following variables as important for the variability between the two experiments (Pereira 2015) in Oz instantaneous amplitude and in Oz instantaneous frequency.
Related to Oz instantaneous amplitude, the 4 variables postIMF 6 SquarePseudo, postIMF 7 diamo, postIMF 4 SquareMask, postIMF 4 DiamondMask, empirical decomposed and post processing (Xie et al. 2014) from Oz event-related changes (Pereira 2015), are selected as important for the variability between the two experiments in instantaneous amplitude.

Related to Oz instantaneous frequency, the 6 variables postIMF 7 Pseudomask, postIMF 6 SquarePseudo, postIMF 5 SquarePseudo, postIMF 5 SquareMask, postIMF 6 DiamondPseudo and postIMF 7 diamo, empirical decomposed and post processing (Xie et al. 2014) from Oz event-related changes (Pereira 2015), are selected as important for the variability between the two experiments in instantaneous frequency.

Conclusions

The repeated measures analysis of variance (ANOVA) with the experiment I and experiment II (Pereira 2015) as a between-subjects factors and the postIMF variables selected as important by significance multivariate correlation (sMC) statistic as a within-subject factors gave the following significant (Greenhouse-Geisser correction for violations of the sphericity) results for Oz instantaneous amplitude [$F(1.197,548.082)= 146.612$, $p < 0.001$, $\eta p^2 = 0.24249$, 90% CI [0.96 , 1.29], $\eta G^2 = 0.14940$]. For Oz instantaneous frequency, the repeated measures ANOVA results are [$F(3.111,1424.755)= 73.586$, $p < 0.001$, $\eta p^2 = 0.13843$, 90% CI [0.64 , 0.96], $\eta G^2 = 0.08082$] (Oz). See (Lakens 2013), for calculating and reporting effect sizes.

The statistically significant contrast in the variability of intrinsic mode functions, empirical decomposed and post processing (Xie et al. 2014) from occipital (Oz) event-related changes (Pereira 2015), between the two experiments correlated with a contrast in access is for the instantaneous amplitude within the 3 variables postIMF 6 SquarePseudo, postIMF 4 SquareMask, postIMF 4 DiamondMask (Oz).

Related to instantaneous frequency, the statistically significant contrast in the variability of intrinsic mode functions between the two experiments correlated with a contrast in access is within the 4 variables postIMF 6 SquarePseudo, postIMF 5 SquarePseudo, postIMF 5 SquareMask and postIMF 6 DiamondPseudo (Oz).
The statistically significant variability between the two experiments correlated with a contrast in our feelings as what see is like when we see (phenomenology) is for the instantaneous amplitude within the 1 variables postIMF 7 diamo (Oz) (fig.1).

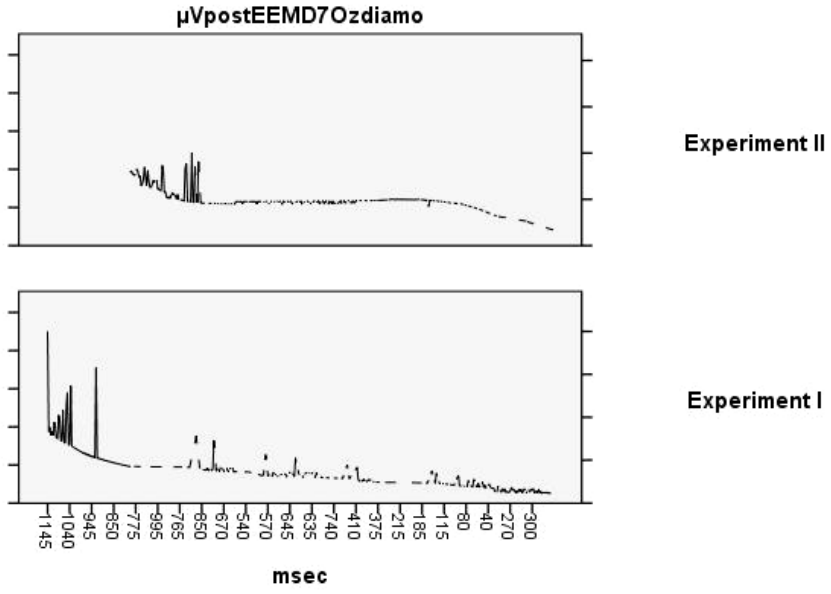

Figure 1. The statistically significant variability between the two experiments correlated with a contrast in phenomenology is for the instantaneous amplitude within the 1 variables postIMF 7 diamo (Oz).

Related to instantaneous frequency, the statistically significant contrast in the variability of intrinsic mode functions between the two experiments correlated with a contrast in our feelings as what see is like when we see (i.e., phenomenology) is within the 1 variables postIMF 7 diamo (Oz) (fig. 2).

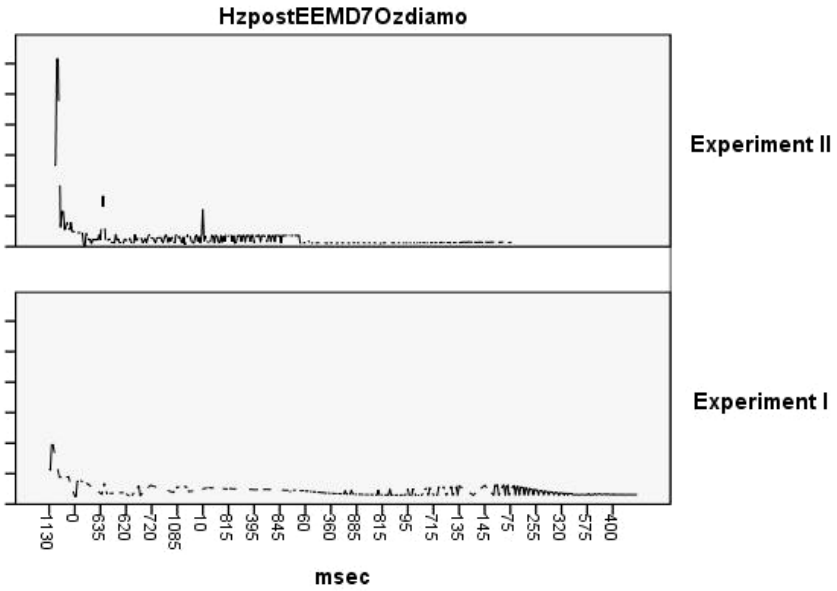

Figure 2. The statistically significant variability between the two experiments correlated with a contrast in phenomenology is for the instantaneous within the 1 variables postIMF 7 diamo (Oz).

These intrinsic mode functions explain the variability of the occipital electrical activity co-occurring with a contrast in access distinctly from the variability of the occipital electrical activity co-occurring with a contrast in our feelings as what see is like when we see (i.e.,phenomenology) (Pereira 2015).

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INVESTIGATING APPLYING DIGITAL DEADBEAT CONTROLLER TO AUTOMATED ANESTHESIA INJECTION SYSTEM

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Abstract: Anesthesia is not only important for surgery but also for intensive care. The anesthetic agent, e.g. a barbiturate, is administered intravenous anesthesia to effect. Intravenous anesthesia provides rapid onset, stable maintenance, and rapid recovery compared with inhaled anesthetics. The aim of this work was to investigate a reliable and safe controller for delivering automatic intravenous anesthesia system using simulated closed-loop control technology.

Drug effect is measured during drug infusion in closed loop anesthesia (CLAN). This may provide superior safety, better patient care, and better quality of anesthesia whilst relieving the clinician of the need to make recurrent and minor alterations to drug administration. A new and generic mathematical model (Pharmacokinetic/Pharmacodynamics PK/PD) of the drug behavior inside the body was used in simulation of closed-loop control drug pumping.

Deadbeat controller is used to control the drug pumping using the PK/PD patient's drug effect model and different parameters were investigated to determine their effects on the final response of the patient to the anesthesia. The investigated parameters are, different levels limiter to limit the control signal (drug infusion), and the number of the digital bits used in the digital controller that affect the performance of the anesthesia system. These investigating lead to the best values which give best results.

The CLAN system was tested using published data of virtual patients modelled. MATLAB \R2015 is used to simulate the proposed controller trying to reduce the dependency on external sensors as a feedback to the control system. The results were very optimistic which lead us to continue the work in the future using different controllers at a certain sequence to enhance the overall intravenous anesthesia performance.

Keywords:Digital controller, Anesthesia feedback control system, patient's model Anesthesia control system

Introduction

The major difficulty in the design of closed-loop control during anesthesia is the inherent patient variability due to differences in demographic and drug tolerance. These discrepancies are translated into the pharmacokinetics (PK), and pharmacodynamics (PD). These uncertainties may affect the stability of the closed loop control system. This paper aims at developing predictive controllers using Deadbeat controller. This study develops patient dose-response models and to provide an adequate drug administration regimen for the anesthesia to avoid under or over dosing of the patients.

Modeling the Patient Response to Anesthesia

Target controlled infusion (TLC) systems were introduced as a step toward automated anesthesia (Absalom, A. and M. M. R. F. Struys, 2007). The TCI system depends on a patient model to compute an adequate infusion profile, which is subsequently delivered to the patient intravenously by means of computer controlled infusion pump. A TCI system is an open-loop feed – forward controller. The anesthesiologist sets a target drug concentration in state of an infusion rate. This is either a blood plasma or effect site (brain) drug concentration, depending upon the TCI system (Pouke, G. E. V ,etal, 2004) It is clear that TCI systems are sensitive to model error and lack a mechanism to counteract disturbances. There are many TCI systems available on several markets, where the dosing regimen has not yet obtained the FDA (the United States Food and Drug Administration) approval. Diprifusor is the oldest commercial TCI system that provides TCI propofol (Glen, J. B.,1998).

The closed – loop control drug dosing regimen is based on feedback from a measure of clinical effect,([Bibian, S, etal ,2005) and (Absalom, A. R,2011). In the literature there are two types of controllers reported; one in

which the controller directly sets the infusion rate of a computer controlled infusion pump, and the other one where the controller sets the target of a TCI system around which it is cascaded, as illustrated in figure(1). The anesthesiologist still plays an important role when a closed – loop controlled drug dosing strategy is used. As illustrated in figure (2) below, the controlling role of the anesthesiologist, frequently adjusting the infusion profile or target concentration, is handled by the feedback controller. However, the expertise of the anesthesiologist is still needed e.g. to predict and counteract disturbances. Robust closed-loop controller can handle all these issues to some extent, but there will always be outlier cases, requiring manual attention. There is also the possibility that manual attention is needed to resolve complications originating either from the surgery or the anesthesia itself, or from equipment failure.

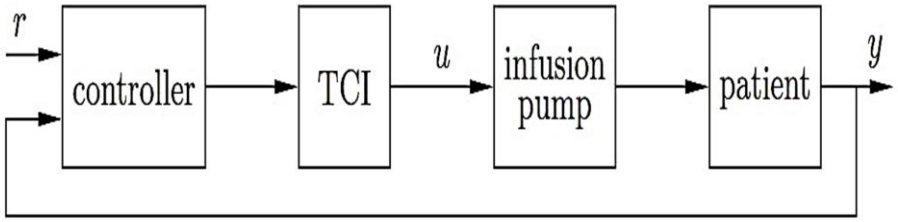


Figure 1. Cassaded control of a TCL system

A lot of research related with automatic control of anesthesia has been made, in the last decade, where most of them use the intravenous drug propofol as the hypnotic agent. There are two trends of works either signal – based control, as PID (Liu, N. , etal, 2006) , (Dumont, G.A ,etal ,2009), and fuzzy controllers (Gil, F.G.,2004), or a model – based control, depending on the controller structure (Ionescu, C.M ,etal , 2008), (Nino J ,etal ,2009), the controlled variable (Struys, M. M. R. F , etal, 2001), (awaguchi, Y , etal ,2003), (Furutani, E ,etal, 2005) and the prediction model used (Sreenivas, Y, etal , 2008), (Syafiie, S , etal ,2009). A comparative study between predictive control and PID techniques applied to the control anesthetic is done in (Sreenivas, Y, etal, 2009).

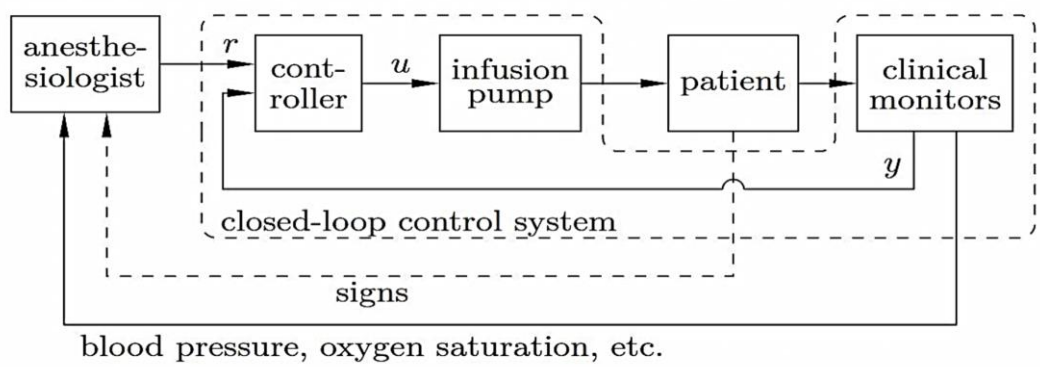


Figure. (2) Closed- loop control

It is clear from above, that the TCI and closed – loop controlled drug dosing regimens rely on patient model; TCI relies directly on the model while the closed –loop approach relies on model indirectly to tune the controller. The most common model structure used to describe the redistribution, elimination and effect of anesthetic drugs, can be decomposed into a series connection of a pharmacokinetic (PK) model relating drug infusion, distribution and elimination and a pharmacodynamics (PD) model, relating effect site concentration to clinical effect. This combined model is referred to as a PKPD model (Derendorf, H. and B. Meibohm ,1999). Nowadays, the PK/PD scheme has three compartments and the biophase (Hull C.J. ,1979), as shown in figure (3), where the volume V_1 is considered the blood compartment or central compartment; volume 2 or second compartment V_2, the fast or vessel-rich compartment, and the volume 3 or third compartment V_3, the slow or vessel-poor compartment. The concentration in the central compartment is defined as the plasma concentration (Cp).

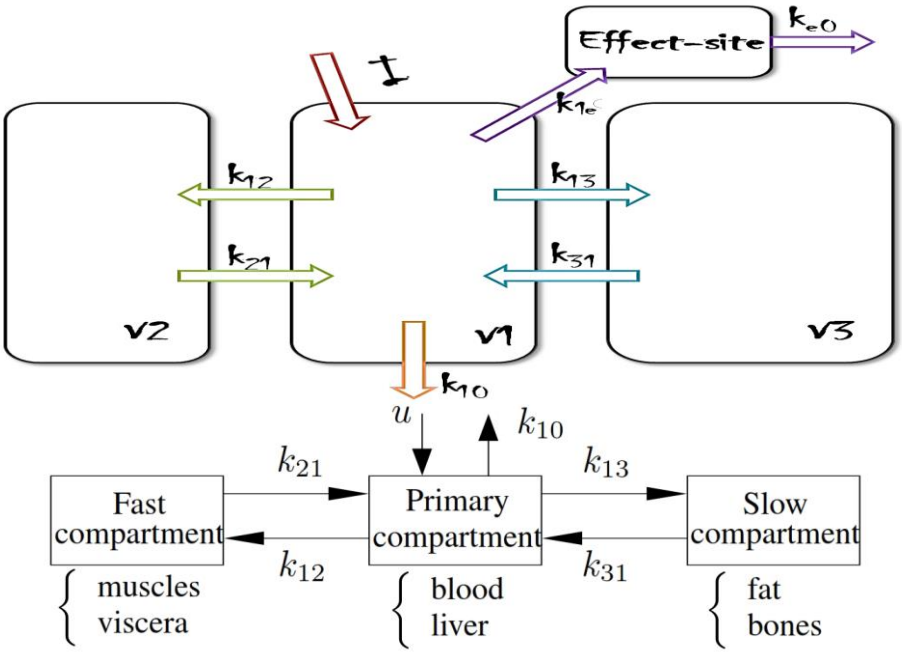


Figure. (3) Pharmacokinetic Model. V_1: volume 1, V_2: volume 2, V_3: volume 3, k_{ij}: constant rates

The PK/PD model simulates the drug behavior inside the body. When a drug dose is administered (I) into the central compartment, it is transferred to the second and the third compartments, as expressed by the rate constants represented by k_{ij}, where i and j express the transfer and elimination between compartments i and j. The rate constant k_{10} is the elimination constant of the drug from the organism.

To better understand the pharmacology of a drug, it can be divided into two phases as follows:

• PK phase:

When a drug is administered intravenously, it goes into the blood, the so called central compartment, from where it is distributed, metabolized and excreted. Pharmacokinetics describe what the body does to the drug (Johansen, J. W. and P. S. Sebel , 2000)

$$PK \equiv G2a(s) = \frac{1\,(s+k21)(s+k31)}{V1(s+p1)(s+p2)(s+p3)}$$

• PD phase:

Part of the drug administered reaches the effect organ that is the organ where the drug will produce the desired clinical effect.

$$PD \equiv G2b(s) = \frac{keo}{s+keo}$$

Where:

$p_1=k_{31}+k_{21}+k_{12}+k_{13}+k_{10}$;

$p_2=k_{31}*k_{21}+k_{13}*(k_{12}+k_{21}) + k_{10}*(k_{21}+k_{31})$;

$P_3=k_{21}*k_{31}*k_{10}$;

The plasma concentration (Gp(t)) is obtained by:

$$G_p(t) = \frac{M1(t)}{V1(t)}$$

Where,

V1 = Vc · Patient Weight

Vc is a parameter from the PK model. If I(t) = 0 t > 0 the plasma concentration

(G_p (t)) is defined in time by:

$$G_p(t) = A \cdot e^{-\alpha.t} + B \cdot e^{-\beta.t} + G \cdot e^{-\gamma.t}$$

Where A, B, C, a, β, γ are pharmacokinetics parameters and t is the time since the bolus. The effect-site concentration (C_e (t)) in time is a convolution of the C_p over time with the disposition of the effect-site (chao dong, 200), as follows:

$$C_e(t) = C_p(t)\,(1\text{-}e^{-keo.t})$$

$$C_e(s) = \frac{keo}{s+keo}\,Cp(s)$$

Deadbeat Controller

A deadbeat controller is a digital controller that places all the closed loop poles in the origin. (From the analog point of view, it is placing closed loop poles at s=-inf, since $z=e^{Ts}$, ie. system reaches set point very fast) For n-zero poles, it guarantees that the system reaches the set point in n steps. The cost is that overshoot is usually very high, and the control signal required may be expensive to generate. As such, it is only used in extreme situations, such as weapons systems (Warwick, Kevin ,1986).
The deadbeat response has the following characteristics:
1. Zero steady-state error
2. Minimum rise time
3. Minimum settling time
4. Less than 2% overshoot/undershoot
5. Very high control signal output

Proposed Method

Based on the depth of anesthesia model (Kristian Soltész ,2013), shown in figure (4), the proposed method of controlling the drug dosing is to apply the deadbeat controller in the internal path of the DOA system. Thus the deadbeat controller is designed to eliminate the effects of the poles of the patients model PKPD (3 poles of PK model, and 1 pole of PD model) to transform the transfer function of the controller from s- domain to z-domain. Tustin approximation ($s = \frac{\frac{2}{T}z-1}{z+1}$) is used to transform the transfer function of the controller from s- domain to z-domain, where T is the sampling period. The resultant transfer function in the z-domain is:

$G_{c\ deadbeat}(s) = (s+p_1)*(s+p_2)*(s+p_3)*(s+k_{e0})$

$G_{c\ deadbeat}(z) = \frac{\sum_{i=0}^{4} b_i z^{-i}}{\sum_{i=0}^{4} a_i z^{-i}}$

Since, there are four poles to be deleted by the proposed controller and due to using the Tustin approximation then the order of the deadbeat controller is also four ($G_{c\ deadbeat}$ (z) illustrated above), so that the response of inner loop system must reach the input signal within four samples.

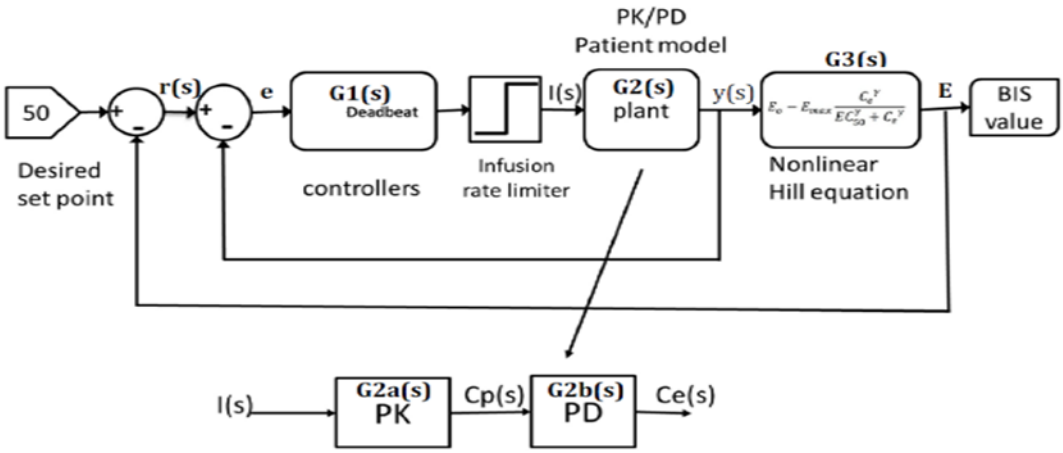


Figure (4) Structure of DOA controller model

Implementation and Results

The data is entered manually on the Matlab spreadsheet. These data are collected and analyzed to establish the relative importance of each independent variable in the prediction. The data analysis results are integrated for model development. The models are developed and designed based on these data analysis and initial results presented.

The performance of the proposed deadbeat controller is tested by using a step input as r(s). Nominal patient's data for DOA parameters of the PK/PD model, illustrated in Table 1, were used to drive all the transfer functions of the inner loop of the DOA model illustrated in fig. (4) above, where these functions were transferred from the s-domain to the z-domain using Tustin approximation, so the resultant difference equations of each block of the inner loop, using sampling step of 0.01 sec, were computed by the simulation program written in MATLAB

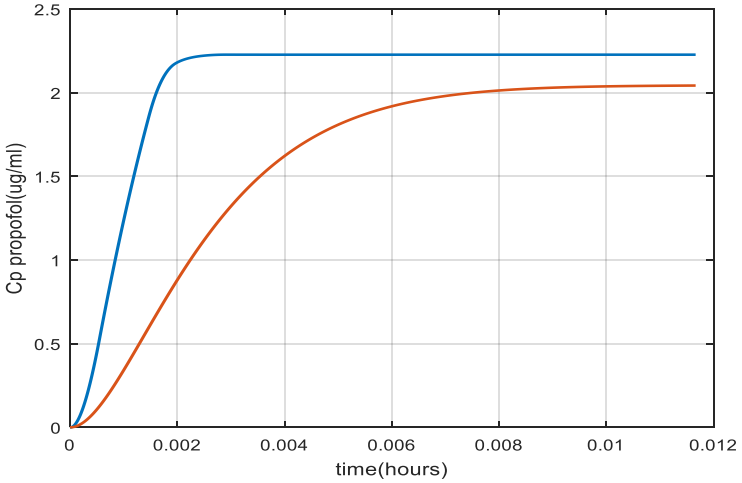
package. Since, the output of the deadbeat controller needs to be in the negative, which cannot be applicable, then a limiter is used to let the minimum control signal be equal to zero. Moreover, the maximum control signal may exceed the safe dose, so an upper limiter is also used, where different values were tested to get the most proper one giving better response. The value of V_1 in G2a(s), above, affects the gain of the system, then also different values were tested to get the most preferable value according to the response of the system for the used sampling frequency. According to these limitations the output response of the inner loop system did not reach the input step input within 4 samples, and there was an overshoot.

Table 1 - Nominal patient's data for DOA parameters

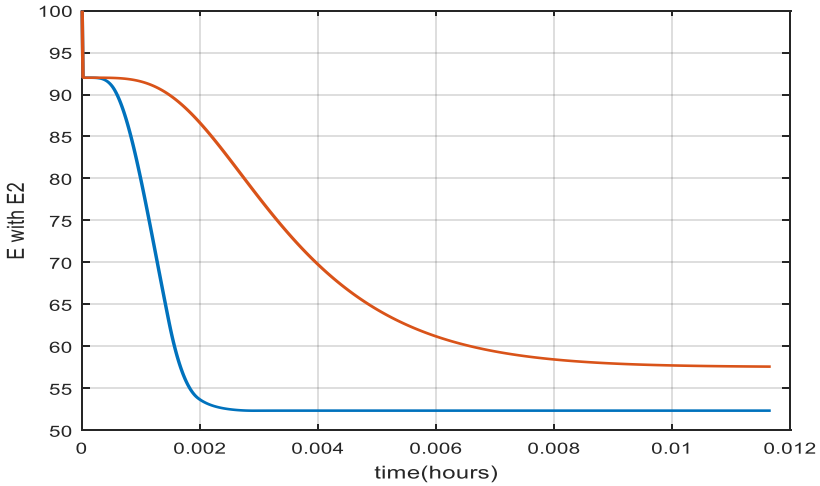
variable	Default value	unit
V_c	15. 9	L/Kg
K_1	0.119	m^{-1}
K_1	0.112	m^{-1}
K_2	0.055	m^{-1}
K_1	0.042	m^{-1}
K_3	0.0033	m^{-1}
K_e	0.26	m^{-1}
E_5	2.56	µg/mL
γ	2.651	none
E_α	92	none
E_m	97	none

Moreover, the effect of using an ADC of specified number of bits (8, 10, &12) were studied using root mean square (RMS) error technique.

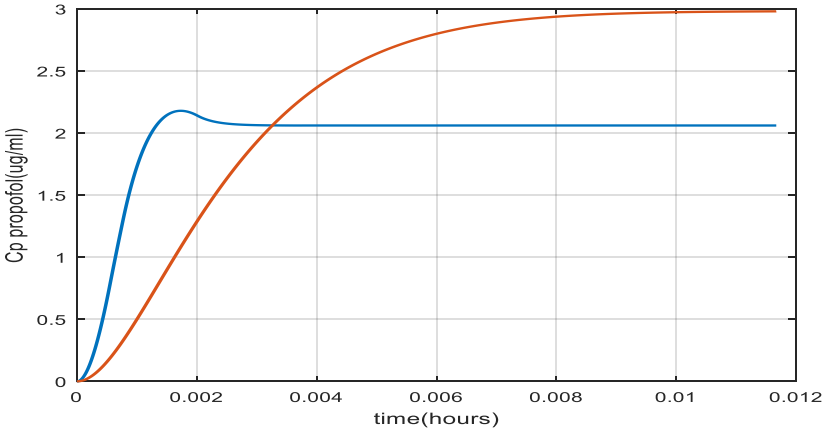
Figure (5-a) illustrates the response of the inner loop system for different V_1 values like (15.9) and figure (5-b) the different response between the original error system and the error with deadbeat controller in same v1.. the response will be with figure(6-a) illustrates the response of the inner loop system for different V_1 values like(10.9) and figure (6-b) the different response between the original error system and the system error with deadbeat controller with the same v1where for each value of V_1 different upper limitation values were used. It is quite clear, that the response of V_1 equal to (15.9) and for limitation of (2.651) is the best response and the Hill effective.



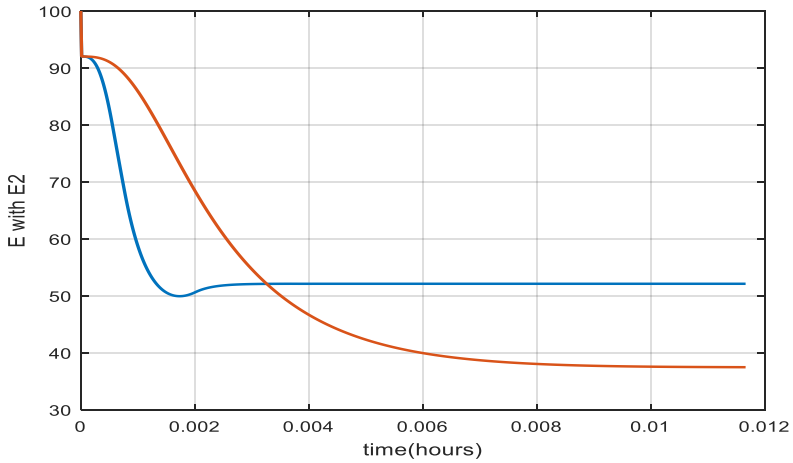
Response V_1 values,(15.9) figure(5-a)



Figure(5-b) Response the error with deadbeat controller



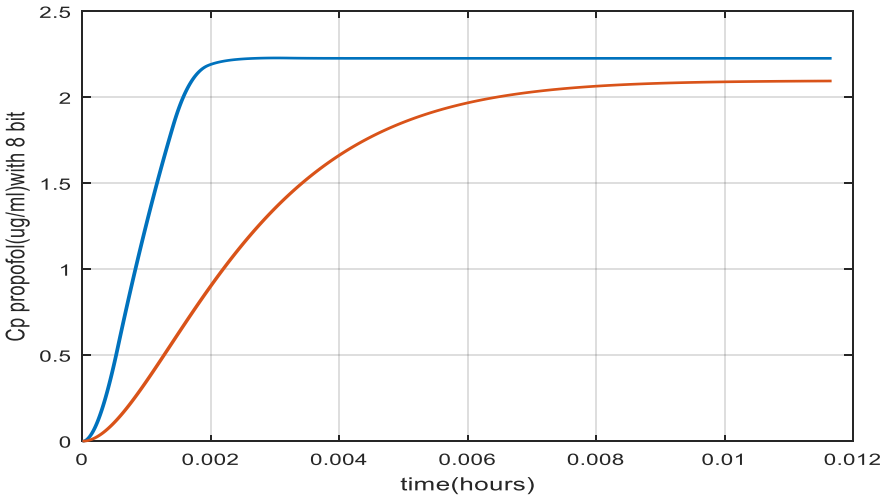
Response V_1 values,(10.9) figure(6-a)



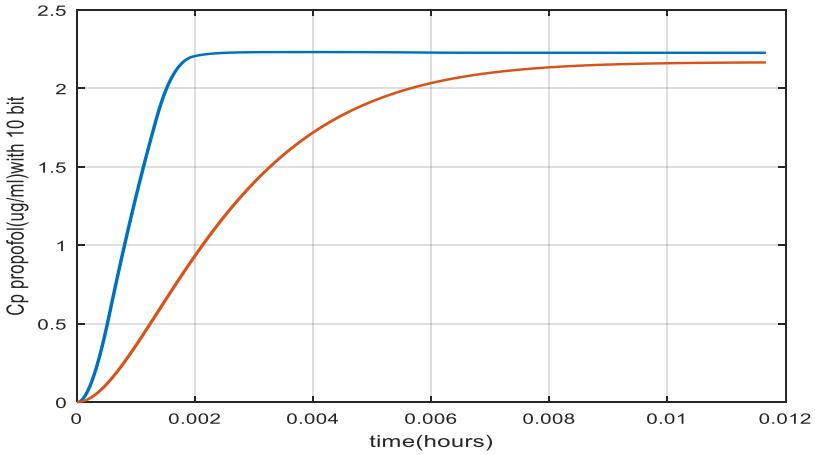
Figure(6-b) Response the error with deadbeat controller

Moreover, the effect of using specified number of bits ,8 bit ADC, 10 bit ADC and 12 bit ADC were studied using root mean square (RMS) error technique.

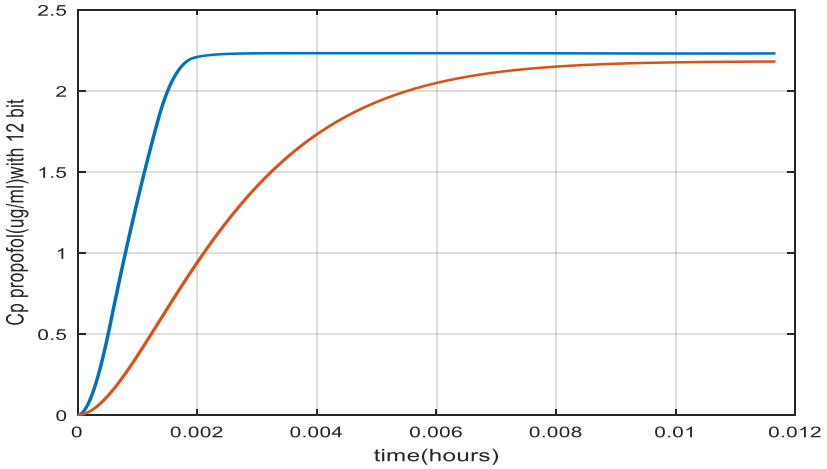
Figure (7-a) illustrates the response of the system for the previous values of V_1 and upper limitation, found above with 8 bit ADC response when different length ADC Figure (7-b) illustrates the response of the system for the previous values of V_1 and upper limitation, found above with10 bit ADC response Figure (7-c) illustrates the response of the system for the previous values of V_1 and upper limitation, found above with12 bit ADC response when different length ADC were used. It is obvious that the ADC of 12 bits is of less difference with respect to the response without ADC.



Figure(7-a) the system with 8 bit ADC



Figure(7-b) the system with 10 bit ADC



Figure(7-c) the system with 12 bit ADC

Conclusion

The results of applying deadbeat controller in the DOA model system are optimistic and the value of V_1 found, above, is within the limits given in the literatures. To enhance the performance of the simulation one can use Rang-Kutta method to simulate the differential equations representing the PK/PD model. In a future work we proposed different controllers applied in a certain sequence to enhance the response.

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EFFECT OF LEPIDIUM SATIVUM AQUEOUS CRUDE EXTRACT IN SOME FERTILITY PARAMETERS IN MICE

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Abstract: The uses of traditional plant extract in the treatment of various diseases have been flourished. The present study was aimed to evaluate the effect of *Lepidium sativum* aqueous extract on the fertility criteria in male mice. Forty eight mice used in this experiment divided into four groups (12 mice each group). Group 1 (Control), group 2 treated with *L. sativum* aqueous extract for 2 weeks, group 3 treated with the sulpiride drug to conduct over weight and hyperprolactinemia for 6 weeks and finally group 4 treated with the sulpiride drug for 6 weeks and then with *L. sativum* aqueous extract for 2 weeks. The results show that the weight does not change over the first three weeks, but there is a significant increase in body weight at the fourth week, especially in the groups (3 and 4). The groups treated with the drug sulpiride showed body weight higher than that of the control group. The group treated with both, drug and LS was showed the higher level of LH, while the group which was treated with LS only showed higher level of FSH. Prolactin showed its lowest level in the group treated only with LS extract when compared with treated groups. Testosterone showed the higher level in the group treated only with LS extract. The group treated with the drug sulpiride and have high level of prolactin showed a decline in all the parameters related with infertility. This group had the lowest sperm count (53.33 ± 1.76) sperm/ml, motility (33.33 ± 3.33) % and viability (46.67 ± 1.67) %, in comparison to other groups. In general there is a significant difference in all the parameters comparison with control group. The group treated with sulpiride drug and has high level of prolactin, showed a decline in all the parameters related with infertility. On the other hand, all the infertility parameters enhanced in the hyperprolactenimic animals which were treated with LS extract. In general there are significant differences in all the parameters comparison with control group.

Histological sections for the testis in the group treated with LS only showed a look-like normal appearance of seminiferous tubule with presence of high number of sperms, while sections of hyperprolactinemic mice testis showed partial degeneration and damage of dispersed spermatogonia cells with still presence of sperms inside the lumen with certain morphological abnormality in the shape of the sperms. Sections of treated mice testis showed a look like normal shape and structure of seminiferous tubules with the presence of normal morphology shape sperms in the lumen.

The findings of this study highlight the usefulness of using local and easily available plant products and constituents in treating or preventing diseases. The findings are encouraging and warrant further work on the aqueous extract of *L. Sativum* seeds and its effects on infertility.

Keywords: Lepidium sativum, reproductivity, hormones, liver function

Introduction

Cruciferous vegetables (Family: Brassicaceae) and their seeds are used in alternative and traditional systems of medicine and healing in many countries. An member of this group of vegetables is the garden cress (*Lepidium sativum* L.) plant and its seeds, which are utilized as nutritional constituents and common ingredients in folk remedies, used mainly in Middle Eastern and Asian countries. *L. Sativum* seeds are re suggested for the treatment of numerous illnesses and they have numerous therapeutic effects (Kasabe *et al*., 2012; Sharma and Agarwal, 2011).

L. sativum known as pepper cress or rashad belongs to the family Brassicaceae (Cruciferae) and it is an erect, annual herb grows up to 50 cm height. The leaves are variously lobed ,the whole flowers are white small and found in racemes the Fruits are obovate pods, about 5 mm long, with two seeds per pods. Both seeds and leaves contain volatile oils (Watt and Breyer Brandwjk, 1962).

The plant is eaten and seed oils are used in treating dysentery and diarrhea (Broun and Massey, 1929) and migraine (Merzouki *et al*., 2000). The plant was found to contain glucosinolate and glucotropaeolin (Songsak

and Lockwood, 2002).

Many studies as detailed above have shown that certain constituents of *L. Sativum* and its extracts have chemo-preventive and chemotherapeutic effects, but no studies have been done on the effects of any extracts of *L. Sativum* seeds on the viability and growth of cancer cells. In fact, and after extensive literature search, we are the only researchers to study the effects of the aqueous extract of *L. Sativum* seeds on human breast cancer cells (Morrison *et al*., 2001).

The objectives of this study were to evaluate the activity of *L. sativum* as treatment for hypertprolactinemia, which is one of the commonest hormonal disorders, recently in both women and men, and its activity in modulating hormone level in the blood, and increasing fertility of male mice.

Materials and Methods

Preparation of Lepidium Stivum Seeds and Dosage

The *L. sativum* seeds were purchased from local markets. The powder of seeds was insoluble in water. So, seeds suspension was prepared directly. The dose used in this research was chosen in view of previous research on *L.sativum* (Juma, 2007; Bafeel and Ali, 2009).

Preparation of Eosin Nigrosin Stain

Eosin nigrosin stain prepared by adding 1% eosin (w/v) and 5% nigrosin (w/v) then they were dissolved in 3% Tri-sodium citrate dihydrate solution (Khan and Ijaz, 2007).

Experiment Design and Biometry

Forty eight males' albino Swiss mice (*Mus musculus*) their age ranged between 8-12 weeks with an average weight 25 ± 3g were obtained from the National Centre for Drug Control and Research /Baghdad. The mice were acclimatized for two weeks before treatment, they housed in plastic cages containing hard wood chips for bedding, in controlled animal house at 25± 2Cº, 4/10 hour's light / dark cycle, and they were divided mainly into four groups; each group included 12 mice. The mice were given water and fed with suitable quantity of complete diet. They were housed at the animal house in Biotechnology Research Center/ Al- Nahrain University.

The animals were treated as following:
Group (1) Control / Treated orally with phosphate buffer saline for 2 weeks.
Group (2) LS / Treated orally with *Lepidium sativum* suspension for 2 weeks.
Group (3) Hyper/ Treated orally with sulpiride suspension for 2 weeks.
Group (4) Treated orally with sulpiride suspension for 6 weeks and then treated orally with *Lepidium sativum* suspension for 2 weeks.

Sulpiride was given for 2 weeks in order to increase weight gain, hyperplasia, hyperprolactinemia and hypogonadism in the animals according to (Mohit *et al*., 2011).

The water suspension of 2g /100 ml D.W (20 mg/ml) of *L. sativum* was prepared as an orally dose. The suspension was shacked before used and gavaged daily to animals using mice gastric tube (0.2 ml/animal/day) (Bafeel and Ali, 2009).

At the end of the experiment, The animals weighted and the blood was obtained by puncture of heart, centrifuged at 3000 r/m. for 10 minutes and the animals were sacrificed.The testis was immediately excised and preserved in 10% formalin for histological study, the serum was stored at -80^{o} C and used to determine the levels of the following parameters:

Hormones: LH, FSH, prolactin and testosterone (ELIZA kit /Orgmetric/Germany).
Sperm analysis: Included three parameters, sperm concentration estimated according to the method of (AL-Dujaily, 1996), sperm motility was recorded according to (Ford, 2006), whereas the percentage of sperms were measured according to the method of (Bearden and Faquay, 1992).

- **Sperm concentration:** A drop of sperm suspension was placed on a slide and covered with a coverslip. The concentration of sperms was calculated from the mean number of sperm in five high power microscopy fields under magnification of 400X. This number was multiplied by a factor of one million ($\times 10^6$ sperm/ml).
- **Sperm motility:** Sperm suspension (50 µl) was placed on a slide and covered with a coverslip. By light microscope, several fields were examined to estimate the percentage of individual motility of sperms.
- **Sperm viability:** A drop of sperm suspension was mixed with a drop of eosin stain (1%) and two drops of nigrosin stain. A thin smear of the semen – eosin – nigrosin mixture was done using other slide and left to dry. Then the slide observed under a light microscope, the dead sperms stained with red color while live sperms were not stained. The amount of 200 sperms were counted to calculate the percentage of viability sperms as in the following equation:

$$\textbf{Sperm viability \% } = \frac{\textbf{No.of viable sperms}}{\textbf{Total No.of sperms}} \times \mathbf{100}$$

Histological study: The histological study was conducted according to the method used by (Bancroft and Stevens, 1982).

Statistical analysis: The Statistical Analysis System- SAS (2010) was used to study the effect of different factors in studied parameters. Least significant difference –LSD test was used to significant compare between means in this study.

Results and Discussion

Body Weight

As shown in the table (1) the weight does not change over the first weeks, but there is a significant increase in body weight at the fourth week, especially in groups (3) and (4). The treated groups with sulpiride showed increasing body weight comparison with control group.

Table 1. Animal weight in the treated groups during five weeks of the experiment

Week	Mean ± SE				LSD Value
	Group 1 Control	Group 2 LS	Group 3 Hyper	Group 4 Treated	
0	37.08 ± 1.002	35.50 ± 2.60	36.97 ± 0.65	35.91 ± 1.63	4.615 NS
1	37.34 ± 1.02	35.98 ± 1.68	37.03 ± 0.79	36.48 ± 1.60	4.126 NS
2	37.54 ± 1.02	36.38 ± 1.67	37.58 ± 0.41	33.44 ± 2.67	4.240 NS
3	37.76 ± 0.99	37.08 ± 1.74	39.89 ± 0.83	38.10 ± 3.98	5.024 NS
4	38.14 ± 1.03	37.90 ± 1.08	41.93 ± 1.99	40.95 ± 0.70	3.674 *
5	37.08 ± 1.00	38.20 ± 1.07	42.37 ± 0.60	40.47 ± 1.68	3.605 *
LSD Value	2.962 NS	4.886 NS	2.579 *	6.661 *	----
* (P<0.05).					

Excessive body weight gain is often observed during chronic administration of typical and atypical antipsychotic drugs (AP) in psychiatric patients (Bhavnani and Levin, 1996). The sulpiride is a typical antipsychotic drug. So; increasing body weight will appear during administered animals with sulpiride. Prolonged administration of diverse AP also increases body weight in female rats (Silverstone *et al*., 1988). During sulpiride treatment (a D2–D3 dopamine receptor antagonist (Baptista *et al*.,1988), the rats display hyperphagia, (Baptista *et al*.,1998) hyperprolactinemia, (Baptista *et al*.,1997) and disruption of the vaginal cycle suggesting drug-induced hypogonadism (Parada *et al*.,1989).

At the same time, *L. sativum* L. seeds increase weight gain as they are found to contain 18-24% of fat. Thirty-four percent of the total fatty acids are an alpha linolenic acid which could give it nutritional advantages (Diwakar *et al*., 2008). The primary fatty acids in *L. sativum* oil were oleic (30.6 wt. %) and linolenic acids (29.3 wt. %) and was found to contain high concentrations of tocopherols. It contains a good amount of lignans and antioxidants, which can balance out the n-3 polyunsaturated fatty acids in seed oil. The essential phytosterols in *L. sativum* were sitosterol and campesterol and avenasterol (Bryan *et al*., 2009).

Hormones

There is a significant increase in prolactin level (4.20 ± 0.17) ng/ml in the group treated with the drug sulpiride (group 3) comparison with the control which was considered normal since the sulpiride belongs to the antipsychotic drugs.

Table 2. Hormones levels in the treated groups at the end of the experiment

Hormone	Mean ± SE				LSD Value
	Group 1 Control	Group 2 LS	Group 3 Hyper	Group 4 Treated	
LH (IU/L)	0.306 ± 0.029	0.137 ± 0.008	0.350 ± 0.017	0.556 ± 0.037	0.084 *
FSH (IU/L)	46.33 ± 0.78	82.73 ± 1.06	77.23 ± 1.49	42.13 ± 1.47	4.041 *
Prolactin (ng/ml)	2.10 ± 0.06	2.67 ± 0.09	4.20 ± 0.17	3.40 ± 0.15	0.413 *
Testosterone (ng/ml)	0.039 ± 0.003	0.290 ± 0.01	0.146 ± 0.01	0.113 ± 0.01	0.046 *
* ($P<0.05$).					

As knew before, the hyperprolactinemia is one of sulpiride adverse effects caused by the prolonged use of those drugs (Silverstone *et al*., 1988). While the co-use of both sulpiride and *L. sativum* extract in group 4 showed less increasing in prolactin level (3.40 ±0.15) as revealed in the table (2). *L. sativum* have hypoglycaemic activity and an aqueous *L. sativum* extract in an acute (single dose) or chronic oral treatments, prompts a significant decrease in blood glucose levels in streptozotocin-induced diabetic rats, there is a marked normalization of glycemia (Eddouks *et al*., 2005).When there is a decrease in glucose level there is a decrease in prolactin level since the correlation between them is positive (Howes *et al*., 2006).

Prolactin influences carbohydrate metabolism and insulin sensitivity, through effects on insulin receptors (Goffin *et al.,* 2002; Schernthaner *et al.,* 1985). Elevated prolactin levels are associated with hyperglycemia, hyperinsulinemia and insulin resistance relative to controls in animal studies (Reis *et al.,*1997). Similarly, in humans, hyperprolactinemia secondary to pituitary adenomas is associated with elevated glucose and insulin levels, and insulin insensitivity compared with controls. Treatment with bromocriptine to reduce prolactin levels over two months is associated with reductions in glucose and insulin levels (Yavuz *et al.*, 2003).

The results in table 2 revealed that the higher level of LH was (0.556 ± 0.037) in the group 4, which is treated both with the drug and LS. While a higher level of FSH was (82.73 ± 1.06) in group 2, which was treated with LS only. Same with testosterone level, the higher value (0.290 ± 0.01) was in the group 2. Prolactin showed the lowest level in the group treated only with LS extract when compared with other treated groups. Prolactin level in group 4 (hyperprolactinemic – LS) was lower than its level in group 3 (Hyperprolactinemic), this is referred to the role of LS in lowering prolactin level in the blood. The results of testosterone support this role, which showed its higher level in the group treated only with LS extract.

Prolactin positively correlated with TSH and negatively with LH,FSH and T3 in infertile groups. Therefore we can say that hyperprolactinemia and hypothyroidism play the key role in etiopathogenesis of infertility. chronic hypothyroidism may develop ovulatory dysfunction, and hyperprolactinemia. Therefore treating hypothyroidism at the earlier stage before the appearance of ovulatory dysfunction and hyperprolactinemia, can preventive fertility disorders. TSH screening of all females at early reproductive age should be done to detect subclinical thyroid problem and to prevent infertility risk (Fupare *et al*., 2015).

Increased serum prolactin (PRL) levels result in decreased kisspeptin expression in Kiss1 neurons in both the hypothalamic arcuate (ARC) and anteroventral periventricular (AVPV) nuclei, mediated by prolactin receptors (PRLR) expressed on both populations of Kiss1 neurons. Suppression of kisspeptin, in turn, reduces GnRH release and results in loss of the ovulatory GnRH surge. This may reduce the ability of pituitary gonadotropin to secrete (LH and FSH) and loss of ovarian stimulation, and consequently results in hypogonadism, infertility, and amenorrhea. Prolactin may also have direct effects on GnRH neurons and pituitary gonadotropes, or on other GnRH afferent neurons (Kaiser, 2012).

Seminal Parameters

According to the results in the table (3), the group treated with the drug sulpiride (which had a high level of prolactin) showed a decline in all the parameters related to infertility. This group was had the lowest sperm count (53.33 ± 1.76) sperm/ml, motility (33.33 ± 3.33) % and viability (46.67 ± 1.67) %, comparison to other groups. On the other hand, all the infertility parameters enhanced in the hyperprolactenimic animals were treated with LS extract. Also, there is a remarkable increasing in the motility of sperm in the group treated with LS in comparison with the control. In general, there is a significant difference in all the parameters in comparison with control group.

Table 3.Seminal parameters values of treated groups at the end of the experiment

Seminal parameters	Mean ± SE				LSD Value
	Group 1 Control	Group 2 LS	Group 3 Hyper	Group 4 Treated	
Count (million)(sperm/ml)	386.67 ± 44.67	365.33 ± 9.27	53.33 ± 1.76	245.0 ± 22.54	85.90 *
Motility (%)	82.67 ± 1.45	91.67 ± 1.67	33.33 ± 3.33	85.00 ± 2.88	804 *
Viability (%)	85.00 ± 2.89	83.33 ± 1.67	46.67 ± 1.67	83.33 ± 1.67	6.65 *
* (P<0.05).					

Lepidium meyenii (Maca) and *L. sativum* , both are a traditional cruciferous vegetable used in the distant past, belongs to the same family (Brassicaceae) . Dry Maca hypocotyls contain 59% carbohydrates, 10.2% proteins, 8.5%fiber, 2.2% lipids and a number of other compounds including most of the essential amino acids Arginine, that has been proven to have a good effect on male fertility and increasing sperm production (Dini *et al*.,1994).

Maca also contains sterols, such as campesterol, stigma sterol and β-sitosterol and β-Carbolines , the latter inhibits apoptosis and have an antioxidant properties that protect sperms and improves spermatogenesis (Gonzales *et al.,* 2004; Rubio *et al.,* 2006) .The first evidence of improvement effect of Maca in spermatogenesis was reported in male rats by oral administration of an aqueous extract from the roots of *Lepidium meyenii* (Maca) in dose of 666.6 mg/day for 14 days to normal adult male rats by acting on first mitosis (stages IX–XI) (Gonzales *et al.,* 2001). It is found that Maca also improved sperm count and sperm motility in normal men without affecting serum testosterone, luteinizing hormone and follicle-stimulating hormone levels (Gonzales *et al.* 2001b) . Maca at doses of 1.5-3.0 g, is enough to improve the sexual desire and does not affect the production and/or catabolism of testosterone (Gonzales *et al.,* 2003).

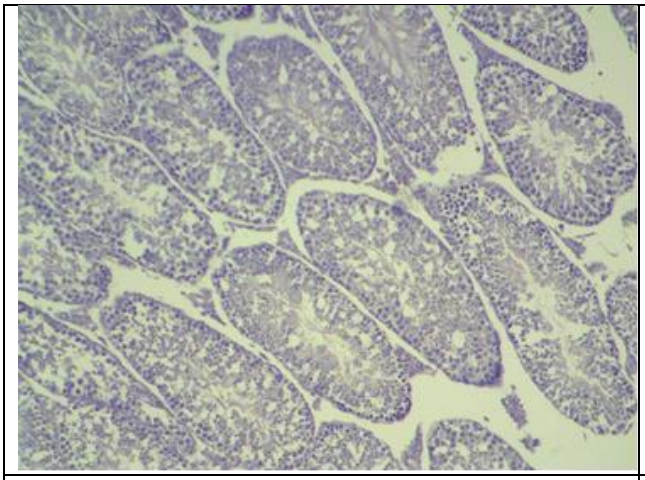
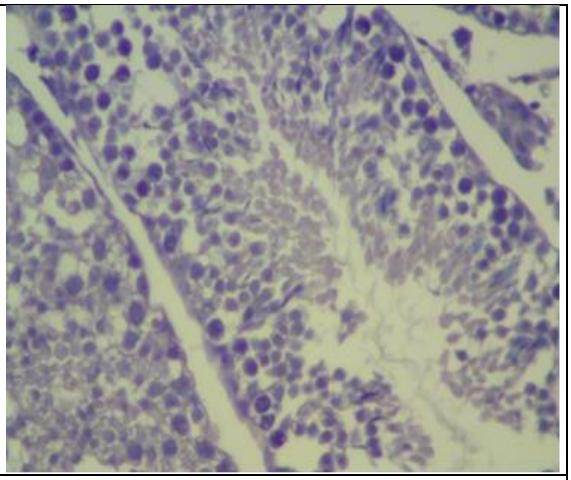
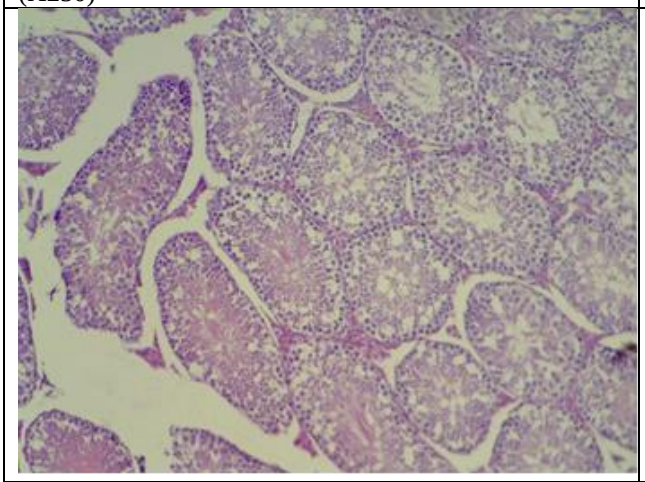
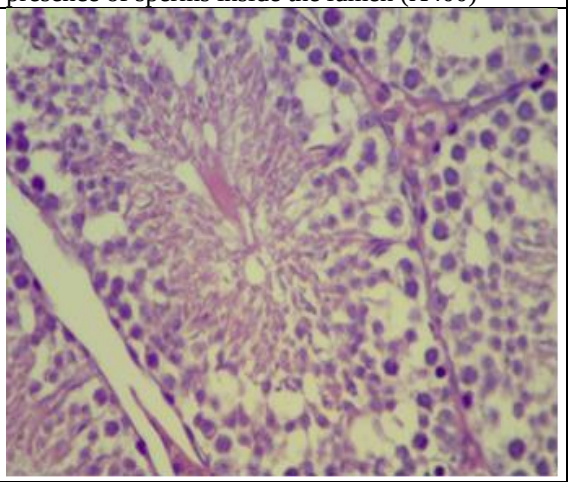
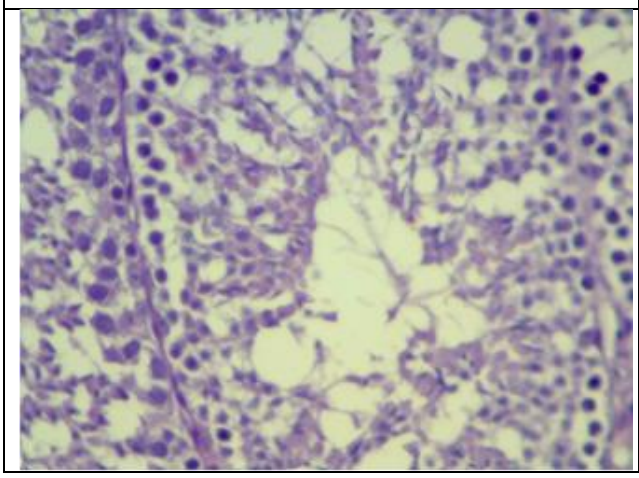
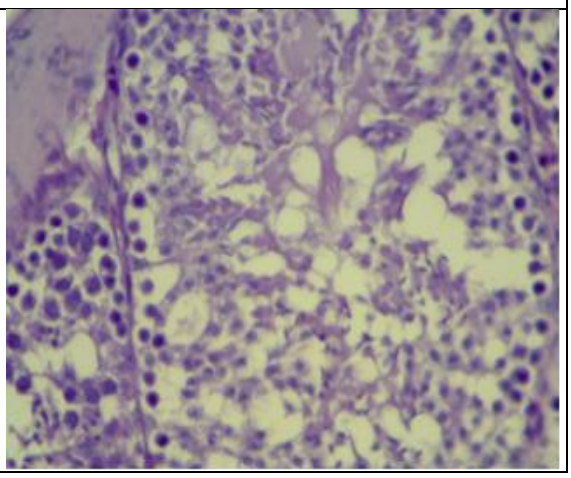
Lepidium sativum seeds have high nutritional value and functional ingredient, (Ahmed *et al*.2013). It is found that the oil of the seeds posses tocopherol, phenolic compounds, nitrogen compounds, terpenoids, and some other metabolites, which are rich in antioxidant activity (Muanda *et al*.2011). The seeds contain two groups of fat-soluble compounds, the first group represent the tocopherols (Vitamin E), which comprises of (21ppm) alpha-tocopherol and (1422 ppm) gamma-tocopherol and (35ppm) Sigma-tocopherol, the second group are tocotrienols (Moser *et al*.2009).Vitamin E cannot be synthesized by the human body and must be obtained from the diet with an abundant source found in vegetable oil, nuts, and egg yolks (Ni and Yeh 2007), and has a beneficial effect on viability, membrane integrity and motility of spermatozoa of different species. Tocopherol administration to male rabbits increases fertility, thus being useful to any animal, mammals as well as human being. (Naji and Abood , 2013). Tocopherol function is to protect sperms through its ability as an antioxidant of body tissues, where it inhibits alpha-tocopherol enzyme protein Kinase, and thus reduces the reactive oxygen species (Christie, 2010).

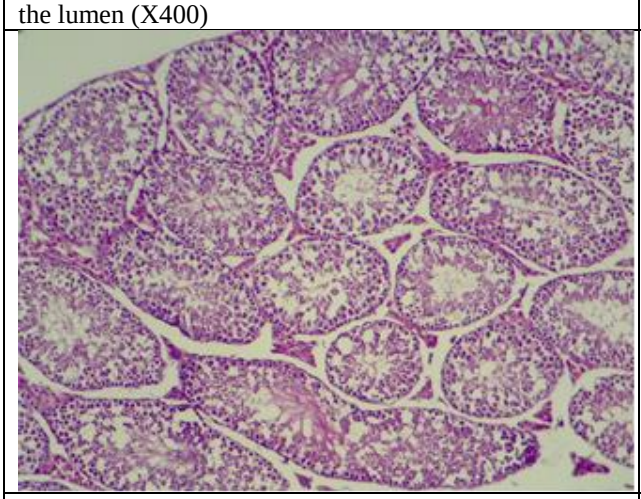
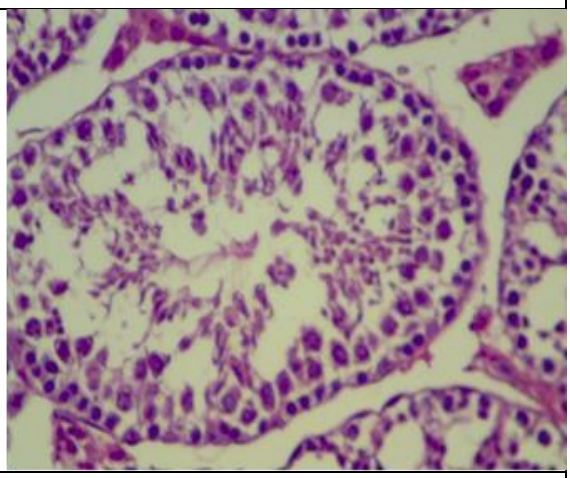
Histological Study

Histological sections for the testis for LS group showed a look-like normal appearance of seminiferous tubule with the presence of a high number of sperms, while sections of hyperprolactinemic mice testis showed partial degeneration and damage of dispersed spermatogonia cells with the still presence of sperms inside the lumen with a certain morphological abnormality in the shape of the sperms. Sections of testis for treated mice showed a look-like normal shape and structure of seminiferous tubules with the presence of normal morphology shape of sperms in the lumen.

The histological sections of the testis in the hyperprolactinemic group reflect the morphological changes that

may cause by disorders in the reproductive hormones. Hyperprolactinemia causes infertility in around 11% of oligospermic males by inhibiting the pulsatile secretion of the gonadotrophin releasing hormone (GRH), which lead to decrease the releasing of follicle stimulating hormone, luteinizing hormone, and testosterone (Masud *et al*.,2007). Chronic hyperprolactinemia in men partly suppresses LH secretion by its inhibitory action on the hypothalamus (Oseko *et al*.,1985), which in turn causes spermatogenic arrest, impaired sperm motility, and altered sperm quality. It later produces secondary hypogonadism and infertility (Masud *et al*.,2007).

	
Histological section of control mice testis showing normal structure appearance of seminiferous tubules (X250)	Histological section of control mice testis showing normal development of spermatogonia cells with presence of sperms inside the lumen (X400)
	
Histological section of SL mice testis showing look-like normal appearance of seminiferous tubule with presence of high number of sperms (X250)	Histological section of SL mice testis showing look-like normal appearance of seminiferous tubule with presence of high number of sperms (X400)
	

Histological section of Hyperprolactinemia mice testis showing partial degeneration and damage of dispersed spermatogonia cells with still presence of sperms inside the lumen (X400)	Histological section of Hyperprolactinemia mice testis showing certain morphological abnormality in the shape of the sperm (X400)
	
Histological section of treated mice testis showing look like normal shape and structure of seminiferous tubules with the presence of sperms in the lumen (250)	Histological section of treated mice testis showing look like normal shape and structure of seminiferous tubules with the presence of sperms in the lumen (X400)

The histological sections of the testis in the groups treated with only LS show sigificant improvement in testis structure and sperm functionality criteria, and the hyperprolactinemic group treated later with LS reflect the regression in the side effect caused by hormone disorders and prolactin high levels. Those results confirm the curability role of *Lepidium sativum* seeds and confirm its ability to reduce risks of infertility. Therefore, according to this study, such treatments are recommended as it may be prepared and administered at home by the patient himself.

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PRICE COMPETITION IN THE TELECOMMUNICATIONS INDUSTRY IN THE REPUBLIC OF MACEDONIA

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Abstract: Price is without a doubt one of the main elements in contemporary market economies when it comes to gaining and maintaining the much needed edge over competition. In the case of the telecommunications industry in the Republic of Macedonia the price could be discussed , apart from assortment which has been the decisive factor in ensuring competitive advantage since the market got deregulated over a decade ago. In fact, in Macedonia just like elsewhere in the world, the telecommunications industry drastically has changed everyday life. The deregulation of the telecommunication industry in the Republic of Macedonia had a rather huge impact on prices. Each of the new market entrants had a serious impact on prices in terms of pressuring the existing companies to lower prices in order to maintain their market share. In fact, usage of dumping prices has not been an unfamiliar concept for companies functioning in the telecommunication industry in the Republic of Macedonia. Perhaps this is the main reason why some of the major players in the industry functioned with losses for the first couple of years on the market. On the other hand, people owning and using more than one cell phone number is also not a rare phenomena in the Republic of Macedonia. The objective of this paper is to offer an analysis of the price and its importance for the growth of the telecommunications industry in the Republic of Macedonia.

Keywords: Price competitiveness, market, demand and supply

Introduction

Subject of this research is analysis of the price competitiveness between companies on the domestic market because offers on its participant's possibility for achieving profit and gives base for stability and growth of a company. Field where we put effort for revolution, innovation and getting competitive advantage of the companies and successful positioning, it is the market which is basic and most important source of information required for continual effective working in the business world.

Companies take part in the market economy to satisfy the customer's needs on prices ready to pay for particular good or service, but at the same time strive to achieve maximal profit. Market orientation positions the selling policy in the center of attention, because it serves as coordinator of other functions and because of that companies should effectively and efficiently use the elements from the marketing mix for successfully positioning on the market.

We live in a period where most of the time is spend on phone or internet, for private as well as business aims. Following the innovation services with prime quality, world trends and consumer requirements lead to strong competition and price battle between companies on the domestic market. Because of that telecommunication industry is the case analyzed in this research, because the aim is to determine the role of the competition in formation of the price between companies which cover the telecommunication service market in the Republic of Macedonia.

With the research we got important and relevant information for which if the change of the prices has impact on the customer change, or if the consumers have trend of changing the operators or are they loyal to one company, because telecommunications is industry prone to fast and considerable innovations. The results give clear picture for possibilities and restriction of the companies which offer same or similar products and services, in this particular case telephony, which developed from monopoly position, after entering of the second operator and strong competence with the third operator. From consumer point of view, benefits for the consumers are bigger, and that is result of more affordable prices, service and products offered from the companies, concerning that consumers' right have central position in company policy.

Price Conception

Concept, Meaning of Prices and Price Policy

The price is an abstract concept, as proof of that there are the big number of considerations from many economists. Because its broad meaning the term price can be understood in narrower and broader sense, because all goods and service launched on the market have price as well as own single value. Hence, due to the different considerations in broad sense everything around us, concerning the price given to the athletes, employee's payment in the company, taxes paid by residence of one country and expenses of the modern living in one society of all natural and legal entities is price.

In broader sense the price is the amount of money paid for one good or service, or amount of all values which consumer change for achieving benefit from the use of the good or service (Kotler e al, 2009).
Analogously to the above mentioned it is required to mention that price is one the elements of the marketing mix, because from itself has not got any meaning without other elements and mutual coordination.

- The meaning of the price in one economy appears in many shapes and can be examined from many aspects: *(Veseli, 2009)*
- Price is monetary term of the value for particular good or service
- Price is amount of money for which the consumer is ready to pay on the opposite side for particular product or service.
- Price is the value and quantity for which is changed one good for another.
- Price is the balance between the offer and demand expressed in money.
- Price is one type of economical-social relation between the buyer and seller in form of change goods for money;

Price of the companies means increase of the profit, or maximization of the current profit, but also measuring refers the quality of the goods and services offered by the market.

Analyses of the Price Competiveness between the Telecommunication Companies-Case T-mobile, One and VIP from 2008-2013

Defining the Problem

The consumer is in the center of attention and satisfying his needs makes the market field for competition between the companies. In conditions when on the market there is a strong competition, the price which has considerable impact on the consumers, but also on companies which need to make profit and at the same time are ready to pay for particular good or service, considering the average income per capita in the Republic of Macedonia.

Telecommunication industry is expanding, because consumer's needs are changing, and that is result of the fast life beat and need of fast, effective, efficient communication due to the consumer's engagement, for instance, people communicate with their closest friends via "smart" phones, employers conduct Skype interviews and etc.

Almost completely we exterminate the mail and replace with" e-mail" which is used as a mean for written communication, except for business or private people, which the Internet or excellent net coverage of smart phones consider necessary. Result of these aspects is increased competition between companies which serve on the Macedonian market with constantly improving of the service and innovation offers for better positioning and attracting consumers.

This analysis is conducted with aim to determine the role of the price in consumer's perception in using particular operator and formation of the companies' price in terms of competition.

The market in the Republic of Macedonia is covered by three telecommunication companies and they are:
[1]T-Mobile Macedonia AD Skopje is the first mobile operator and market leader for mobile telephony which works since September 1996 under the name Mobimak, but on September 7th 2006 was re-named and became part of Deutsche Telecom Group. Today it has over 1, 2 million customers or 48, 62 % market share.
[2]One AD Skopje is mobile operator which entered as second in the mobile market in the Republic of Macedonia since 2003 under the name "Cosmofon", but on November 11th 2008 changed the brand in One and became part

[1] Information are undertaken from www.t-mobile.mk

of Telecom Slovenia Group and it is the first operator in the country which offers complete telecommunication services and positioned as technological leader and innovator and it has 500.000 customers, or 23,06 % from the market share.

[3] Vip is the third operator which has entered in the Macedonian market since 2007 and it is a member of Telecom Austria Group. The main company motto for market competitiveness is the best offer for unlimited communication. Vip is presented as innovation leader with new technologies and services and made real market competitiveness in this area. In 2011 became second mobile operator according the customer's number in Republic of Macedonia and counts over 630.000 or 28, 32 % of the market share.

From the information which the companies applied it is clear the problem for which we like to get information which will be considerable and relevant, and they refer to the customer's loyalty, who the price affects the customer's number, company profitability and etc. With the results we will notice the possibilities and restrictions of the companies, because the market nature of the telecommunication services is changeable, T-Mobile was company monopoly which established high price and customers didn't have other choice, than with the second operator terms has changed and companies follow the procedures of the competitor, while with entrance of the third operator created strong competitiveness or war among the companies for attracting customers with better offer.

With examination of particular number of examinees and conducting financial results in the last six years, that will form conclusion for the state on the telephony market in the framework with determined goals and tested hypothesis. This period is chosen because since the beginning of 2008 all three companies have covered the Macedonian market.

Research Project

Sources and Data

For this research are used: primary and secondary data.
The primary data are taken directly from the users to analyze their opinions, attitudes, needs, behavior and expectations in the process of using mobile operators.
Secondary data are gathered from internal company's basis, public institutions and internet sources.

Methods of Data Collection

Primary data are gathered by method of survey. Using of structural survey with formal list of question on which examiners answer on the same way. The data is gathered personally or by phone.

For secondary data it is used historical method or method of direct data because the data has already existed and it is combined with statistical and dynamic approach.

Forms of Data Collection

Data are collected through closed dichotomy questions and closed questions with multiple choices. The questions are objective, clear, simple with logical order, from them you can get answer for the determined objective and make conclusion for dynamic approach.

Sample Method

For the survey is used representative sample (helped by the student from the Faculty of Business and Economy, SEEU-Tetovo) from 700 examinees randomly chosen from the cities in Republic of Macedonia, customers of one of the three operators. All examinees are majors on age above 18 year due to the possibility of number registration, no sex difference, because as variable doesn't affect the research objective.

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[2] Information are undertaken from www.one.mk
[3] Information are undertaken from www.vip.mk

Analysis and Data Interpretation of the Questionnaire

After realization of the representative sample, it has been made analysis of the questionnaire data. Results represented are from the second, third and fourth question category. The first category is not represented because it is related to the basic data from the examinees and as that did not have effect on solving the problem. The results got from the research are the following:

Numerical and percentage results of the examinees' attitude for prices and quality that companies offer

1. Company's prices in comparison with the incomes in the Republic of Macedonia are:	Number of examinees	Percentage participation
High	270	38,57%
Medium	240	34,28%
Satisfying	170	24,28%
Low	20	2,85%

2. Which was the key factor in choice of the operator?	Number of examinees	Percentage participation
Quality	140	20%
Price	230	32,85%
Both factors	330	47,14%

3. Services provided by the operator as a customer:	Number of examinees	Percentage participation
Completely fulfills your expectations	250	35,71%
Partially fulfills the expectations	380	54,28%
It does not fulfills the expectation	70	10%

Table 1,2 and 3 display examinees' attitudes for the prices of the companies where 38,57% think that prices are high in relation to the average incomes in the Republic of Macedonia, 34,28% think that prices are neither high nor low, 24, 28% are satisfied with the prices, and considerably small number , or 2,85 % say that prices are low. In the second table examinees' say about the factors of decision in operator choice, 47, 14% choose on basis of two factors under influence of one factor, price versus quality, we have the following results, 85 % versus 20 %. The satisfaction degree from examinees' expectation is completely 35, 71%, while 54, 28 % are partially satisfied from the offered and real service, and small number of examinees is not satisfied from the offer.

4. Packages offered by the company are for business customers with acceptable price and they offer quality for business decisions: (answered only business customers, total 300)	Number of examinees	Percentage participation
Yes	190	63,33%
No	30	10%
Partially	80	26,66%

Business customers are more satisfied than private, or 63, 33% answered with yes; partially satisfied are 26, 66%, while 10 % are not satisfied.

Numerical and percentage results from the examinees' attitudes for the operator competence and operator advantage

1. What attract your attention to become operator customer?	Number of examinees	Percentage participation
Convincing marketing campaign	150	21,42%
Stability of the company	210	30%
Lower prices from the competence	340	48,57%

2. If the operator increase the service's price which offers will	Number of examinees	Percentage

you replace with the competitor who offers lower price?		participation
I don't change, I am a loyal customer	250	35,71%
I will change, company which offers lower price is my primary choice	450	64,28%

3. Does the company which you are a customer offers benefits, awards?	Number of examinees	Percentage participation
Yes, often	300	42,85%
Sometimes	250	35,71%
Very rarely	90	12,85%
Never	60	8,57%

Second category of questions was imposed to test customer's attitudes for the company in terms of competence, and the results are the following: almost half of the examinees were attracted to become operator customers due to the lower prices of the competitor, 30 % were attracted by the company stability, or reliability and protection of the customer and 21, 42 % were attracted by the convincing marketing campaign. On the question do examinees change the operator if the price increase even 64, 28% answered positive, but only 35, 71% are loyal customers. Even half of the examinees answered that company offers discounts, benefits and it's socially agreed, while the others have split attitudes.

Numerical and percentage results from examinees' attitudes for the strategies used by the operators and formation of prices and market positioning

1. According to your vision does the company invest in researching and development for better positioning and segmentation on the Macedonian market?	Number of examinees	Percentage participation
Yes	570	81,42%
No	130	18,57%

2. Do you consider that the company uses strategies for differencing the services?	Number of examinees	Percentage participation
Yes	590	84,28%
No	110	15,71%

3. Positioning of the company depends from:	Number of examinees	Percentage participation
Benefit that is offered to the customers	100	14,28%
Prices that are paid	180	25,71%
Quality of the products and services	270	38,57%
Combination of the marketing mix elements	150	21,42%

Almost all examinees consider that the company invests in research and development and makes effort for better position, and only 18, 57% gave negative answer. The same case of answers is for the question of the services used by the examinees are differentiated, or 84, 28% answered with yes and 15, 71 answered with no. On the question from which depends positioning of the company the examinees have different attitudes, but the most dominate quality of the products and services with 38, 75%.

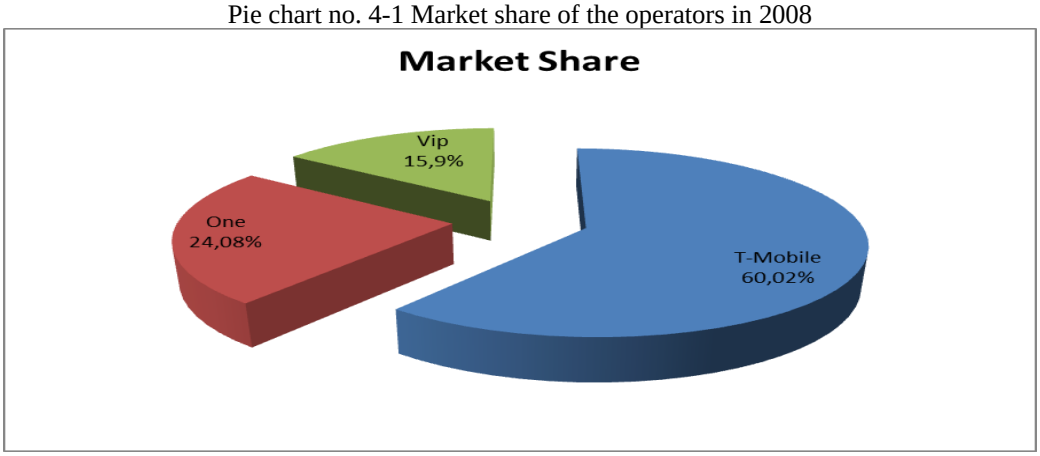
The data got from the questionnaire give us clear picture for the customers' attitudes in relation to the prices formed by the mobile operators, quality, and competence and positioning. The same are used for formulation of the report and together with the data from secondary sources are taken important conclusions which are in benefit for companies' decision and explain the hypothesis which are tested.

Statistical Data from 2008-2013

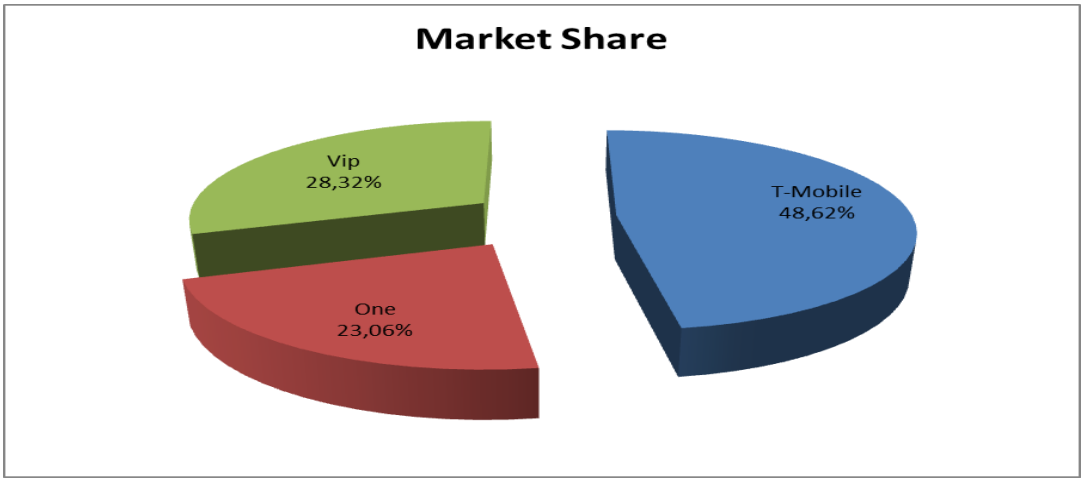
To answer the questions which are subject of this research, apart from the analyses of the questionnaire, it is necessary the analyses of the companies' statistical data.

Annual Report of Shares of the Three Operators on the Market 2008-2013

Pie chart no. 4-1 Market share of the operators in 2008



Pie chart no. 4-2. Market share of the operators in 2013



Source: www.aek.mk

The applied annual reports are conducted by the Agency for Electronic Communication. Here the share data are applied of the three telecommunication operators, from which you can see that T-Mobile is the market leader with shares of 48, 62%. One takes part with 23,06%, while Vip takes part with 28,32% and it is second operator in the Republic of Macedonia, but compared with 2008 T-Mobile decreased its shares on the market which than was 60,02% on the market. The benefit is on Vip operator which with strategies of lower prices ménage to become second on the market with increase of 15,9% to 28,32. One operator obviously does not apply good strategies for acquiring competent advantage and increasing the market shares and there is an increase of 1.02%. According to the market shares, from second telecommunication operator, get to the third place on the Macedonian market.

Report from the Research

According to the measuring value after conducted statistical processing of the primary data from the questionnaire and secondary data from the companies, Agency for the Electronic Communications and State Statistical Office pursuant to the determined objectives, subject of the research and determined hypothesis the following conclusions are following:

- Prices formed by the telecommunication companies are relatively high in relation to the income per capita, but customers in the choice of the operator despite the price they give big importance to the meaning and quality.

- There is a strong competence because the customers do not have loyalty trends to the operator, attracted by the lower prices and satisfaction is not complete in comparison to the promised offer and value.
- The customers are aware for social responsibility of the operator and investment in the research and development for better position and differentiation of the services, but that confirms that competence is high and they should form the price, the companies make effort to satisfy the demands of the customers and better the service.
- Examinees have split opinions for facts from which depend company position and analogously on that the combination of all elements is the most appropriate for positioning and increasing the market holdings together with offering the high quality services.
- Statistical data in period of six years is proof that strategies for entering the market with penetrating prices succeed to increase the market share, that was made by the Vip operator which offered relatively low prices for pre-paid and post paid costumers, or at the beginning do not decide for following the market leader, and with that succeeded to increase the market holdings and to became second mobile operator on the Macedonian market.
- In the last year, the number of customers is decreased and price war lead to decreasing the company benefits, or when T-Mobile was the only company on the market with telephone offer that achieved bigger benefit, there is no analyzes for the competiveness and menace of entering new competitiveness was big, but it could not long sustain the barrier for entrance. With entrance of One in the market, and then Vip, operators determine the prices on the basis of the competence and together act reasonably, form "fair" prices not to increase the profit, because minimal difference lead to losing the customers.

Established and analyzed hypothesis from the research,

- The price as a factor impacts on positioning the companies on the market;
- Combination of the market mix elements affects on the company success on the market;
- Price war between the competences affects on decreasing the incomes in the mobile telephony;

As a result of the credibility and representativeness of the model for statistical processing and theoretical understanding are completely accepted.

Conclusions and Recommendations

Research Findings

From this paper we can conclude that price competiveness is determinant from which depend profitability and positioning of the companies on the Macedonian market. The price is one of the elements of the marketing mix and it has importance in coordination with other elements. Price policy used by the companies and the role of the competence during formation, factors which have impact on marketing policy and formation of company's prices, precisely defined objectives and use of actual method for formation of prices and strategies used by the companies for formation competitive advantage with price concept determined each company for successful and profitable working. Price of the company means increased profit, or maximization of the current profit, but also tells the value of the product quality or services offered by the market.

The policy used by the companies is necessary to be rational, which means elasticity on longer period. It can be changeable on changed market conditions which can be identified throughout continual analyze in the company working period and use of alternative strategies. In the 21st century the market is bigger, offer of goods and services is increased enormously, also customer's needs and because of that companies need to be prepared on constant changes in the image opinion, not to have enormously increase or decrease of the prices. Decisions made by the companies for determination of the prices caused by internal factors in the company, as the marketing objectives, marketing strategies, organization for particular prices and external outside factors, nature of the market and demand, competence, economy in the country, government regulation, social aspects and etc.

Marketing objectives are formed differently depending from the activities of the company and market nature. Short term objectives are defined on the manner which enables achievement of long term, or they are activity chain for particular time period with objective to achieve long term efficiency through business strategy and in that context it is necessary mutual balance and coordination.

Objectives which are realized through prices from companies can be different, as maximization of the profit, providing existence of the company, increasing or maximization of the market share, service differentiation, sustaining profitability, liquidity and etc. Companies that are competitive orientated it is necessary to analyze the competitive objectives and make adequate future predictions.

After marketers will make relevant analyzes and make rational analyzes it is decided for the choice of most adequate method for price formation relating of the market nature, targeted segments and other internal and external factors. The prices are determined based on working expenses, offer and demand, competence and etc. The methods oriented to competition are determinate on the markets where customers where value estimation of the products or services are based on the price basis of the competence. The company may decide for following the market leader, determination of the current prices and policy for premium prices, sealed for bidding and closed offers.

Strategies used by the companies are created to fulfill the determined objectives, but unique and complexity for copying makes the strategy sustainable and competitive. Acquiring competitive advantage can be realized through satisfaction of customers' needs better than competitive companies. It is necessary companies to compare products prices or services, distribution channels, production capacities and manner of promotion of competence. With comparison companies can identify areas where they can achieve competitive advantage or areas where they are weaker. For acquiring of competitive advantage companies create information inquiring system through which comes to information to competent movies. Starting from benefits offered by the analysis, company can make stronger marketing campaign and make scheme for defense potential activities of the competence.

The rivalry among the permanent competitors, thread of new competitors, negotiator power of buyers, supplying and threat of substitutes determine the industry attraction of one national market. Following the innovation services with supreme quality, world trends and customer's need lead to strong competence and price war among companies in mobile industry and make very attractive for investigation.

Prediction in relation with the analysis of this industry determined and gives base for further investigation. The market offers terms for increasing the competence, entrance of the companies in the new marker and increasing the market segments. If on the market enter additional operator it is necessary analyzes for price competence and permanent companies, annual benefits which will be achieved in future and market share

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SYNTHESIS AND ANTIOXIDANT ACTIVITIES OF SOME NOVEL 2-[3-ALKYL (ARYL)-4,5-DIHYDRO-1H-1,2,4-TRIAZOL-5-ONE-4-YL]-PHENOXYACETIC ACIDS

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Abstract: In this study, nine novel 2-[3-alkyl(aryl)-4,5-dihydro-1H-1,2,4-triazol-5-one-4-yl] phenoxyacetic acids **(2)** were obtained by the reactions of 3-alkyl-4-amino-4,5-dihydro-1H-1,2,4-triazol-5-ones with 2-formylphenoxy acetic acid. Their structures were characterized by using ^{1}H-NMR, ^{13}C-NMR and IR spectral data together with elemental analysis. The synthesized novel compounds were analyzed for their in vitro antioxidant activities in three different techniques such as reducing power, free radical scavenging and metal chelating activity.

Keywords: 1,2,4-Triazol-5-one, synthesis, antioxidant

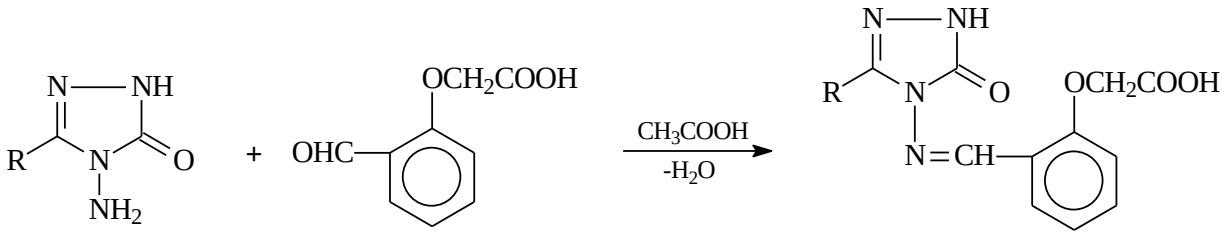
Introduction

1,2,4-Triazole nucleus and its derivatives an important class of heterocyclic compounds which show different biological activities such as antifungal (Kahveci et al., 2008), antimicrobial (Isloor et al., 2009; Nadkarni et al., 2001), antioxidant (Arslantas et al., 2012; Gursoy-Kol et al., 2012), antiviral (Henen et al., 2012), anti-inflammatory (Uzgoren-Baran et al., 2012), anticancer (Holla et al., 2002; Ibrahim 2009; Padmavathi et al., 2009), anticonvulsant activities (Zhang et al., 2012) and antibacterial (Yuksek et al., 1997; Pitucha et al., 2010). Several compounds possessing 1,2,4-triazole nucleus are clinically used drugs such as fluconazole, itraconazole, terconazole (Sztanke et al., 2008,;Haber 2001), etizolam (Shiroki et al., 1975) and furacylin (Povelista et al., 1973). There are numerous researches reporting the method of synthesizing 1,2,4-triazole Schiff bases and their diverse biological activities such as antioxidant, antitumor and antimicrobial. The results of these previous studies indicated that the Schiff bases possess mostly moderate to significant activities against different bacterial and fungal strains, which might be due to azomethine linkage and/or hetero atoms present in such compounds (Holla et al., 2003; Bayrak et al., 2010; Chandramouli et al., 2012; Wahi1 et al., 2011; Cicekli et al., 2012; Khanmohammadi et al., 2013).

Antioxidants have the capacity to protect organisms and cells from damage induced by oxidative stress; therefore, considerable research has been conducted to examine this feature. Natural sources that provide the active components for preventing or reducing the impact of oxidative stress on cells have been used (Hussain et al., 2003).

Exogenous chemicals and endogenous metabolic processes in the human body or in food systems might produce highly reactive free radicals, especially oxygen, which are capable of oxidizing biomolecules that can result in cell death and tissue damage. Oxidative damage has a pathological role in serious human diseases (e.g., emphysema, cirrhosis, atherosclerosis and arthritis). Furthermore, a variety of pathophysiological processes, such as inflammation, diabetes, genotoxicity and cancer, stem from the excessive generation of reactive oxygen species (ROS) induced by various stimuli that exceed the antioxidant capacity of the organism (McClements and Decker 2000). Even several natural sources of these active components have been used to synthesize and obtain effective new antioxidative compounds. It is well-known that 1,2,4-triazole derivatives present an antitumor activity on many cancer types, such as leukemia, non-small cell lung, colon, melanoma, ovarian, renal, prostate, and breast cancers. Several in vitro studies were performed for this purpose in recent years (Al-Soud et al., 2004; Mavrova et al., 2009; Bekircan, et al., 2006).
In the present study, the antioxidant activities of nine new 2-[3-alkyl(aryl)-4,5-dihydro-1H-1,2,4-triazol-5-one-4-yl] phenoxyacetic acids **(2)**, which were synthesized by the reactions of of 3-alkyl-4-amino-4,5-dihydro-1H-

1,2,4-triazol-5-ones (**1**) with 2-formylphenoxy acetic acid were determined. In addition, structures of all the synthesized compounds were elucidated with ^{1}H-NMR, ^{13}C-NMR, IR spectral methods and elemental analysis (Sinim, 2015). The starting compounds 3-alkyl(aryl)-4-amino-4,5-dihydro-1*H*-1,2,4-triazol-5-ones **(1)** were prepared from the reactions of the corresponding ester ethoxycarbonylhydrazones with an aqueous solution of hydrazine hydrate as described in the literature (Ikizler & Un, 1979; Ikizler & Yüksek, 1993).



1 **2**

a) R=CH_3, b) R=CH_2CH_3, c) R=$CH_2CH_2CH_3$, d) R=$CH_2C_6H_5$, e) R=$CH_2C_6H_4CH_3$ (*p*-), f) R=$CH_2C_6H_4OCH_3$ (*p*), g) R=$CH_2C_6H_4Cl$ (*p*-), h) R=$CH_2C_6H_4Cl$ (*m*-), i) R=C_6H_5

Scheme 1. Synthesis pathway of compounds 2

Methods

General Procedure for the Synthesis of Compounds 2

The corresponding compound **1** (0.01 mol) was dissolved in acetic acid (15 mL) and treated 2-formylphenoxy acetic acid (0.01 mol). The mixture was refluxed for 1 h and then evaporated at 50-55 °C *in vacuo*. Several recrystallizations of the residue from an appropriate solvent gave pure compound **2** as colourless crystals.

Antioxidant Activity: Chemicals

Butylated hydroxytoluene (BHT) was obtained from E. Merck (Germany). Ferrous chloride, α-tocopherol, DPPH., 3-(2-pyridyl)-5,6-bis(phenylsulfonic acid)-1,2,4-triazine (ferrozine), butylated hydroxyanisole (BHA), ethylenediaminetetraacetic acid (EDTA) and trichloroacetic acid (TCA) were obtained from Sigma (Germany).

Reducing Power

The reducing power of all the title compounds was determined according to the method of Oyaizu (Oyaizu 1986; Arslantas et al., 2012; Gursoy-Kol et al., 2012). The reductive capabilities of compounds were assessed by the extent of conversion of the Fe3+ / ferricyanide complex to the Fe^{2+} / ferrous form. The reducing powers of the compounds were observed at different concentrations (50–250 μg/mL), and results were compared with BHA, BHT and α-tocopherol. It has been observed that the reducing capacity of a compound may serve as a significant indicator of its potential antioxidant activity (Meir et al., 1995).

Free Radical Scavenging Activity

Free radical scavenging activity of all the synthesized compounds was measured 1,1-diphenyl-2-picryl-hydrazyl (DPPH), using the method of Blois Blois 1958; Arslantas et al., 2012; Gursoy-Kol et al., 2012). The model of scavenging the stable DPPH radical model is a widely used method to evaluate antioxidant activities in a relatively short time compared with other methods. The effect of antioxidants on DPPH radical scavenging was thought to be due to their hydrogen donating ability (Baumann et al., 1979). DPPH is a stable free radical and accepts an electron or hydrogen radical to become a stable diamagnetic molecule (Soares et al., 1997). The reduction capability of DPPH radicals was determined by decrease in its absorbance at 517 nm induced by antioxidants. The absorption maximum of a stable DPPH radical in ethanol was at 517 nm. The decrease in absorbance of DPPH radical was caused by antioxidants because of reaction between antioxidant molecules and radical, progresses, which resulted in the scavenging of the radical by hydrogen donation. It is visually noticeable as a discoloration from purple to yellow. Hence, $DPPH^{\cdot}$ is usually used as a substrate to evaluate antioxidative activity of antioxidants (Duh et al., 1999).

Metal Chelating Activity

The chelation of ferrous ions by the synthesized compounds and standards were estimated by the method of Dinis et al. (1994) as explained in literature (Arslantas et al., 2012; Gursoy-Kol et al., 2012). The chelating effect towards ferrous ions by the compounds and standards was determined. Ferrozine can quantitatively form complexes with Fe^{2+}. In the presence of chelating agents, the complex formation is disrupted with the result that the red colour of the complex is decreased. Measurement of colour reduction therefore allows estimation of the chelating activity of the coexisting chelator (Yamaguchi et al., 2000).

Results and Findings

In this study, the structures of nine novel 2-[3-alkyl(aryl)-4,5-dihydro-1H-1,2,4-triazol-5-one-4-yl] phenoxyacetic acids **(2)** were identified using spectral data. In addition, the compounds **2** were screened for their in-vitro antioxidant activities.

2-(3-Methyl-4,5-dihydro-1*H*-1,2,4-triazol-5-one-4-yl)-phenoxyacetic Acid (2a)
Yield 2.61 g (94.63 %). mp. 270 ºC. IR (KBr): 3246-2486 (OH), 3170 (NH), 1706 (C=O), 1597 (C=N), 1255 (COO), 755 (1,2-disubstituted benzenoid ring) cm^{-1}. ^{1}H-NMR (DMSO-d_6): δ 2.28 (s, 3H, CH_3), 4.86 (s, 2H, OCH_2), 7.04 (d, 1H, ArH; *J*=8.40 Hz), 7.08 (t, 1H, ArH; *J*=7.20 Hz), 7.48 (t, 1H, ArH; *J*=7.20 Hz), 7.94 (d, 1H, ArH; *J*=7.60 Hz), 10.06 (s, 1H, N=CH), 11.81 (s, 1H, NH), 13.15 (s, 1H, COOH). ^{13}C-NMR (DMSO-d_6): δ 11.64 (CH_3), 65.28 (OCH_2), 113.27; 121.73; 122.38; 126.18; 133.26; 157.59 (ArC), 144.85 (Triazole C_3), 149.61 (N=CH), 151.69 (Triazole C_5), 170.39 (COOH). Anal. Calcd. for $C_{12}H_{12}N_4O_4$ (276.25): C: 52.17; H: 4.38; N: 20.28, Found: C: 52.25; H: 4.58; N: 20.12.

2-(3-Ethyl-4,5-dihydro-1*H*-1,2,4-triazol-5-one-4-yl)-phenoxyacetic Acid (2b)
Yield 2.79 g (96.08 %). mp. 227 ºC. IR (KBr): 3196-2471 (OH), 3160 (NH), 1712 (C=O), 1599 (C=N), 1258 (COO), 758 (1,2-disubstituted benzenoid ring) cm^{-1}. ^{1}H-NMR (DMSO-d_6): δ 1.22 (t, 3H, $CH_2C\underline{H}_3$; *J*=7.60 Hz), 2.69 (q, 2H, $C\underline{H}_2CH_3$; *J*=7.60 Hz), 4.86 (s, 2H, OCH_2), 7.04 (d, 1H, ArH; *J*=8.40 Hz), 7.08 (t, 1H, ArH; *J*=8.00 Hz), 7.46-7.50 (m, 1H, ArH), 7.91 (d, 1H, ArH; *J*=8.00 Hz), 10.06 (s, 1H, N=CH), 11.84 (s, 1H, NH), 13.14 (s, 1H, COOH). ^{13}C-NMR (DMSO-d_6): δ 10.57 ($CH_2\underline{C}H_3$), 19.05 ($\underline{C}H_2CH_3$), 65.28 (OCH_2), 113.28; 121.77; 122.41; 126.10; 133.25; 157.59 (ArC), 148.61 (Triazole C_3), 149.59 (N=CH), 151.84 (Triazole C_5), 170.40 (COOH). Anal. Calcd. for $C_{13}H_{14}N_4O_4$ (290.28): C: 53.79; H: 4.86; N: 19.30, Found: C: 55.61; H: 5.19; N: 16.39.

2-(3-*n*-Propyl-4,5-dihydro-1*H*-1,2,4-triazol-5-one-4-yl)-phenoxyacetic Acid (2c)
Yield 2.90 g (95.43 %). mp. 247 ºC. IR (KBr): 3269-2639 (OH), 3172 (NH), 1710 (C=O), 1592 (C=N), 1256 (COO), 759 (1,2-disubstituted benzenoid ring) cm^{-1}. ^{1}H-NMR (DMSO-d_6): δ 0.96 (t, 3H, $CH_2CH_2C\underline{H}_3$; *J*=7.60 Hz), 1.69 (sext, 2H, $CH_2C\underline{H}_2CH_3$; *J*=7.60 Hz), 2.65 (t, 2H, $C\underline{H}_2CH_2CH_3$; *J*=7.60 Hz), 4.86 (s, 2H, OCH_2), 7.04 (d, 1H, ArH; *J*=8.40 Hz), 7.09 (t, 1H, ArH; *J*=7.60 Hz), 7.48 (t, 1H, ArH; *J*=7.60 Hz), 7.92 (d, 1H, ArH; *J*=7.60 Hz), 10.05 (s, 1H, N=CH), 11.85 (s, 1H, NH), 13.15 (s, 1H, COOH). ^{13}C-NMR (DMSO-d6): δ 13.96 ($CH_2CH_2\underline{C}H_3$), 19.41 ($CH_2\underline{C}H_2CH_3$), 27.24 ($\underline{C}H_2CH_2CH_3$), 65.28 (OCH_2), 113.29; 121.80; 122.41; 126.07; 133.26; 157.60 (ArC), 147.47 (Triazole C_3), 149.60 (N=CH), 151.78 (Triazole C_5), 170.40 (COOH). Anal. Calcd. for $C_{14}H_{16}N_4O_4$ (304.31): C: 55.26; H: 5.30; N: 18.41, Found: C: 55.25; H: 5.56; N: 18.16.

2-(3-Benzyl-4,5-dihydro-1*H*-1,2,4-triazol-5-one-4-yl)-phenoxyacetic Acid (2d)
Yield 3.30 g (93.89 %). mp. 274 ºC. IR (KBr): 3279-2509 (OH), 3176 (NH), 1710, 1680 (C=O), 1596 (C=N), 1256 (COO), 817 ve 694 (monosubstituted benzenoid ring), 760 (1,2-disubstituted benzenoid ring) cm^{-1}. ^{1}H-NMR (DMSO-d_6): δ 4.07 (t, 2H, CH_2Ph), 4.84 (s, 2H, OCH_2), 7.02 (d, 1H, ArH; *J*=8.40 Hz), 7.07 (t, 1H, ArH; *J*=7.60 Hz), 7.21-7.25 (m, 1H, ArH), 7.29-7.33 (m, 4H, ArH), 7.46 (t, 1H, ArH; *J*=7.60 Hz), 7.86 (d, 1H, ArH; *J*=7.60 Hz), 10.03 (s, 1H, N=CH), 11.97 (s, 1H, NH), 13.12 (s, 1H, COOH). ^{13}C-NMR (DMSO-d_6): δ 31.56 (CH_2Ph), 65.25 (OCH_2), 113.27; 121.76; 122.32; 126.12; 127.16; 128.91 (2C); 129.22 (2C); 133.28; 136.34, 157.60 (ArC), 146.77 (Triazole C_3), 149.31 (N=CH), 151.69 (Triazole C_5), 170.37 (COOH). Anal. Calcd. for $C_{18}H_{16}N_4O_4$ (352.35): C: 61.36; H: 4.58; N: 15.90, Found: C: 61.30; H: 4.87; N: 15.85.

2-(3-*p*-Methylbenzyl-4,5-dihydro-1*H*-1,2,4-triazol-5-one-4-yl)-phenoxyacetic Acid (2e)
Yield 3.40 g (92.96 %). mp. 282 ºC. IR (KBr): 3304-2648 (OH), 3181 (NH), 1706, 1681 (C=O), 1595 (C=N), 1242 (COO), 879 (1,4-disubstituted benzenoid ring), 756 (1,2-disubstituted benzenoid ring) cm^{-1}. ^{1}H-NMR (DMSO-d_6): δ 2.25 (s, 3H, *p*-$PhCH_3$), 4.01 (s, 2H, CH_2Ph), 4.84 (s, 2H, OCH_2), 7.02 (d, 1H, ArH; *J*=8.40 Hz), 7.08 (t, 1H, ArH; *J*=7.60 Hz), 7.11 (d, 2H, ArH; *J*=7.60 Hz), 7.20 (d, 2H, ArH; *J*=8.00 Hz), 7.47 (t, 1H, ArH; *J*=8.40 Hz), 7.87 (d, 1H, ArH; *J*=7.60 Hz), 10.02 (s, 1H, N=CH), 11.95 (s, 1H, NH), 13.13 (s, 1H, COOH). ^{13}C-NMR (DMSO-d_6): δ 21.08 (*p*-$PhCH_3$), 31.16 (CH_2Ph), 65.25 (OCH_2), 113.26; 121.76; 122.33; 126.12; 129.09

(2C); 129.48 (2C); 133.22; 133.27; 136.21, 157.60 (ArC), 146.92 (Triazole C_3), 149.26 (N=CH), 151.69 (Triazole C_5), 170.38 (COOH). Anal. Calcd. for $C_{19}H_{18}N_4O_4$ (366.38): C: 62.29; H: 4.95; N: 15.29, Found: C: 61.95; H: 5.12; N: 15.30.

2-(3-*p*-Methoxybenzyl-4,5-dihydro-1*H*-1,2,4-triazol-5-one-4-yl)-phenoxyacetic Acid (2f)
Yield 3.62 g (94.75 %). mp. 254 ºC. IR (KBr): 3254-2511 (OH), 3166 (NH), 1712 (C=O), 1584 (C=N), 1247 (COO), 880 (1,4-disubstituted benzenoid ring), 759 (1,2-disubstituted benzenoid ring) cm^{-1}. ^{1}H-NMR (DMSO-d_6): δ 3.71 (s, 3H, OCH_3), 3.99 (s, 2H, CH_2Ph), 4.83 (s, 2H, OCH_2), 6.87 (d, 2H, ArH; *J*=8.40 Hz), 7.02 (d, 1H, ArH; *J*=8.80 Hz), 7.08 (t, 1H, ArH; *J*=7.60 Hz), 7.24 (d, 2H, ArH; *J*=8.40 Hz), 7.47 (t, 1H, ArH; *J*=8.40 Hz), 7.89 (d, 1H, ArH; *J*=7.60 Hz), 10.03 (s, 1H, N=CH), 11.94 (s, 1H, NH), 13.11 (s, 1H, COOH). ^{13}C-NMR (DMSO-d_6): δ 30.70 (CH_2Ph), 55.47 (OCH_3), 65.31 (OCH_2), 113.27; 114.33 (2C); 121.75; 122.33; 126.13; 128.09; 130.29 (2C); 133.27; 157.63; 158.52 (ArC), 147.08 (Triazole C_3), 149.30 (N=CH), 151.71 (Triazole C_5), 170.40 (COOH). Anal. Calcd. for $C_{19}H_{18}N_4O_5$ (382.38): C: 59.68; H: 4.74 N; 14.65, Found: C: 58.93; H: 4.99; N: 14.49.

2-(3-*p*-Chlorobenzyl-4,5-dihydro-1*H*-1,2,4-triazol-5-one-4-yl)-phenoxyacetic Acid (2g)
Yield 3.72 g (96.37 %). mp. 260 ºC. IR (KBr): 3277-2483 (NH), 3158 (NH), 1706 (C=O), 1597 (C=N), 1244 (COO), 850 (1,4-disubstituted benzenoid ring), 750 (1,2-disubstituted benzenoid ring) cm^{-1}. ^{1}H-NMR (DMSO-d_6): δ 4.08 (s, 2H, CH_2Ph), 4.84 (s, 2H, OCH_2), 7.03 (d, 1H, ArH; *J*=8.40 Hz), 7.07 (t, 1H, ArH; *J*=7.60 Hz), 7.34-7.39 (m, 4H, ArH), 7.47 (t, 1H, ArH; *J*=8.40 Hz), 7.85 (d, 1H, ArH; *J*=7.60 Hz), 10.03 (s, 1H, N=CH), 11.99 (s, 1H, NH), 13.13 (s, 1H, COOH). ^{13}C-NMR (DMSO-d_6): δ 30.88 (CH_2Ph), 65.26 (OCH_2), 113.28; 121.77; 122.28; 126.15; 128.85 (2C); 131.17 (2C); 131.86; 133.22; 135.35; 157.62 (ArC), 146.44 (Triazole C_3), 149.42 (N=CH), 151.67 (Triazole C_5), 170.37 (COOH). Anal. Calcd. for $C_{18}H_{15}N_4O_4CI$ (386.79): C: 55.89; H: 3.91; N: 14.48, Found: C: 56.14; H: 4.18; N: 13.88.

2-(3-*m*-Chlorobenzyl-4,5-dihydro-1*H*-1,2,4-triazol-5-one-4-yl)-phenoxyacetic Acid (2h)
Yield 3.59 g (92.97 %). mp. 260 ºC. IR (KBr): 3218-2509 (OH), 3175 (NH), 1715 (C=O), 1593 (C=N), 1262 (COO), 801 ve 682 (1,3-disubstituted benzenoid ring), 765 (1,2-disubstituted benzenoid ring) cm^{-1}. ^{1}H-NMR (DMSO-d_6): δ 4.10 (s, 2H, CH_2Ph), 4.83 (s, 2H, OCH_2), 7.02 (d, 1H, ArH; *J*=8.40 Hz), 7.06 (t, 1H, ArH; *J*=7.60 Hz), 7.27-7.29 (m, 3H, ArH), 7.44 (s, 1H, ArH), 7.47 (t, 1H, ArH; *J*=8.40 Hz), 7.85 (d, 1H, ArH), 10.03 (s, 1H, N=CH), 11.10 (s, 1H, NH), 13.13 (s, 1H, COOH). ^{13}C-NMR (DMSO-d_6): δ 31.20 (CH_2Ph), 65.34 (OCH_2), 113.29; 121.69; 122.27; 126.13; 127.20; 128.03; 129.43; 130.73; 133.26; 133.29; 138.72; 157.66 (ArC), 146.27 (Triazole C_3), 149.38 (N=CH), 151.66 (Triazole C_5), 170.39 (COOH). Anal. Calcd. for $C_{18}H_{15}N_4O_4CI$ (386.79): C: 55.89; H: 3.91; N: 14.48, Found: C: 55.30; H: 4.26; N: 13.92.

2-(3-Phenyl-4,5-dihydro-1*H*-1,2,4-triazol-5-one-4-yl)-phenoxyacetic Acid (2i)
Yield 3.28 g (97.14 %). mp. 292 ºC. IR (KBr): 3208-2362 (OH), 3159 (NH), 1708 (C=O), 1597 (C=N), 1229 (COO), 801 ve 678 (monosubstituted benzenoid ring), 758 (1,2-disubstituted benzenoid ring) cm^{-1}. ^{1}H-NMR (DMSO-d_6): δ 4.88 (s, 2H, OCH_2), 7.06 (d, 1H, ArH; *J*=8.40 Hz), 7.07 (t, 1H, ArH; *J*=8.00 Hz), 7.49 (t, 1H, ArH; *J*=8.00 Hz), 7.52-7.56 (m, 3H, ArH), 7.85 (d, 1H, ArH; *J*=7.60 Hz), 7.89-7.92 (m, 1H, ArH), 10.01 (s, 1H, N=CH), 12.38 (s, 1H, NH), 13.15 (s, 1H, COOH). ^{13}C-NMR (DMSO-d_6): δ 65.36 (OCH_2), 113.43; 121.89; 122.19; 126.30; 127.19; 128.48 (2C); 128.97 (2C); 130.53; 133.55; 157.78 (ArC), 145.16 (Triazole C_3), 151.83 (N=CH), 152.17 (Triazole C_5), 170.38 (COOH). Anal. Calcd. for $C_{17}H_{14}N_4O_4$ (338.32): C: 60.35; H: 4.17; N: 16.56, Found: C: 60.08; H: 4.43; N: 16.41.

Antioxidant Activity

The antioxidant activities of nine new compounds **2a-i** were determined. Several methods have been used to determine antioxidant activities and the methods used in the study are given below:

Total Reductive Capability using the Potassium Ferricyanide Reduction Method

In this paper, all the title compounds showed lower absorbance than standard antioxidants in made measurements at 700 nm. Therefore, Total reductive capability wasn't observed for reducing metal ion complexes to their lower oxidation state or for any electron transfer reaction. Hereby, all the compounds did not exhibit a reductive activity.

DPPH· Radical Scavenging Activity

Antiradical activities of compounds and standard antioxidants such as BHA, BHT and α-tocopherol were determined by using DPPH· method at 517 nm. Scavenging effect values of compounds **2a-i,** BHA and α-tocopherol at various concentrations (12.5–37.5 µg/mL), are given Figure **1**. The radical scavenging effect of the compounds and the standards were found as following order: α-tocopherol > BHA > BHT > **2b** > **2d** > **2g** > **2e** > **2i**

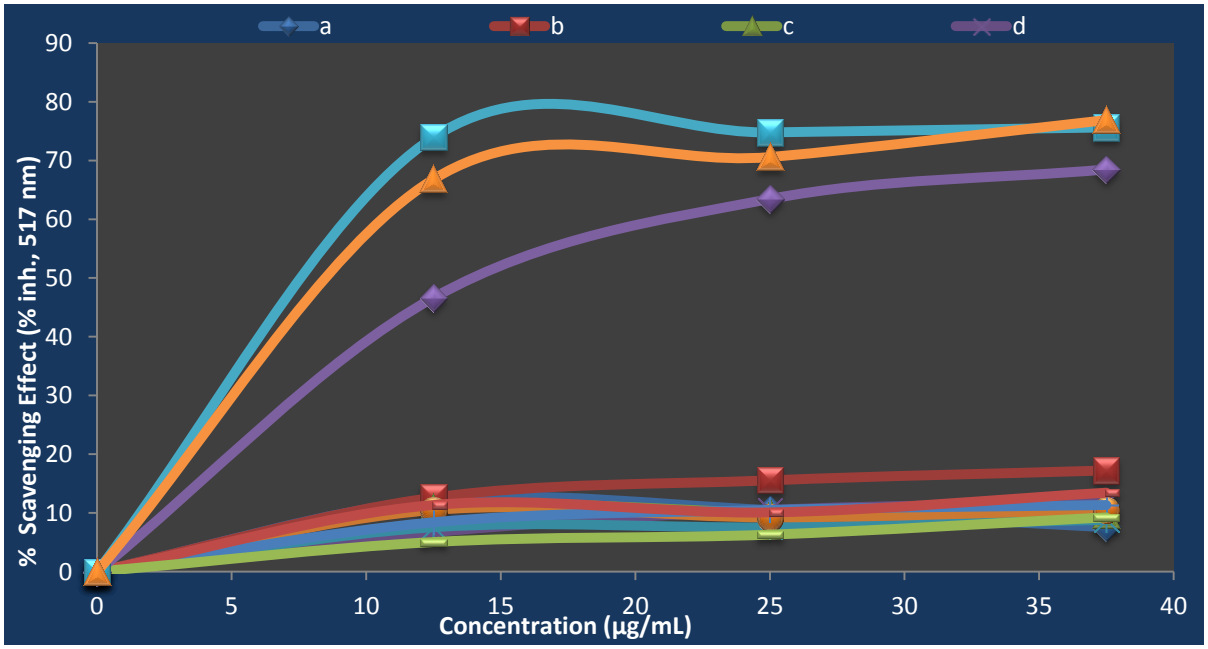


Figure 1. Scavenging effect of compounds 2a-i, BHT, BHA and α-tocopherol at different concentrations (12.5, 25, 37.5 µg/mL).

Metal Chelating Activity

Metal chelating activities of synthesized compounds and standards indicates in Figure 2 as % inhibition at 562 nm. The values obtained from Figure **2** reveal that the metal chelating effects of the newly synthesized compounds **2d**, **2f**, **2g**, **2h** and **2i** were concentration-dependent although **2a**, **2b**, **2c** and **2e** were not. Ferrous ion chelating activity of the novel compounds and standards increased in the order of **2g** < **2i** = **2f** < **2h** < **2d** < α-tocopherol < EDTA. Moreover, the compound-iron complex may be active, because it can occur metal-catalyzed reactions.

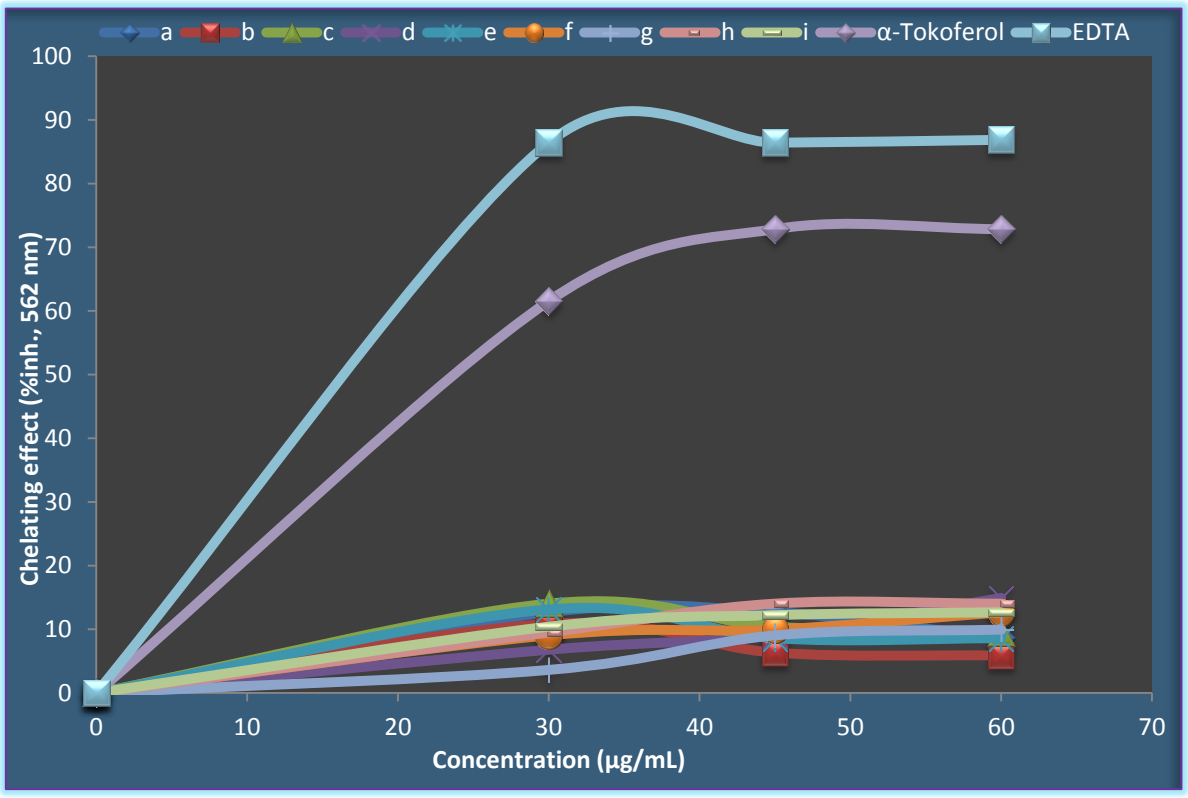


Figure 2. Metal chelating effect of different amount of the compounds 2a-i, EDTA and α-tocopherol on ferrous ions (30, 45, 60 µg/mL).

Conclusion

In the present study, a series of nine novel 1,2,4-triazol-5-one derivatives were synthesized by the reactions of **1** type compounds with 2-formylphenoxyacetic acid in acetic acid. The different spectral techniques and the elemental analysis confirmed the structure of the compounds. Compounds **2d**, **2f** and **2h** demonstrate a marked capacity for antioxidant activity. Design and synthesis of novel small molecules, (specifically **2f** and **2h** compounds), can play specifically a protective role in biological systems and in modern medicinal chemistry. These results may also provide some guidance for the development of novel triazole-based therapeutic target.

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FN-DBSCAN-GM: A PARAMETER FREE AND ROBUST VERSION OF DBSCAN ALGORITHM

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Abstract: Today, the popularity of cloud technology, internet of things applications and big data concepts are steadily increasing. In addition to the size of the resulting data, the necessity of making it meaningful is also important. Different methods and researches are becoming widespread and applied. Clustering is one of the methods commonly used in applications in the process to reach knowledge. This study proposes a new clustering algorithm, called FN-DBSCAN-GM. This algorithm does not need input parameters. Moreover, it is observed that the FN-DBSCAN-GM algorithm is more robust than DBSCAN (density-based spatial clustering of applications with noise) algorithm, and it provides more correct results for some known datasets. K-Means and G-Means algorithms also are used and are analyzed in the current work.

Keywords: Fuzzy clustering, FN-DBSCAN, parameter free algorithm

Introduction

Clustering groups the data according to similarities of their properties. After applying a clustering algorithm, data with different properties must be in different clusters. Clustering algorithms are divided into 5 main groups (partitioning based, hierarchical, density basedi grid based, model based). One of the most important methods is density-based clustering. There are many clustering algorithms based on densities. However, the developed algorithms are still inadequate to obtain good clustering [Yasar F. G. and Ulutagay G., 2016].

DBSCAN (density-based spatial clustering of applications with noise) algorithm has been developed by Ester et al. in year 1996. Clusters with different densities are discovered through the concepts of density reachable and connectivity. However, DBSCAN has some disadvantages. It needs two input parameters and results vary according to the input parameters which are entered. Some algorithms have been developed to eliminate the disadvantages.

DBSCAN-GM algorithm has been developed by Smiti and Elouedi in year 2012. They combine the algorithms of DBSCAN and Gaussian-Means. There is no need to enter parameters through the Gaussian Means (G-Means) algorithm. G-Means algorithm is used to find optimal number of clusters [Hammerly G. and Elkan C., 2003].
VDBSCAN (Varied Density Based Spatial Clustering of Applications with Noise) algorithm has been developed in year 2007 [Liu, P et al., 2007]. VDBSCAN estimates parameters before running DBSCAN algorithm like DBSCAN-GM. K-dists are calculated for each point and local ε values are used in this algorithm.

Fuzzy set theory provides robustness to clustering methods like FN-DBSCAN, FJP, FJP based clustering algorithms and Soft-DBSCAN algorithms [Nasibov E.N. and Ulutagay G., 2009-Nasibov E.N. and Ulutagay G., 2007-Ulutagay G. and Nasibov E.N., 2013]. Therefore, we develop the fuzzy version of DBSCAN algorithm (FN-DBSCAN) and we make the FN-DBSCAN parameter free. There are five sections in this paper. In the rest of this paper, Section 2 summarizes the clustering algorithms. Section 3 describes the FN-DBSCAN-GM algorithm which we have developed. The results from our experiments have been demonstrated in section 4. Section 5 concludes and has the future work.

Background

K-Means Algorithm

J.B. MacQueen has proposed K-Means algorithm in year 1967 [MacQueen J.B., 1967]. It is one of the most frequently used clustering algorithms. The number of clusters, k, must be entered as an input parameter in this

algorithm. Data is divided into k clusters. Cluster similarity is measured by the average value of the coordinates of objects in the cluster and it is the center of gravity of the cluster [Xu R. and Wunsch D., 2005].

G-Means Algorithm

Hamerly and Elkan have developed Gaussian Means algorithm in year 2003. Finding the optimal value of k in K-Means algorithm is an important problem to provide best clustering. Small changes in k may lead to big changes in clustering. Gaussian Means algorithm achieves automatic estimation of k.

FN-DBSCAN Algorithm

FN-DBSCAN algorithm has been proposed in year 2008 [Nasibov, E. and Ulutagay, G., 2008]. It takes the advantages of fuzzy neighborhood relation.

In fuzzy approach, each object belongs to clusters with membership degrees. If any problem involves uncertainty, using the methods with fuzzy approach gives more advantages than using crisp methods [Yasar F. G. and Ulutagay G., 2016]. ε_1 and ε_2 are the input parameters for FNDBSCAN algorithm.

Proposed System

FN-DBSCAN-GM algorithm is the combination of FN-DBSCAN and Gaussian Means (G-Means) algorithms. FN-DBSCAN-GM takes advantages of FN-DBSCAN and G-Means algorithms. It takes robustness from FN-DBSCAN algorithm and getting rid of input parameter from G-Means algorithm.

Firstly, each point x_{ik} is normalized to interval of [0, 1]. All distances between points are calculated using Euclidean distance formula. If we do not have the knowledge about the number of clusters, k, it is started from 1. To find the correct value of k for obtaining optimal clustering, a statistical test is run. In equation (1), the square of the distance between center cj and point x_{ij} is divided by the number of points which belongs to center j. Radius r_j of each cluster is the square root of the division. Global ε_1 is the minimum element of radii. After that, total volumes for each center (V_j) are calculated as in equation (2).

ω_i is the cardinality of a point in the neighborhood of ε_1. ω_{max} is the maximum cardinality value. ε_{2j} values are calculated as in eq. (3). Global ε_2 is the smallest ε_{2j} (4). The required parameters for FN-DBSCAN algorithm are determined. So, FN-DBSCAN can be run without parameter entry.

$$r_j = \sqrt{\frac{\sum_{i=1}^{n} d(c_j, x_{ij})^2}{n_j}}, \quad j = 1,2, \ldots \tag{1}$$

$$V_j = \frac{4}{3}\pi r_j^3, \; j = 1,2, \ldots \tag{2}$$

$$\varepsilon_{2j} = \frac{\frac{\pi r_j^2 n_j}{V_j}}{\omega max}, \; j = 1,2, \ldots \tag{3}$$

$$\varepsilon_2 = \min_j \varepsilon_{2j} \tag{4}$$

FNDBSCAN-GM algorithm is in below (Algorithm 1)

Algorithm 1. Algorithm of FN-DBSCAN-GM

Step 1:If there is a knowledge about the number of clusters, k is started from the number which is known. Otherwise, assign 1 to k.

Step 2: Use K-Means algorithm for initial set of centers.

Step 3: Apply a statistical test for all data points which are assigned to each center to find out whether these data points follow Gaussian distribution or not.

Step 4: If there is Gaussian distribution for a center, keep the center. Otherwise replace with two centers.

Step 5: Repeat Step 3 while new centers are added.

Step 6: Calculate radius r.

Step 7: Calculate ε_1 and ε_2.

Step 8: Mark all points as unassigned.

Step 9: Set t to 1.

Step 10: Find an unassigned fuzzy core point p within the neighborhood of ε1 and with ε_2 limit.

Step 11: Mark p as to be assigned. Assign p to a new cluster C_t.

Step 12: Create an empty set S. Put all unassigned points within the neighborhood of ε_1 into S.

Step 13: Get an unassigned point q in the S. Mark q as to be assigned. Assign q to the C_t. Remove q from S.

Step 14: If q is fuzzy core point with the limits of ε_1 and ε_2, add all unassigned points in ε_1 neighborhood of q to the set of S.

Step 15: Repeat Step 10 while the set of S is not empty.

Step 16: If any point is still unassigned, it is noise.

Step 17: End.

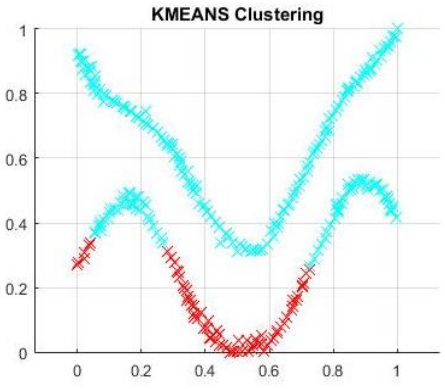
Experimental Results

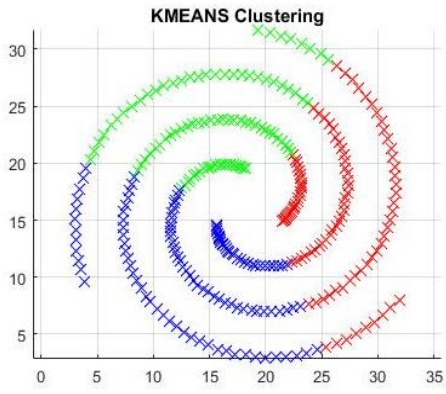
Methods have been tested on 4 datasets taken from internet. There is information about artificial datasets (sizes and number of clusters) which we used in this study in Table I.

Table 1. Used datasets

	Number of Points	**Dimensions**	**Cluster Numbers**
Wave	287	2	2
Spiral	312	2	3
Face	320	2	4
Moon	514	2	4

FN-DBSCAN-GM algorithm has given a hundred percent correct results for all of the artificial datasets as shown in Fig.1 and Fig.2. While DBSCAN is successful for some datasets (Face and Wave), K-MEANS has never been successful for these overlapping datasets. DBSCAN cannot find clusters correctly in Fig.1(b) and Fig.2(b). According to these results, FN-DBSCAN-GM is the best clustering algorithm compared with the other algorithms which we used in this study. This achievement is obtained through the fuzzy approach.





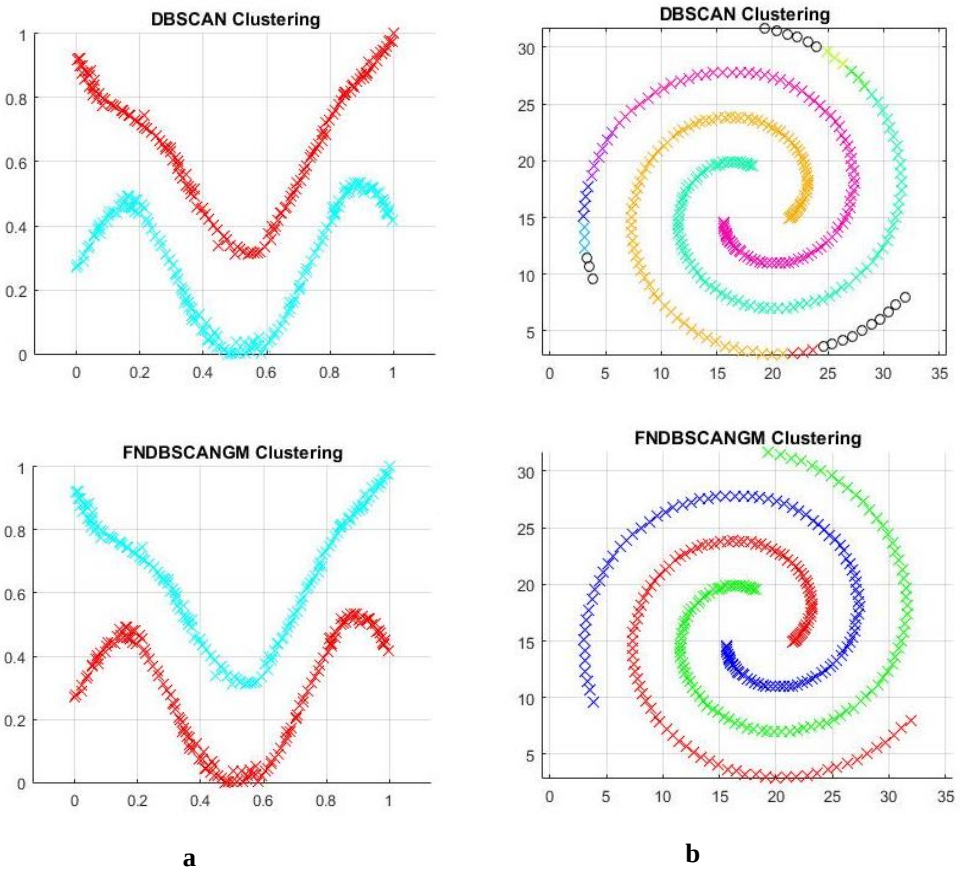
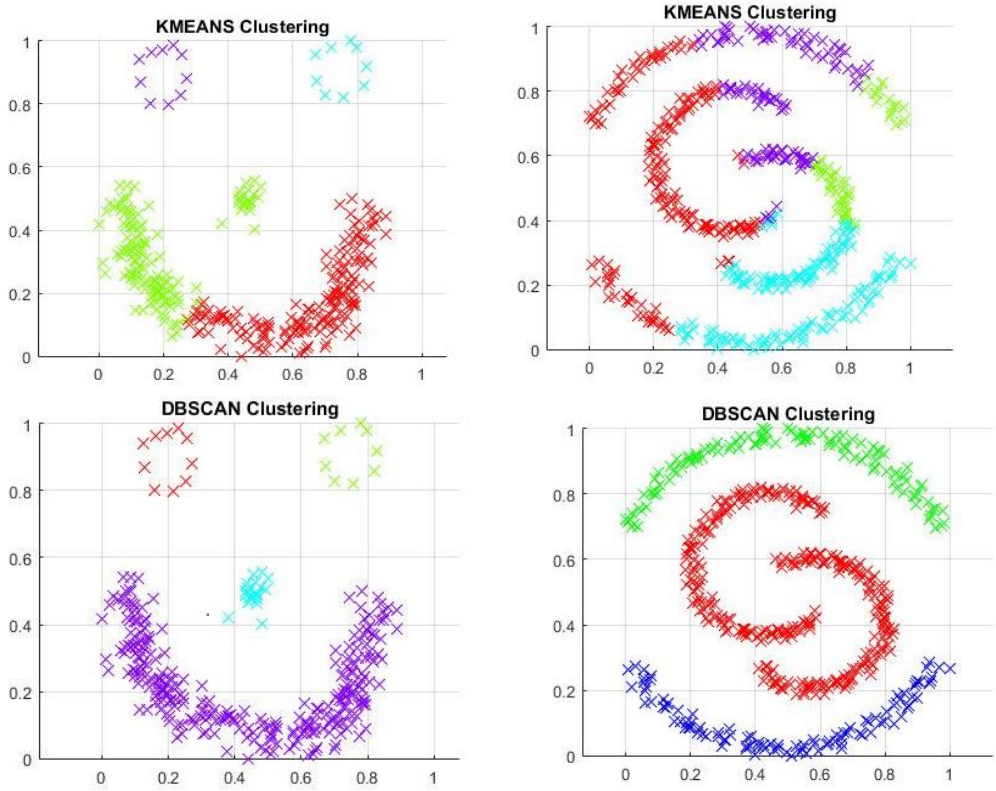


Figure 1. Results (a) wave dataset (b) spiral dataset



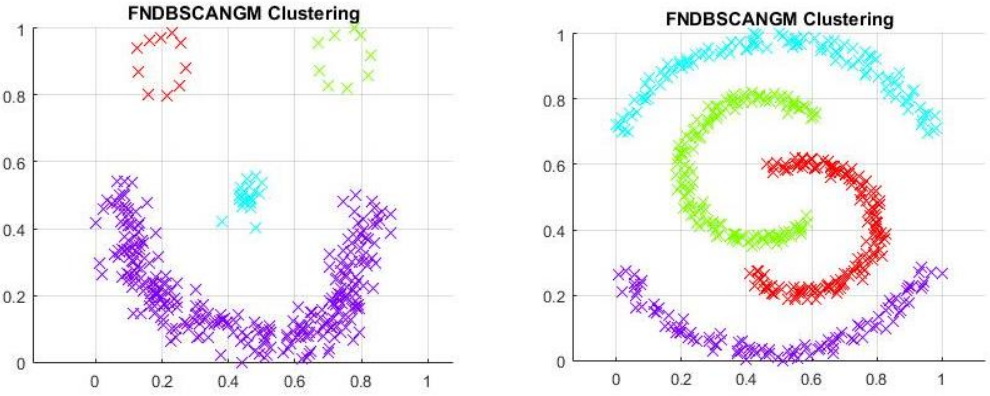


Figure 2. Results (a) face dataset (b) moon dataset

Conclusion

In this paper, a density based clustering algorithm, called FN-DBSCAN-GM, has been proposed. It is a fuzzy version of DBSCAN-GM algorithm and a parameter free version of FN-DBSCAN algorithm. Tests have been done on 4 artificial datasets. Our experiments show that FN-DBSCAN-GM can find the parameters of FNDBSCAN automatically and also it gives robust results like FN-DBSCAN algorithm. While K-MEANS cannot be successful for any dataset, FN-DBSCAN-GM algorithm has given a hundred percent correct results for all of the artificial datasets. Most of results in fuzzy approach are better than the results of crisp approach. Therefore, FN-DBSCAN-GM is a more preferable algorithm than other algorithms.
Note that, the time complexity of FN-DBSCAN-GM is $O(n^2)$. Our future work is to decrease the time complexity of the algorithm.

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ENERGY SAVING IN VENTILATION SYSTEMS OF AGRICULTURAL BUILDINGS

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Abstract: The article discusses the results of experimental studies of energy efficient ventilation system of sheepfold. The information-measuring system for remote registration of thermo technical parameters of the ventilation systems have been used. They are given the results of testing of the experimental energy efficient ventilation system in the winter and summer periods. The description of the experimental energy-efficient ventilation system sheepfold for lambing is shown.

Keywords: Ventilation, low-potential heat of the soil, underground duct, underground heat exchanger, sheepfold

Introduction

Rational using of fuel and energy resources is one of the global problems. One promising solution to this problem is the use of new energy-saving technologies, using renewable energy sources. The range of renewable energy on farms is quite broad: it is heating or cooling buildings, and drying of agricultural products, and desalination and water heating, and even autonomous power supply. The advantages of the energy sources are environmental friendliness and low cost of labor and funds for the operation of facilities for their use [1, 2].

The solution of the problem in the energy-saving ventilation systems of agricultural buildings is the effective use of low-grade soil heat. The ground surface layers of the Earth, actually is a heat accumulator of unlimited capacity, which thermal regime is formed by the action of solar radiation. Low-grade heat of the Earth can be used in agricultural buildings for heating, hot water, air-conditioning (air-cooling).

There are a number of examples of the use of soil heat for heating and cooling of livestock buildings through underground air conduits and heat exchangers. They are allowed to save from 50 to 75% of the costs for heating and cooling the buildings [1-2]. Studying these examples allowed to develop energy-saving ventilation system for sheep premises [3-5].

Object of Study

Ventilation device (figure 1) contains the intake shaft 1 and 2 provided with a fan motor 3 and water spray 4, exhaust shaft 5 with control valve 6 and air supply ducts 7, 8 with control valves 9, outlets in air 10-ventilated room with a 11 - coil temperature of 12 linked via the intake 13 air shutter shaft 1 and placed in the soil below the freezing and the latter program controller 14 microclimate temperature sensors 16, 17, 19, 20 and 15 velocity , humidity 18 connected to the fan motor 3 control valve 6, 2, 9 exhaust shafts and air intakes to 7, 8 and 4, and the atomizer coil units 12 temperature.

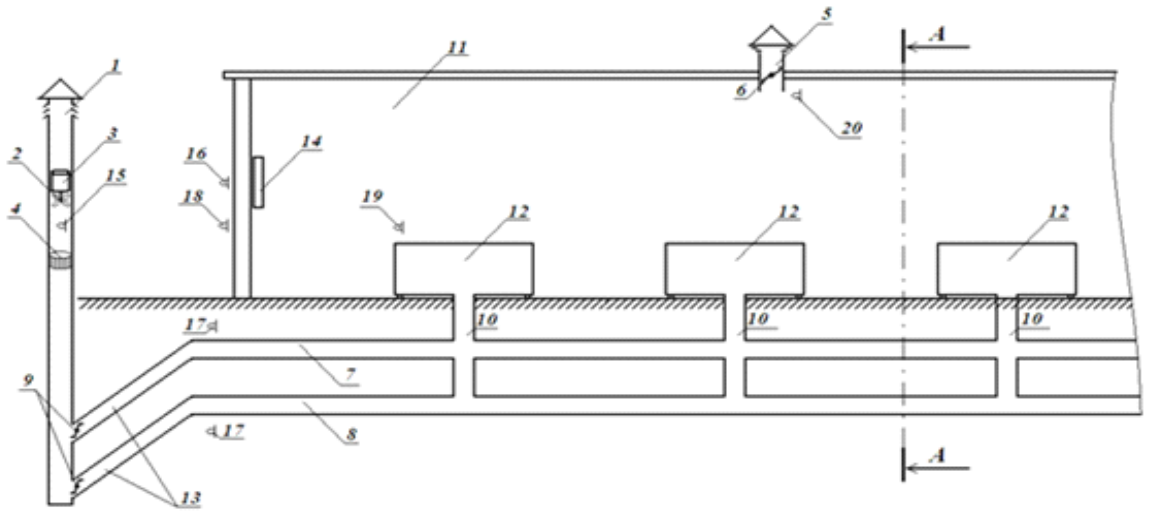

Figure 1. Diagram of the ventilation system

The device contains two air-supply ducts 7, 8 to ensure continuity of supply of heated air into the room 11 during charging one of them. Assembly and manufacture of air handling unit is made from prefabricated modular elements, designed to suit the required volume of ventilation air and the type of agricultural premises. In a cold season the heavy gravity fresh air enters the intake shaft 1 and through air shutter 13 enters the outdoor air duct 7 contacts with the surface of the walls, is heated with the warmth of a soil and moves up , goes through 10 outlets in room 11, flowing temperature closer 12. Air shutter 13 threshold, which is located below the bottom of the duct 7, 8 does not allow exit easily of the heated air from the air in the intake shaft 1. Thereby it provides a strictly unilateral movement gravity flow of fresh air. Exit from the ventilated room of the exhaust air through the exhaust shaft 5 with a control valve 6, which is controlled by software regulator microclimate 14.

Program controller 14 controls operation of the electric motor 3 of the fan 2 which supports the set speed of a self-flowing stream and adjusting valves 9, stitched air ducts 7, 8, providing the set threshold of temperature of a self-flowing stream, and also temperature closer. As the temperature of the walls of the duct 7 or soil mass reduces the intensity of heat removal and at a certain temperature the threshold exceeds a specified value. At this point, the temperature sensor signal ground 17 climate control 14 closes the control valve air supply duct 7 and opens the valve 8. An array of ground round duct 7 after a while restores its natural temperature, i.e. recharges, and the array of soil around the duct 8 is cooled, i.e. discharges. Upon reaching the ground temperature values are normalized by the sensor 17, the controller 14 closes the valve 9 microclimate supply duct 8 and 9 opens the valve duct 7. Thus, blowing ducts alternately operate in the mode of charging and discharging, provides normalized stable supply air temperature, i.e. stabilizing the temperature of the supply air. Enter the room heated inlet air temperature 12 wraps closer, increases its temperature to the rated value. Enable or disable the controller 14 performs closers microclimate by temperature sensor 19.12 closers provide radiant and convective heat transfer in the process of creating a local microclimate.

Under this scheme, designed and built experimental energy-saving ventilation system for the sheepfold and conducted production tests during the lambing.

Conclusion

In times of testing energy saving ventilation system provided the required power saving mode and zootechnical parameters of the microclimate in the maternity ward of the sheepfold. Functional block diagram of energy saving ventilation system is developed. Experimental energy-saving ventilation system for the sheepfold is built. Energy saving ventilation system has been adopted for economic use and recommended for implementation in the sheep farms.

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DATA PROTECTION FRAMEWORK IN PUBLIC CLOUDS: AN EMPIRICAL STUDY

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Abstract: The advancement of cloud computing has introduced new security frontiers requiring different approaches from the conventional protection mechanisms. By moving resources away from owning and maintaining data centers, the adoption of cloud computing allows organizations to concentrate on core competencies to tackle competitive challenges and increase market share. However, relocation to public clouds – many organizations still perceive public clouds as imprecise zones – portends profound and far-reaching implications for organizations as clouds expose data to startling vulnerabilities and shift security responsibility to cloud service providers. With the increased number of data breaches both in businesses and governments in recent years, empirical evidence has shown that security and regulatory requirements remain the main factors largely hindering rapid relocation to public clouds. In the era of cloud computing, perimeter security is no longer enough to secure corporate information and data assets. Thus, in deploying best practices, an all-encompassing data protection policy has become paramount. This paper investigates the complexity associated with protecting data in public clouds and presents a holistic framework aimed at managing security in cloud environments. Combining both qualitative and quantitative methods, the paper draws predominantly on empirical data from National Health Services (NHS) Ambulance Service Trusts and Incident Reports by the European Union Agency for Network and Information Security (ENISA).

Keywords: Public clouds, data breach, regulatory requirements, security perimeter, security framework

Introduction

Since the emergence of computing, there has never been a time when there were such grave concerns about security and compliance in the computing landscape as we see today with cloud computing. Computing has been evolving from mainframe in the early 50s to the current era of cloud computing, and the rapid technological advancement introduces new challenges. Perimeter security was the requirement to protect the physical facility housing mainframe computers. The perimeter model in the form of demilitarized zones (DMZs) continued through various computing deployment models. Today, in cloud environments, the perimeter model is no longer adequate for protecting the vast computing environment. This paper, which is a component part of an ongoing PhD study *(EXPLORATORY RESEARCH ON THE NATIONAL HEALTH SERVICES AMBULANCE SERVICE TRUSTS' INFORMATION SYSTEMS)* at Loughborough University, England, looks into the evolution of computing vis-à-vis the associated challenges. The paper attempts to address one of the sub-research questions: *What are the critical factors and risks that foster or impede the use of cloud computing in English NHS Trusts?* It is an exploratory study that draws predominantly on data collected from National Services (NHS) Ambulance Service Trusts and Incident Reports by the European Union Agency for Network and Information Security (ENISA).

Evolution of Computing

Centralized Computing

From the late 50s through the late 70s, centralized computing in the form of mainframe brought power and performance to computing. Securing the mainframe environment required a physical security facility given the lack of network connectivity to the outside world. Then came mini-mainframes, which equally offered companies security, high-power computing and total control over applications and data. Without Internet connection but with huge pools of central processing unit (CPU) and memory, and massive amounts of storage for objects and images, mainframe leverages those resources to virtualize workloads with a view to maximizing efficiency and dealing with high transaction volumes. Even with hardwired dumb terminal access to data centers,

restricted physical access still remained the governing security policy. As the evolution of computing continues, the mainframe in and of itself has evolved. While not widespread, bigger businesses are still running their business-critical applications on the mainframe. Today, Linux operating systems run on mainframes and virtualizations akin to VMware, which essentially is a private cloud that is also available on the mainframe. As IBM continue to retool and reshape the mainframe, mainframe technology—hardware, software and services—remains a large and lucrative business for IBM, and mainframes are still the back-office engines behind the world's financial markets and much of the global commerce (Lohr, 2008). However, the protection of systems, applications and data has taken on a completely new dimension.

Distributed Computing

Technological advancements in the late 80s through the 2000s heralded distributed desktop personal computers (PCs), client servers and remote-access computing. The new architecture shifted the pattern of computing toward powerful but economical PCs, thereby enabling networked computing from various departments and business units. However, with the increase in PC popularity and opportunity, there was also an increase in associated challenges in terms of management, administration, ownership costs, configuration, user support and application development. Initially, PCs were standalone systems, until the 90s, when they could be linked into networks using the operating system. Based on Windows software and Intel microprocessors, the client-server model allows desktop or laptop computers to act as clients to request services and resources from the servers, thereby splitting the processing work between the two types of machines. Users are at the clients' side requesting services and resources from servers, which process and house shared data, web pages, or other services or resources. Distributed computing increased heterogeneity, which in itself was a huge issue for administrators, who have to resolve software conflicts, compatibility, updates and licensing issues. At the same time, policies were designed in relation to availability, integrity and confidentiality using access control and authorization mechanisms. With distributed computing, a piece of code could be replicated across massive networks and corrupt millions of computers either by crashing them or by means of data corruption. The replication from PC to PC occurred at lightning speed. To protect the computing environment from attacks such as viruses, denial of service and other threats, the perimeter model formed the basis of security. Physical restriction to data centers was vital, as were authentication, authorization and accounting (AAA) (Jensen, Schwenk, Gruschka, & Iacono, 2009; Mather, Kumaraswamy, & Latif, 2009).

Mobile and Cloud Computing

In the 2010s, computing yet again evolved into mobile and cloud. On the one hand, the continuum computing evolution comes with exciting, radical and innovative ideas. The most attractive benefits that cloud computing offers are still capital expenditure and operational expenditure, including reduced hardware, software, license and management costs. On the other hand, security vulnerabilities increased over time.

Mobile Computing

The last decade saw the emergence of an enormous human reliance on mobile computing devices. The number of mobile devices worldwide is in the billions and the upward trend shows no sign of abating. The technology enables users to connect to the Internet at any time and from anywhere without utilizing a fixed physical link. Utilizing mobile devices, users can stream videos, transmit voice and data, and access social networks. As users enjoy the benefits of mobile computing in whatever form possible, the risks introduced by the technology also grow. Although bandwidth and energy are the top issues in this area, security issues have presented the biggest challenge thus far. The bottom line is that a compromised device can replicate viruses or malware to other devices in the network, be it corporate or the Internet.

Cloud Computing

Cloud computing refers to the offering of computing resources such as servers, storage, applications and services as services over the Internet in a shared, scalable and elastic manner. With this deployment model, users can rent resources as a utility (similar to electric power utility), and measure and pay for actual usage instead of permanently owning an entire infrastructure.

As shown in Figure 1, the cloud computing service model comprises Software as a Service (SaaS), e.g. Google Apps, Salesforce, Hotmail and Yahoo Mail; Platform as a Service (PaaS), e.g. Google App Engine, Windows

Azure and Amazon Elastic; and Infrastructure as a Service (IaaS), e.g. Amazon EC2, Rackspace and Cloud Storage (Liveri & Skouloudi, 2016; Subashini & Kavitha, 2011; Mather, Kumaraswamy, & Latif, 2009).

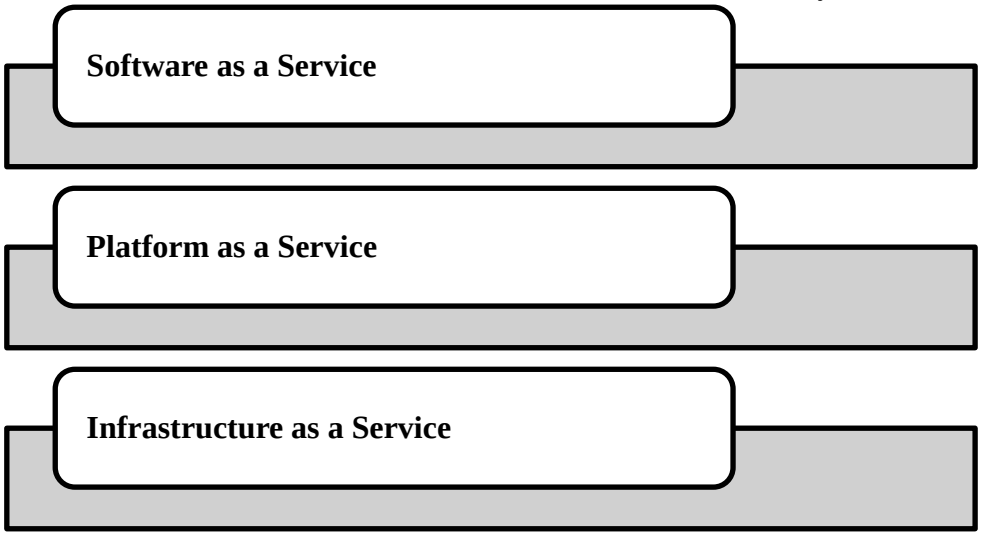

Figure 1. Cloud computing service models

The Cloud Computing Deployment Model depicted in Figure 2 comprises Community Cloud, in which resources are controlled and used by a group of people or companies, Private Cloud, in which resources are within a company and managed by the company, Public Cloud, in which resources are available to the public, and Hybrid Cloud, which allows organizations to outsource a portion of their computing to public clouds while retaining parts of the computing in-house.

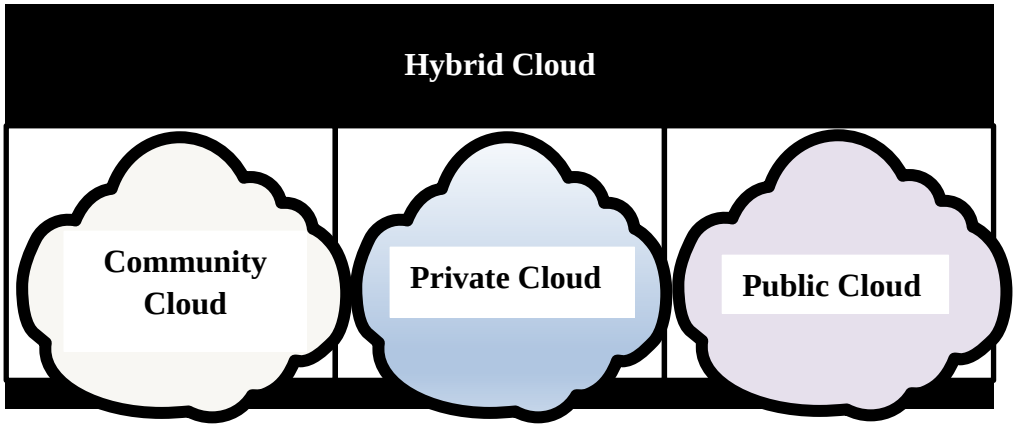

Figure 2. Cloud computing deployment models

Research Methods

Grounded Theory (GT), pioneered by Barney Glaser and Anselm Strauss, was the approach underpinning this research. After thoroughly evaluating alternative methods, it became clear that GT is the most appropriate. GT is not a research technique but a method that encompasses the entire research process from the inception of the research idea to the end of the research. The GT method is most suitable for exploratory areas of study, areas in which this study falls. With a sound understanding of the research, it became obvious that only GT would enable use in new situations; in gaining a new point of view in a familiar setting; and in enhancing the possibility of a fresh perspective. Additionally, GT has both inductive and deductive elements and enables the inclusion of data from larger sources beyond the qualitative data collected. Owing to the mixed elements, Glaser (1974, p. 116) argues that "in grounded theory circles, it is acknowledged to be the only true method of research." And according to Glaser and Strauss (1967), quantitative data can be used to support or further explore initial analysis, doing that strengthens the research.

We evaluated phenomenology, discourse analysis and GT. The goal in phenomenology is to study how people make meaning of their lived experience; discourse analysis examines how language is used to accomplish

personal, social and political projects; and grounded theory develops explanatory theories of basic social processes studied in context (Stark & Trinidad, 2007; Glaser, 1978; Glaser, 1994).

In essence, the quantitative part of the research, including data collection and analysis, serves in the body of the study as a validation or "verification" to use the word of Strauss and Corbin (1990) of the findings in the qualitative part. What Strauss and Corbin are referring to is internal verification within the mind of the researcher as he sifts the data back and forth in the sense of developing the emerging theory. "While coding we are constantly moving between inductive and deductive thinking. . . . There is a constant interplay between proposing and checking. This back and forth movement is what makes our theory grounded!" (Strauss & Corbin, 1990 p. 111). Rather, we argue in the whole, of which qualitative and quantitative are parts, that the theory has some enhanced scientific credibility due to comparison with an externally determined real world gleaned from the quantitative part. In the end, it was imperative to appreciate the advantages and drawbacks of the qualitative and quantitative methods; that understanding informs us how the two different methods contribute different perspectives to the same phenomenon.

Qualitative Data Collection

Qualitative data collection was performed over a period of two years across seven out of the ten NHS Trusts in England; altogether we conducted 28 one-to-one interviews. The main instruments used were recorded semi-structured face-to-face interviews, participant observation, field notes, published articles, web articles and newspapers. The exploratory nature of this study requires the inclusion of all public-domain information in addition to the primary data. The most interesting aspect of the data collection process was being able to occupy the instrument space as well as the intersubjective interactions as well as being reflexive throughout the entire process (Engward & Davis, 2015). Knowledge is created through intersubjective exchange, according to Swanson and Holton (2005). To better understand the social setting under study, it became a habit to become immersed in the organization and be part of it. Doing that was in line with the view of Bryman and Bell (2003): "by experiencing the dynamics within the premise of study and gaining extensive familiarity, a researcher would become flexible in the inquiry about the people in context, and that would allow for the evaluations of different perceptions and concerns." Further, Bryman and Bell (2003) argue that qualitative researchers view "events and the social world through the eyes of the people that they study." All recorded interviews were fully transcribed and tabulated; field notes snapshotted and inputted into NVivo for analysis. In addition, all other data sets were also uploaded into NVivo.

Quantitative Data Collection

Quantitative data in the form of survey data from ENISA and the CEU School of Public Policy and public-domain information were aggregated. The data used were international in nature; however, emphasis was placed on the data from ENISA and the CEU School of Public Policy.
The CEU data encompassed the following:

- Data from 28 European Union member countries plus Norway and Switzerland;
- Data collected from 2005 through 2014;
- Sampled with high social science standards for event database construction with multiple sourcing, intercoder reliability tests, recording and specific exclusion criteria.

Data Analysis

Qualitative Data Analysis

Qualitative data analysis was conducted using NVivo software, and it turned out that doing that became a practical process. The software enables ease of data integration into the 'project,' as it is called in NVivo. Various types of file formats such as Word, PDFs, websites and spreadsheets can be imported, coded and reported as the user may desire. Codes can be linked by methods of open or axial coding. Additionally, the software enables linkage to nontextual data such as audio, video, websites and pictures. And direct coding from videos and audios can be done. Furthermore, visualization of data and codes is simplified in NVivo by using any contemporary charts, be it in graphs or pies. Throughout the process, users are able to iterate the collected data at the back end while manipulation is going on at the front end. The massive amount of data collected in this research—which was not surprising given the combined methods in the study—was easily handled by the software, which can handle 10 GB of data in a single project. NVivo software in many ways seems to align with different concepts of GT, be it conceptualization—formatting and linking of nodes, memos and other files—or

iteration of the data as well as the back and forth elements. New data are easily integrated into the existing project. Strauss (1984, p. 14) advises that the theory is generated by being tightly aligned with the data from which it emerged. In terms of the organization and conduct of the work at hand, NVivo is an important and useful too.

Figure 3 depicts theory generation from data by means of iteration and interpretation of data.

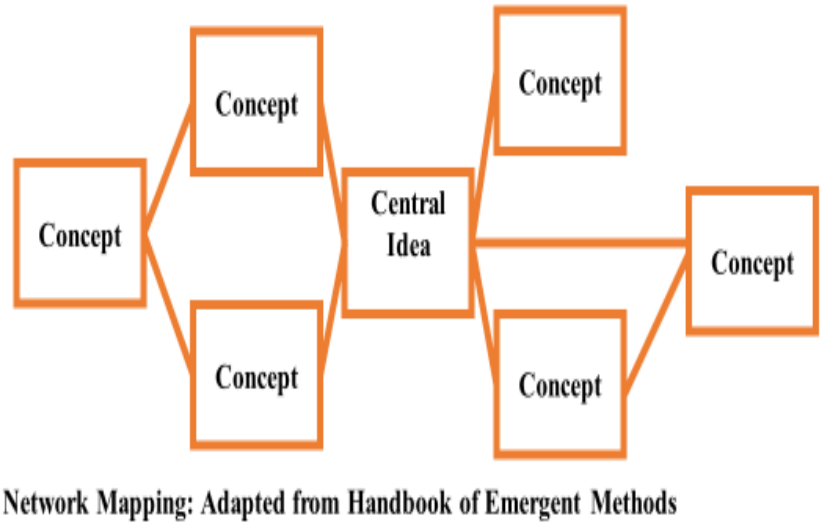

Figure 3. Network mapping

The process of coding in this research evolved back and forth during data analysis in that each time a category was changed or a new category was added, the entire data were recoded again to allow for conformity in the whole data. This process, just like the other processes involved in qualitative data analysis, was cumbersome and time-consuming, but ensuring conformity was the only way the researcher could return to the data sets and retrieve and organize the data that support that particular theme. It was challenging to analyze the large volume of data, but the researcher used Nvivo program to manipulate and manage the data, and that eliminated having to print out the interviews, and label them with sticky notes or similar. The researcher stopped coding at a point where all incidents could be readily classified and a sufficient number of regularities had emerged. Throughout the data analysis process the researcher actively reflected on the field notes, and the things observed during the interviews.

Quantitative Data Analysis

Quantitative data analysis was conducted using Microsoft Excel software.

Excel has powerful and useful features for quantitative data analysis. In addition to the attractive Excel features, the time constraint was also a reason we used Excel in this research. After learning how to use NVivo software for qualitative analysis, using Excel for the quantitative data removed the need to learn another full-fledged data analysis software such as IBM SPSS while getting to grips with analysis techniques in research.

We found four major Excel tools specifically useful during the analysis. Statistical functions that enable the use of data manipulation tasks including statistical tests are one of the most useful tools in Excel. The Data Analysis ToolPak, which contains functions that enable the use of inferential statistical analysis, is another Excel add-in that is especially useful for quantitative data analysis. Charts are invaluable data exploration and presentation tools in research. Using charts allows for concise visual presentation of findings. And pivot tables provide a way of generating summaries of data and are extremely useful for creating contingency. During the analysis process, pivot tables work extremely well with texts and generate useful outputs.

We reviewed and utilized the reports from the quantitative data by ENISA and the CEU School of Public Policy. Further, we dived deeply into the CEU raw data, and analyzed them with an emphasis on medical data in the UK, given the general scope of the main research. Then we examined the findings and compared them against the findings from the qualitative analysis and incorporated the end results into our reports.

Designing Exploratory Research

Doing exploratory research requires the inclusion of data from several different sources, including qualitative and quantitative data. Figure 4 depicts how data and methods are combined in exploratory research.

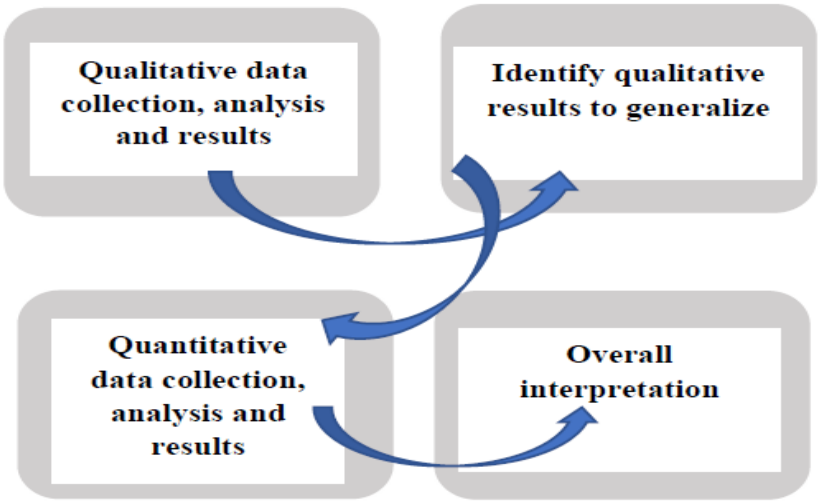

Figure 4: Exploratory design

Triangulation in Research

Triangulation is the use of multiple methods of data collection in order to enhance construct validity in research where data converge around a particular theory. In a mixed-methods research, quantitative data are utilized to confirm or disprove findings in initial analysis. Figure 5 depicts a triangulation design.

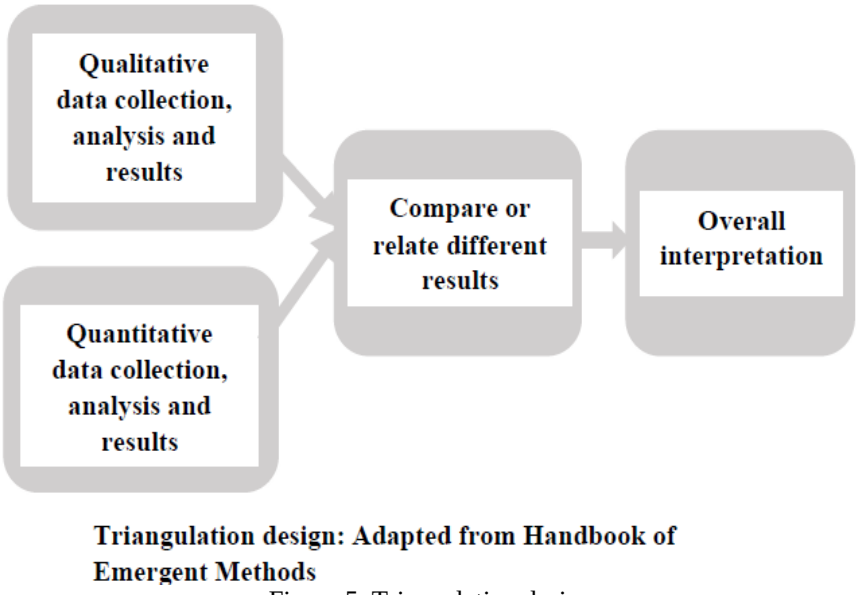

Figure 5. Triangulation design

Results and Findings

Evidence shows that security-related knowledge and expertise remain the most significant computing challenge for businesses and organizations when relocating to clouds. Clearly, security in and of itself continues to be the main focus across all spectrums, and methods to apply known and tested on-premises expertise to cloud environments are being widely considered. With data breaches on the rise, compliance is another vital concern to all stakeholders. Medical data, being extremely sensitive, require adequate protection, and so too do other data,

be it finance, insurance or government. As a result, organizations remain skeptical about relocating to public clouds. Skepticism varies from one organization to another; for example, organizations such as media and entertainment, as well as hotels, appeared less skeptical. Nevertheless, a high percentage of companies are not ready to relocate applications, data and services to public clouds yet. Instead of public clouds, hybrid clouds are gaining momentum.

Cybersecurity Skills Shortage

The shortage of cybersecurity skills is acknowledged across all organizations. Figure 6 depicts findings in descending order in response to issues affecting your organization's usage of cloud computing.

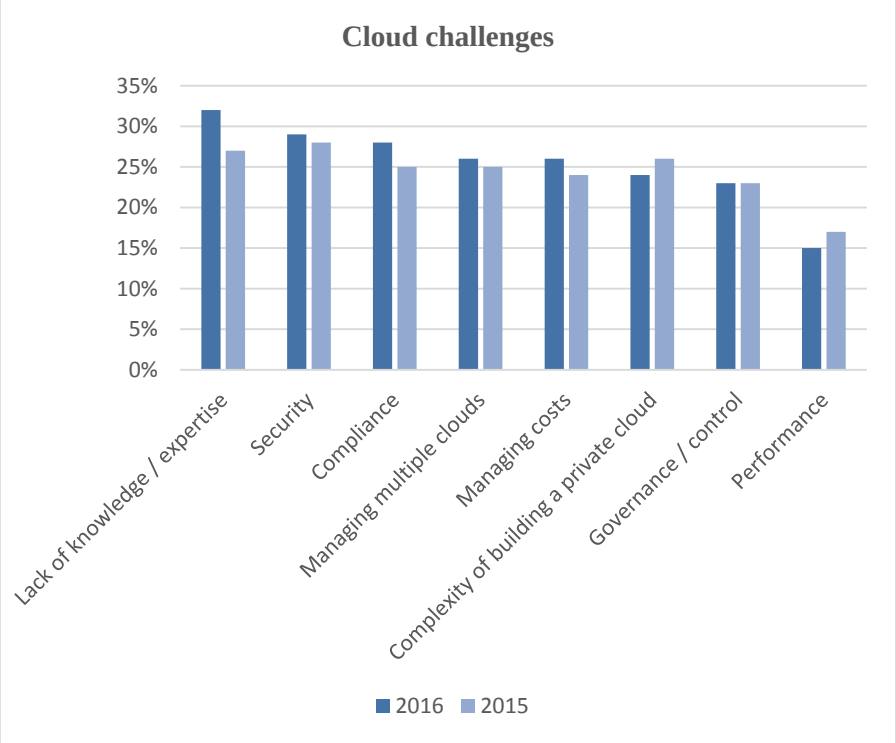

Figure 6. Issues affecting your organization's usage of cloud computing

Respondents also acknowledged that the lack of cybersecurity skills impedes their adoption of cloud technology. Figure 7 depicts responses to the question of whether the shortage of cybersecurity skills affects their organization's usage of cloud computing.

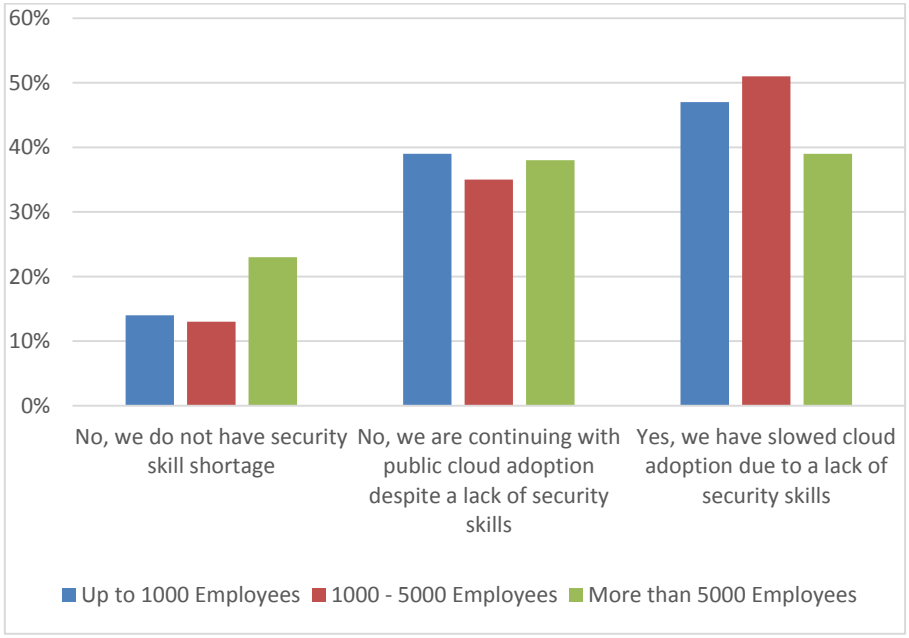

Figure 7. The impact of cybersecurity skills shortage in organizations

Policy Compliance Roadblocks

Both the UK and the EU in their Data Protection Laws; Data Protection Act (1998), General Data Protection Regulation (GDPR) (EU Regulation, 2016) respectively) specifically mandated the protection of personal data: "Appropriate technical and organisational measures shall be taken against unauthorised or unlawful processing of personal data and against accidental loss or destruction of, or damage to, personal data" (EU: subsection 78; UK: Section 4:1.7) as well as the geographical confines of personal data to ensure appropriate and adequate protection: "Personal data shall not be transferred to a country or territory outside the EEA unless that country or territory ensures an adequate level of protection for the rights and freedoms of data subjects in relation to the processing of personal data" (EU: subsection 101; UK: Section 4:1.8; Scotland, 2003).

The principles of the DPA provide the framework under which data controllers have to ensure that they process personal data fairly and lawfully. Traditional service providers are subjected to external audits and security. Therefore, as the threat landscape continues to evolve, organizations across the EU are taking the above regulatory requirements, among other things, into consideration when they relocate data and applications to cloud environments. When deploying to clouds, organizations need guarantees from cloud providers about the physical location of the data. Customers are ultimately responsible for the security and integrity of their own data, even when it is held by a service provider.

Thus, deployments to public clouds are negatively impacted given that most providers cannot guarantee that specific data will remain within the country of the customer. As a result, organizations are left with options to pick and choose what they should or should not deploy to public clouds. Consequently, and owing to the nature of clinical data, deployments to public clouds are rare.

Other Factors

There are several other issues impeding the adoption of cloud computing as depicted in Figure 6:

- managing multiple clouds; some organizations run multiple applications in multiple cloud environments. The cloud environments could be public and private which makes such a deployment hybrid. Doing that enables the deployment of certain cloud environments for certain applications depending on which cloud environment best suits a given application.
- managing costs; organizations expect to save costs by moving to clouds. However, cost savings are becoming a challenge when customers deploy cloud platforms. Therefore, it is vital to acquire cloud services with restraint in order to avoid waste or acquiring services that are underutilized. When resources are no longer in use, they should be released in time to prevent further costs being accrued. Organizations need adequate visibility of both on-premises and public cloud infrastructure resources to control costs and make better business decisions.

- the complexity of building a private cloud; managing private cloud environments in combination with the classical data center is a complex issue as organizations have to manage, and are learning new methods of doing so, the combined environments in terms of governance, security, integrity, availability and performance.
- governance/control; customers expect rapid, immediate and highly scalable cloud services. With increased choices regarding where they get the services and the ability to digitally innovate, customers feel more governance policies and control processes slow down the service requests and ultimately the deployment of public clouds (Leavitt, 2009).
- performance; some organizations are concerned about resolving the bottleneck issues within their infrastructure, especially when deploying to public clouds when wide area networks (WANs) are involved. Its high performance is one of the most important advantages of cloud computing; however, customers have to determine their sweet spots when deploying and accessing applications in public clouds. The cloud itself is, for the most part, not the issue, but rather connectivity to the cloud.

Medical Record Breach: UK and NHS

Also gleaned from the data was the extent to which the UK and the NHS were affected by data breaches. Among countries that suffered medical record breaches, the UK suffered the most, with 93% or 8,670,357 out of 9,337,197 records breached. Out of the 9,337,197 breached medical records, 8,670,357 were in the UK and 8,663,000 were NHS records. In other words, out of 8,670,357 records, only 7,357 were not NHS records, a number too insignificant to be captured as a percentage. Therefore, 100% of the medical data breached in the UK were NHS records.

For the most part, data were breached from internal sources, stolen or lost. This lends credence to security concerns associated with relocation to public clouds. For if on-premises data can be breached at that level and frequency, then the fear associated with deployment to public clouds is substantiated**.**

Data Breach: General Overview

A data breach is defined as any incident involving the loss or exposure of digital personal records. Personal records are defined as: a) data containing privileged information about an individual that cannot be readily obtained through other public means; and b) this information is only known by an individual or by an organization under the terms of a confidentiality agreement (Howard & Gulyas, 2014).

Overview of breached records over the last decade

- Globally 329 data breach incidents and 645 million personal records have been reported;
- 200 cases and 227 million records involving people in Europe have been reported;
- The total population of the countries covered in the study is 524 million, and the total population of Internet users in these countries is 409 million. Expressed in ratios, this means that for every 100 people in the study countries, 43 personal records have been compromised. For every 100 Internet users in the study countries, 56 records have been compromised;
- Fully 51 percent of the breaches involved corporations and 89 percent of all the breached records were from compromised corporations. Among all the kinds of organizations from which records have been compromised, 41 percent of the incidents involved clear acts of theft by hackers, but 57 percent of the incidents involved organizational errors, insider abuse or other internal mismanagement;
- The level of sophistication and detail in journalism about issues of privacy and personal data has increased, but it is largely driven by national "mandatory reporting" rules in particular countries. In other words, we know most about data leaks in countries where organizations are required to report that personal records have been compromised (Howard & Gulyas, 2014).

Figure 8 depicts the breakdown of the data in terms of breached records by type of organization.

Data Breach by Type of Organization Compromised	By Number of Incidents	Percent	By Number of Records	Percent
Commercial	117	36%	539,349,868	84%
Educational	111	34%	80,221	0%
Government	55	17%	59,173,346	9%

Medical	18	5%	9,337,197	1%
Military	8	2%	917,001	0%
Nonprofit	12	4%	1,818,765	0%
Unknown	8	2%	32,303,143	5%
TOTAL	329	100%	642,979,541	100%

Figure 8: The breakdown of breaches by organizations

Recommendations

Security and compliance remain the major concerns with cloud environments where data confidentiality, availability and integrity are not only essential, but also mandated. When public clouds are deployed and managed by a third party, data, applications and resources are located with the provider. This results in the loss of control by the customer. The consequence of giving up control is that providers manage user identity, user access control rules, security policies and enforcement for customers. Furthermore, the providers also manage data security and privacy, resource availability, monitoring and repairing of resources and services. Consequently, customers have to rely on the providers to implement efficient security mechanisms for their overall protection.

Cloud computing in the context of public clouds is replete with vulnerability, which becomes heightened when multi-tenancy is implemented, which means multiple independent customers share the same physical infrastructure. Thus, an attacker can legitimately collocate in the same physical machine as the target. An attacker could be a disgruntled insider at the customer's or provider's organization, or an outside intruder whose purpose is to breach the provider's security by sniffing out login and authentication information in order to gain access to, and then control of, a given client's machine, and if successful, then they can start their exploit.

Attackers can do a whole host of things, such as logging client communication to ascertain patterns, reading unencrypted data, copying a virtual machine, inserting malicious traffic, launching a denial of service (Dos) or probing the entire cloud structure. Additionally, attackers have tools and skills for eavesdropping, cryptanalysis, security shutdown, deploying malware and viruses, compromising supporting tools, compromising key devices and compromising private keys. However, organizations can be protected against most forms of attack (Chen, Paxson, & Katz, 2010; Dekker, Karsberg, & Daskala, 2012; Liveri & Skouloudi, 2016).

Mitigating Risks and Attacks in Public Clouds

Retaining control of security policies

- Instead of outsourcing security policy to cloud providers, it is recommended that access control, privacy, security polices and enforcement be jointly managed by the customer and cloud provider. If security policies are partly retained by the customer, it will prevent services from bypassing the physical, logical and personal controls.
- Avoid multi-tenancy (use data and research to advance this) with other customers, as doing that would prevent colocation with other users on the same physical server.
- Avoid arbitrary privileged user access to the physical server. Evidence shows spikes in insider intrusion in recent years. It is recommended that customers work with providers to obtain specific information on the hiring and oversight of privileged administrators, and the controls over their access.
- Ensure disengaged employees do not have access to the cloud infrastructure and every misbehavior in the cloud is fully reported.
- Integrate adequate identity management as well as monitoring and notification mechanisms.

Virtual Environment Protection

- Separate hypervisors for different types of applications.
- Understand the type of virtualization used by the provider as well as the security technology augments the virtual operating systems use.
- Use the big picture approach to engage in a full risk management process.
- Network segregation is recommended. It allows a cloud provider to create virtual networks for a customer via virtual DMZs, which enhance security against network attacks. VLAN tagging and trunking can also be implemented to create virtual LANs.

- Storage server segregation is recommended. It enables data for all virtual machines for a given customer to be segregated.
- Hypervisor updates should be performed periodically and kept up to date.
- Resource allocation monitoring is recommended to ensure data are properly purged from devices such as hard drives or physical memory before reallocation.
- Traffic filtering enables analysis of traffic for known attacks.
- Virtual machine migration should be performed via a secure communication channel to enhance security.

Drop the Perimeter Model

- Use data encryption efficiently. The cloud provider should provide evidence that encryption schemes were designed and tested by experienced specialists.
- Deploy a strong authentication server to handle access control from clients and ensure enhanced password security with encryption is in place.
- Streamline the services required and disable all unused services.
- Use MPLS, VPNs, VLANs and firewalls for network separation.
- Implement web application security such as firewalls as well as application security and vulnerability scanners, penetration testing, code analyzers and efficient coding.
- Deploy a secure inter-host communication channel.
- Risk assessment, on network and information systems, is a central part of information security governance and information security risk management (Zissis & Lekkas, 2012; Subashini & Kavitha, 2011; Jensen, Schwenk, Gruschka, & Iacono, 2009; Cox, 2011).

The Employee's Role in Data Protection

Employees and contractors present both internal and external threats to organizations. Internal threats come from intentional misdeeds and from lack of care; mistakes, errors in judgment, lost and stolen electronic devices, and simple failure to follow established procedures are among the most common ways that employees create risk for their organization. External threats come from people outside an organization who want to gain unauthorized access to the organization's sensitive information. Some of the more common schemes used by these individuals include: phishing attacks; deploying malware via email; pretexting; and gaining physical access to the workplace.

Therefore, every action or inaction of an employee can put an organization's information at risk. Thus, adequate training and adherence to internal data protection and other policies by employees are required. Doing the following could reduce the risks to an organization's data and information:

- Follow the organization's policies, including password policies.
- Make sure electronic devices and computers are secure; don't leave laptops or portable devices unattended in public spaces.
- Avoid storing personal information or trade secrets on portable devices.
- Don't open any email attachments or click on any links received from unknown senders.
- Use public networks and wireless technology only if permitted.
- Don't connect a personal device to a work computer or network unless authorized.
- Speak with an internal source if you have questions or need to report a suspected violation of policy.
- Immediately report security breaches—including loss or theft of any electronic device, personal information or trade secrets—to an internal source.

Limitations

This study has incorporated different methods and draws from several studies (Cutcliffe, 2000; Urquhart, Lehmann, & Myers, 2010; Hesse-Biber, & Leavy, 2010; Bryman & Bell, 2003). While, on the one hand, that was not only absolutely necessary given the nature and area of study, but it also strengthened the paper, less detailed and more focused studies would shed more light in the areas of study. For example, future studies could focus only on public cloud adoption decision processes, or organizational elements that are determinants for public cloud adoption, or purely on security in public clouds, or predominant challenges in public cloud environments. The aforementioned are all interesting and important areas of study that would benefit the research community. Focusing future research on a particular area of study would bring greater clarity and enable in-depth investigation into the subject of study.

On the other hand, however, researchers have been warned that gathering and sifting through massive amounts of data when doing research is cumbersome and painstaking to the extent that Miles (1979) labeled qualitative data "an attractive nuisance," stating that collecting and analyzing them is laborious, stressful and demanding. However, Miles (1979) also states that owing to their richness, realness, fullness and holisticness, their face validity seems unimpeachable. Thus, for us, the advantages of working with massive data sets outweigh the disadvantages, even if it means more man hours at the end of the day. The more parallels we can find in the data sets, the greater the validity of the findings.

Conclusions

This paper answers a sub-research question from a broader PhD study that is currently ongoing at Loughborough University, England. In answering the question *What are the critical factors and risks that foster or impede the use of cloud computing in English NHS Trusts?,* the paper empirically establishes, in descending order and in a wider context, factors and risks fostering or impeding organizational deployment of public cloud technology. The NSH case findings are in parallel with findings of a host of other organizations in different industrial sectors such as commerce, government and education. We used mixed methods in the research by gathering and analyzing data through a combination of qualitative and quantitative techniques before integrating the results from both data sets. Security expertise, data and application security, and compliance are the top three factors with the most impacts on public cloud deployment decisions evident in the data. Given that security is an overarching factor, the recommendation section of the paper introduces a holistic protection approach to cloud environments, which, if adapted by any organization in their security policy, would mean the given organization would be on a solid security footing.

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EXTRACTING THE CONNECTIVITY PROPERTIES OF THE TURKISH HIGHWAY TRANSPORTATION NETWORK

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Abstract: As a complex system consisting of interconnected nodes, highway networks are a form of complex networks that cover a region to provide transportation between locations. In this study, we focused on the national transportation network of Turkey consisting of roads between the junction points. We extracted the network data from the KGM (Karayolları Genel Müdürlüğü) maps, which are divided into 18 detailed sub-sections. The nodes and edges data are collected manually, with a time-consuming process, also including the distance between junctions in kilometers. Once the data was exported to proper database tables, we performed network analysis and visualization procedures using Gephi software. We also executed some distributional analysis together with their plots in MATLAB. As a result, we extracted numerous network metrics together with the tables of top 20 cities by the means of eigenvector, betweenness and closeness centrality measures. By the way, these cities together with their connections emerge as the most important junctions of the network since they locate between the most important pathways connecting other cities.

Keywords: Transportation networks, complex networks, centrality, data analysis

Introduction

Transportation network analysis is primarily concerned with the spatial, but also the temporal, nature of the movement of people and freight across land, where the movement is performed onto roads, railways, airways etc. (Bell & Iida, 1997). The movement patterns of individuals are mostly influenced with the infrastructure of these transportation facilities. Since the infrastructure of a network often affects its function, uncovering the topology and dynamics of the underlying networks is a critical action to elaborate connected systems (Soh et al., 2010).

The recent studies approach public transportation systems in both land based structures as subway, railway or highway networks (Haibin, 2016; Latora & Marchiori, 2002; Li & Cai, 2007; Mohmand & Wang, 2013; Mukherjee, 2012; Praveen, Mukherjee, & Ganguly, 2008; Sen et al., 2003), or airway structures defined by flight routes between airports (DeLaurentis, Han, & Kotegawa, 2008; Guimera, Mossa, Turtschi, & Amaral, 2005; Lacasa, Cea, & Zanin, 2009). These studies outline the universal properties of complex real networks like being small-world, scale-free, clustered, modular etc. are also evident in the transportation networks.

As a complex system consisting of interconnected nodes, highway networks are a form of complex real networks, defining the connectivity properties between cities. National highways define the backbone of economic development in the country as many locations are connected via highways (Mukherjee, 2012). They define the transportation web in mathematical presentation (nodes, edges), provide a framework to define important cities and roads in a network and quantize the facilitation of transporting between places in a national/regional map.

In this study, we focused on the national transportation network of Turkey consisting of roads between the junction points. We extracted the network data from the KGM (Karayolları Genel Müdürlüğü) maps ("Karayolları Genel Müdürlüğü Bilgi İşlem Dairesi, "Haritalar"," 2017), which are divided into 18 detailed sub-sections. The nodes and edges data are collected manually, with a time-consuming process, also including the distance between junctions in kilometers. By the way, we extracted the network properties of the highway structure of Turkey in detail, outlined the important nodes in the map, and performed visualizations in various aspects in the next section.

Methods

We manually collected the nodes data from the detailed KGM maps, to an MS Access database consisting of three tables corresponding to three levels of cities. We also collected the edges (links) data, corresponding to the connections between the cities with given IDs, to the same database. The edges table is responsible for the roads data, while it also contains the metric distance between the localizations in kilometers. Based on the edges table, we analyzed the network characteristics using Gephi software (Bastian, Heymann, & Jacomy, 2009) and visualized the results in MATLAB.

An instance of the KGM maps, involving the 12th region of Turkey is presented in Fig. 1. The node-edge data is extracted manually from the map and processed into the database. The database diagram is also visualized in Fig.2.

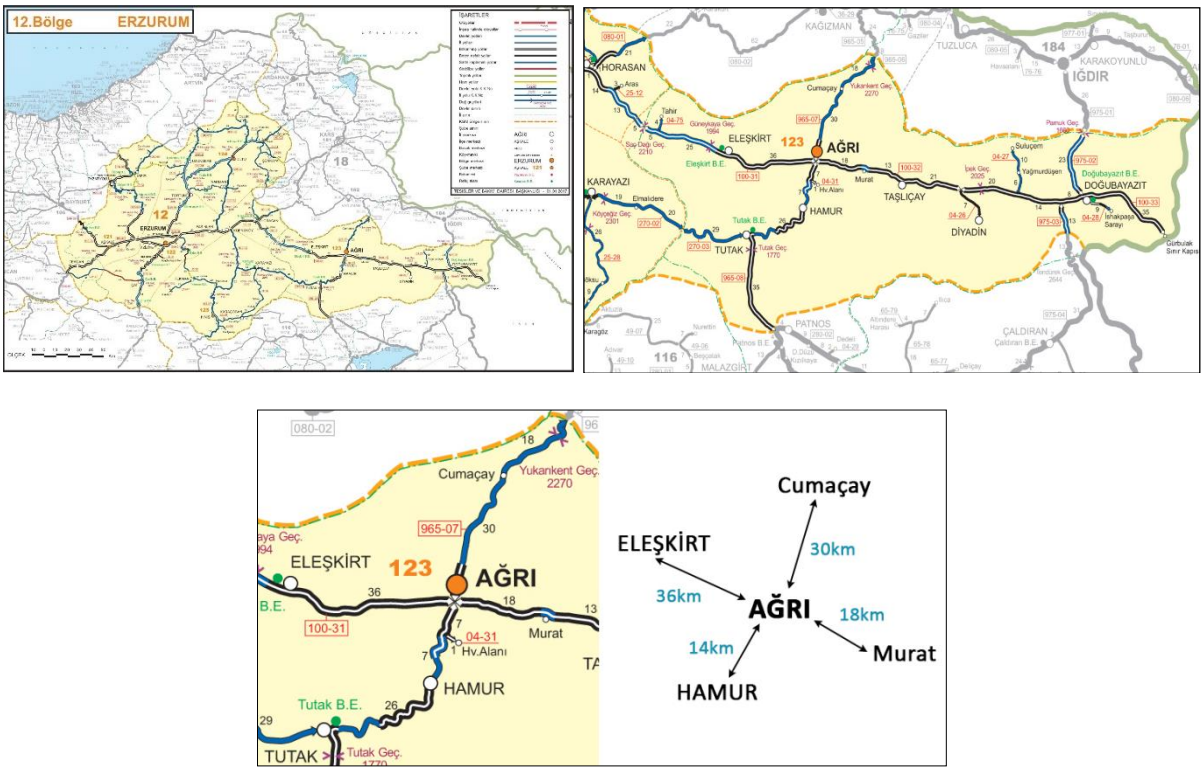

Figure 1. The screenshot of the KGM map, involving the 12th region of the national map. The process of extracting the node and edge data is visualized in the below panel of the figure, together with the distance data in kilometers.

The storage of locations in three levels (cities, towns, villages) facilitate the functionality of finding the town and city relevance of a specific village/small town. We used the location IDs in the third level city table (cities3) as nodes, while it also includes town or city centers as duplicates of the upper level tables.

We performed network analysis in Gephi Software (Bastian et al., 2009), which has several utilities that output network parameters, distributions, together with the network visualizations. We used the essential utilities in the statistics tab as average degree, average path length, average clustering coefficient, modularity, betweenness centrality, closeness centrality, eigenvector centrality, the distributions of these metrics, together with the degree distribution. We also constructed network visualizations in several aspects provided by Gephi.

The graphical plots about the distributions are performed in MATLAB since the plotting services in GEPHI are not sufficient by the means of logarithmic scales or customization of the plots. These processes of processing are also mentioned in the next section together with the results.

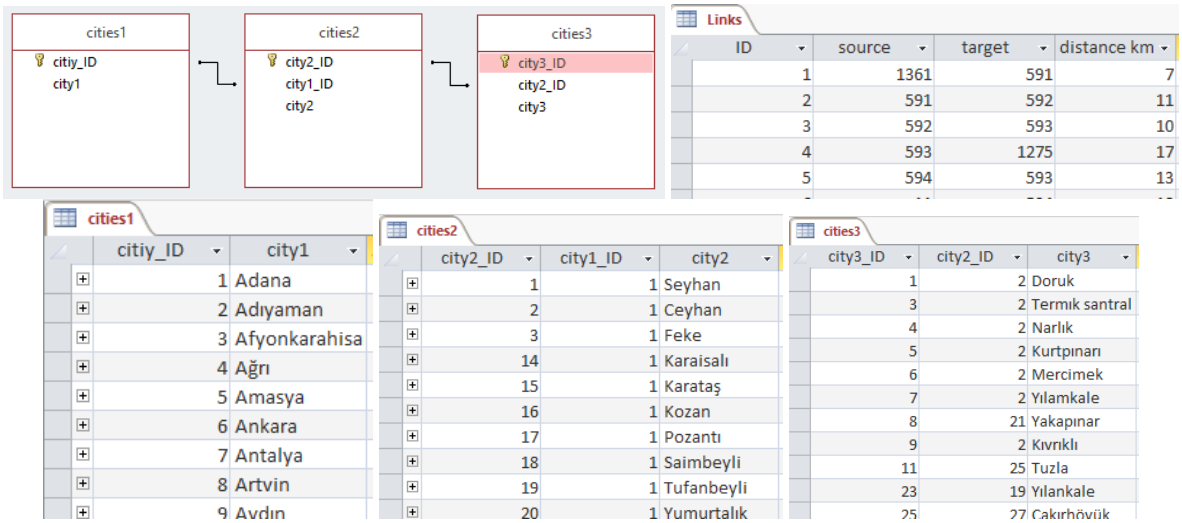

Figure 2. Node and Edge Structure Stored in the Database

Results and Findings

We start with presenting the basic network metrics. The transportation network of Turkey yields an average degree of 2.221, indicating the number of alternative transportation paths for each node (location). Average path length for our network, indicating the mean number of path distances between all the nodes, is 28.304 for our network. This metric is expected as low as 6 or less for real networks, representing the small-world property. The noteworthily high value for our network is mostly influenced by the spatial structure of the highway network, which in turn result high separation between node pairs. We can therefore conclude that transportation networks having spatial dependencies have high separation values in conjunction with small average degrees.

This high separation behavior is not observed in the recent studies since they are constructed by different approaches like travelling patterns between cities (Mohmand & Wang, 2013) or bus routes which links the two stations (Mukherjee, 2012). As a result of the mentioned spatial structure of the Turkish highway transportation network, the diameter is extracted as 83, similar with regular networks. The spatial dependency avoids the linkage of two distant cities with a short number of paths, since there are numerous cities between them. Therefore, high diameter is an expected scene for this type of network.

Modularity is a measure describing the ratio of a network to consist of separate modules. A module is described as a cluster that is strongly interconnected, but have sparse connections to the other modules. Our network displays a distinct modularity measure of 0.918, indicating that the close cities are strongly interconnected with local roads, having sparse connections to the other modules that spatially locate in distant locations.

Clustering coefficient catches how much the neighbors of a given node are connected to each other. Average clustering coefficient of 0.034 for our network means a small portion of the nodes' neighbors are linked, unlike the majority of the real networks. Real networks display high clustering property together with small path lengths. Our network deviates from this behavior by displaying high distances with low clustering, again influenced by the spatial dependency of the network structure.

Betweenness centrality (BC) can be defined simply by denoting how many times can the node act as a bridge between two other nodes connected with shortest paths (Barabási, 2016). According to this definition, we extracted the list of top 20 cities having highest BC values as in Table 1.

Table 1. Top 20 cities with Highest Betweenness Centrality Values

City	Betweenness Centrality
Buğdaylı	0.1098
Mahmatlı	0.1083
Akdağmadeni	0.0998
Alanya	0.0976
Demirözü	0.0923
Doğubayazıt	0.0913
Sivrihisar	0.0909

Gürbulak	0.0903
Bayburt	0.0901
Suşehri	0.0897
Bandırma	0.0893
Şerefiye	0.0871
Dİnar	0.0829
Gökçedere	0.0823
Mustafakemalpaşa	0.0819
Büyüköz	0.0801
Kelkit	0.0769
Şiran	0.0768
Gümüşsu	0.0760
Güneyyurt	0.0751

Eigenvector centrality (EC) represents the importance of a node within a network. The nodes with high degree of importance have high influence on the network (Barabási, 2016; Newman, 2010). We extracted the list of top 20 cities having highest EC values as in Table 2.

Table 2. Top 20 cities with highest eigenvector centrality values

City	**Eigenvector Centrality**
Diyarbakır	1
Bismil	0.9679
Mudurnu	0.9310
Ankara	0.9271
Köselerli	0.8531
Gülnar	0.8271
Karaman	0.8162
Sarıkavak	0.8107
Hatay	0.7967
Silifke	0.7798
Nallıhan	0.7764
Ermenek	0.7442
Mut	0.6918
Edirne	0.6858
Mermer	0.6538
Silivri	0.6474
Mustafakemalpaşa	0.6281
Uluhan	0.6179
Bartın	0.6115
Söğütalan	0.6028

Closeness centrality (CC) measures the mean distance from a node to other nodes (Newman, 2010). Nodes having high CC values are more central and closer to other nodes in the whole network. We extracted the list of top 20 cities having highest CC values as in Table 3.

Table 3. Top 20 cities with Highest Closeness Centrality Values

City	**Closeness Centrality**
Bademli	1
İstanbul	1
Ortacalar	1
Kalekoy	1
Kalecik	1
Gölbaşı	1
Oymapınar	0.8
Mutki	0.6667
Solhan	0.6667
Meydan	0.5714

Koyunlu	0.5714
Yenibaşak	0.5
Kömür liman	0.4210
Şirinköy	0.4
Barbaros	0.4
Kavakbaşı	0.4
Geyikpınar	0.4
Kuzulimanı	0.3478
Uğurlu	0.3478
Aydıncık	0.2285

By the way, we have outlined the most important locations in the Turkish highway transportation map. We can conclude that the roads related with these locations are of greater importance and therefore should receive greater enhancement by the public authorities.

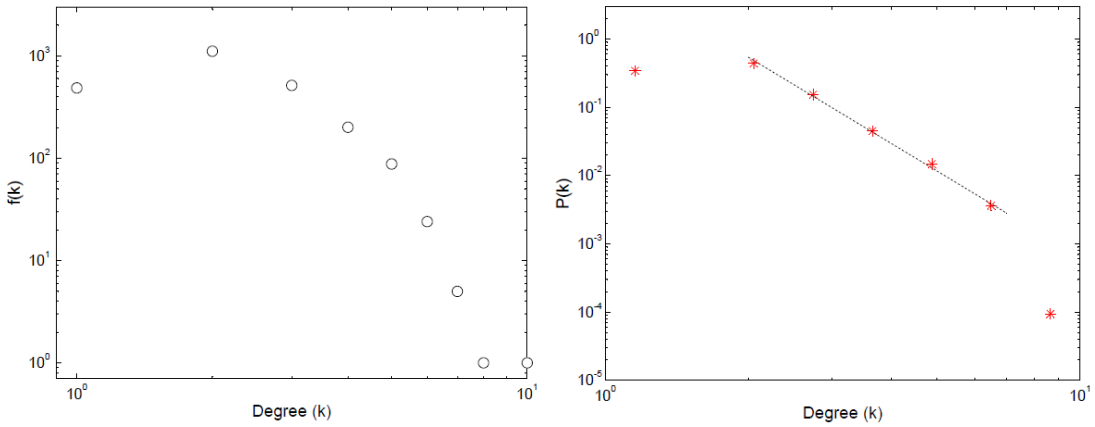

Figure 3. Degree occurrence frequencies (left panel) and log-binned degree distribution (right panel). The dotted line in the right panel corresponds to the power-law fit ($P(k) \sim k^{-\gamma}$) with exponent γ=4.2.

In Fig. 3, we present the frequencies of degree occurrences for all nodes, together with the log-binned distribution of the same data. Power-law consistency is best diagnosed in log-binned degree distributions. While a small portion of real networks display perfect power-law consistencies, the majority display left-side saturation regions together with right side cutoff regions. Our degree distribution graph display both of these saturations and cutoff regions together with a power-law consistent tail with a slope of -4.2. This region is a sufficient requirement to label the network as scale-free. But we can say that the power-law coefficient (4.2) is sensibly high compared to the other real networks. This type of power-law consistent tails with high coefficients are labeled as random regime of the scale-free networks by Barabasi (Barabási, 2016).

Conclusions

Analyzing the main network parameters, we see that the network has an average degree value slightly over 2, indicating that each location (city) has approximately two conjunctions to other cities. Since the endpoints of some paths, through the villages yield 1 connections, this average degree means that the other cities locating towards the inside of the network should have more than 2 or 3 connections to other cities.

The network yields a noteworthy average path value of 28.309, higher than the several types of real networks. Since the studies transportation network involves from crowded cities to small villages, the pathways connecting two distant villages is naturally expected to have numerous hops. Originating from the spatial structure of the network, the low-degree nodes cannot directly connect to a popular node as in a social network. This fact increases the path lengths and network diameter. As expected, the diameter also has a great value of 83.

The spatial structure, combining with the cost of constructing main roads, results a very small average clustering coefficient of 0.034, like a Barabasi-Albert network without clustering property. In fact, there should be secondary roads between close locations but since KGM maps include only main roads, the real clustering between spatially close nodes does not come into the picture. On the other hand, the network displays a distinct modularity measure of 0.918. In combination with very low clustering, this is a very interesting result to

expound. We predict that this behavior of very low clustering with very high modularity emerges from the consulting of the main roads which are sufficient to define modules, but insufficient to connect small but close locations.

Another significance of this study is the extraction of important nodes (locations) in Turkish highway transportation network, with respect to three centrality measures.

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DYNAMIC BEHAVIOUR OF RAILWAY BRIDGE SUBJECTED TO DIFFERENT STRONG GROUND MOTIONS CONSIDERING SOIL-STRUCTURE INTERACTION

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Abstract: The dynamic behaviour of a four-span continuous railway bridge subjected to different ground motion considering soil-structure interaction is investigated using finite element method. Taking a multi span railway bridge as an example, a full two-dimensional finite element model of the railway bridge system was established, in which the soil-structure interactions were considered. Considering the soil property of bridge site, three types of earthquake was used as input motion. Kocaeli (Turkey, 1999), Kobe (Japan, 1995) and Manjil (Iran, 1990) earthquakes are defined as input motions. The analysis was performed for one type of soil; the soil was specified as a soft. Time domain dynamic analyses of the structure-soil model and also a 2D version of PLAXIS, a specially developed finite element software for solving geotechnical problems, have been performed. By inputting the Kobe, Kocaeli and Manjil earthquake accelerations to the bridge system, the dynamic responses of the bridge, including the horizontal displacements of the top of the railway bridge are calculated by the PLAXIS program. The displacement obtained by the Kocaeli earthquake is compared with the results obtained by the Kobe and Manjil earthquakes.

Keywords : Railway bridge, soil-structure ınteraction, dynamic behaviour, finite element method

Introductıon

Railway bridges are mechanical systems consisting of foundations and embankments, the bridge and the superstructure. Railway bridges are very important elements of the infrastructure in modern societies and they are an important part of the surface transportation system. Failure in a bridge operation can cause severe economic, environmental and social consequence. Due to railway bridges importance, loss of functionality after a seismic event is not an acceptable performance criterion for the vast majority of those structures. The modern transportation facilities demand that the railway bridges are to be constructed in seismically active areas and at the same time the site conditions compel the engineers to rest the pier foundation on soil.

In the past, many railway bridges have suffered extensive damage due to strong motion earthquakes. Seismic damage to bridges consisting of simply supported girders rested on massive piers were commonly caused by foundation failures resulting from excessive ground deformations and loss of bearing capacity of the foundation soils. Failure of bridge during a strong earthquake event might cause an obstruction to the necessary rescue and rehabilitation activities, it's very important to predict the behavior of a bridge structure subjected to potential strong motions. Therefore, safety of the railway bridges in seismic region is of great importance particularly for post-earthquake relief operations.

Research on the dynamic response of bridges, especially to seismic actions, has reached a great interest because the amounts of bridge failures which have happened in recent earthquakes such as Kobe (1995), Northridge (1994) and Loma Prieta (1989). The seismic evaluation of major long-span bridges typically requires consideration of dynamic soil-structure interaction (SSI) effects on the seismic response of such bridges. Consideration of soil-structure interaction (SSI) effects is extremely important for determining the seismic response of bridges and it allows researchers and practicing engineers to design more seismically resilient bridges (M. Baheddi and Y. Youb, 2015).

A number of studies investigated the influence of SSI on the earthquake response of conventionally designed bridges in recent years.

Mylonakis and Gazetas (2000), documented a case history in Kobe, Japan considering the 1995 Kobe earthquake where the Hanshin Expressway failed catastrophically during the earthquake because SSI effects were not considered during the analyses and design. According to the obtained results, Mylonakis and Gazetas (2000) concluded that "as a result of soil or seismological factors, an increase in the fundamental period due to SSI may lead to increased response (despite a possible increase in damping), which contradicts the expectation incited by

the conventional design spectrum". Recent analytical studies conducted by Crouse et al. (1987), Somani (1984) and Spyrakos (1990, 1992) have identified the significant role of soil–structure interaction during seismic excitation of non-isolated bridges. It is shown that the soil–structure interaction effects decrease the seismic response of bridge leading to reduction in design cost. This is expected since the flexibility of the surrounding soil will tend to reduce the overall stiffness of the system and thus reduce its frequencies and modify the response. In all the three methods of analysis (the single mode spectral analysis, the multi-mode spectral analysis and the elastic seismic response coefficient) recommended by the AASHTO (1989), specific consideration is given to soil site effects and recognising the importance of the soil conditions. In another study, Jangid and Tongaonkar (2003) looked at assessing the effects of soil-structure interaction (SSI) on three-span continuous deck bridges isolated with elastomeric bearings. They assumed linear elastic behavior for the piers of the bridge and the isolation system and carried out a time–history analysis using the complex modal analysis method to account correctly for the large damping contributed to the system by the seismic isolators. Three actual seismic motions utilized and conducted a parametric study looking at the effects of soil flexibility and the isolation system parameters on the response of the isolated bridge system. They concluded that consideration of the soil-structure interaction in the analysis will result in enhancement of safety and reduction in design costs. They also reported if soil-structure interaction is not accounted for in the analysis, isolation bearing displacements at abutment locations only might be underestimated.

In the solution of soil-structure problems, the carefully modeling of the unbounded nature of the underlying media is required. For solving this problem many numerical methods have been developed, such as using absorbing or transmitting boundaries at the truncated region of the soil. Two main approaches for analyzing soil-structure interaction are existing. These are the substructure method and direct method (K. Bab. et al., 1996). Both methods are still being developed to overcome the shortcomings related to each of them, especially the unboundedness and nonlinearity nature of the problem. Developments in the finite element method made by (J.P. Wolf. et al., 1996) have shown that using the direct method with a limited zone of the soil may capture the essential aspects of the non-linear nature of the problem related to soft soil conditions.

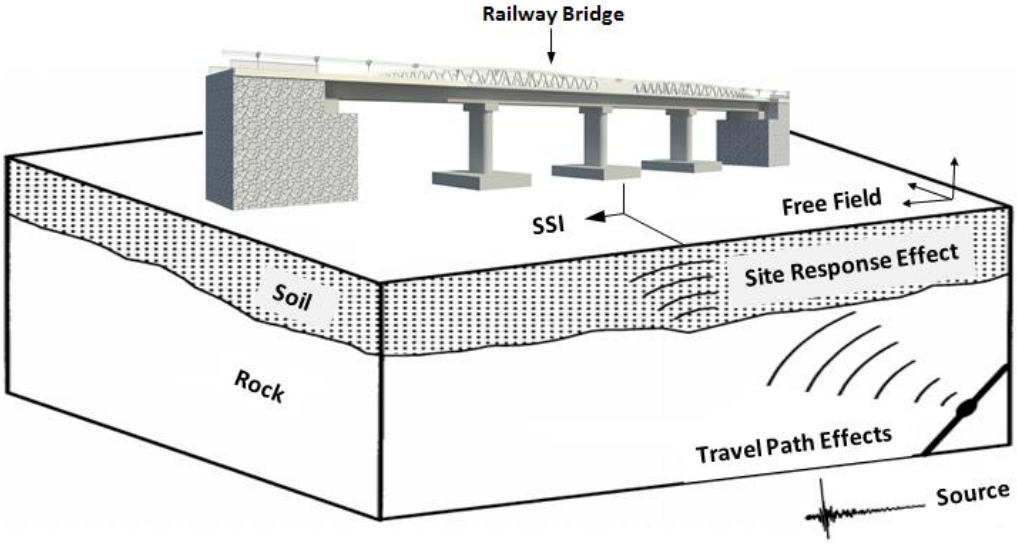


Figure 1. Schematic showing context of SSI in an engineering assessment of seismic loading for Railway Bridge system

Bridge Description

The Railway-Bridge studied is a four span simply-supported plate girder bridge as shown in Figure 2. The investigate railway bridge is located in Afyon (Turkey), subjected to a typical seismicity. Some standard measures were taken into consideration for analyses. The bridge is a 128 m long and 4-span structure. The substructure of bridge consists of rigid abutments and reinforced concrete piers. The bridge is supported on three elliptical reinforced concrete columns 7.38 m deep. The superstructure consists of a main girder of 3.25m deep and 12m wide. The soil surrounding the pier of Railway Bridge is considered as soft. The seismic response of railway bridge system is investigated for the three types of earthquakes. Kobe (Japan, 1995), Kocaeli (Turkey, 1999) and Manjil (Iran, 1990) earthquakes are defined as input motions.

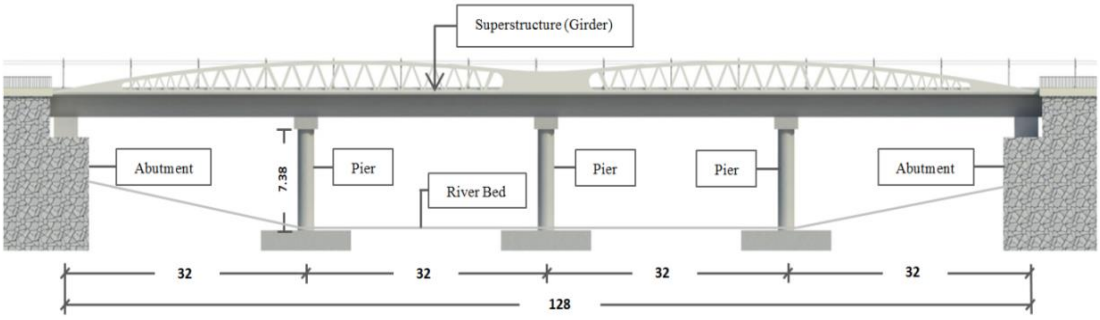
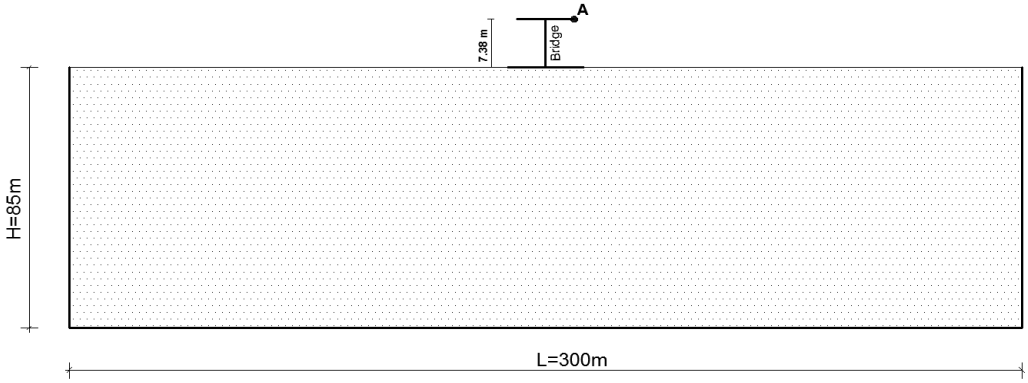


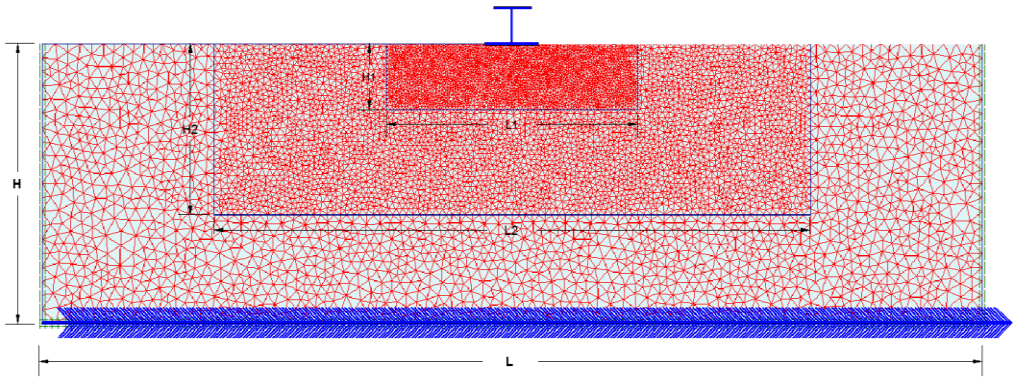
Figure 2. Elevation view of the proposed Railway Bridge

Numerical Study

The dynamic behaviour of a four-span continuous railway bridge including SSI is investigated under three recorded earthquake ground motions. The present study details a series of 2D dynamic analyses of the railway bridge illustrated in Figure 2. The arrangement of the analyses is based on a simplified model of a railway bridge which is located in Afyon, Turkey. As the purpose of this study, the example of the Afyon Railway Bridge used to set up the numerical model by taking into account absorbing boundary conditions. For numerical analysis, analytical models were developed by Finite Element Method (FEM). Different analyses were performed on Railway Bridge system in terms of comparative results. The dynamic behaviour of bridge pier-soil systems is observed and the comparative results are presented. In the present study, earthquake-induced wave propagation problem with SSI effects is directly analysed by employing a two-dimensional finite element model under plane-strain condition considering elasto-plastic Mohr–Coulomb constitutive law. For this purpose, the soil-structure model was defined using the PLAXIS 2D and finite element method (Brinkgreve et al., 2002). For determining of the finite element model dimensions many analyses were employed in the past and it is suggested that these boundary areas must be as far at least 8-10 times of the superstructure base width (Rosset et al., 1976). In the present study, in addition to the existing information, two dimensional (2D) plane strain analyses of soil were employed to find the sufficient soil dimensions for soil-structure analyses. In this study, discretization of the finite element model of the soil area has been made by taking into account the absorbing boundary conditions. Firstly, the effect of wave propagation on the horizontal expansion of the soil model was investigated by keeping the height of the soil model constant (H = 60 m). According to the time-displacement relationships results obtained from the points where the wave propagation is controlled, it is concluded that L = 300 m is sufficient. After determining the horizontal expansion of the finite element model of the soil area (L = 300 m), the effect of the wave propagation on the height of the soil model was also investigated. According to the time-displacement relationships taken from the points where the wave propagation is controlled, it is concluded that it is sufficient to choose H = 85m and Δh = 4m. According to analyses results the finite element model dimensions of the soil component were chosen as 300 m by 85 m. The mesh of the remaining subzones (hereby, H_1 = 20 m, L = 80 m; Δh_1 = 1 m → H_2 = 52 m, L_2 = 190 m; Δh_2 = 2 m) are used in the modeling (Figure 3.).



a) General form of Soil-Structure Model



b) PLAXIS 2D Finite Element Mesh

Figure 3. Soil-Structure Model

In this study we assume plane strain conditions, that is, all frames parallel to the plane of calculation in Figure 3. deform identically. In the present study for 2D analysis of bridge-soil system, a 15-node triangular is chosen (Figure4.). This element is powerful and provides an accurate calculation of strains and stresses. As a first approximation of soil behavior, Mohr-Coulomb model is used in general. The model involves five parameters. These parameters are Poisson's ratio (ν), Young's modulus (E), the friction angle (ϕ), the cohesion(c) and the dilatancy angle (ψ).

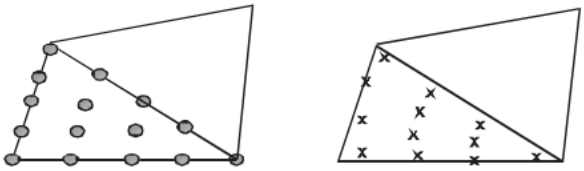


Figure 4. Position of nodes and stress points in soil elements
(Brinkgreve et al., 1998)

Time history analyses of the soil- structure models were carried out. The seismic response of railway bridge system is investigated for the three types of earthquakes taken from the PEER NGA database (http://peer.berkeley.edu/nga). Kobe (Japan, 1995), Kocaeli (Turkey, 1999) and Manjil (Iran, 1990) earthquakes are defined as input motions (Figure 5.). The properties of these earthquake ground motions are shown in Table 1. By inputting the Kobe, Kocaeli and Manjil earthquake accelerations to the bridge system, the dynamic responses of the bridge, including the horizontal displacements of the top of the railway bridge (Point A) were calculated by the PLAXIS program and the displacement result obtained by the Kocaeli earthquake is compared with the results obtained by the Kobe and Manjil earthquakes (Figure 6.).

Table 1. Properties of the earthquake ground motions

Earthquake	**Date**	**Station**	**Magnitude**	**Peak acceleration (g)**	**Resonance Frequency (Hz)**
Kobe	16-01-1995	NISHI-AKASHI/CUE	6.9	0.50	2.07
Kocaeli	17-08-1999	KOCAELI/SKR090	7.4	0.35	0.29
Manjil	20-06-1990	ABHAR-IRAN/BHRC	7.4	0.51	2.92

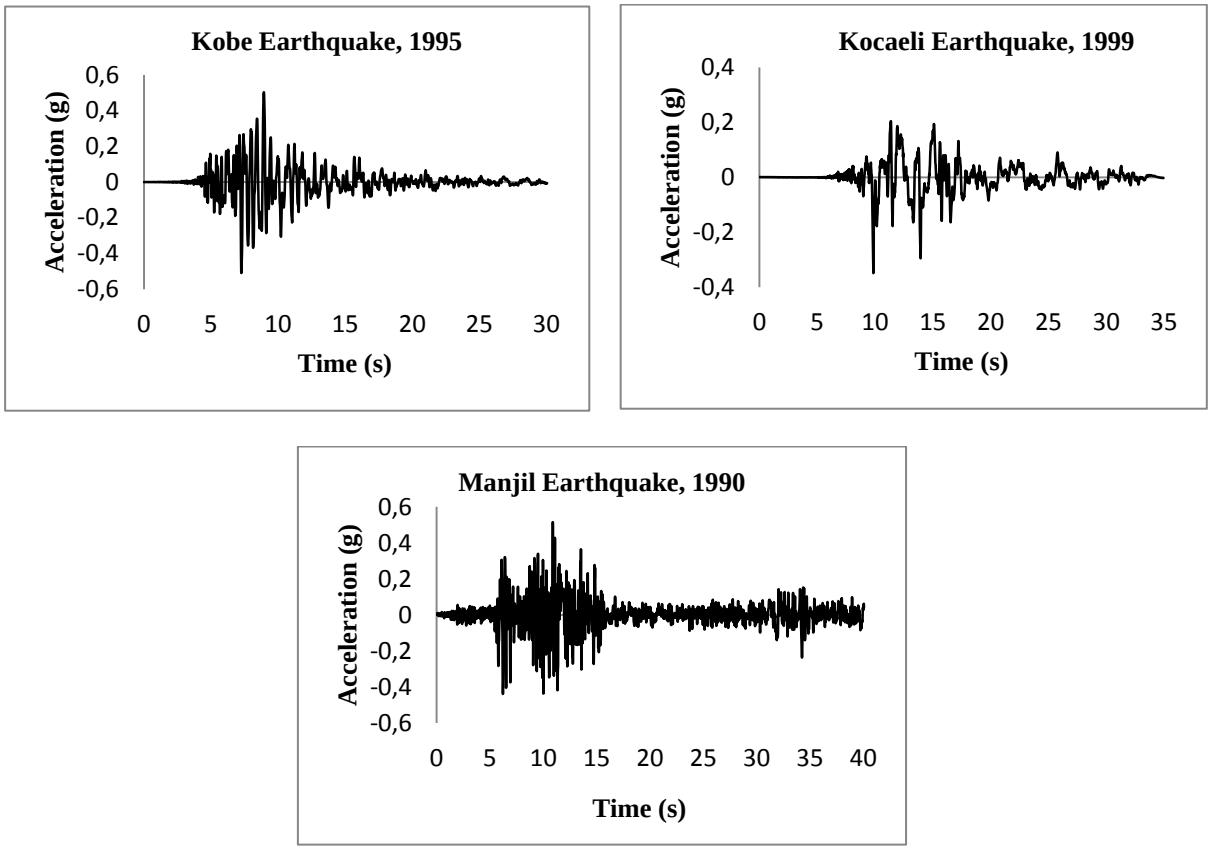
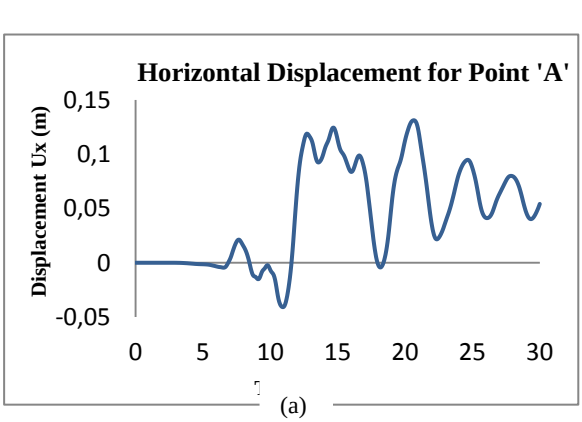


Figure 5. Acceleration records of Kobe, Kocaeli and Manjil earthquakes

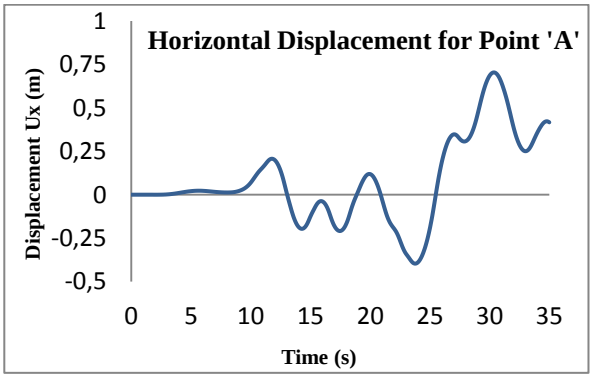
Considering the soil property of bridge site, analysis was performed for one type of soil. To create the substructure soil models, bridge site soil was selected as soft. The properties of the soil are given in Table 2.

Table 2. Properties of the soil for undrained mohr–coulomb model (Dave et al., 2006)

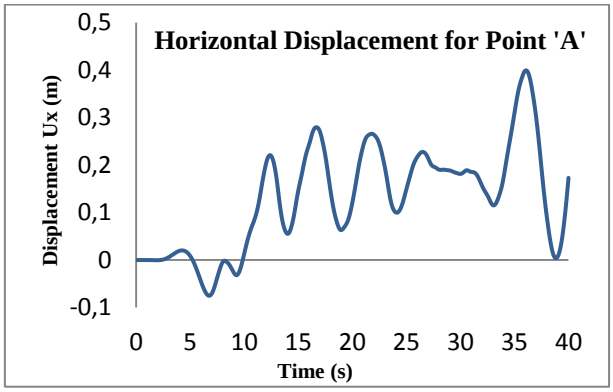
Parameter	Symbol	Magnitude	Unit
Total unit weight	γ	16.68	kN/m^3
Young's modulus	E	15000	kN//m^2
Shear modulus	G	5434.78	kN//m^2
Poisson's ratio	ν	0.38	-
Compression wave velocity	V_p	128.40	m/s
Shear wave velocity	V_s	56.51	m/s
Cohesion	c	25	kN//m^2
Friction angle	φ	35	o
Dilatancy angle	ψ	0	o
Interface strength reduction factor	R_{inter}	0.67	-



(a)



(b)



(c)

Figure 6. Time-history displacement results under the influence of different earthquakes
a) Kobe Earthquake, 1995 b) Kocaeli Earthquake, 1999 c) Manjil Earthquake, 1990

Resuls and Conclusions

The main purpose of this investigation was to study the dynamic behaviour of a four-span continuous railway bridge subjected to different ground motion considering soil-structure interaction using finite element method. Soil-structure interaction effects under different ground motion are directly accomplished by applying a two dimensional plane-strain finite element model with elasto-plastic Mohr Coulomb approach. In this study, the primary goal was to develop an understanding of the seismic response of a soil-bridge system under influence of different earthquakes. To accomplish this goal, a suite of three earthquake motions was selected. The Kocaeli (Turkey, 1999), Kobe (Japan, 1995) and Manjil (Iran, 1990) earthquakes were used as inputting motion. Additionally, one type of soil was considered for analyses and defined as soft soil. According to the results of the dynamic analysis, the numerical results and relative horizontal displacement graph for the top of bridge (Point A) were prepared and shown in Fig 4. The obtained results of maximum horizontal displacements under the influence of Kocaeli, Manjil and Kobe earthquakes are respectively 0.703m, 0.399m and 0.131m. Examining the results, it was found that the horizontal displacement of the top of bridge (Point A) under the Kocaeli earthquake was respectively 43% and 81% bigger than Manjil and Kobe earthquakes.

According to the obtained results, in order to design structures to resist strong earthquakes, it is necessary to have an understanding for selecting earthquake ground motion records in a form convenient for evaluating existing structures or proposed designs for new structures and also for performing time-history analyses. The selection procedure presented considers the important characteristics of the ground motions (pulse, directivity, fling, basin, duration etc.) consistent with the hazard conditions. Also the contributing factors in selecting records for a given site are magnitude, distance and site conditions.

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TO SIMULATION OF HEAT TRANSFER SYSTEM FOR THE SHEEPFOLD

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Abstract: The article discusses the information-measuring system of modular ventilation system for testing the energy efficient heat transfer system of sheepfold. Scheme of experimental energy saving heat transfer system for placing of the sheepfold is shown. The information-measuring and automation study modes of modular energy efficient ventilation system for agricultural buildings were used. The information-measuring system for remote registration of thermo technical parameters of the ventilation systems was described.

Keywords: Temperature field of soil, temperature over the length of the channel walls, sheepfold, ventilation.

Introduction

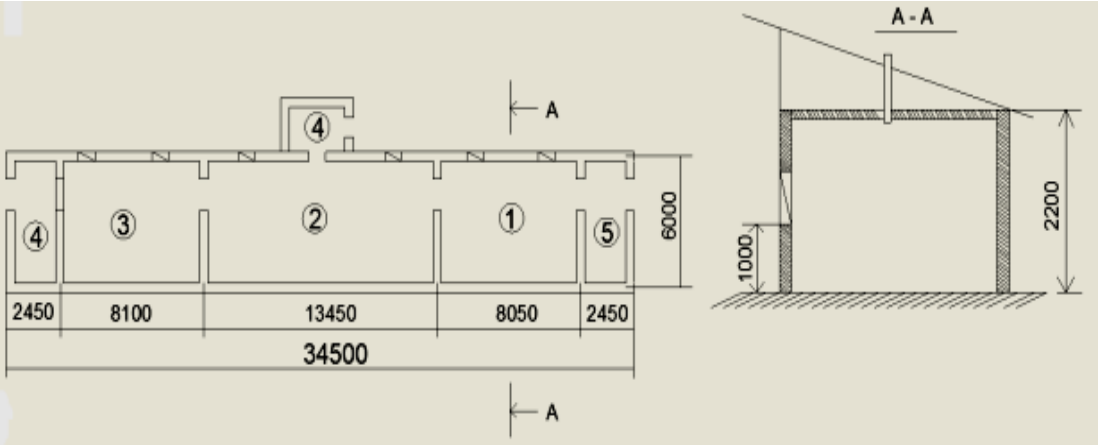
One promising solution to problem rational using of fuel and energy resources is one is the use of new energy-saving technologies, using renewable energy sources. The range using its on farms is quite broad: it is heating or cooling buildings, and drying of agricultural products, and desalination and water heating, and even autonomous power supply and other. The solution of the problem in the energy-saving ventilation systems of agricultural buildings is the effective use of low-grade soil heat.

The ground surface layers of the Earth, actually is a heat accumulator of unlimited capacity, which thermal regime is formed by the action of solar radiation. Low-grade heat of the Earth can be used in agricultural buildings for heating, hot water, air-conditioning and cooling.

There are a number of examples of the use of soil heat for heating and cooling of livestock buildings through underground air conduits and heat exchangers. Studying these examples allowed develop energy-saving ventilation system for sheep premises.

Heat Transfer Scheme of the Sheepfold

The experimental energy saving system was built in the sheepfold for lambing in Almaty region of Kazakhstan. Plan and photograph of the sheepfold are presented in Figures (1, 2).



1 - maternity ward; 2 - compartment for keeping of the ewes; 3 - compartment for keeping of the lambs from 2 months; 4 - tambours; 5 - switchboard room

Figure 1. Plan of the sheepfold for lambing

Figure 2. Sheepfold for lambing

Scheme of experimental energy saving heat transfer system for placing of the sheepfold is shown in Figure (3). Here the following notation are used: 1 – placement of air-intake shaft; 2 - vertical forced air ducts; 3 - horizontal forced air ducts; 4 - soil temperature sensors; 5 - control cabinet; 6 - control wiring; 7 - power shield; 8 - electric meters; 9 - bucking transformer 220/22 V; 10 - closers – electric heating panels; 11 - underground heat exchanger-horizontal air conduits; 12 –ventilating shaft with air conduit; 13 – electric wire sensors.

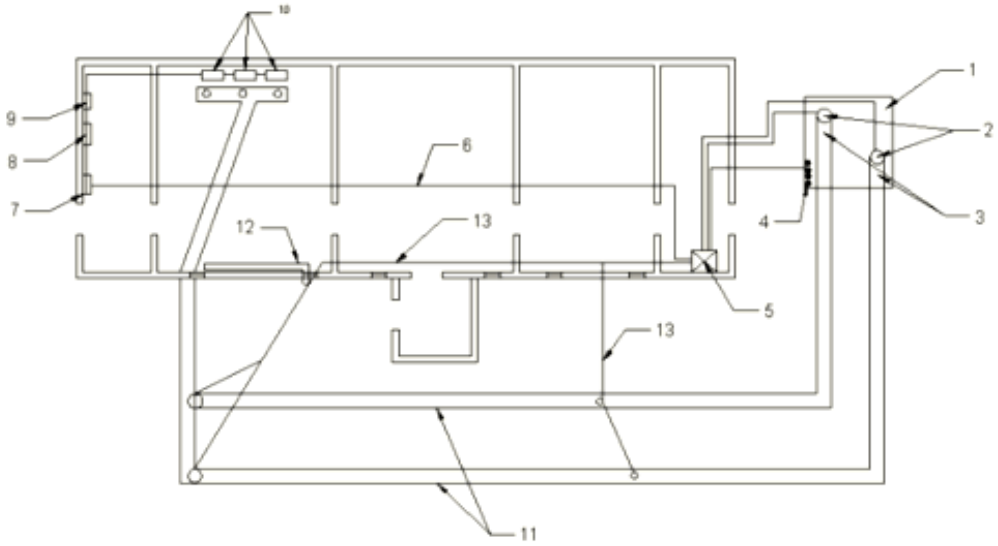


Figure 3. Diagram of the experimental energy saving heat transfer system for the sheepfold

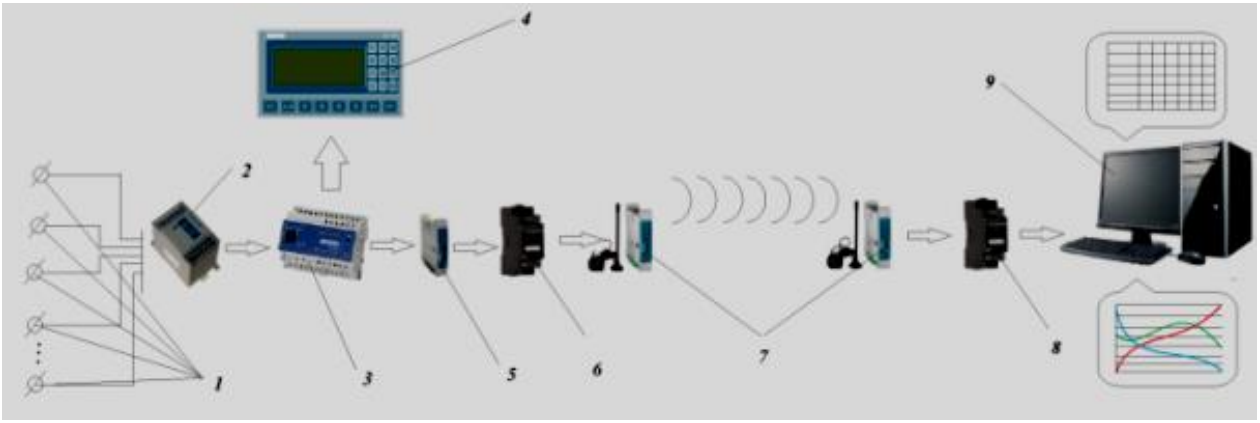
Designed experimental energy-efficient ventilation passed an economic test in the winter and summer periods. For registration of thermo technical parameters of ventilation system, that is temperature of the outer, inside air, soil and humidity external and internal air have been developed information-measuring system [2].

Information-Measuring System of Modular Ventilation System

Block scheme of information-measuring system and automation study modes of modular energy efficient ventilation system for agricultural buildings is shown in Figure 4 and is arranged as follows: the sensors (sensor OWEN DTS 3015 PT1000.B2.200 designed to measure the temperature in the air conduit of ventilation system, OWEN DTS 3005 -PT1000.B2 designed to measure the temperature of outer air, relative humidity sensor and temperature DVT-03.RS are installed on a flat surface of the wall and connected to the analog input module OWEN MV110-8A.

The device operates in the RS-485 network under the protocols OWEN, ModBus-RTU, ModBus-ASCII, DCON. Controller OWEN PL Cisusedas the master network. Device is given with OPC driver and standard library WIN DLL, which are used for connecting the device to the SCADA-systems and controllers from other manufacturers. Configuring the device is carried out on a PC via the interface adapter RS-485 / RS-232 or RS-485 / USB (for example, OWEN ASZ-M or AS4, respectively) using the "Configurator M110" included the

supply package. Then all the data from all the sensors are transmitted to the programmable logic controller PLC OWEN 100-220. P-M. OWEN PLC controllers allow you to organize a gateway between devices with the protocol OWEN (RS-485) and industrial networks with protocols, Modbus TCP, DCON.



1 - sensors (of temperature, humidity, air flow rate); *2* - analog input modules OWEN MV110-8A; *3* - programmable logic controller OWEN PLC 100-220. P-M; *4* - graphic operator terminal OWEN IP320; *5* - data acquisition module OWEN MSD200; *6* - Interface Converter USB / RS485 AC4; *7* - GSM / GPRS; *8* - Interface Converter USB / RS485 AC4; *9* - a personal computer.

Figure 4. Block scheme of information-measuring system

At the control center of station operator received a personal computer. To communicate through (CSD) GPRS-connection, it is installed Modbus OPC / DDE server to a PC. OPC supports the work with a modem and allows you to work both in Mastermode and in Slavemode. To transfer data to the computer modem operator is connected working in master mode, then the signals are transmitted to the processing and visualization into "Skado system» Master Scada. Operator views messages and parameters from the facilities and on his own initiative, makes communication and management of the facility, such as for the processing of emergencies [3].

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CALCULATION PARAMETERS OF THE SHEEPFOLD VENTILATION SYSTEM

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Abstract: In paper the differential heat transfer equation describing the temperature field of the soil around the ductwork of the ventilation system of the sheepfold is used. The calculation example of dimensionless criteria for given initial and boundary conditions is given. The values of the air temperature at the outlet of the duct and the value of the heat flux are determined. The results of the calculations are consistent with the test data using the information and measuring system for remote recording of the thermal characteristics of ventilation systems.

Keywords: Temperature field of soil, sheepfold, ductwork, ventilation system

Theoretical Part

Within the framework of the problem statement, an experimental energy-saving ventilation system for the sheep-dog was developed and constructed and production tests for the time of lambs litter were carried out and its calculations were performed. When designing the energy saving ventilation system, was viewed the differential equation of the temperature field of soil around the ductwork of ventilation system

$$\frac{\partial t}{\partial \tau} = a\left(\frac{\partial^2 t}{\partial R^2} + \frac{1}{R}\frac{\partial t}{\partial R}\right) \quad (1)$$

where a- temperature conductivity of the soil

The boundary conditions for equation (1):

$$t = t_{soil} \quad at \quad 1.\tau = 0; \quad 2.R \to \infty, \quad \tau \geq 0$$

$$3. \quad -\lambda\frac{\partial t}{\partial R} = \alpha'\left[t(R_o,\tau) - t_{aver}(\tau)\right] = 0 \quad (2)$$

where λ is the temperature conductivity of the soil; α - heat transfer coefficient of the channel walls**.**

The value of integral air temperature along the channel length with the total area of heat transfer *F:*

$$t_{aver}(\tau) = \frac{1}{F}\int_0^F t(x,\tau)dF \quad (3)$$

where $t\,(x, \tau)$-is local temperatures determined from the heat balance equation duct area *dF*:

$$cGdt = \alpha\left[t(R_o,\tau) - t(x,\tau)\right]dF \quad (4)$$

The solution of the equation (2) has the form:

$$\varphi_x = \frac{t(x,\tau) - t(R_o,\tau)}{t_0 - t(R_o,\tau)} = \exp\left(\frac{-\alpha F_x}{cG}\right) \quad (5)$$

where $t\,(R_0, \tau)$- is the average temperature over the length of the channel walls at a given moment of time;

Fx - the area of heat exchange of channel through section x.

The solution of the differential equation (5) allows calculate the thermal technical parameters of the energy-saving system [1, 2].

Calculation of Thermo-Technical Parameters

Let's calculate the thermal engineering parameters of the ventilation system at the following initial data:
$D_o = 0.22m$ and $L = 12m$ - are the diameter and the length of the air duct;
$t_{soil} = +10^{\circ}C$ - is the initial uniform temperature of the soil;
$a_{soil} = 5.2 \cdot 10^{-7} m^2 / s$ - is the coefficient of soil temperature-conductivity;
$\lambda_{soil} = 1.3 \ W/\left(m^2 \cdot {}^{\circ}C\right)$ - is the coefficient of thermal conductivity of the soil;
$\rho_{soil} = 1700 \ kg/m^3$ and $c_{soil} = 1.47 kJ/\left(kg \cdot {}^{\circ}C\right)$ -are the density and the specific heat of soil;
$t_{out-air} = t_o = -16^{\circ}C$ - is the estimated ventilation or the temperature of the incoming outside air;
$t_{aver} = -5^{\circ}C$ - is the average temperature of the heating period;
$n = 198 days$ - is the duration of the heating season;
$\vartheta = 2m/s$ - is the speed of air flow;
$\nu_{air} = 12.42 \cdot 10^{-6} m^2 / s$ - is the kinematic viscosity of air;
$\lambda_{air} = 0.0253 W/\left(m^2 {}^{\circ}C\right)$ - is the coefficient of kinematic heat conductivity of air;
$a_{air} = 17.44 \cdot 10^{-6} m^2 / s$ - is the coefficient of kinematic air temperature-conductivity;

Then the Prandtl criterion equals $\Pr = \dfrac{\nu_{air}}{a_{air}} = \dfrac{12.42 \cdot 10^{-6}}{17.44 \cdot 10^{-6}} = 0.71$
It is possible to calculate the length of the air duct based on condition: $St^{/} = 2$.
We have from the next formula: $L = \dfrac{R_0 \operatorname{Re} \Pr}{Nu}$ that $L = \dfrac{R_0 \cdot \operatorname{Re} \cdot \Pr}{Nu} = \dfrac{0.11 \cdot 35427 \cdot 0.71}{78.48} = 35.35m$
The maximum operating time of the air duct is determined from the next condition $Bi^{//}\sqrt{Fo} = 1$:

$Bi^{//} = Bi^{/} + 0.375$ and $Bi^{/} = \bar{\varphi} \cdot Bi$
$\bar{\varphi} = \dfrac{1 - \exp\left(-St^{/}\right)}{St^{/}} = \dfrac{1 - e^{-2}}{2} = 0.43$
$Bi = \dfrac{\alpha \cdot R_o}{\lambda_{soil}} = \dfrac{9.02 \cdot 0.11}{1.3} = 0.76$
$Bi^{/} = \bar{\varphi} \cdot Bi = 0.43 \cdot 0.76 = 0.33$
$Bi^{//} = Bi^{/} + 0.375 = 0.33 + 0.375 = 0.705$
$\tau = \dfrac{R_0^2}{\left(Bi^{//}\right)^2 \cdot a_{zp}} = \dfrac{(0.11)^2}{(0.705)^2 \cdot 5.2 \cdot 10^{-7}} = 46817 = 13 hours$
The air temperature at the outlet of the duct is equal to
$t_L = t_0 + \bar{\varphi} \cdot St^{/} \cdot \theta_w \cdot \left(t_{soil} - t_0\right)$
$\varphi_L = \dfrac{t(L,t) - t_0}{t_{soil} - t_0} = \bar{\varphi} \cdot St^{/} \cdot \theta_w$
$\theta_w = 1 - \dfrac{Bi^{/}}{Bi^{//}} f_1(x)$,
where
$f_1(x) = 1 - \exp\left(Bi^{//}\sqrt{Fo}\right)^2 erfc\left(Bi^{//}\sqrt{Fo}\right) = 1 - \exp(1)^2 \cdot erfc(1) = 1 - 2.72 \cdot 0.157 = 0.572$
$\theta_w = 1 - \dfrac{Bi^{/}}{Bi^{//}} f_1(x) = 1 - \dfrac{0.33}{0.71} \cdot 0.57 = 0.73$
$\varphi_L = \bar{\varphi} \cdot St^{/} \cdot \theta_w = 0.43 \cdot 2 \cdot 0.73 = 0.63$
$t_L = t_0 + \bar{\varphi} \cdot St^{/} \cdot \theta_w \cdot \left(t_{soil} - t_0\right) = -16 + 0.63 \cdot (10 + 16) = +0.44^{\circ}C$
The amount of heat removal in a time τ is equal:

$$\Delta Q = 2 \cdot Po^{/} \cdot c \cdot \rho \cdot V \cdot (t_{soil} - t_0) \cdot Bi^{/} \cdot Fo$$

$$Fo = \frac{a_{soil}\tau}{R_0^2} = \frac{5.2 \cdot 10^{-7} \cdot 46817}{0.11^2} = 2$$

$$Po^{/} = 1 - \frac{Bi^{/}}{Bi^{//}} f_3(x),$$

where

$$f_3(x) = 1 - \frac{2}{\sqrt{\pi} \cdot Bi^{//} \cdot \sqrt{Fo}} + \frac{f_1(x)}{\left(Bi^{//} \cdot \sqrt{Fo}\right)^2} = 1 - \frac{2}{\sqrt{3.14} \cdot 1} + \frac{0.57}{1^2} = 0.44$$

$$Po^{/} = 1 - \frac{Bi^{/}}{Bi^{//}} f_3(x) = 1 - \frac{0.33}{0.705} \cdot 0.44 = 0.79$$

$$\Delta Q = 2 \cdot Po^{/} \cdot c \cdot \rho \cdot V \cdot (t_{soil} - t_0) \cdot Bi^{/} \cdot Fo = 2 \cdot 0.79 \cdot 1.47 \cdot 1700 \cdot 1.9 \cdot (10 + 16) \cdot 0.33 \cdot 2 = 129092 kJ$$

The average capacity of the air ventilation system is

$$P_{aver} = \frac{\Delta Q}{\tau} = \frac{129092}{46817} = 2.75 kW$$

The air duct feeding zone:

$$\overline{R_z} = 4\sqrt{Fo} + 1 = 4\sqrt{2} + 1 = 6.6, \quad R_z = R_0 \cdot \overline{R_z} = 0.11 \cdot 6.6 = 0.726 m$$

Then Stanton's criterion is equal:

$$St^{/} = \frac{Nu}{\mathrm{Re} \cdot \mathrm{Pr}} \times \frac{2L}{R_o}, \quad St^{/} = \frac{Nu}{\mathrm{Re} \cdot \mathrm{Pr}} \times \frac{2L}{R_o} = \frac{78.48}{35427 \cdot 0.712} \times \frac{2 \cdot 12}{0.11} = 0.68$$

The Bio criterion is equal:

$$Bi = \frac{\alpha \cdot R_o}{\lambda_{soil}} = \frac{9.02 \cdot 0.11}{1.3} = 0.76$$

$$Bi^{/} = \overline{\varphi} \cdot Bi; \quad \overline{\varphi} = \frac{1 - \exp(-St^{/})}{St^{/}} = \frac{1 - ext(-0{,}6788)}{0.68} = 0.73,$$

$$Bi^{/} = 0.73 \cdot 0.375 = 0.554, \quad Bi^{//} = Bi^{/} + 0.375 = 0.554 + 0.375 = 0.929$$

The experimental energy saving ventilation system was built in the sheepfold for lambing in Almaty region. The registration of thermo technical parameters of ventilation system (temperature of the outer, inside air, soil and humidity external and internal air) was made using the information-measuring system [3, 4]. To transfer data to the computer modem operator is connected working in master mode after the signals are transmitted to the processing and visualization.

During tests energy saving ventilation system during the winter period found that the room temperature of the sheepfold ranged from +5.4^{0}C to + 6.0^{0}C, on average +5.6^{0}C, with the number of measurements *n*=72. The relative humidity of the room of the sheepfold was in average 79.2%. The maximum and minimum value of relative humidity was respectively 93.4% and 64.1%. At the lowest outdoor temperature -18^{0}C (04.02.2014) supply air temperature reached 6^{0}C. Supply flow rate fluctuate depending on the outdoor temperature within 70-140 m^3/h. The maximum heat output of installation was 2.2kW.

During tests energy saving ventilation system in summer found that the room temperature of sheepfold ranged from +16.6^{0}C to +27.29^{0}C on average +22.3^{0}C, with the number of measurements n = 820. The relative humidity of the room of sheepfold averaged 30.5%. Maximum and minimum value of relative humidity was respectively 58.88% and 10.37%. At the highest temperature of the outside air +33.4°C supply air temperature reached +19.6^{0}C and humidity increased from 12% to 23%. Air flow rate was 140m^3/h. The cooling capacity of the installation was 2.6 kW.

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PREDICTION GENERATION FROM BASKETBALL DATA BY ARTIFICIAL NEURAL NETWORKS AND WITH ANFIS

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Anadolu University

Abstract: In this study, estimation of points scored per minute was made by going out of the basket in a certain time frame. Both the Artificial Neural Network (ANN) and the Adaptive Neuro Fuzzy Inference System (ANFIS) models were used for estimation. In the study, it was tried to estimate how many points were gained in average per minute, which corresponds to 9 inputs. The test performance of the two models was obtained in terms of the mean square error (MSE) and the root mean square error (RMSE) and compared with each other. The results obtained show that ANFIS has superior performance to YSA in the point estimation function.

Keywords: Points per minute, basketball, ANN, ANFIS, MSE, RMSE

Introduction

Artificial intelligence technology is developing more and more every day. New products are emerging and show themselves more in daily life. Automation systems are also equipped with artificial intelligence technology to make use of the computer's decision making power. More and more commercial system are emerging every day and the functional features of the systems are increasing. Artificial intelligence technologies are especially used in such areas as expert systems, artificial neural networks, genetic algorithms, fuzzy propositional logic, intelligent factors[1].

- Expert systems: It is a system that produces solutions to problems as an expert solves them. The deduction mechanisms make decisions by establishing relationships between information.
- Artificial neural networks: It is the systems that determine the relationships between the events by learning the examples and then using the information they learned about the samples that they have never seen
- Genetic algorithms: They are developed to solve problems that cannot be solved by conventional optimization technology.
- Fuzzy propositional logic: It is a technology that processes indefinite information makes it easy to manipulate and make decisions in situations that cannot be expressed with exact figures.
- Intellıgent factors: It is a system that can use different artificial intelligence techniques and can work independently.

Material and Methods: Artificial Neural Networks and Anfis

Dataset

In this study, we used Basketball dataset. Points scored per minute is being treated as the class attribute. Dataset from Smoothing Methods in Statistics (ftp stat.cmu.edu/datasets). In this dataset contain four attributes that assists_per_minute real, height integer, time_played real, age integer. This dataset label is points_per_minute real.
[http://www.cs.toronto.edu/~delve/].

Artificial Neural Networks

Artificial neural networks are computer systems developed by means of biological neural networks with the aim of spontaneously realizing the ability to derive and discover new information through learning from the properties of the human brain without any help[2].

The biggest problem in artificial neural networks is the need for artificial neural networks that contain multiple layers and multiple neurons to solve complex problems[3].

Artificial nerve cells come together to form ANN. It is not random that the nerve cells come together. In general, the cells form a network of 3 layers and in parallel within each layer. These layers[1]:

- **Input layer:** The process elements in this layer are responsible for transferring information from the outside world to intermediate layers. In some networks there is no information processing on the input layer.

- **Intermediate layers:** The information from the input layer is processed and sent to the output layer. Processing of this information is performed in intermediate layers. There can be more than one middle layer for a network.

- **Output layer:** The process elements in this layer generate the output that should be produced for the input set (sample) presented from the input layer of the network by processing the information from the intermediate layer. The output produced is sent to the outside world.

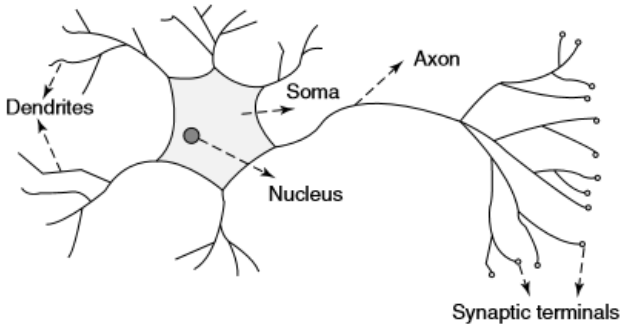

Figure 1. Mammalian neuron

The human brain is a collection of more than 10 billion interconnected neurons. Each neuron is a cell (Figure 1) that uses biochemical reactions to receive, process, and transmit information.

In general, artificial neural networks mdels; a) network structure, b) feed forward, c) feed back, d) the symmetry or asymmetry of the weight matrices, e) the weight matrix values are fixed or variable, f) the characteristics of the nodes in the network, g) for the threshold function used, h) node for only analog / binary or constant values to be applied, j) depends on education or learning rules[4].

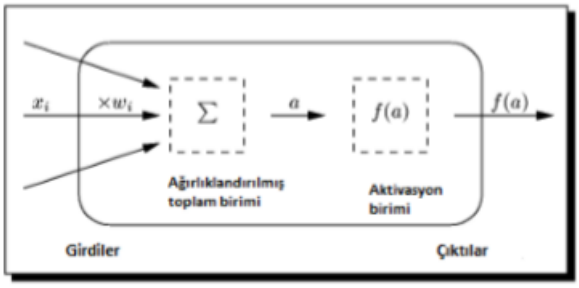

Figure 2. Single layer perceptron structure

In monolayer artificial neural networks, the weighted input values are summed with the threshold value (θ) to pass through the activation function and reach the output. W_i: the weight of the i-th input value, θ: Threshold value of f (a): the output value to indicate.

The multi-layer artificial neural network model was developed by Rumelhart et al. The backpropagation algorithm is used in the MPA model. The learning of the MLB network is a generalized version of the Delta Learning Rule based on the rule of least squares. Therefore, the rule of learning is also referred to as "Generalized Delta Rule". It is an idea-based rule to continuously adjust and improve the input connections to reduce the difference between the actual output value and the desired output value of a neuron according to the "delta rule" used in the backpropagation algorithm[5]. In this network structure, "Teacher Learning" method is used. Each vector associated with target output values in teacher learning is presented to the network for network learning. The weights are corrected based on the specified learning rule[6]. In Figure 2, an exemplary back propagation network is provided.

ANN is classified under two architectural structures as "feed forward" and "feed back" according to the binding behavior of the cells[7].

Feed-Forward Networks: Only forward data from the input units to the output units of the data is the network structure. In this structure, the neurons are in layers. The outputs of the neurons in one layer are given as inputs over the weights to the next layer. There is no connection or feedback loop between neurons in the same layer or the previous layer. In practice, such networks are generally preferred.

Feedback Networks: It is a structure in which data flow is performed backwards. It has at least one feedback loop. Feedback can also be found between cells in the same layer or cells in different layers.

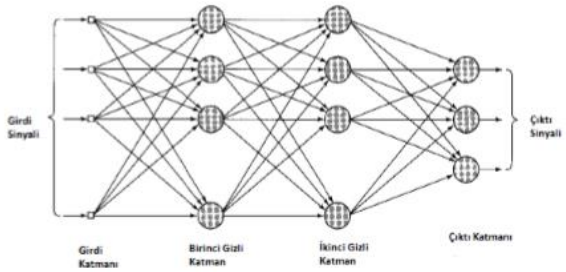

Figure 3. Sample Back-propagation network

Some studies with artificial neural networks in the literature are given below.

It is performed[8] forecasting using artificial neural networks method using seven technical analysis indicators between 1990 and 2003 in order to estimate the daily direction of the ISE 100 index, and estimated the model's prediction success rate to 60.8%. They[9] tried to estimate the direction of all ISE 30 and ISE indices using daily, weekly and monthly data of artificial neural networks and regression methods. The direction of the index of artificial neural networks was estimated as 57.8%, 67.1% and 78.3% on a daily, weekly and monthly basis, respectively.

ANFIS

ANFIS was developed by a researcher named Jang based on the Takagi-Sugeno fuzzy model[10]. ANFIS has a structure in which you can load input / output data sets separately in training and test clusters, and you can select the number and type of membership functions on the model. These selections allow the number of rules on the model to be determined. The error values shown in the training and test phase represent the square root of the sum of the squares of the difference between the system output and the actual output. In other words, the error values we get are root mean square error (RMSE) values.

The performance of the model established by this error value can be evaluated. Also in the test phase, the graphical part of the model and system outputs and actual output values can be displayed graphically.

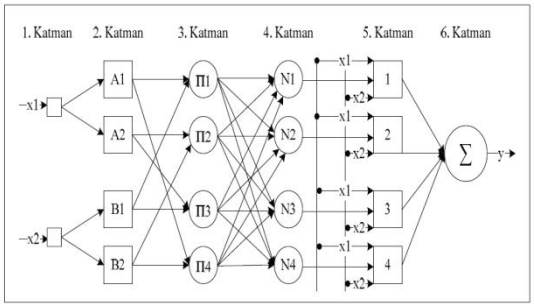

Figure 4. ANFIS - adaptive neuro fuzzy inference system

ANFIS contains 6 different layers. This structure containing 6 layers is shown in figure 3. We can summarize the layers in this structure as follows[11]:

- **Layer 1:** It is input layer. In this layer, the input values from each node are transferred to the other layers.
- **Layer 2:** It is fuzzification layer. The functions of your membership are found in this layer. The output of each node in this layer consists of input values and membership values depending on the membership function used.

- **Layer 3:** It is expressed as a rule layer. In the previous layer, a number of rules will be created that will depend on the number of membership functions selected for each entry. That is, each node in this layer represents the number and number of rules generated by the Sugeno fuzzy logic derivation system.
- **Layer 4:** It is the normalization layer. Each node in this layer accepts all nodes coming from the rule layer as input values and calculates the normalized weight level of each rule.
- **Layer 5:** It is the fuzzification layer. Each neuron in this layer is connected to the respective normalization neuron, and also receives initial inputs.
- **Layer 6:** It is represented by a single summation neuron. This neuron calculates the sum of outputs of all defuzzification neurons and produces the overall ANFIS output.

Experiments and Results

Pre-Test Operations

In order to minimize the error, each value in the data set was normalized before the experiments were carried out, since the value range of each item in the data set to be used is different from the others. 70% of the data (67 samples) were used for training and 30% (29 samples) were used for the test.

State Forecast of Artificial Neural Network

In the generated model, the number of neurons used in the hidden layer was changed each time and the test operation was performed and the model giving the Mean Square Error (MSE) was determined.

Experiments	Number of hidden layer	Epoch	Train Error (MSE)	Test Error (MSE)
1	3	1000	1.28e-07	1.96e-07
2	4	1000	1.89e-07	9.91e-08
3	5	1000	1.61e-07	2.04e-07
4	6	1000	1.42e-07	1.89e-07
5	7	1000	2.31e-07	9.72e-08
6	8	1000	1.32e-07	2.42e-07
7	10	1000	4.67e-08	5.16e-07

Table 1: Results obtained with ANNs with various number of layers

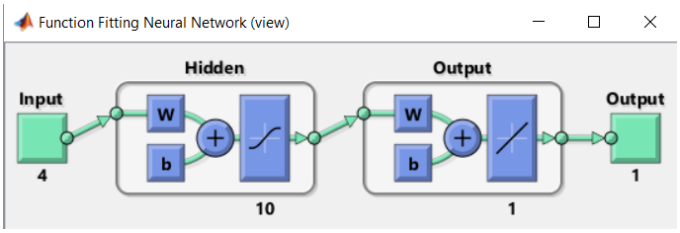

Figure 5.ANN model giving the best test result

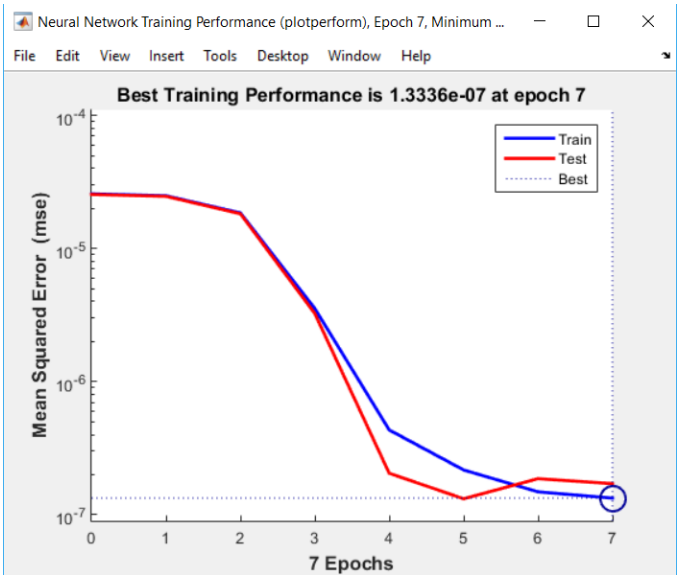

Figure 6. The performance of the YSA model that gives the best test results

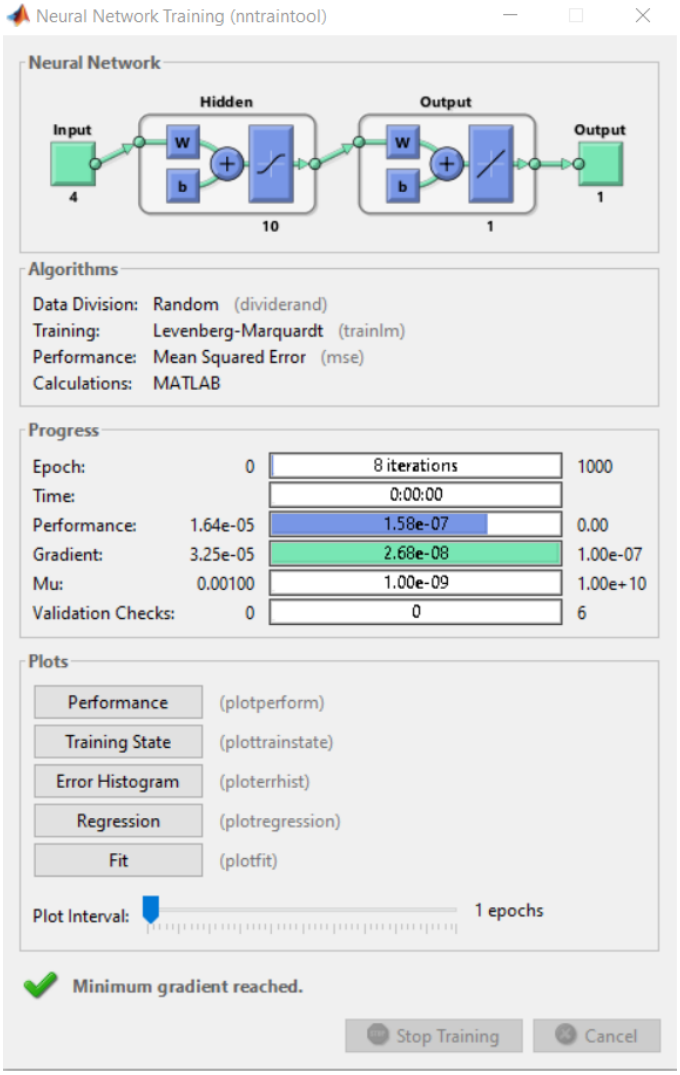

Figure 7: Neural network training

State Forecast with ANFIS

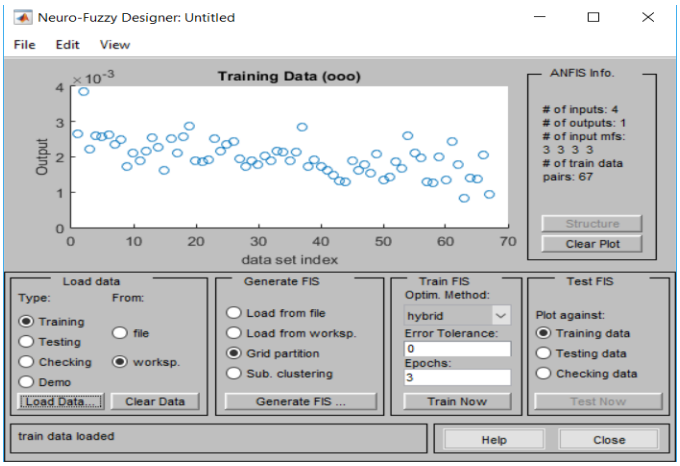

Figure 8: Train and test data

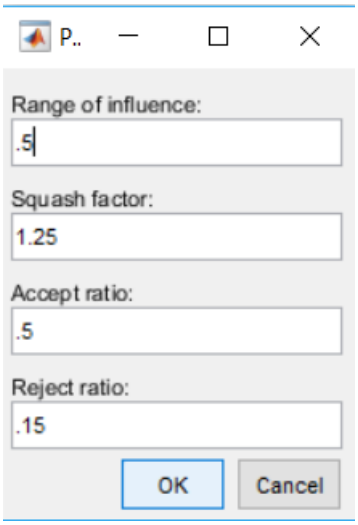

Figure 9: Parameters for clustering genfis

Table 2. Results with ANFIS models

Deneyler	Range of influence	Squash Factor	Accept Ratio	Eğitim Hatası (RMSE)	Test Hatası (RMSE)
1	0.5	1.25	0.5	0.00024186	0.00306
2	0.7	1.25	0.5	0.00037117	0.00049
3	0.6	1.50	0.6	0.00036659	0.00049764
4	0.8	1.50	0.8	0.00035741	0.00048654

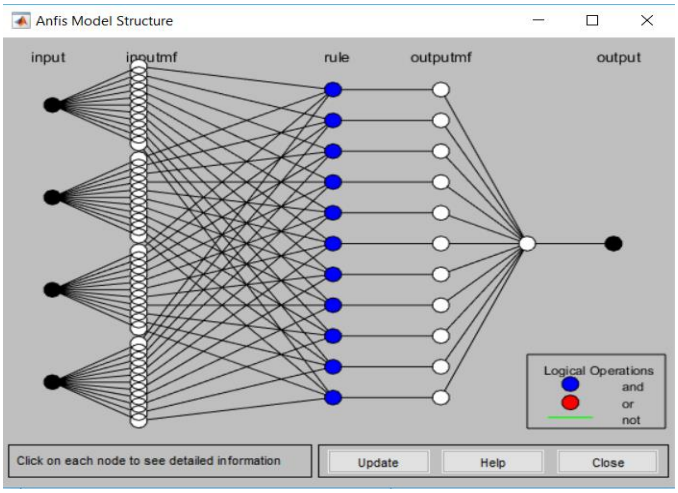

Figure 10: ANFIS model that gives the best test performance

Conclusions

In this study, the score per minute obtained from the basketball data was estimated by using the artificial neural network model and the ANFIS model for this purpose and the prediction results of these models were compared with each other. Training and testing functions were performed based on 10 input variables on a daily basis and ANFIS model performed better than artificial neural network model with the lowest average prediction error.

As a result, the score earned per minute on the basketball (Adaptive Neural Fuzzy Inference System) has been reached as a short-term predictable at high consistency.

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AFFECT OF POPULATION SIZE ON THE PERFORMANCE OF THE MOEA/D ALGORITHM

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Abstract: Multiobjective Evolutionary Algorithm Based on Decomposition (MOEA/D) is a population based evolutionary algorithm by modifying the single-objective Evolutionary Algorithm (EA). MOEA/D decomposes a multiobjective optimization problem into a number of different single objective subproblems and then uses a population-based method to optimize these subproblems at the same time. In this study, population number of the MOEA/D algorithm was set as varying numbers from 10 to 1000 and affect of varying population number on the performance of the MOEA/D algorithm was investigated on multi-objective problem families ZDTs and WFGs. Four different quality indicators were used to evaluate the performance of the tested MOEA/D algorithms: Hypervolume (HV), SPREAD, EPSILON, Inverse Generational Distance (IGD). Affect of population size on the performance of the MOEA/D algorithm was analyzed with the experimantal results.

Keywords: Multi-objective optimization, evolutionary computation, MOEA/D

Introduction

In real-world, many optimization problems have multiple objectives that are generally incompatible with each other. These problems are named as Multi-objective problems or shortly MOPs. Mathematical notation of a MOP is given below (Zhang & Li, 2007):

$$Minimize\ F(X) = (f_1(X), f_2(X), \dots, f_p(X))$$
$$subject\ to\ x \in \Omega \quad (1)$$

Here f_1, f_2,…,f_p express the objective functions to be minimized, p is the number of objective functions, X is the decision variables vectors, and Ω is the variable space.

In MOPs, many researchers use concepts of Vilfredo Pareto (Pareto, 1964) to obtain best solutions in the population. All solutions are compared with each other in respect to the concept of Pareto dominance which enables the comparison as to more than one objective function values. In this comparision, better solution is named as non-dominated solution and worst solution is named as dominated one. The set of non-dominated solutions are named as Pareto optimal Front (PF). Obtained PFs are evaluated according to some performance metrics such as hypervolume (HV), SPREAD, EPSILON, IGD (Durillo & Nebro, 2011). By using these metrics, different algorithms can be compared with each other..

Multi-objective optimization (MOO) is a very important area for different science discipline. For this reason, many researchers study on MOO and propose novel algorithms such as (Mirjalili, Saremi, Mirjalili, & Coelho, 2016),(Xiang, Zhou, & Liu, 2015) and (Dai, Wang, & Ye, 2015) to overcome MOPs. Each algorithm has some parameters and values of these parameters is very important success of that algorithm. One of the most important running parameter is population number of the algorithm. In this study, population number of the MOEA/D algorithm was set as varying numbers from 10 to 1000 and affect of varying population number on the performance of the MOEA/D algorithm was investigated on multi-objective problem families ZDTs (Zitzler, Deb, & Thiele, 2000) and WFGs (Huband, Hingston, Barone, & While, 2006).

The other parts of the study are organized as follows: In METHODS, MOEA/D algorithm is explained shortly; In RESULTS AND FINDINGS, the experimental results of the MOEA/D algorithm with different population size are presented and analyzed. In CONCLUSION, obtained results of the study are evaluated and concluded. In RECOMMENDATIONS, the opinions for the further studies are stated.

Methods

Multi-objective Evolutionary Algorithm Based On Decomposition (MOEA/D) is a decomposition-based evolutionary algorithm. Decomposition is a basic strategy which decomposes a MOP into a number of scalar optimization subproblems and optimizes them at the same time. Each subproblem is only optimized by utilizing

from the knowledge of some neighbor subproblems and so it is targeted for the complexity of algorithm to decrease. Subproblems have a neighborhood relation in respect to their Euclid distance and the optimal solutions of subproblem of two neighbors are wished to be the similar.

There are several methods to convert the problem of approximation of the PF into a number of scalar optimization problems. In this study, Tchebycheff approach (Miettinen, 1999) is used and its mathematical form was given below:

$$minimize g^{te}(x|\lambda, z^*) = \max_{1 \le i \le p} \{\lambda_i f_i(x) - |z_i^*|\} \quad subject\ to\ x \in \Omega \tag{2}$$

where $z^* = (z_1^*, \ldots, z_p^*)^T$ is the reference point, for instance $z_i^* = min\{f_i(x)|x \epsilon \Omega\}^3$, each i= 1,…,p. There is a weight vector λ for each Pareto optimal solution x* in such a way that x*is the optimal solution of (2) and each optimal solution of (2) is a Pareto optimal solution of (1).

Results and Findings

Population number of the MOEA/D algorithm was set as varying numbers from 10 to 1000 and affect of varying population number on the performance of the MOEA/D algorithm was investigated on multi-objective problem families ZDTs and WFGs. For a fair comparision, all versions of the MOEA/D algoritm was run for 25,000 maximum fitness evaluations. Other parameters of the MOEA/D algorithm was given in Table 1. Four different quality indicators were used to evaluate the performance of the tested MOEA/D algorithms: Hypervolume (HV), SPREAD, EPSILON and Inverse Generational Distance (IGD) (Durillo & Nebro, 2011). Obtained values of each metric was given Table2-5.

Table 1. Parameters of the MOEA/D algorithm

Variable	Value
Population Size	10, 50, 100, 150, 200, 300, 1000
delta	0.9
nr	2
T	10

Table 2. Average value of the HV Metric

	MOEAD10	MOEAD50	MOEAD100	MOEAD150	MOEAD200	MOEAD300	MOEAD1000
ZDT1	6.08E-01	6.55E-01	**6.57E-01**	6.51E-01	6.48E-01	6.07E-01	0.00E+00
ZDT2	2.82E-01	3.23E-01	**3.26E-01**	3.22E-01	2.82E-01	2.67E-01	0.00E+00
ZDT3	4.85E-01	5.09E-01	**5.13E-01**	5.11E-01	5.08E-01	4.58E-01	0.00E+00
ZDT4	6.08E-01	**6.55E-01**	5.81E-01	3.72E-01	2.83E-01	1.11E-01	6.46E-01
ZDT6	3.52E-01	3.96E-01	4.01E-01	**7.28E-01**	6.96E-01	3.88E-01	7.27E-01
WFG1	**5.69E-01**	5.48E-01	4.23E-01	4.01E-01	3.33E-01	2.55E-01	3.72E-02
WFG2	5.20E-01	5.53E-01	5.55E-01	5.56E-01	5.56E-01	**5.63E-01**	3.59E-01
WFG3	4.35E-01	4.88E-01	4.93E-01	**4.96E-01**	**4.96E-01**	4.42E-01	2.58E-01
WFG4	1.65E-01	2.04E-01	2.08E-01	2.10E-01	2.08E-01	**2.14E-01**	2.08E-01
WFG5	1.48E-01	1.89E-01	1.94E-01	1.96E-01	1.97E-01	**1.98E-01**	**1.98E-01**
WFG6	1.64E-01	2.04E-01	2.08E-01	2.10E-01	2.10E-01	**2.11E-01**	2.02E-01
WFG7	1.64E-01	2.04E-01	2.09E-01	2.11E-01	**2.12E-01**	2.11E-01	2.06E-01
WFG9	1.76E-01	2.17E-01	2.23E-01	2.36E-01	**2.38E-01**	2.37E-01	2.34E-01

Table 3. Average value of the SPREAD Metric

	MOEAD10	MOEAD50	MOEAD100	MOEAD150	MOEAD200	MOEAD300	MOEAD1000
ZDT1	**2.79E-01**	2.84E-01	2.95E-01	3.79E-01	4.34E-01	8.74E-01	1.09E+00
ZDT2	**1.35E-01**	1.39E-01	1.66E-01	2.32E-01	6.48E-01	1.06E+00	1.17E+00
ZDT3	**4.28E-01**	9.41E-01	1.01E+00	1.08E+00	1.14E+00	1.06E+00	1.18E+00
ZDT4	**2.79E-01**	2.84E-01	8.50E-01	1.18E+00	1.174E+00	1.30E+00	1.07E+00
ZDT6	**1.48E-01**	1.51E-01	1.54E-01	4.84E-01	1.20E+00	1.04E+00	4.82E-01
WFG1	**3.80E-01**	7.89E-01	9.00E-01	1.11E+00	1.11E+00	1.02E+00	9.89E-01
WFG2	**7.49E-01**	1.02E+00	1.10E+00	1.15E+00	1.19E+00	1.19E+00	1.10E+00

WFG3	**3.42E-01**	3.43E-01	3.45E-01	3.52E-01	3.71E-01	5.71E-01	9.95E-01
WFG4	**4.10E-01**	4.21E-01	4.49E-01	5.80E-01	8.58E-01	9.92E-01	4.63E-01
WFG5	**4.41E-01**	4.60E-01	4.59E-01	4.59E-01	4.63E-01	5.38E-01	8.85E-01
WFG6	**4.04E-01**	4.10E-01	4.17E-01	4.12E-01	4.14E-01	4.39E-01	1.19E+01
WFG7	**4.04E-01**	4.10E-01	4.11E-01	4.24E-01	4.16E-01	4.29E-01	1.10 E+00
WFG9	**4.15E-01**	4.26E-01	4.67E-01	4.92E-01	5.08E-01	6.08E-01	1.05 E+00

Table 4. Average value of the EPSILON Metric

	MOEAD10	**MOEAD50**	**MOEAD100**	**MOEAD150**	**MOEAD200**	**MOEAD300**	**MOEAD1000**
ZDT1	7.98E-02	1.70E-02	9.62E-03	**1.13E-02**	1.52E-02	5.21E-02	1.72E+00
ZDT2	6.63E-02	1.27E-02	**1.00E-02**	1.38E-02	2.24E-02	1.13E-01	2.77E+00
ZDT3	7.19E-02	3.07E-02	2.98E-02	1.25E-02	2.96E-02	**1.21E-02**	2.16E+00
ZDT4	7.61E-02	**2.34E-02**	1.56E-01	4.89E-01	1.16E+00	7.89E-01	19.3E+00
ZDT6	5.25E-02	9.90E-03	5.10E-03	**2.89E-03**	8.86E-02	5.54E-02	4.92E-03
WFG1	2.80E-01	**2.62E-01**	3.48E-01	4.03E-01	5.16E-01	7.28E-01	1.81E+00
WFG2	2.80E-01	6.73E-02	2.78E-02	1.96E-02	**1.21E-02**	1.24E-02	9.55E-01
WFG3	2.64E-01	5.12E-02	2.53E-02	1.78E-02	**1.25E-02**	2.01E+00	1.28E+00
WFG4	2.34E-01	4.78E-02	3.29E-02	3.00E-02	**2.79E-02**	3.42E-02	3.63E-02
WFG5	2.77E-01	9.46E-02	7.26E-02	6.49E-02	6.26E-02	6.08E-02	**5.87E-02**
WFG6	2.36E-01	4.54E-02	2.46E-02	1.85E-02	1.46E-02	**1.04E-02**	3.40E-02
WFG7	2.37E-01	4.78E-02	2.51E-02	1.44E-02	1.43E-02	**1.34E-02**	2.36E-02
WFG9	2.26E-01	4.89E-02	2.77E-02	2.40E-02	**2.24E-02**	2.45E-02	2.52E-02

Table 5. Average value of the IGD Metric

	MOEAD10	**MOEAD50**	**MOEAD100**	**MOEAD150**	**MOEAD200**	**MOEAD300**	**MOEAD1000**
ZDT1	1.6E-03	3.21E-04	2.23E-04	**2.02E-04**	3.63E-04	1.27E-03	4.68E-02
ZDT2	1.54E-03	2.84E-04	**1.73E-04**	2.03E-04	3.93E-04	3.93E-04	6.96E-02
ZDT3	2.66E-03	6.15E-04	5.54E-04	**2.13E-04**	2.61E-04	9.61E-04	2.45E-02
ZDT4	1.62E-03	**4.53E-04**	6.45E-04	1.12E-02	1.51E-02	1.83E-02	8.62E-01
ZDT6	1.53E-03	2.82E-04	**1.41E-04**	2.92E-04	8.27E-04	7.54E-04	2.96E-04
WFG1	1.71E-03	**1.54E-03**	3.01E-03	4.42E-03	4.91E-03	1.04E-02	1.66E-02
WFG2	2.54E-03	6.92E-04	4.34E-04	3.01E-04	**2.36E-04**	6.50E-04	9.77E-03
WFG3	1.39E-03	2.50E-04	1.19E-04	5.86E-05	4.38E-05	**3.48E-05**	1.19E-04
WFG4	1.73E-03	4.08E-04	2.15E-04	**1.46E-04**	1.70E-04	1.71E-04	2.41E-04
WFG5	2.59E-03	1.07E-03	9.91E-04	9.79E-04	9.74E-04	**9.70E-04**	**9.70E-04**
WFG6	3.46E-03	6.33E-04	3.17E-04	2.06E-04	1.58E-04	**1.22E-04**	4.39E-04
WFG7	1.29E-03	2.47E-04	1.22E-04	6.52E-05	6.58E-05	**4.53E-05**	1.34E-04
WFG9	2.30E-03	2.57E-04	1.39E-04	1.13E-04	**1.01E-04**	1.07E-04	1.47E-04

When analyzed Table 2, MOEA/D algorithm has best performance on ZDT and WFG problems for HV metric while population size (PS) was set as 100 and 300 respectively. Table 3 shows that MOEA/D algorithm has best performance on all problem set for SPREAD metric while PS was set as 10. Table 4 shows that MOEA/D algorithm has best performance on ZDT and WFG problems for EPSILON metric while PS was set under 150 and upper 200 respectively. Finally, Table 5 shows that MOEA/D algorithm has best performance on ZDT and WFG problems for IGD metric while PS was set under 150 and upper 200 respectively.

Table 6. Number of best metric values of different population size

	10	**50**	**100**	**150**	**200**	**300**	**1000**
HV	1	1	3	2	3	4	1
SPREAD	13	-	-	-	-	-	-
EPSILON	-	2	1	2	4	3	1
IGD	-	2	2	3	2	4	1

Conclusion

In this study, population number of the MOEA/D algorithm was set as varying numbers from 10 to 1000 and affect of varying population number on the performance of the MOEA/D algorithm was investigated on multi-objective problem families ZDTs and WFGs. Four different quality indicators were used to evaluate the performance of the tested MOEA/D algorithms: Hypervolume (HV), SPREAD, EPSILON, Inverse Generational Distance (IGD). Number of best metric values of different population size was given in Table 6. It is shown that MOEA/D algorithm has generally best results for HV, EPSILON and IGD metrics while PS set as 200 and 300. For SPREAD metric, MOEA/D has best performance while PS set as 10.

Recommendations

In this study, affect of population size on the performance of the MOEA/D Algorithm was analyzed. In future work, researchers can analyze affect of other parameters on the performance of the MOEA/D algorithm and expand the problem set.

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"WHOLE (INTEGRAL) AND FUZZY MODEL OF E –TEXTBOOK IN 3D"

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Abstract: Electronic textbooks, replacing paper books are enriching traditional forms of teaching, as it allows including a huge number of teaching and visual materials in it and promotes the development of qualitative new methods of teaching. However, in many textbooks teaching material is structured in memorizing, learning and applying of knowledge The proposed program-methodical complex – "Whole (integral) and fuzzy model of e –textbook in 3D" develops mental abilities of students and provides an opportunity to interactively learn the curriculum.

The proposed "Integral and fuzzy model of e –textbook in 3D" will be applied in smart phones and tablets. Working with this model of e-textbook in 3D, students acquire the ability to build their knowledge by learning the meaning and essence of the material they are learning. Knowledge of e –textbook in 3D will be built on synergistic approaches of psychology, didactics and high technology.

The content of knowledge of e-textbook in 3D will be structured according to the mechanisms of logical integrity by Piaget and fuzzy logic by Zadeh. New knowledge is based on ontogenesis knowledge learned by consistent, logical questions and is logically linked with further knowledge.

Keywords*:* Fuzzy logic by Zadeh, logical integrity by Piaget, model of e –textbook in 3D, synergistic, ontogenesis knowledge

Introduction

In connection with the development of ICT, E-textbooks are becoming a powerful means of improving individual and distant forms of teaching. The Internet makes it virtually accessible everywhere in the world. Electronic textbooks, replacing paper books are enriching traditional forms of teaching, as it allows including a huge number of teaching and visual materials in it and promotes the development of qualitative new methods of teaching. However, in many textbooks teaching material is structured in memorizing, learning and applying of knowledge.

The proposed program-methodical complex – "Whole (integral) and fuzzy model of e –textbook in 3D" develops mental abilities of students and provides an opportunity to interactively learn the curriculum.
The proposed "Integral and fuzzy model of e –textbook in 3D" will be applied in smart phones and tablets Working with this model of e-textbook in 3D, students acquire the ability to build their knowledge by learning the meaning and essence of the material they are learning. Knowledge of e –textbook in 3D will be built on synergistic approaches of psychology, didactics and high technology.

The content of knowledge of e-textbook in 3D will be structured according to the mechanisms of logical integrity by Piaget and fuzzy logic by Zadeh. New knowledge is based on ontogenesis knowledge learned by consistent, logical questions and is logically linked with further knowledge.

Methods

The model of e-textbook in 3D is described below:
1. While compiling, the subject program of the model of e-textbook in 3D, didactic unit of knowledge is interpreted as

structure of knowledge. It allows to combine the knowledge in connective, reversible, associated, identical and

canceled logical structures in the model of e-textbook.

2. Model of the knowledge is structured by mechanisms of psychological concepts of integral logic by Piaget and mathematical concepts of fuzzy logic Zadeh (Bunyatova).

In connection with it:
1. In the outline of the integrity of the subject knowledge of e-textbooks, the structure of subject knowledge is determined as a structure of subject according to Piaget or "as a mathematical set" according to Zadeh.
2. Discovered structure of subject knowledge, or knowledge of "mathematical set" is classified as:
a) Invariant (by Piaget) or "universal set" (by Zadeh);
b) Variables - categorical (by Piaget) or linguistic variables (by Zadeh)
c) Compound -invariant variables (Bunyatova).
3. Invariant or "universal sets" structures of knowledge is denoted by x0,1, x0,2, x0,3, etc. and are placed horizontally on the plane surface in the coordinate model of the e-textbook
4. Variables or "linguistic variables" structures of knowledge is denoted by y0,1, y0,2, y0,3 etc. and placed vertically on a coordinate model
5. Compound -invariant variables knowledge is denoted by Z x0,1; Zx0,2 y 0,3; etc. and placed on the third part of the coordinate plane surface .

In the model of e-textbook in 3D, every class of knowledge or an element of the set is determined as a cluster or module of appropriate knowledge structure.

Knowledge of each cluster or module has its own rules and regularity. They are always in the mobile movement, uniting, disconnecting, associating according to the given installation around the logical structure of knowledge, or an element of the set and converts into nano-structures of knowledge.

Lesson modules of the e-textbook in 3D are based on the principles of constructive teaching.
CL technology is based on the cognitive constructivism by Piaget and on the social constructivism by Vygotsky. Interactivity of teaching includes links of logical connections between the previous and subsequent knowledge of the subject.

In the process of teaching, students are encouraged to study the model and the mental interactive activity. This will allow students to construct their own personal knowledge based on their own experience and knowledge.

In the model of e-textbook in 3D keywords "Taxonomy of the Intelligence" by Bloom, the theory of "Multiple Intelligence" by H. Gardner and "clinical method" by Piaget were created as a battery of new tasks by means of which students:
a) form and determine the level of personal comprehension, knowledge and application;
b) operate on knowledge: analyze, synthesize, enrich, replaced, conduct multiplicative operation, generate new knowledge and assess them. The speed and level of personal transformation depends on the internal potential of every student.
Evaluation of the activities of students will be assessed according to four criteria - the improvement of academic, intellectual and social knowledge and skills.

The proposed model of e-textbook is significantly different from the existing models of e-tutorial on the following parameters:
1. All of structures the knowledge are classified, digitized and placed in the coordinate plane.
2. The structures of knowledge are arranged in a logical sequence. They are operational and are transformed into new knowledge by logical units and mental operations.
3. Knowledge, repeating constantly, is transformed into new knowledge and strengthened it in the memory not in an isolated form, but in a logical connection.
4. The constructive basis of e-textbooks creates an opportunity for each student to carry out an operational activity on knowledge originated from their type and stage of thinking. At this time, during the interactive discussions, the personal type of thinking enriches with the help of and settings of other forms of thought.
5. e- textbook was modeled as a textbook for all and at the same time, as a textbook for individual development trajectory.
6. The proposed "Integral and fuzzy model of e –textbook in 3D" can or an element of the set is determined as a cluster or module of appropriate knowledge structure.

Knowledge of each cluster or module has its own rules and regularity. They are always in the mobile movement, uniting, disconnecting, associating according to the given installation around the logical structure of knowledge, or an element of the set and converts into nano-structures of knowledge.

Lesson modules of the e-textbook in 3D are based on the principles of constructive teaching.
CL technology is based on the cognitive constructivism by Piaget and on the social constructivism by Vygotsky. Interactivity of teaching includes links of logical connections between the previous and subsequent knowledge of the subject. In the process of teaching, students are encouraged to study the model and the mental interactive activity. This will allow students to construct their own personal knowledge based on their own experience and knowledge.

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Evaluation of the activities of students will be assessed according to four criteria - the improvement of academic, intellectual and social knowledge and skills.

Recommendations

The proposed model of e-textbook is significantly different from the existing models of e-tutorial on the following parameters:
1. All of structures the knowledge are classified, digitized and placed in the coordinate plane.
2. The structures of knowledge are arranged in a logical sequence. They are operational and are transformed into new knowledge by logical units and mental operations.
3. Knowledge, repeating constantly, is transformed into new knowledge and strengthened it in the memory not in an isolated form, but in a logical connection.
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5. e- textbook was modeled as a textbook for all and at the same time, as a textbook for individual development trajectory.
6. The proposed "Integral and fuzzy model of e –textbook in 3D" can serve the basis for creating the subject of a new generation of e- textbooks.

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A DESIGN OF MOBILE APPLICATION FOR ANDROID DEVICES

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Abstract: Mobile applications which are very integrated to people's daily life activities are designed to run on mobile devices. Especially in recent years, with the development in smarth phone technologies, people can communicate, share pictures and videos with each other very rapidly and easily. Because of the energy contraints of mobile phones, compression of huge data such as image and video, becomes an important topic especially while transmitting them between mobile devices. In this study, a mobile application which provides user an interface to load, compress and transmit image data is designed for Android based mobile devices.

Keywords: Android programming, image compression

ANDROİD CİHAZLAR İÇİN MOBİL UYGULAMA TASARIMI

Özet: Mobil uygulamaları, özellikle de son dönemlerde insanların günlük yaşamlarının vazgeçilmezi haline gelmiş olan mobil cihazlar üzerinde çalışmaları için tasarlanmaktadır. Akıllı cihaz teknolojilerindeki gelişmeler ile birlikte, görüntü ve video gibi verilerin anlık olarak kişiler arasındaki iletimi çok kolay ve hızlı bir şekilde gerçekleşebilmektedir. Mobil cihazların sahip olduğu kısıtlı enerji, özellikle de video ve görüntü gibi büyük boyuttaki verilerin iletiminde tüketilen enerjinin fazla olması nedeniyle önemli bir konu haline gelmiştir. Bu çalışmada, android tabanlı cihazlardaki büyük boyuttaki görüntü ve video gibi verilerin iletimi sırasındaki enerji kaybının azaltılması amacıyla geliştirilen görüntü sıkıştırma algoritması hakkında bilgi verilmektedir.

Anahtar Sözcükler: Android programlama, görüntü sıkıştırma

Giriş

Akıllı mobil cihaz teknolojilerindeki gelişmelerin sağladığı günlük yaşamdaki kolaylıklar, insanların bu cihazları daha sık ve yoğun kullanımına sebep olmuştur. Mobil cihazlardaki uygulamalar sayesinde istenilen yer ve zamanda bilgiye her an erişim mümkün olmakla birlikte, anlık görüntü veya video paylaşımları da yapılabilmektedir. Bütün bu uygulamaların sağladığı kolaylıkların yanında getirdiği enerji maliyeti de bulunmaktadır. Mobil cihazların sahip oldukları enerjinin, belirtilen uygulamaların sık kullanılması sonucu hiç beklenmedik bir zamanda tükenmesi ve insanların ulaşılabilirliğinin kısıtlanması günlük yaşamda bir sorun haline gelmiştir. Bu sorunlara geçici çözüm olarak havaalanları, otogarlar gibi belirli yerlere şarj dolum cihazları yerleştirilmiştir.

Kablosuz iletişim için geliştirilen teknolojiler hızla ilerleme ve gelişim göstermektedir. İlk geliştirilen sistem olan 1G'de sesin analog olarak iletilmesi üzerinde durulmuştur. [1,2]'de 1G iletişimin geliştirilmesi ile ilgili çalışmalarda bulunulmuştur. 2G iletişim ile birlikte kapasite ve kapsama alanı kavramları gündeme gelmiştir. 1G iletişim ile kıyaslandığında, daha yüksek spektrum etkinliği, daha iyi veri servisi ve daha gelişmiş hareketlilik olanağı sağlanmıştır. 2G üzerine yapılan çalışmalardan birisi de [3]'tür. Teknoloji platformundan bağımsız olarak servis sunabilecek ve network tasarım standardı global olarak aynı olan bir sistem geliştirilmesi amacıyla 3G önerilmiştir. Mobil iletişim sistemlerinde yeni teknolojilerin gelişmesi ile kullanıcı isteklerindeki artış ve çeşitlilik nedeniyle, 4G mobil iletişim sistemleri geliştirilmiştir [4]. 4G sistemleri ile mevcut bütün mobil teknolojileri birleştirerek çok servisli sistem geliştirilmesi hedeflenmektedir [5].

Android işletim sistemine sahip mobil cihazlar için dosya sıkıştırma programları incelendiğinde, literatürde çeşitli sıkıştırma yöntemlerinin bulunduğu görülmüştür. 7Zipper, AndroZip, ArchiDroid, B1 Free Archiver, Easy Unrar, Unzip ve Zip, iZip, RAR for ANdroid, Simple Unrar, Winzip, Xzip, ZArchiver bu yöntemlerden en çok bilinenlerindendir.

Bu çalışma kapsamında mobil cihazlar için geliştirilen görüntü sıkıştırma uygulaması ile, mobil kullanıcılarının birbirlerine resim gibi büyük boyuttaki verileri iletirken, mobil cihazlarındaki enerji tüketiminin azaltılması hedeflenmektedir. Bu amaçla geliştirilen görüntü sıkıştırma uygulamasına kullanıcılar seçtikleri resmi yükleyebilecek, istedikleri oranda sıkıştırabilecek, WhatsApp, Facebook ve Messenger gibi programları kullanarak istedikleri kişilere sıkıştırılmış resmi gönderebilecektir.

Gereç ve Yöntem

Çalışma kapsamında mobil cihazlar arasında özellikle resim gibi büyük boyuttaki verilerin gönderimi esnasında enerji tüketiminin azaltılması amaçlanmıştır. Bunun sağlanabilmesi için de iletilecek dosyaların boyutunun sıkıştırılarak düşürülmesi gerekmektedir. Artık bilgisayarların yerini akıllı telefon ve tabletlerin almaya başladığı düşünülürse, mobil cihazlarda da kullanmak için sıkıştırma uygulamaları bulundurmak zorunluluk haline gelmiştir**.**

Projenin tamamlanması için 5 temel aşamadan geçilmiştir: Kullanılacak Teknolojilerin Analizi, Genel Tasarım, Ayrıntılı Tasarım, Simülasyon Ortamında Kod Yazımı ve Geliştirilen Yazılımın Gerçek Ortama Aktarılması

1.Adım: Kullanılacak Teknolojilerin Analizi

Çalışma kapsamında, BİTMAP sıkıştırma yönteminin kullanılmasına karar verilmiştir. Bu sıkıştırma yönteminin dosya formatından bağımsız olması ve koda müdahale edilebilir olması özellikleri yöntemin kullanılmasında tercih sebebi olmuştur. Android yüklü cep telefonu yazılımının geliştirilmesi için Android Studio yazılım programı bilgisayara yüklenmesine, Kodlama için Java Android programlama dilinin, Tasarım için de XML dilinin kullanılmasına karar verilmiştir. Bu amaçla, aşağıda belirtilen Cep Telefonu Android Yazılım Programları bilgisayara yüklenmiştir: Android Studio, Anal Aygıt Emülatör, SDK Android 7.0, Java Android, XML

2.Adım: Genel Tasarım

Geliştirilmesi planlanan görüntü dosyasının sıkıştırılarak göndericiden alıcıya düşük boyutta gönderilmesi uygulaması, Android yüklü cep telefonlarında çalışması düşünülerek tasarlanmıştır. Tasarımın sade, rahat kullanılabilir ve kullanıcı dostu olması hedeflenmiştir. Bu amaçla XML programlama dili kullanılarak tasarlanmış, Java Android programlama dili kullanılarak kodlanmış ve Android işletim sisteminin yüklü olduğu Samsung Note 4'e yüklemesi yapılarak test edilmiştir.

3.Adım: Ayrıntılı Tasarım

Çalışmanın ayrıntılı tasarımında, genel tasarımda belirtilen ana başlıkların içinin doldurulması hedeflenmiştir. Android yüklü cep telefonundan çekilmiş ve galeride bulunan bir fotoğrafı, dosya menüsünden seçip, telefon ekranında göstermek; yüklemesi yapılan resmin yüklendiği adresin, resim çözünürlüğünün ve resmin boyutunu ekranda göstermek, BİTMAP sıkıştırma yöntemi ile, yüklenen resmin hangi oranda sıkıştırılacağı gibi işlemler, projenin ayrıntılı tasarım aşamasında tamamlanmıştır. Mobil cihazda ayrıntılı tasarım, XML programlama dili kullanılarak gerçekleştirilmiştir.

4.Adım: Simulasyon Ortamında Kod Yazımı

Proje kapsamında görüntü verisinin sıkıştırılabilmesi için BİTMAP Compression sıkıştırma algoritması kullanılmıştır. Bu amaçla, Android Studio, Anal Aygıt Emülatör, SDK Android 7.0, Java Android ve XML Cep Telefonu Android Yazılım Programları bilgisayarlara yüklenmiş olup, resim sıkıştırma algoritmasının gerçekleştirimi için Java Android programlama dili, Uygulama Tasarımı için de XML programlama dili kullanılmıştır.

Bulgular

Geliştirilen yazılım Android işletim sisteminin yüklü olduğu Samsung Note 4 mobil cihazına yükleme işlemi tamamlanmış olup, emülatör ortamında test edilen yazılımın gerçek ortama aktarılması sağlanmıştır.

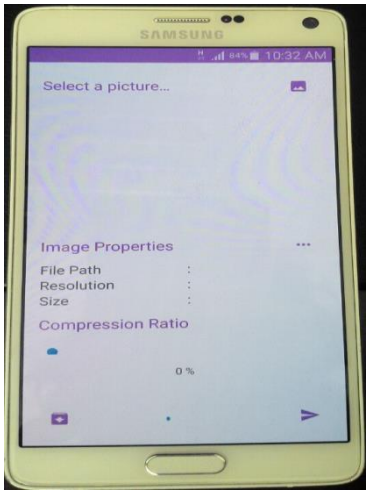
5.Adım: Geliştirilen Yazılımın Gerçek Ortama Aktarılması

Aşağıda geliştirmiş olduğumuz yazılımın ekran görüntüleri ve detaylı açıklamaları sunulmaktadır.

Şekil 1. Resim sıkıştırma uygulamasının kısa yol ikonu

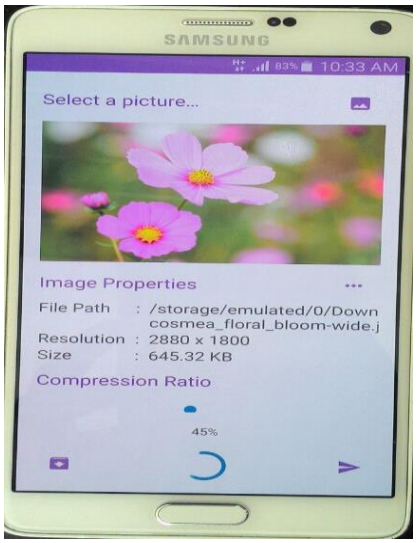
Kullanıcılar Play Store'a nullovy yazdıklarında çıkan listeden geliştirmiş olduğumuz Resim Sıkıştırma uygulamasına cep telefonlarına yükleyerek uygulamamızdan faydalanabilirler. Cep telefonuna yükleme yapıldığında Şekil 1 de belirtilen kısa yol tuşu ekranda görülebilecektir.

Kullanıcı kısa yol ikonunu çift tıklayarak uygulamaya çalıştırabilmektedir ve Şekil 2'de belirtilen başlangıç ara yüzü ile karşılaşmaktadır.



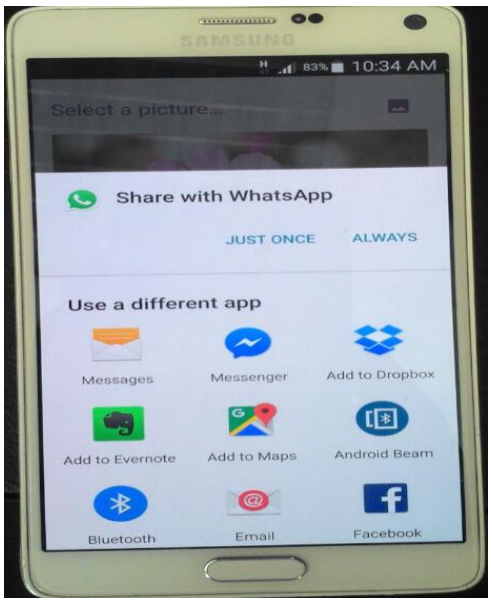
Şekil 2. Resim sıkıştırma uygulamasının ana ara yüzü

Şekil 2'de belirtilen arayüzde kullanıcı "Select a picture" yazısının sağında bulunan  ikona tıklayarak daha önce çekmiş ve cep telefonunda bulunan resimleri uygulamaya yükleyebilmektedir.



Şekil 3: Resim sıkıştırma uygulamasına resmin yüklenmesi ve resim hakkında bilgilerin ara yüz ekranında gözükmesi

Şekil 3'de görüldüğü gibi seçilen resim uygulamaya yüklenir. Yüklenen resim ile ilgili Dosya Yolu, Çözünürlük ve Boyut bilgileri "Image Properties" alanında görülebilmektedir. Kullanıcı "Compression Ratio" bölümünde resmi hangi oranda sıkıştıracağını belirler. Örneğin Şekil 3'de kullanıcı resmin %45 oranında sıkıştırılmasını seçmiştir.



Şekil 4. Sıkıştırılan resmin başka bir mobil kullanıcısına iletilmesi

Şekil 4'te sıkıştırılan resmin başka bir mobil kullanıcıya gönderilebilmesi için kullanılabilecek programlar gösterilmektedir. Kullanıcı bu programlardan herhangi birini seçerek resim gönderme işlemini gerçekleştirebilir.

Sonuç

Bu çalışmada geliştirilen algoritmalar ile günümüzün vazgeçilmez iletişim cihazları haline gelen cep telefonları arasındaki kablosuz iletişim için enerji etkin algoritmaların gerçekleşmesi hedeflenmiştir. Amacımız mobil cihazlar arasındaki iletişim sağlanırken, enerji tüketimini minimum seviyede tutmaktır. Bu amaçla bu mobil ve kablosuz iletişim kurabilen cihazlar üzerinde çalışacak yazılımlar gerçekleştirilmiştir. Görüntü verisinin iki mobil kullanıcısı arasında sıkıştırılarak iletilmesi sağlanmıştır

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INVESTIGATION OF INTERIOR STRUCTURES OF SOME WOOD SPECIES SUITABLE FOR INDUSTRIAL USE BY ULTRASONIC METHOD

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Abstract: Due to the climatic conditions and geographical location of Turkey, many different species of trees are grown in different regions. All the woods are generally exposed to injury, wear and decay due to various reasons such as climatic conditions, vegetation cover, insect species and human factor. It is possible that such negative effects on woods can be removed by restoration. The woods that can be used as industrial raw materials are expected to have high durability and to be least affected by environmental factors. The effects such as decay and wear on the woods can be determined by ultrasonic method, one of the non-destructive measurement techniques. In this study, ultrasonic wave velocity measurements were made on samples taken from chestnut, pine, fir and hornbeam woods which are used as industrial raw materials and average velocities of these wood samples were determined. They were left to natural environment conditions to determine how they are affected by factors such as rain, snow, hot-cold change. Afterwards, ultrasonic velocity measurements were made on these wood samples at different time periods and the results obtained were evaluated. According to these results, Weak (cracked, decayed zones) and massive areas within the wood can be determined by ultrasonic velocity maps. It was understood that chestnut in the woods samples were more resistant to external factors than others. Moreover, hornbeam and fir were decayed faster.

Keywords: Ultrasonic, chestnut, pine, fir, hornbeam, wood quality

ENDÜSTRİYEL KULLANIMA UYGUN BAZI AHŞAP TÜRLERİNİN İÇYAPILARININ ULTRASONİK YÖNTEM İLE ARAŞTIRILMASI

Özet: Türkiye'nin iklim koşulları ve coğrafi konumu nedeniyle farklı bölgelerinde pek çok farklı ağaç türleri yetişmektedir. Bu ağaçlar iklim şartları, bitki örtüsü, böcek türleri ve insan faktörü gibi değişik nedenlerle yaralanma, yıpranma ve çürümeye maruz kalabilmektedirler. Ağaçlar üzerindeki bu tür olumsuzluklar, restorasyon ile giderilebilmektedir. Endüstriyel ham madde olarak kullanılabilecek ağaçların dayanıklılığın yüksek olması, çevresel faktörlerden en az etkilenmesi beklenmektedir. Ağaçlar üzerindeki çürüme, yıpranma gibi etkiler ve ahşabın dayanıklılığı hasarsız ölçüm tekniklerinden biri olan ultrasonik yöntem ile belirlenebilmektedir. Bu çalışmada, endüstriyel hammadde olarak kullanılan kestane, çam, köknar ve gürgen gibi numuneler üzerinde ultrasonik yöntem ile ses dalgası hız ölçümleri yapılarak, bu numunelerin ortalama ses dalgası yayılım hızları belirlenmiştir. Bu numuneler yağmur, kar, sıcak-soğuk değişimi gibi faktörlerden nasıl etkilendiğini belirlemek amacıyla doğal ortam koşullarına bırakılmışlardır. Daha sonra farklı zaman periyodlarında, bu numuneler üzerinde ultrasonik hız ölçümleri yapılmış ve elde edilen sonuçlar değerlendirilmiştir. Bu sonuçlara göre, ahşap içerisinde zayıf (çatlaklı, çürümüş zonlar) ve sağlam (masif) bölgeler ultrasonik hız haritaları ile belirlenebilmekte ve ağaç numuneleri içinde kestane ağacı diğerlerine göre dış faktörlere karşı daha dayanıklı iken gürgen ve köknarın ise daha hızlı bozulduğu anlaşılmıştır.

Anahtar Sözcükler: Ultrasonik, kestane, çam, köknar, gürgen, ahşap kalitesi

Giriş

Ormancılık yönetiminde, yaşayan ağaçların değerlendirilmesi veya endüstriyel ham madde olarak da hangi ağaç türlerinin kullanımının daha uygun olduğunun tespit edilmesi önemli bir konudur. Günümüzde, özellikle ormanlık alanlarda kesimini karar verilecek ağaçların belirlenmesinde ya da kullanım aşamasında, iklim şartları, bitki örtüsü, böcek türleri ve insan faktörü gibi değişik nedenlerle yaralanmış, yıpranmış ve çürümeye maruz kalmış ahşabın restorasyonunda ultrasonik yöntemler başarılı bir şekilde uygulanabilmektedir. Ayrıca, orman ürünleri sanayisinde; ağaç ev veya prefabrik ev, bank, kamelya, mobilya, gemi, ahşaptan yapılan her türlü

malzeme gibi ürünlerinin kullanımında hangi tür ağaçların çevresel koşullara daha dayanıklı olduğunun ya da bu ürünlerde meydana gelebilecek bozulmanın tespitinde ultrasonik yöntemler kullanılabilir.

Ultrasonik hız ölçüm yöntemi, uzun yıllardır beton ve kayaçların yapısal özelliklerinin incelenmesinde kullanılmaktadır. Ultrasonik hızda meydana gelen değişimler, beton veya kayaç içeresindeki zayıf, problemli ve heterojen bölgeleri tanımlamaya yardımcı olmaktadır. Ultrasonik hız ölçümü, beton ve kayaç numuneleri dışında, son yıllarda canlı ağaçların içerisinde meydana gelen içsel çürümenin de tespit edilmesinde kullanılabilen bir yöntemdir (Najafi vd., 2009). Ağacın mekaniksel özellikleri ile ilişki olan ultrasonik hız, çürümenin tespitinde bir tanı parametresi olarak kullanılabilir (Socco vd., 2004). Ultrasonik yöntemlerin hem arazide hem de laboratuvarda uygulanabilir olması en önemli avantajlarından biridir. Ağaç veya ağaçla ilgili herhangi bir ürün içerisinde meydana gelen bozulmanın veya çürümenin ağaca zarar vermeden belirlenebilmesi oldukça önemlidir. Bu kapsamda, ultrasonik yöntem ile ağaç ve türevleri içerisindeki herhangi bir bozulma veya çürümenin ağaca zarar vermeden hızlı, kolay ve ucuz bir şekilde tespit edilmesi mümkündür. Ultrasonik hız, yoğunluk ve elastik modüllerle ilişkili olduğu için, gövde içindeki reçine artışı nedeniyle artan ultrasonik hız da bu teknik ile saptanabilir (Akmad vd., 2012). Ultrasonik yöntem, ağaç içerisinde mantara bağlı çürümenin belirlenmesinde (Bucur, 2005) ve ağaç çürümesinin erken dönem evresinin tespitinde (Wilcox, 1988) başarılı bir şekilde kullanılmıştır. Ayrıca, ultrasonik yöntem, tarihi ahşap yapıların değerlendirilmesinde de birçok araştırmacı tarafından kullanılmıştır (Kandemir vd., 2007; Divos, 2011; Hasnikova ve Kuklik, 2014).

Bu çalışmada, endüstriyel hammadde ve orman sanayisinde en çok kullanılan kestane, çam, köknar ve gürgen gibi birkaç ağaç türünün çevre şartlarına maruz bırakıldığında içyapısında nasıl bir değişim olduğunu tespit etmek için ultrasonik hız ölçüm yöntemi kullanılmıştır. Bu amaçla, çevre şartlarına bırakılmış olan bu ağaç türleri üzerinde farklı zaman dilimlerinde ultrasonik hız ölçümleri yapılmış ve elde edilen sonuçlar değerlendirilmiştir. Bu sonuçlara göre ölçüm yapılan ahşap türlerinin içyapıları ortaya konulmuş ve ağaç örnekleri içerisinde kestane ağacının diğerlerine göre dış faktörlere karşı daha dayanıklı olduğu anlaşılmıştır.

Yöntem

Ahşap malzemenin niteliği ultrasonik ölçülerle malzemeye hasar vermeden belirlenebilmektedir. Elde edilen veriler malzemenin performansı ya da güvenilirliğini değerlendirmede kullanılmaktadır. Bu çalışmada ultrasonik hız ölçümlerinde Puntid Plus marka cihaz kullanılmıştır. Pundit Plus ile kaya, beton, ağaç gibi malzemelerde hassas ölçümler yapmak mümkündür. Boyuna dalga hızını (Vp) belirlemek için 24, 54, 82 ve 150, 250 ve 500 kHz'lik piezoelektriksel özellikte alıcı-verici problar kullanılabilir. Bu probların seçimi kullanılan numune türüne ve çalışmanın amacına göre belirlenmektedir. Verici prob tarafından üretilen elektriksel sinyaller mekanik titreşime dönüştürülerek beton, kaya veya ahşap numunesi içerisine gönderilir, numune içinde seyahat eden sinyal, ölçüm yapılan numunenin karşı tarafına yerleştirilen alıcı prob tarafından kayıt edilir. Boyuna dalga hızı ölçümü yapılırken, alıcı ve verici problar ile numune arasına, sinyalin iletimini artırmak için jel veya buna benzer bir malzemenin sürülmesi ve probların belli bir kuvvet ile numuneye iyi temas ettirilmesi daha doğru ve güvenilir sonuçların alınabilmesi açısından çok önemlidir. Ultrasonik sinyalin numune içindeki seyahat zamanından boyuna dalga hızı aşağıdaki gibi belirlenebilmektedir.

$$\text{Ultrasonik Puls Hızı} = \frac{\text{Numunenin Boyu}}{\text{Seyahat Zamanı}} \quad (1)$$

Kayaç, beton, ağaç gibi malzemelerin ultrasonik hızları direkt, yarı direkt ve indirekt yöntemler kullanılarak hesaplanabilmektedir. Bu çalışmada, ultrasonik hız ölçüm yöntemlerinden biri olan direkt iletim tekniği kullanılmıştır (Şekil 1). Bu uygulamada ahşap örneklerinin ultrasonik puls hızı; hazırlanan ağaç numunelerinin karşılıklı yüzeyleri üzerine alıcı ve verici probları yerleştirmek suretiyle seyahat zamanları ölçülerek belirlenmiştir.

Şekil 1. Ultrasonik hız ölçüm ekipmanı ve direkt iletim tekniği

Ölçümlerde Kullanilan Ağaçlarin İçyapisi Ve Dayanimi Araştirilan Ağaç Türleri

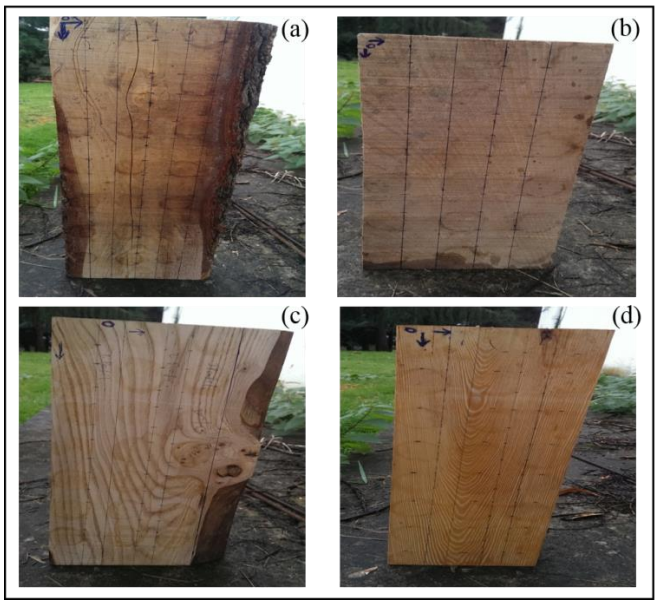
Doğu Karadeniz bölgesinde yetişen ve endüstriyel amaçlı yaygın olarak kullanılabilen çam, gürgen, kestane ve köknar gibi 4 farklı ağaç türü (Şekil 2) ultrasonik hız ölçüm yöntemi kullanılarak incelenmiştir.

Çam Ağacı: Çam ağacı, çamgiller ailesinin Pinus cinsinden orman ağaçlarını içeren iğne yapraklı türlere verilen isimdir. Türkiye'de hemen hemen her bölgede yetişmektedir. Türlerin çoğunda gövde kabuğu kalın, pürüzlü ve çatlaklıdır. Çam ağaçları kuraklığa dayanıklı olmakla birlikte, iyi gelişip çoğalabilmeleri için temiz hava ve bol ışık gereklidir. Çok çeşitli yüksekliklerde yetişen, kışın yapraklarını dökmeyen, genellikle ormanlar teşkil eden iğne yapraklı ağaçlardır. Çamların toprak yönünden istekleri az olduğu için diğer ağaçların yetişmediği topraklarda da kolaylıkla yetişebilirler. Fakat kurak, kumlu, çakıllı topraklarda yetişen pek çok çam türleri olduğu gibi, asitli topraklarda ve hatta bataklıklarda yetişenleri de mevcuttur. Çam ağaçlarının ömürleri genel olarak 100 ile 1000 yıl arasında değişmektedir (URL-1).

Gürgen Ağacı: Kerestesi çok tutulan bir ağaç olup aynı zamanda yakacak olarak kullanılmaktadır. Gürgen ağacının kerestesi çok sağlam olduğu için mobilya üretimine oldukça uygundur ve Türkiye'de genelde mobilya üretiminde kullanılmaktadır. Yurdumuzda Karadeniz kıyılarında pek çok gürgen ormanı mevcuttur. Gürgen, özel şartlar isteyen nazik bir ağaç değildir. Kurak ve verimsiz topraklarda da yetiştirilebilir. Başlıca çeşitleri: Akgürgen, Amerikan gürgeni, yürek yapraklı gürgen ve Japon gürgenidir. Yurdumuzda en çok akgürgen yetişir. Gürgen ağaçlarının ışık istekleri azdır ve gölgeyi severler. Bu sebeple meşe ormanları için kıymetli bir dolgu ağacıdır. Fakat nem ve toprak istekleri yüksektir (URL-2).

Kestane Ağacı: Kayıngiller ailesinden olan Kestane ağacının Türkiye'de genel olarak yetiştiği yerler; Marmara ve Karadeniz bölgesidir. Daha çok Akdeniz çevresi memleketlerinde yetişen, kupulası dikenli veya çengelli dikenli, küre şeklinde ve nişastaca zengin meyveleri olan ağaçlardır. Kestane ağacı daha çok kayalık yamaçları ve kumlu toprakları sever. Kireçli topraklarda yetişmez. Kestane ağacının kerestesi iyi cila kabul ettiğinden mobilyacılıkta; odunu sert ve dayanıklı olması sebebiyle de inşaatlarda kullanılır. Ayrıca, kerestesi, dayanıklılık ve dekoratif özellikleri bakımından meşe ağacının odununa benzemekle birlikte, kuruma esnasında çatlaması ve eğrilmesi nedeniyle, bu ağaçtan büyük boyutlu kereste elde edilememektedir. Ancak dayanıklılığı nedeniyle bazı ahşap bahçe işlerinde ve ahşap tekne yapımında bu ağaçtan faydalanılmaktadır (URL-3).

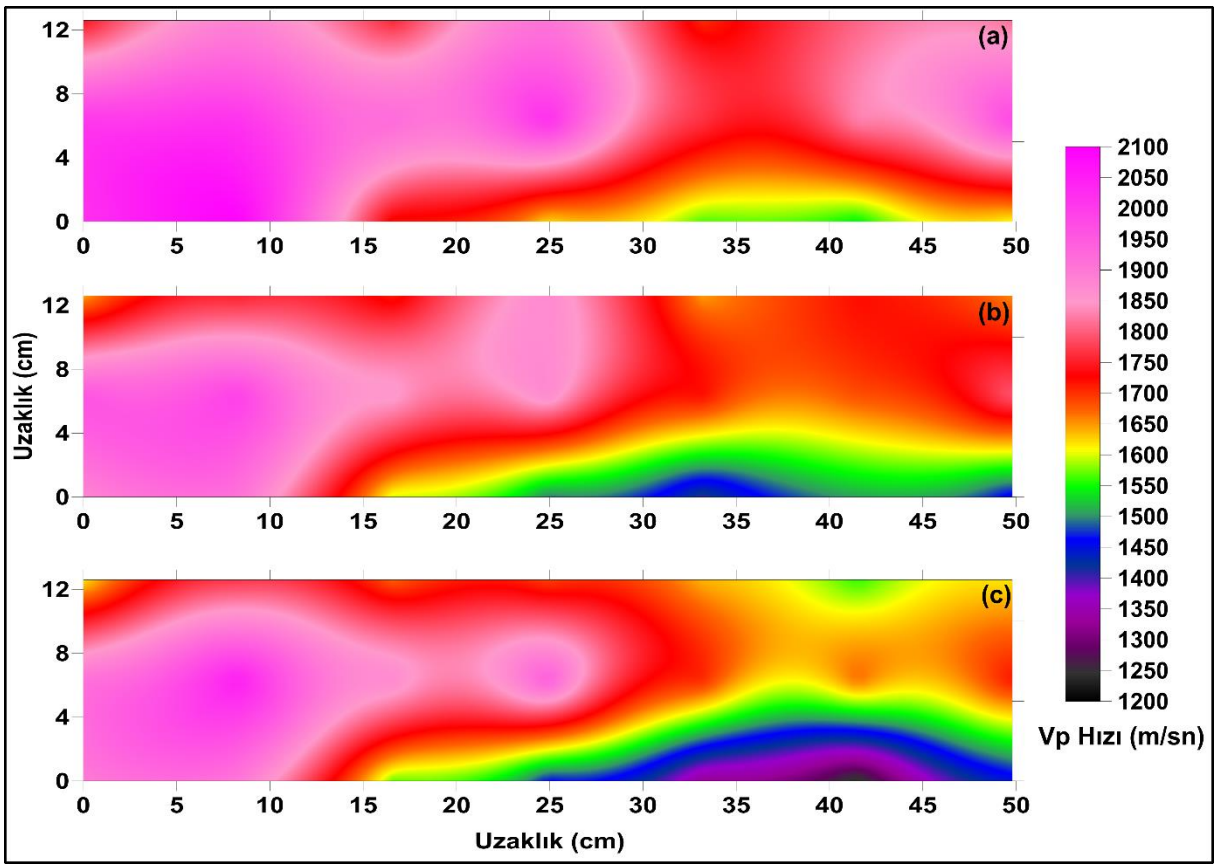
Köknar Ağacı: Köknar ağacının Türkiye'de yetiştiği yerler; Karadeniz, Akdeniz, Marmara bölgelerinde deniz seviyesinden 300-1800 m yüksekliklerdedir. 20-70 m boylarında, yalnız uzun sürgünler taşıyan, kısa sürgünleri olmayan, yaprak dökmeyen bir orman ağacıdır. Gövdeleri düzgün, açık boz renktedir. Dallar yatay uzar, gövdenin alt dalları erken kurur. Köknar, gölgede, derin ve zengin topraklarda iyi yetişir. Azami 300 yıl yaşarlar ve soğuğa karşı dayanıklıdırlar. Kerestesi yumuşak, beyaz, hafif ve reçinesizdir. Ülkemizde, kâğıt fabrikalarında odunundan selüloz elde edilir. İnşaatlarda kalıplık olarak kullanılmaktadır (URL-3).



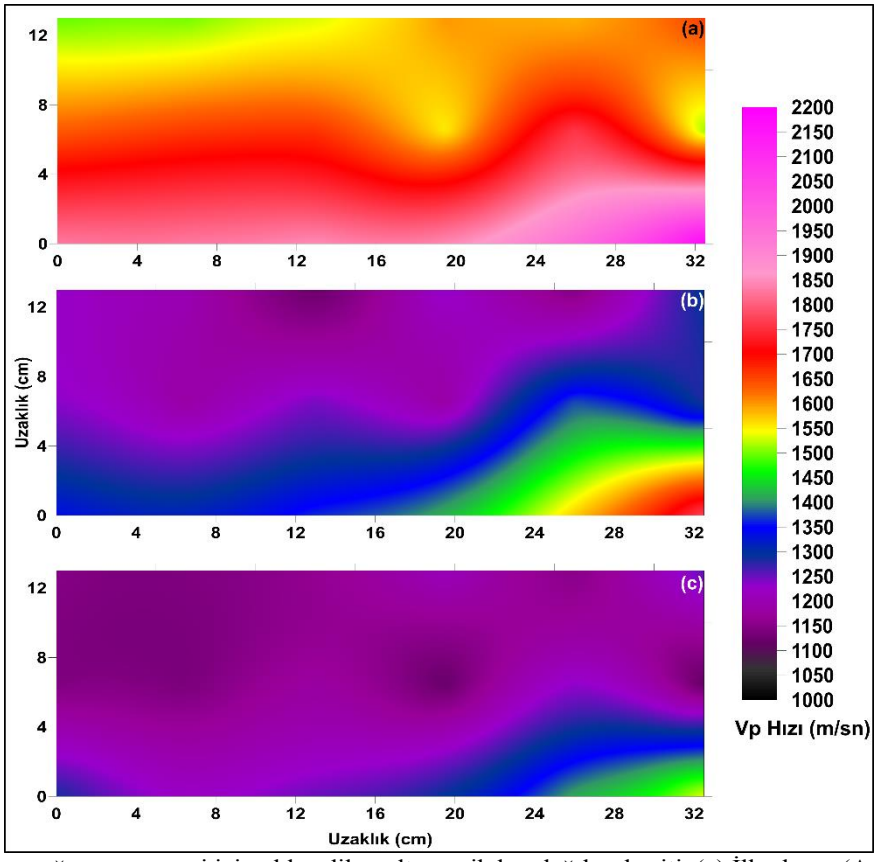
Şekil 2. Çalışmada incelenen ağaç numuneleri. (a) Çam ağacı (b) Gürgen ağacı (c) Kestane ağacı (d) Köknar ağacı

Ultrasonik Hiz Ölçümleri

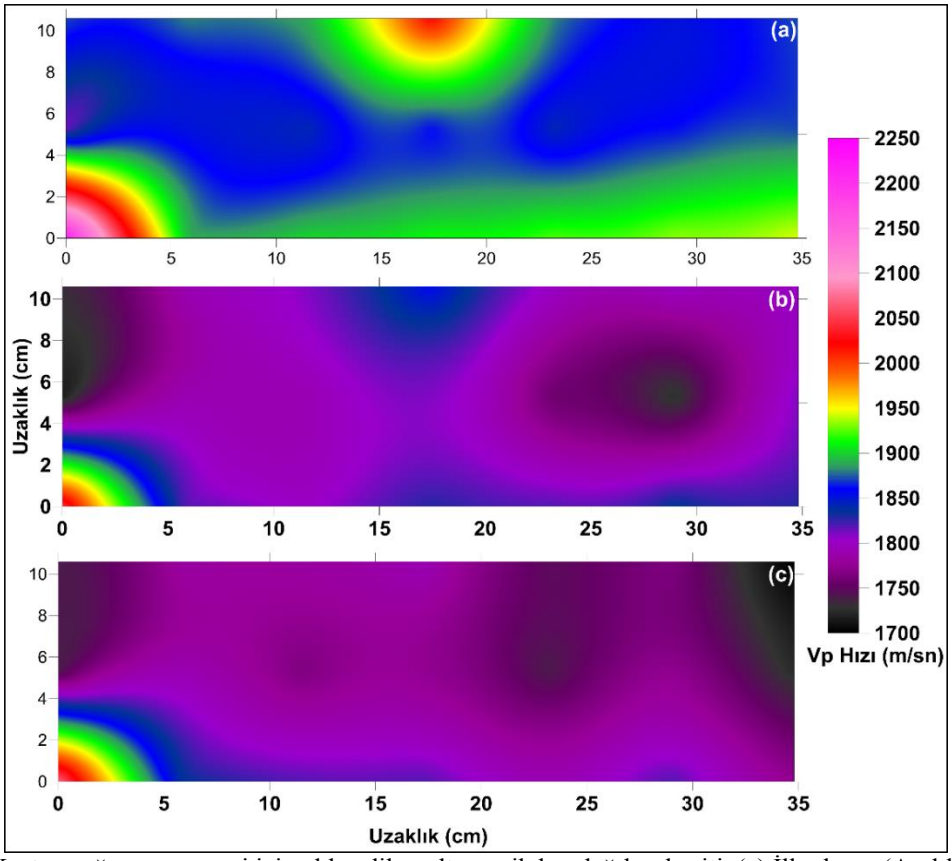
Bu çalışma için temin edilen ağaç türleri (çam, gürgen, kestane ve köknar) yüzeyleri düzeltilerek ultrasonik hız ölçümlerin yapılması için hazırlanmıştır. Öncelikle numuneler hazırlanmış ve laboratuvar ortamında ultrasonik ses dalgası hızları ölçülmüştür (Aralık, 2015). Daha sonra numuneler doğal çevre koşullarına bırakıldıktan üç ay sonra tekrar (Mart, 2016) ölçümler yapılmış ve son olarak ise bir ay sonra (Nisan, 2016) ölçümler tekrar edilmiştir. Belirli dönemlerde gerçekleştirilen ölçümlerde temel amaç; ilk ölçümden sonra doğaya bırakılan numunelerin üç aylık bir süreçte kar, yağmur, nem, rüzgâr gibi faktörlerden ne derece etkilendiğini, hangi numunenin daha fazla bozulmaya maruz kaldığını tespit etmektir. Bu amaçla, ilk olarak çam ağacı üzerinde ultrasonik hız ölçümleri alınmıştır. Çam ağacı üzerinde, 3 profil boyunca ölçümler alınmış ve her bir profilde 7 noktada olmak üzere toplamda 21 adet ölçüm gerçekleştirilmiştir. Profiller arası 6.3 cm ve ölçüm noktaları arası 8.3 cm olarak belirlenmiştir. Çam ağacı üzerinde 3 farklı dönemde elde edilen ultrasonik hızlara ait kesitler Şekil 3'te verilmiştir. İkinci olarak gürgen ağacı üzerinde ultrasonik hız ölçümleri yapılmıştır. Gürgen ağacı üzerinde de, her bir profile 6 ölçüm olmak üzere 3 profilde toplamda 18 adet ölçüm yapılmıştır. Profiller arası 6.5 cm ve ölçüm noktaları arası 6.5 cm olarak belirlenmiştir. Gürgen ağacı üzerinde 3 farklı dönemde elde edilen ultrasonik hızlara ait kesitler ise Şekil 4'te görülmektedir. Üçüncü olarak kestane ağacı üzerinde ultrasonik hız ölçümleri gerçekleştirilmiştir. Kestane ağacı üzerinde de, 3 profilde ölçümler alınmış ve her bir profile 7 ölçüm olmak üzere toplamda 21 adet ölçüm gerçekleştirilmiştir. Profiller arası 5.3 cm ve ölçüm noktaları arası 5.8 cm olarak belirlenmiştir. Kestane ağacı üzerinde 3 farklı dönemde elde edilen ultrasonik hızlara ait kesitler Şekil 5'de verilmiştir. Son olarak ise köknar ağacı üzerinde ultrasonik hız ölçümleri yapılmıştır. Köknar ağacı üzerinde de, 3 profilde ölçümler alınmış ve her profile 8 ölçüm olmak üzere toplamda 24 adet ölçüm gerçekleştirilmiştir. Profiller arası 5.3 cm ve ölçüm noktaları arası 6.3 cm olarak belirlenmiştir. Gürgen ağacı üzerinde 3 farklı dönemde elde edilen ultrasonik hızlara ait kesitler de Şekil 6'da görülmektedir.



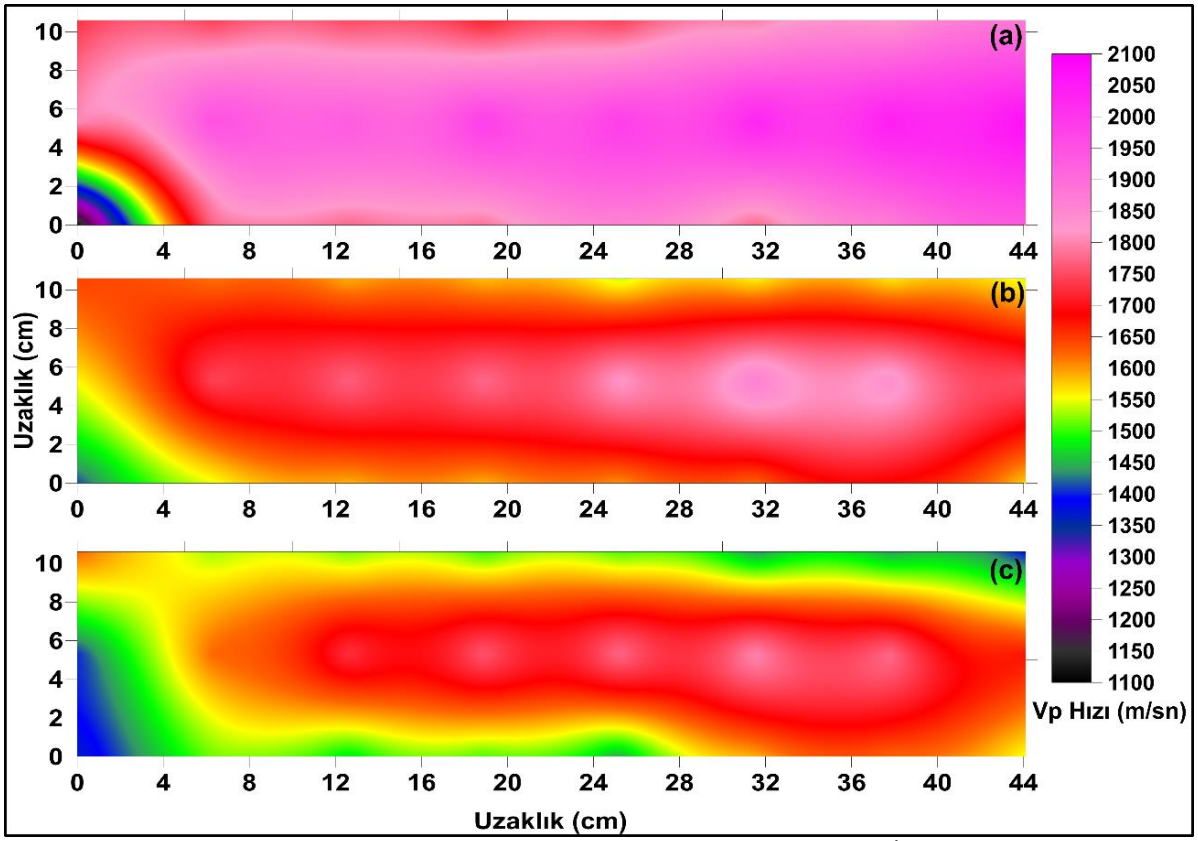
Şekil 3. Çam ağacı numunesi için elde edilen ultrasonik hız dağılım kesiti. (a) ilk ölçüm (Aralık ayı), (b) ikinci ölçüm (Mart ayı), (c) son ölçüm (Nisan ayı)



Şekil 4. Gürgen ağacı numunesi için elde edilen ultrasonik hız dağılım kesiti. (a) İlk ölçüm (Aralık ayı), (b) ikinci ölçüm (Mart ayı), (c) son ölçüm (Nisan ayı)



Şekil 5. Kestane ağacı numunesi için elde edilen ultrasonik hız dağılım kesiti. (a) İlk ölçüm (Aralık ayı), (b) ikinci ölçüm (Mart ayı), (c) son ölçüm (Nisan ayı)



Şekil 6. Köknar ağacı numunesi için elde edilen ultrasonik hız dağılım kesiti. (a) İlk ölçüm (Aralık ayı), (b) ikinci ölçüm (Mart ayı), (c) son ölçüm (Nisan ayı)

Bulgular Ve Sonuçlar

Dört farklı ağaç türü üzerinde farklı dönmelerde gerçekleştirilen ultrasonik ölçümler sonucunda elde edilen boyuna dalga hız kesitleri incelendiğinde, ultrasonik hızların çam ağacında 1200-2100 m/sn arasında, gürgen ağacında 1100-2200 m/sn, kestane ağacında 1700-2225 m/sn ve köknar ağacında ise 1100-2100 m/sn arasında değiştiği görülmektedir. Genel olarak 4 ağaç türü için maksimum hızlar birbirine yakın olmakla beraber kestane ağacının hızlarının diğerlerine göre bir miktar daha yüksek olduğu görülmektedir. Benzer şekilde minimum hızlarda birbirine oldukça yakın olup en düşük hız gürgen ve köknar ağacında görülmüştür.

Çam ağacı üzerinde yapılan ilk ölçüm sonucu elde edilen hız kesiti hemen hemen homojen bir yapıdadır. Bu kesitte yatay eksen boyunca 30-45 cm ve düşey eksen boyunca ise 0-4 cm arasında diğer kısımlara göre daha düşük hızlı bir alan mevcuttur. İkinci ölçüm sonucunda, hızlarda bir miktar düşüş görülmekle (100-150 m/sn civarında) beraber bir önceki ölçümde düşük hızlı görülen kısım daha da büyümüştür. Son ölçümde ise hızlar bir önceki ölçüme göre bir miktar daha düşmüş (150 m/sn) ve daha önceki iki kesitte düşük hızlı olarak görülen alan daha da genişlemiştir. Bu düşük hızlı alanda bir çatlak olduğu ve çevre koşullarına bırakıldıktan sonra bu bölgede bozulmanın meydana geldiği düşünülmektedir.

Gürgen ağacında yapılan ilk ölçüm sonucu elde edilen verilerden numunenin neredeyse büyük bir kısmının benzer bir hız dağılımı gösterdiği anlaşılmaktadır. Bu ölçüm sonucu yatayda 0-12 cm ve düşeydi ise 10-12 cm ler arasında diğer alanlara göre nispeten düşük hızlı bir bölgenin varlığından söz edilebilir. Aynı şekilde yatayda 22-32 cm ve düşeyde 0-4 cm arasında yüksek hızlı bir bölgenin varlığı mevcuttur. İkinci ölçüm sonucu hızlarda belirgin bir düşüş (yaklaşık 400 m/sn) meydana gelmiştir. Birinci ölçümde düşük ve yüksek hızlı olarak tanımlanan bölgelerin her ikisinde de bariz bir değişim gözlenmektedir. Üçüncü ölçüm sonucunda ise hızlar biraz daha düşmüş ve numunenin neredeyse tamamını düşük hızlı bölgeler kaplamıştır. Bu durumda gürgenin bozulma sürecinin daha kısa olduğu ortaya çıkmaktadır.

Kestane ağacında yapılan ilk ölçüm sonucu numunenin ultrasonik hızları 1850-2225 m/sn arasında değişmekte olup minimum ve maksimum hız değerleri birbirine yakın ve diğer ağaç türlerine göre daha yüksektir. Bu durum kestane ağacının daha homojen ve sağlam olduğunu göstermektedir. İkinci ölçüm sonucu hızlarda birinci ölçüme göre belirgin bir değişim olmamış sadece lokal olarak yüksek olan iki bölgede hızlar çok az miktarda düşüş göstermiştir. Üçüncü ölçümde elde edilen sonuç da neredeyse ikinci ölçüm ile aynıdır. Bu sonuç kestane ağacının dış etkenlerden aynı sürede daha az etkilendiğini ortaya koymaktadır.

Son olarak ise köknar ağacı üzerinde alınan ilk ölçümler sonucunda yatay ve düşey eksende 0-4 cm arasında oldukça düşük hızlı bir bölge mevcut olup diğer geriye kalan bölgelerin neredeyse tamamı aynı hız değerinde ve nispeten yüksektir. İkinci ölçüm sonucu birinci ölçümde hemen hemen aynı özellikte hız değişimi gösteren bölge belirgin bir hız düşüşü göstermiştir. Aynı şekilde bu bölge üçüncü ölçüm sonucunda da orantılı bir azalış göstermiştir. Burada dikkat çekici olan kısım ilk ölçümde düşük hızlı bölge olarak tanımlanan 0-4 cm arasındaki kısmın hız değerlerinde bir artış gözlenmesidir. Bu durum kendini üçüncü ölçüm sonuçlarında da göstermiştir. Bu durumun çatlak ve nispeten daha zayıf olan düşük hızlı (1100-1300 m/sn) bölgenin birkaç ay doğal ortamda kalması sonucu su alarak şişmesi olarak düşünülmektedir. Burada suyun hızı 1500 m/sn olduğu düşünülürse, bu bölgede meydana gelen hız artışı (ortalama 1300-1400 m/sn) şaşırtıcı bir durum değildir.

Sonuç olarak, 4 farklı ağaç türü içerisinde her üç ölçüm sonucu ultrasonik hız değerlerinde en az değişimin olduğu ve dolayısıyla çevre koşullarından en az etkilen ağaç türünün kestane ağacı olduğu anlaşılmıştır. İkinci olarak ise kestane ağacı kadar olmazsa da hız değişimin diğerlerine göre daha az olduğu çam ağacı gelmektedir. Gürgen ve köknar ağaçları ise hemen hemen birbirine yakın bir değişim göstermekle beraber hız değişimine göre köknar ağacının çevre koşullarından gürgen ağacına göre daha az etkilendiği görülmüştür. Hız değerlerine baktığımızda ise kestane ve daha sonra ise çam ağacının dayanımının diğerlerine göre daha yüksek olduğu anlaşılmaktadır.

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INVESTIGATION OF CONCRETE STRUCTURES WITH NONDESTRUCTIVE GEOPHYSICAL MEASUREMENTS

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Abstract: Due to the geographical location and geological structure of Turkey, many destructive earthquakes have occurred in the past and these earthquakes will take place in the future too. Researches and evaluations made after recent earthquakes were revealed that the earthquake strength of existing buildings were weak. The concrete quality used in constructions for earthquake strength must be in certain standards. It is also necessary in terms of building quality to determine the condition and damaged zones of reinforcement in concrete. In addition, determination of moisture and corrosion of concrete is used to examine the quality of concrete and the concrete improvement works. Determination of the structural quality without damaging the structure is very important with regard to reveal of whether or not there is damage in reinforced concrete structure over time or due to any effect such as an earthquake. In recent years, the use of Geophysical methods in nondestructive construction studies has been increasing steadily. In this study, concrete quality was tried to determine by ultrasonic velocity measurement method which is one of the nondestructive measurement techniques. For this purpose, concrete block specimens with 3 different properties were prepared in the laboratory and ultrasonic velocity measurements were performed on these specimens. Uniaxial Compressive strength (UCS) tests were carried out by taking samples from prepared concrete blocks and the results obtained from UCS were compared with ultrasonic velocities. Besides, high frequency electromagnetic georadar method has been tried to determine the properties of reinforcements in many model concrete. Moreover, micro-electrical resistivity devices have been used to determine the moisture content of concrete. As a result of, the quality condition of the concrete has been successfully proved by the ultrasonic velocity measurement technique. Also, the presence of a significant relationship between uniaxial compressive strength and ultrasonic velocities determined from samples taken from concrete blocks was determined. It has been shown that the nondestructive high frequency georadar method reveals by all the features of the reinforcement. At the same time, the humidity level in concrete can be quickly and easily determined with the electrical resistivity measurements.

Keywords: Construction geophysics, concrete quality, reinforcement detection, corrosion

HASARSIZ JEOFİZİK ÖLÇÜLERLE BETON YAPISININ ARAŞTIRILMASI

Özet: Ülkemizde coğrafi konumu ve jeolojik yapısı nedeniyle geçmişte birçok yıkıcı deprem meydana gelmiş ve gelecekte de yıkıcı depremler meydana gelecektir. Yakın geçmişte yaşadığımız depremler sonucu yapılan incelemeler ve değerlendirmeler mevcut yapı stokumuzun deprem dayanımının zayıf olduğunu ortaya koymuştur. Yapıların depreme dayanımı için kullanılan beton kalitesinin belirli standartlarda olması gereklidir. Bunun yanında betondaki demir donatının durumu ve hasar görmüş yerlerinin belirlenmesi de yapı kalitesi açısından önemlidir. Ayrıca, betonun nemlilik ve korozyonunun belirlenmesi de beton kalitesinin incelenmesi ve beton ıslah çalışmalarının başarısının araştırılmasında kullanılmaktadır. Yapıya bir hasar vermeden yapı kalitesinin belirlenmesi, zamanla veya deprem gibi bir etki karşında betonarme yapıda zararın oluşup oluşmayacağı açısından çok önemlidir. Son yıllarda jeofizik yöntemlerin hasarsız yapı incelemelerinde kullanımı gittikçe artmaktadır. Bu çalışmada, beton kalitesi hasarsız ölçüm tekniklerinden biri olan ultrasonik hız ölçüm yöntemi ile belirlenmeye çalışılmıştır. Bu amaçla, 3 farklı özelliğe sahip beton blok örnekleri laboratuvarda hazırlanarak, bu örnekler üzerinde ultrasonik hız ölçüm testleri gerçekleştirilmiştir. Hazırlanan beton örneklerinden alınan numunelere tek eksenli basınç deneyleri yapılmış ve elde edilen sonuçlar ultrasonik hızlar ile karşılaştırılmıştır. Ayrıca yüksek frekanslı elektromanyetik radar yöntemiyle, oluşturulmuş birçok model betonlardaki donatı özelliklerinin belirlenebilirliği araştırılmıştır Bunun yanında mikro elektrik özdirenç cihazı ile betonun nemlilik içeriğini belirleme uygulamaları gerçekleştirilmiştir. Sonuç olarak, ultrasonik hız ölçüm tekniği ile betonların kalite durumu başarı bir şekilde ortaya konulmuştur. Bunun yanında beton bloklardan alınan örneklerden belirlenen tek eksenli basınç dayanımı ile ultrasonik hızlar arasında anlamlı bir ilişkinin varlığı belirlenmiştir. Yapıya bir hasar vermeksizin yüksek frekanslı EM radar yönteminin beton içindeki

donatıyı bütün özellikleri ile ortaya koyduğu görülmüştür. Ayrıca, nemlilik düzeyinin elektrik özdirenç ölçümleri ile hızlı ve kolay bir şekilde belirlenebileceği sonucuna varılmıştır.

Anahtar Sözcükler: Yapı jeofiziği, beton kalitesi, donatı tespiti, korozyon

Giriş

Aktif deprem kuşaklarından biri olan Alp-Himalaya kuşağı üzerinde yer alan Türkiye'de, karmaşık jeolojik yapısı ve tektonik özelliklerinden dolayı yıllardır pek çok deprem meydana gelmiş ve bundan sonra da depremler olmaya devam edecektir. Türkiye'de bu gibi doğal olaylar nedeniyle önemli oranda can ve mal kayıpları meydana gelmektedir. Yapıların beton kalitesinin, donatı durumunun, beton içerisinde kırık-çatlakların oluşup oluşmadığının belirlenmesinin önemi meydana gelen büyük depremler sonrasında ortaya çıkan aşırı yıkımlar nedeniyle daha da artmıştır. Türkiye'de özellikle deprem tehlikesinin daha büyük olduğu bölgelerde "Kentsel Dönüşüm Projesi" başlatılarak, şehir planlamalarına uymayan binalarla birlikte, düşük kalitede yapılmış ve doğal afetlerle veya çevresel etkiler ile yorulmuş binaların yenilenmesine çalışılmaktadır. Depreme karşı dayanıklı yapı, sadece uygun zemin üzerine, uygun temel sistemi seçilerek yapılmış yapı değil, aynı zamanda yapının doğru ve kaliteli malzeme kullanılarak yapılması ile mümkün olacaktır. Deprem riski yüksek olan bölgelerde problemli olduğu düşünülen yapıların hızlı bir şekilde incelenmesi ve bu incelemelerde gelişmiş ülkelerde olduğu gibi ülkemizde de yapı jeofiziği çalışmalarının yapılması gerekmektedir. Yapı incelemelerinde hem hasarlı hem de hasarsız ölçüm yöntemleri kullanılmaktadır. Hasarlı ölçüm yöntemlerinin, yapıya zarar vermesi, pahalı ve zaman alıcı olması gibi dezavantajları nedeniyle mühendisleri hasarsız ölçüm yöntemlerinin kullanılmasına yöneltmektedir. Son yıllarda hasarsız beton dayanımı testlerinden, özellikle de yer radarı, ultrasonik ve elektrik özdirenç yöntemlerinin kullanımı gittikçe artmaktadır. Depremlerde hasar gören yapıların hızlı bir şekilde incelenmesi gerekmektedir. Bununla beraber sadece deprem sonucu değil yıllar içerisinde yorulmuş binaların da durumunun ortaya konulması son derece önem arz etmektedir. Ayrıca, karayollarında çift yol çalışmaları kapsamında yeni yapılan veya var olan yolların genişletilmesi sürecinde birçok yeni yol, köprü ve tünel yapılmıştır. Zamanla bu yollarda, köprülerde ve tünellerde meydana gelecek yapısal sorunların da hızlı ve güveniler bir şekilde ortaya konulması yapısal problemlerin çözümünde oldukça kolaylık sağlayacaktır. Bu tür yapılarda meydana gelecek sorunlar yapıya ayrıca bir zarar vermeden, düşük maliyetle, hızlı ve kolayca Jeofizik yöntemlerden yer radarı, ultrasonik ve özdirenç yöntemi ile belirlenebilmektedir. Yer radarı yöntemi ile betonarme yapılardaki taşıyıcılar içerisindeki kırık-çatlak zonlarının belirlenmesi, donatıların yeri ve korozyon durumunun 2 ve 3-boyutlu olarak ortaya konulması mümkündür. Karayollarında, tünel ve köprülerde aynı şekilde yer radarı yöntemi ile beton kalınlığı, kırık-çatlak durumu belirlenebilmektedir. Ultrasonik yöntem ile beton kalitesi, elektrik özdirenç yöntemi ile ise donatının korozyona uğrayıp uğramadığı ve yapının su içeriği ortaya konulabilmektedir.

Bu çalışmada, beton kalitesi ve beton içerisindeki zayıf bölgelerin hasarsız ölçüm yöntemlerinden biri olan ultrasonik hız ölçüm tekniği ile belirlenebilirliği araştırılmıştır. Bu amaçla, üç farklı oranda çimento içeriğine sahip beton blok numuneleri laboratuvarda hazırlanarak, bu numuneler üzerinde ultrasonik hız ölçümleri yapılmıştır. Hazırlanan beton numunelerinden karotlar alınarak, ultrasonik hızları ve tek eksenli basınç dayanımları belirlenmiş ve elde edilen sonuçlar karşılaştırılmıştır. Ayrıca yüksek frekanslı elektromanyetik radar yöntemiyle birçok model betonda ve kolonlarda donatı araştırması ve özellikleri belirlenmeye çalışılmıştır. Bunun yanında mikro elektrik özdirenç cihazı ile betonun nemlilik içeriği ve korozyon durumu yapılan ölçümler ile ortaya konulmuştur. Sonuç olarak, ultrasonik hız ölçüm tekniği ile betonların kalite durumu belirlenmiş, beton bloklardan alınan karotlardan belirlenen tek eksenli basınç dayanımı ile ultrasonik hızlar arasında anlamlı bir ilişkinin varlığı ortaya konulmuştur. Yüksek frekanslı EM radar yöntemi ile donatının özellikleri ve beton içerisindeki yapısal bozukluklar hasarsız bir şekilde belirlenmiştir. Ayrıca, nemlilik ve korozyon düzeyinin elektrik özdirenç ölçümleri ile hızlı ve kolay bir şekilde belirlenebileceği sonucuna varılmıştır.

Çalişmada Kullanilan Jeofizik Yöntemler

Bu çalışmada beton kalitesi, beton içeresindeki kırık-çatlak gibi yapısal bozukluklarının belirlenmesi ve donatıların yerleri ile korozyon durumunun ortaya çıkarılması amacıyla Jeofizik yöntemlerden ultrasonik, elektrik özdirenç ve yer radarı yöntemleri kullanılmıştır.

Ultrasonik Yöntem

Beton malzemenin niteliği ultrasonik ölçülerle malzemeye hasar vermeden belirlenebilmektedir. Elde edilen veriler malzemenin performansı ya da kalitesinin değerlendirmesinde kullanılmaktadır. Bu çalışmada ultrasonik

hız ölçümlerinde Puntid Plus marka cihaz kullanılmıştır. Pundit Plus ile kaya, beton, ağaç gibi malzemelerde hassas ölçümler yapılabilmektedir. Boyuna dalga hızını (Vp) belirlemek için 54 kHz'lik piezoelektriksel özellikte alıcı-verici problar kullanılmıştır. Verici prob tarafından üretilen elektriksel sinyaller mekanik titreşime dönüştürülerek beton numunesi içerisine gönderilir, numune içinde seyahat eden sinyal, ölçüm yapılan numunenin karşı tarafına yerleştirilen alıcı prob tarafından kayıt edilir. Boyuna dalga hızı ölçümü yapılırken, alıcı ve verici problar ile numune arasına, sinyalin iletimini artırmak için jel veya buna benzer bir malzemenin sürülmesi ve probların belli bir kuvvet ile numuneye iyi temas ettirilmesi daha doğru ve güvenilir sonuçların alınabilmesi açısından çok önemlidir. Ultrasonik sinyalin numune içindeki seyahat zamanından boyuna dalga hızı aşağıdaki formül ile belirlenebilmektedir.

$$\text{Ultrasonik Puls Hızı} = \frac{\text{Numunenin Boyu}}{\text{Seyahat Zamanı}} \quad (1)$$

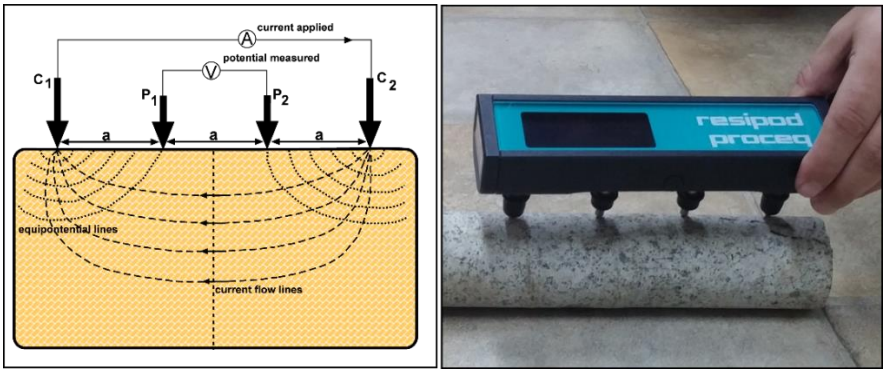
Kayaç, beton, ağaç gibi malzemelerin ultrasonik hızları direkt, yarı direkt ve indirekt yöntemler kullanılarak hesaplanabilmektedir. Bu çalışmada, ultrasonik hız ölçüm yöntemlerinden biri olan direkt iletim tekniği kullanılmıştır (Şekil 1). Bu uygulamada beton örneklerinin ultrasonik puls hızı; hazırlanan beton numunelerinin karşılıklı yüzeyleri üzerine alıcı ve verici probları yerleştirmek suretiyle seyahat zamanları ölçülerek belirlenmiştir.

Şekil 1. Çalışmada kullanılan ultrasonik hız ölçüm ekipmanı ve direkt iletim tekniği

Elektrik Özdirenç Yöntemi

Elektrik özdirenç yöntemi, sığ yeraltı ve yapı araştırmalarında en çok kullanılan jeofizik yöntemlerden birisidir (Telford vd.,1990; Reynolds, 1997). Elektrik özdirenç yöntemi yere yapay bir kaynak yardımıyla bir çift akım elektrotu ile verilen akımın yer içinde yayılırken yer içi malzemelerinin elektrik akımına karşı direnç özelliklerine göre oluşan potansiyel farkların bir çift potansiyel elektrotu ile ölçülmesi esasına dayanan bir yöntemdir. Yöntem farklı arazi uygulamalarına sahiptir.

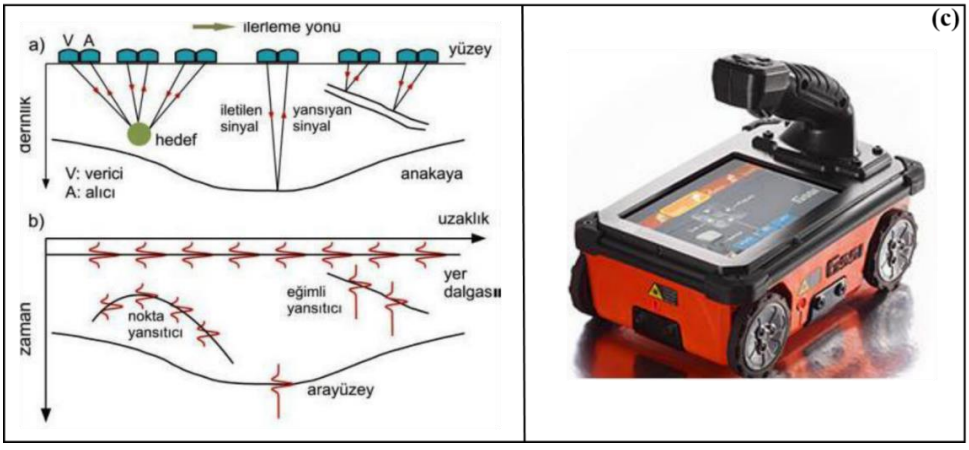
Betonun elektrik özdirenci, beton içinde bulunan demir donatıların korozyona uğrayıp uğramadığını belirlemek için önemli bir parametredir. Beton özdirenci, çimento tipi ve miktarına, boşluk iletkenliğine, sıcaklığa, nem içeriğine ve beton içine konan katkı maddelerine bağlı olarak değişmektedir. Betonun elektrik özdirenç değerinin düşük çıkması korozyon meydana gelme ihtimalini göstermektedir. Yapı Jeofiziği uygulamalarında en çok sabit elektrot aralığı ile bir doğrultu boyunca elektrotlar eşit mesafelerde hareket ettirilerek ölçümler alınır ve belli bir derinlikteki yanal yönde özdirenç dağılımı elde edilir. Bu gibi çalışmalarda daha çok Wenner elektrot dizilimi tercih edilmektedir (Şekil 2). Şekil 2' de elektirk özdirenç ölçülerinde kullanılan cihaz ve Wenner dizilimi ile ölçü alımı görülmektedir. Wenner elektrot diziliminde akım elektrotları dışta, potansiyel elektrotları içte yer alır ve akım ve potansiyel elektrotları arasındaki mesafe eşittir.



Şekil 2. Wenner dizilimi ve çalışmada kullanılan elektrik özdirenç ölçüm aleti

Yer Radarı Yöntemi

Yer Radarı yöntemi; araştırılan ortamın sığ derinliklerini (0-60m) yüksek ayrımlılıkta görüntüleyebilen yüksek frekanslı elektromanyetik bir yöntemdir. Bu yöntemde, verici anten ile araştırılan ortama gönderilen ve zaman içinde değişen yüksek frekanslı elektromanyetik alanlar kullanılarak araştırmalar yapılmaktadır (Annan, 2003; Daniels, 2004). Bir verici antenle yeraltına gönderilen yüksek frekanslı elektromanyetik dalgaların bir kısmı, yeraltında farklı dielektrik özelliklere sahip yüzeylerden yansırken, diğer kısmı da daha derin ortamlara ilerleyebilmektedir. Alıcı bir anten ise yansıyan sinyalleri almaktadır (Şekil 3ab). Alınan sinyaller kontrol biriminde toplanmakta ve çift yol seyahat zamanı olarak kaydedilmektedir (Davis ve Annan, 1989). Yer radarı yöntemde kullanılan verici antenlerin merkez frekansları 10 MHz ile birkaç GHz arasında değişmektedir. Yöntemde, yapı içine gönderilen yüksek frekanslı elektromanyetik dalgalar, yapı süreksizliklerinden yansıyarak kaydedilmekte ve bu kaydedilen sinyaller ölçü noktalarına göre yan yana konularak, "radargram" adı verilen incelenen yapının 2B görüntüleri elde edilmektedir. Son yıllarda çok yüksek frekanslı radar cihazları üretilmiştir. 2.7 GHz frekanslı GSSI marka yer radarı cihazı (Şekil 3c) kullanılarak, beton yapılar 50 cm derinliğe kadar yüksek ayrımlılıkta görüntülenebilmektedir. Yer radarı yönteminde elektromanyetik dalganın frekansına bağlı olarak yer altındaki yapıların derinlik ve geometrileri santimetre bazında belirlenebilmektedir. Yer Radarı çalışmalarında çalışılan ortamın iletkenliği ve dielektrik sabiti, yüzeysel özelliklerin bulunmasını etkilemektedir (Ulriksen,1982). Bu yöntemin kullanımının çok kolay olması, hızlı, ekonomik ve kesin sonuç vermesi nedeniyle; mühendislik çalışmalarında, biyoloji ve biyofizik alanlarda, köprü ve yapı incelemesinde, kara mayınları araştırılmasında, adli tıpta, jeoteknik araştırmalarda, yeri bilinmeyen mezar yeri araştırmalarında, yer altı suyu araştırmalarında, alt yapı incelemelerinde, karstik yapıların bulunmasında, atık borularının konumlarının tespitinde, maden aramalarında, karayolları, havaalanları, demiryolları ve sedimantolojik yapıların incelenmesinde, yer altı boşluklarının taranmasında, tarım alanında su içeriğinin belirlenmesinde, tünel incelemelerinde vb. çalışmalarda oldukça yaygın olarak kullanılmaktadır (Greaves vd. 1996; van Overmeeren vd., 1997; Garambois vd., 2002, Loeffler ve Bano, 2004, Şeren vd., 2008, Şeren vd., 2012).



Şekil 3. (a) Yer radarı yönteminin genel çalışma sistemi (b) Radargram (Grégoire vd., 2003), (c) çalışmada kullanılan yüksek frekanslı yer radarı aleti

Beton Numuneleri Üzerinde Alinan Jeofizik Ölçümler

Ultrasonik Ölçümler

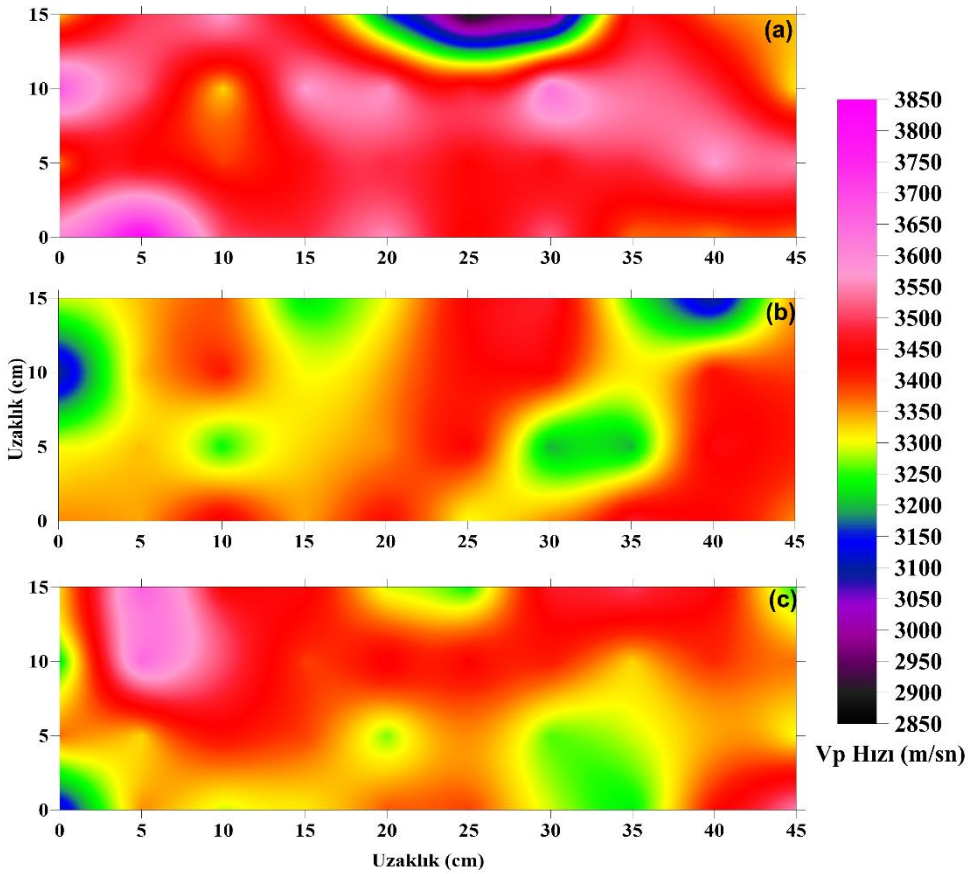
Bu çalışmada, farklı özelliklerdeki betonların fiziksel ve mekanik özelliklerini belirlemek amacıyla, 250 kg, 350 kg ve 450 kg lık karışımlı beton numuneler hazırlandı ve bu beton karışımlar daha önceden hazırlanmış olan 9 adet 10x20x50 cm lik kalıplara döküldü (Şekil 4). Bir mikser yardımıyla hazırlanan beton karışımların kalıplara homojen bir şekilde dağılması için titreşim tablası kullanıldı. Beton numuneler hazırlanırken kullanılan malzemeler ve oranları Tablo 1'de verilmiştir. 450 kg lık hazırlanan karışımda 2 adet kalıba sadece beton dökülmüş üçüncü kalıba ise ızgara şeklinde tek sıra donatı yerleştirilmiştir (Şekil 4).

Tablo 1. Beton karışımlarda kullanılan malzemeler ve oranları

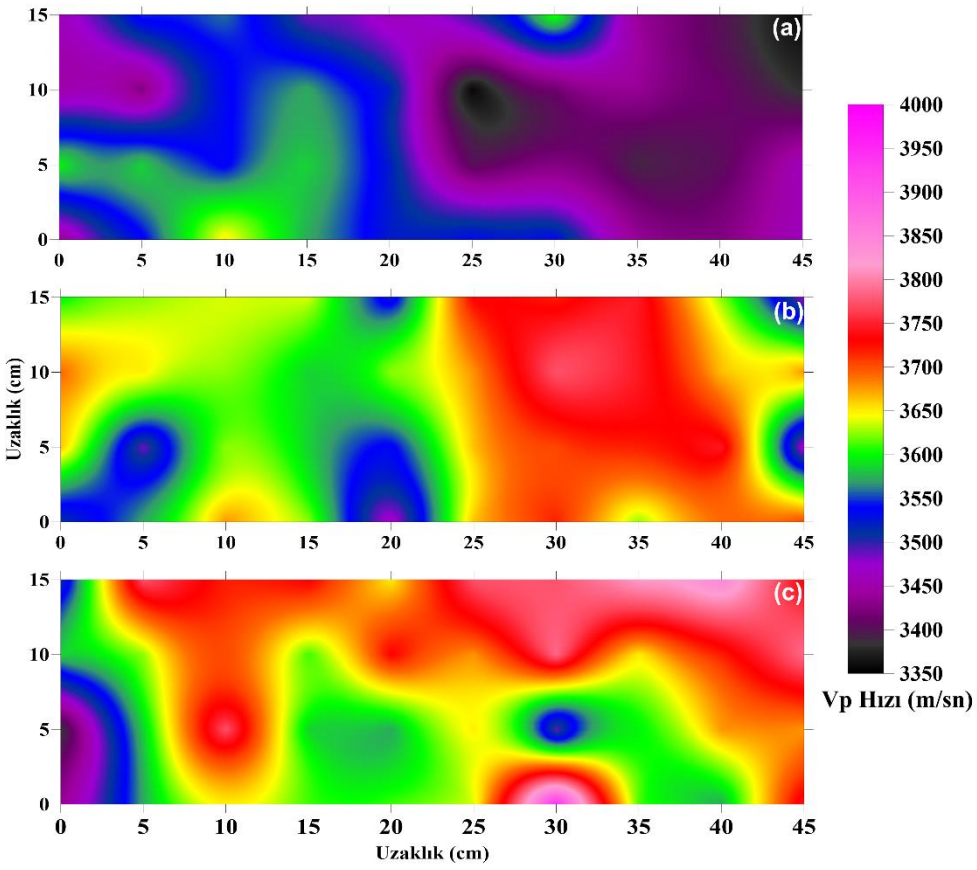
250 kg lık Karışım		**350 kg lık Karışım**		**450 kg lık Karışım**	
İri agrega	7.56 kg	İri agrega	6.72 kg	İri agrega	6.6kg
Orta agrega	15.10 kg	Orta agrega	13.44 kg	Orta agrega	13.2kg
İnce agrega	52.9 kg	İnce agrega	47.04 kg	İnce agrega	46.2kg
Çimento	10 kg	Çimento	14 kg	Çimento	18kg
Karşım Suyu	8 kg	Karışım Suyu	8.6 kg	Karışım Suyu	10.6kg
Doyma suyu	1.5 L	Doyma suyu	1.350 L	Doyma suyu	1.300L

Şekil 4.Ultrasonik hız ölçümleri için hazırlanan donatısız ve donatılı beton numuneler

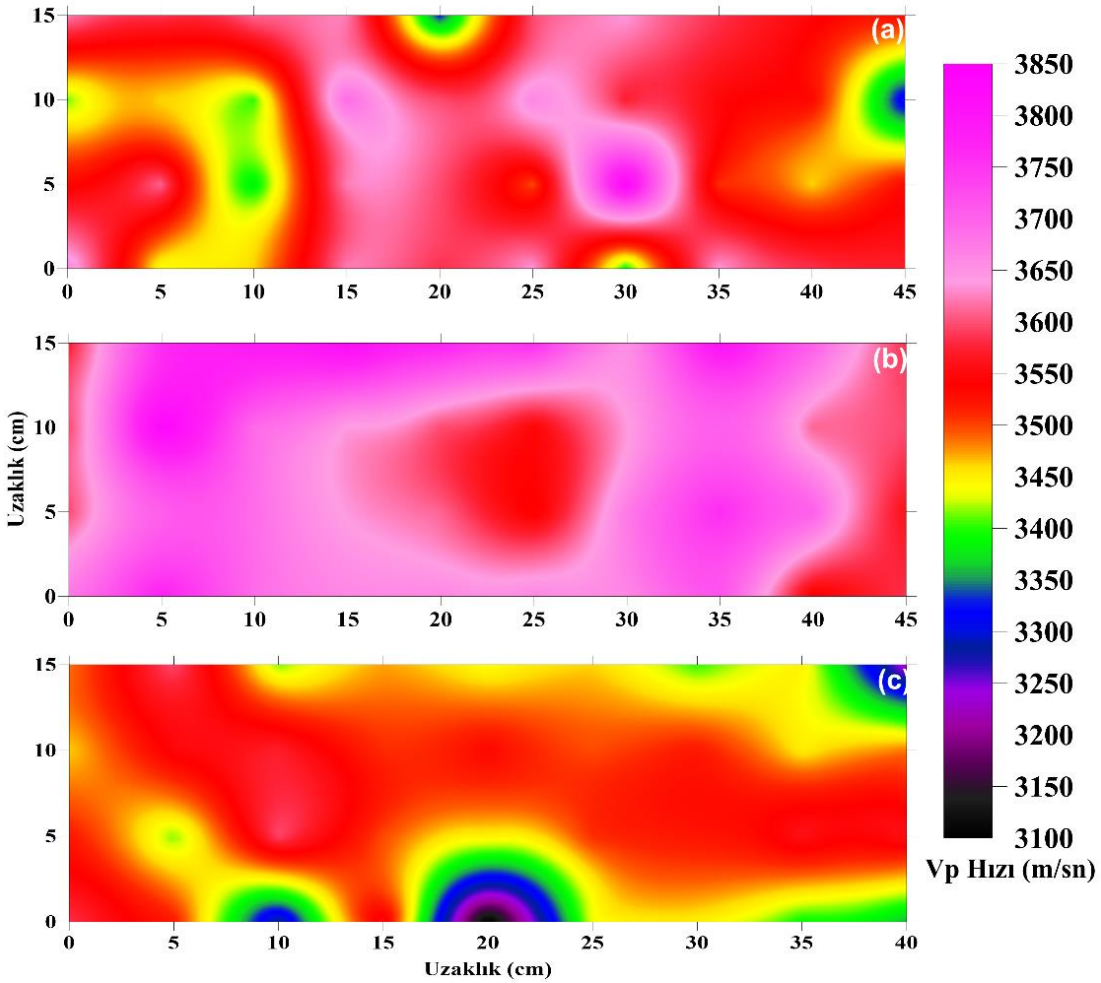
Hazırlanan beton numuneler donduktan sonra kalıplardan çıkartılarak birkaç gün içerisinde ultrasonik ölçümler gerçekleştirilmiştir. Bu çalışmada hazırlanan numuneler su içerisine bırakılarak doyurma işlemine tabi tutulmamıştır. 10x20x50cm boyutundaki beton numunelerin geniş yüzeyi boyunca 4 profilde 5 cm aralıklarla ölçümler alınmıştır. Her bir profilde ölçüm noktaları arası da 5 cm olmak üzere toplamda 9 noktada ölçüm alınmıştır. 250 kg, 350 kg ve 450 kg lık beton karışımlar için elde edilen ultrasonik hız haritaları sırasıyla Şekil 5, 6 ve 7'de verilmiştir.



Şekil 5. 250 kg lık hazırlanan beton yapılardan elde edilen ultrasonik hız dağılımları



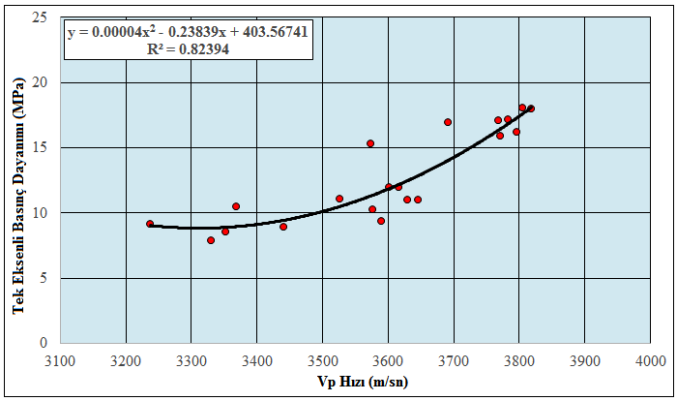
Şekil 6. 350 kg lık hazırlanan beton yapılardan elde edilen ultrasonik hız dağılımları



Şekil 7. 450 kg lık beton yapılardan elde edilen ultrasonik hız dağılımları. (a) donatılı beton yapısı, (b, c) donatısız beton yapısı

Hazırlanan beton yapıalrı üzerinde ultrasonik ölçümler yapıldıktan sonra, bu yapılardan bir karotiyer yardımıyla 24 adet karot alınmıştır (Şekil 8). 24 karottan 4 tanesi deneyler esnasında kırıldığı için 20 adet karot üzerinde önce ultrasonik hız ölçümleri, daha sonra ise tek eksenli basınç testleri gerçekleştirilmiştir. Ultrasonik hızlar ile tek eksenli basınç değerleri basit bir regresyon analizi ile değerlendirilmiş ve aralarında yüksek oranda bir ilişkinin olduğu tespit edilmiştir (Şekil 9).

Şekil 8. Oluşturulan beton bloklardan alınan karotlar ve bir karo üzerinde ultrasonik hız ölçümü

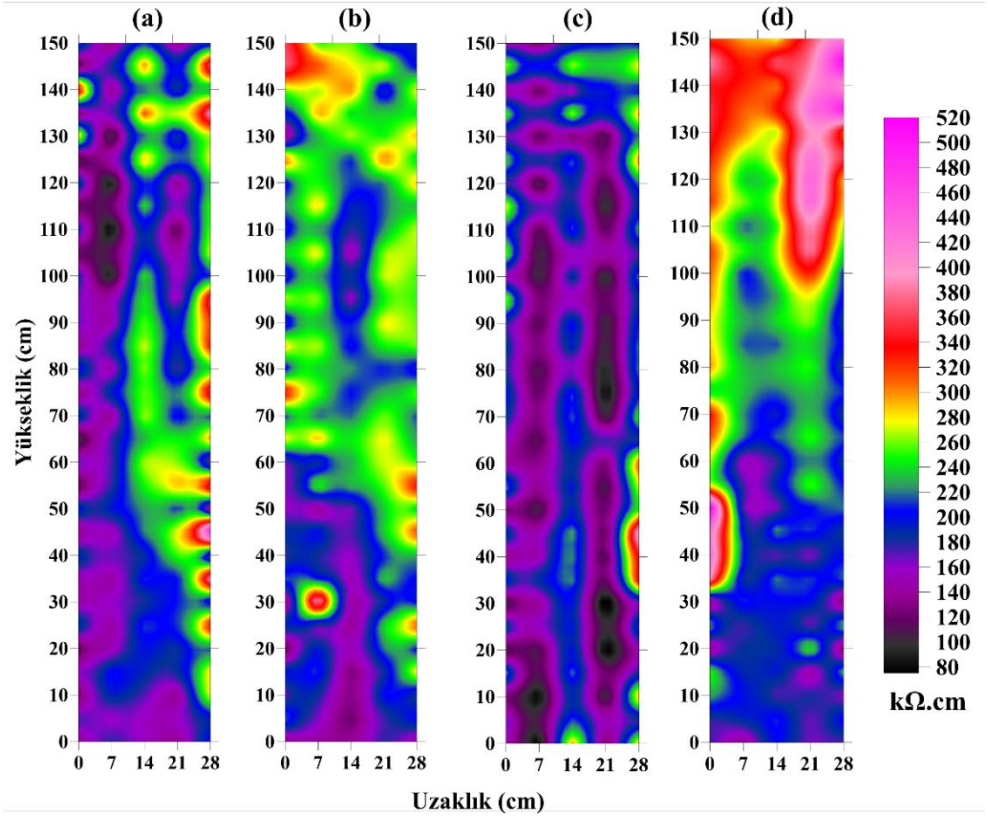


Şekil 9. Oluşturulan beton yapılardan elde edilen numunelerin ultrasonik hızları ve ölçülen tek eksenli basınç dayanımları arasındaki ilişki

Elektrik Özdirenç Ölçümleri

Bu çalışma kapsamında ikinci olarak, Karadeniz Teknik Üniversitesi Jeofizik Mühendisliği Bölümünün amfisinin altında bulunan zemine yakın kolonlardan bir tanesi örnek seçilerek üzerinde betonun nemlilik ve korozyon durumunu belirlemek için Wenner elektrot dizilimi ile elektrik özdirenç ölçümleri alınmıştır. Beton kolonun tüm yüzeylerinde (A, A' ve B, B') elektrik özdirenç ölçümleri gerçekleştirilirmiştir. Kolonun A, A', B ve B' yüzeylerinde 5 profil boyunca 7 cm aralıklarla ölçümler alınmıştır. Her bir profilde de ölçüm noktaları arası mesafe 5 cm seçilerek, 31 noktada, toplamda 155 adet ölçüm yapılmıştır. Kolonun tüm yüzeylerinde toplamda 20 profilde olmak üzere 620 adet elektrik özdirenç ölçüsü alınmıştır. Toplanan verilerden oluşturulan elektrik özdirenç kesitleri Şekil 10' da verilmiştir.

Elde edilen özdirenç haritaları betonun nemliliğinin dağılımını yansıtmaktadır. Özdirenç haritalarına göre; kolonun A ve A' yüzeylerindeki özdirenç değişim aralığı yaklaşık 82-480 kΩ.cm arasındadır. Bu değerlere göre kolon bu yüzeyleri için korozyon riski ihmal edilebilir korozyon riski sınıfına girmektedir. Aynı kolonunun B ve B' yüzeylerinde ise özdirenç değişim aralığı 75-520 kΩ.cm arasında değişmektedir. Bu değerlere göre ise kolon bu yüzeyleri için korozyon riski düşük ya da ihmal edilebilir korozyon riski sınıfına girmektedir.

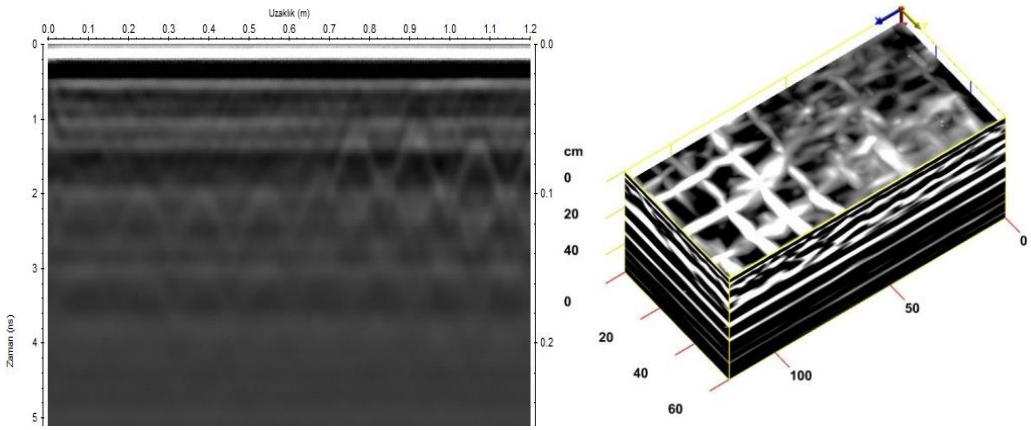


Şekil 10. Beton nemliliğini belirlemek amacı ile alınan ölçülerden elde edilen elektrik özdirenç kesitleri (a) A yüzeyi, b) A' yüzeyi, (c) B yüzeyi, (d) B' yüzeyi

Yer Radarı Ölçümleri

Bu çalışmada son olarak beton donatıların görüntülenmesi ve beton içerisinde herhangi bir yapısal bozukluğun meydana gelip gelmediğinin tespiti için yer radarı araştırması yapılmıştır. Bu amaçla, ilk olarak jeneratör tablası amacı ile 3.75 m boyunda, 2.40 m eninde ve 38 cm yüksekliğinde yeni dökülen bir beton üzerinde ölçümler alınmıştır (Şekil 11). Bu beton yapının içine 15*18 cm genişliğinde çapı 5 mm olan hasırlar yerleştirilmiştir. Hasırlar beton içinde 7 cm ve 10 cm'e derinliklere yerleştirilmiştir (Şekil 11). Bu beton yapı üzerinde 60*120 cm lik gridlere ayrılarak 2B-3B yer radarı verileri toplanmıştır (Şekil 12). Şekil 12'de hasırların yerleri açıkça görülmektedir.

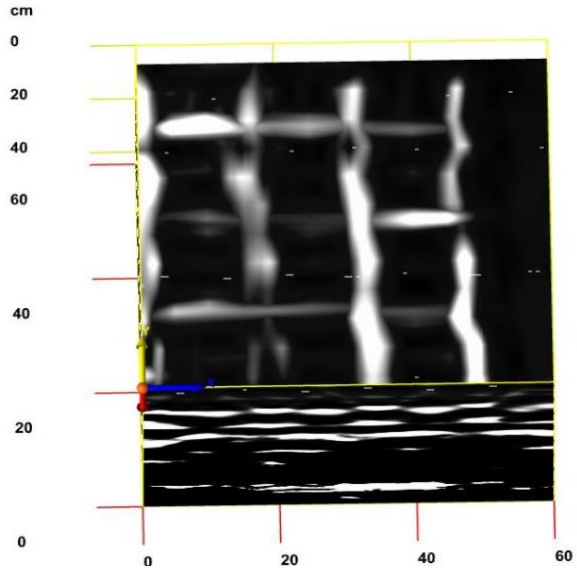
Şekil 11. Yer radarı araştırmasının yapıldığı çelik hasırlı beton yapı ve yer radarı ölçülerinin alınması



Şekil 12. Beton yapıdan elde edilen ölçülerden oluşturulan 2B (radargram) ve 3B yer radarı görüntüleri

Yer radarı ölçümlerinde ikinci olarak ise test amacıyla tasarlanan 60 cm eninde 100 cm yüksekliğindeki C25/30 sınıfı beton üzerinde deneme ölçüleri alınmıştır (Şekil 13). Tasarlanan beton içerisine 4 donatı ve donatıyı saracak şekilde 5 adet etriye yerleştirilmiştir. Deneme ölçüleri 3B olacak şekilde tasarlanmıştır. Bunun için 60 cm*60 cm lik grid ağı kullanılmıştır. Beton kalıba ait 3B radar görünümü Şekil 14'de görülmektedir. Radar kesitlerinin hazırlanması için ölçülere gerekli veri işlem adımları uygulanmıştır. Tüm donatı ve etriyelerin konumları ve sayıları 3B kesitte net olarak belirlenmiştir.

Şekil 13. Donatı-etriye görünümü ile tasarlanan beton kalıp



Şekil 14. Tasarlan beton kalıba ait 3B yer radarı görüntüsü

Sonuçlar

Bu çalışmada, beton kalitesini, dayanımını ve beton içerisindeki donatıların yeri, sayısı ve korozyon durumunu belirlemek için eski ve yeni beton örnekler üzerinde Jeofizik yöntemlerden olan ultrasonik, elektrik özdirenç ve yer radarı yöntemleri kullanılmıştır.

Ultrasonik yöntem ile 3 farklı özellikte dökülen beton numuneler üzerinde yapılan çalışmaların sonucunda; 250 kg, 350 kg ve 450 kg lık beton karışımlar için elde edilen ultrasonik hız dağılımları sırasıyla 2850-3850 m/sn, 3350-4000 m/sn ve 3100-3850 m/sn arasında değişmektedir. Her üç beton karışımı için oluşturulan hız haritaları incelendiğinde homojen bir dağılımın olmadığı görülmüştür. Ayrıca aynı özellikte dökülen 3 örnek bile kendi içerisinde belirgin hız farklılıkları göstermektedir. Beton numuneler içinde çimento oranı en yüksek seçilen ve dayanımı en yüksek olduğu düşünülen 450 kg lık karışımın hız değerleri, diğer karışımlar ile hemen hemen aynıdır. Bu durum dayanım üzerinde sadece çimento oranının değil aynı zamanda kullanılan agregaların boyutu ve dağılımı da etkin olduğunu ortaya koymaktadır. Böylece bu tür çalışmalarda betonun rastgele herhangi bir yerinden değil de sadece problemli olan alanlardan karot alınıp incelenmesi hem yapıya daha az zarar verecek hem de daha doğru sonuçların elde edilmesini sağlayacaktır. Ultrasonik yöntemle ayrıca beton numunelerden alınan karotlar üzerinde de ultrasonik hız ölçümleri ve tek eksenli basınç dayanım testleri yapılmıştır. Elde edilen sonuçlar basit bir regresyon analizi ile incelenmiş ve ultrasonik hız ve tek eksenli basınç dayanımı arasında anlamlı bir ilişkinin olduğu belirlenmiştir. Beton içerisindeki donatıların korozyon riskini değerlendirmek amacıyla bina kolonlarında elektrik özdirenç ölçümleri gerçekleştirilmiştir. Kolonun dört bir yüzeyinden elde

edilen özdirenç sonuçlarına göre; donatıların korozyon riski, düşük ya da ihmal edilebilir korozyon riski sınıfına girmektedir. Son olarak ise beton içerisindeki donatıların yerleri ve sayıları ile birlikte beton içerisinde zamanla herhangi bir yapısal bozukluğun meydana gelip gelmediğini tespit etmek için betonlar üzerinde yer radarı ölçümleri alınmıştır. Elde edilen 2B ve 3B kesitlerinden donatıların konumları ve sayıları başarılı bir şekilde belirlenmiştir. Jeofizik yöntemler ile hızlı, ucuz ve yapıya bir hasar vermeden ölçümler elde edilebilmektedir.

Teşekkür

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GEOTHERMAL SOURCE RESEARCH WITH GRAVITY AND ELECTRICITY METHODS

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Abstract: The study area is near Afyon. There are many geothermal wells in the immediate vicinity of the area with 55-120 °C temperature. After the gravity method results, information was collected about the local tectonic structure, the basis uplift and subsidence basins. As a result of electrical applications, construction of the underground was studied to determine the cracks and broken systems, geothermal activity, location and depth. Thus, it was aimed to investigate the geothermal energy potential of the field. It was determined the boundaries of the possible hot areas determining the places where geothermal energy activity is intensive.

Keywords: Electric, gravity, geothermal, metamorphic rocks, gravity first derivative

GRAVİTE VE ELEKTRİK YÖNTEMLERLE JEOTERMAL YAPI ARAŞTIRMASI

Özet: Çalışma alanı, Afyon yakınındadır. Alanın yakın çevresinde 55-120 ºC sıcaklığına sahip pek çok jeotermal kuyu bulunmaktadır. Gravite yöntemi uygulamaları sonucunda, yerel tektonik yapı, temel yükselimleri ve çöküntü havzaları hakkında bilgi toplanmıştır. Elektrik uygulamaları sonucunda, yeraltının yapısı, çatlak ve kırık sistemleri, jeotermal aktivitenin yeri ve derinliği belirlenmeye çalışılmıştır. Böylece, sahanın jeotermal enerji potansiyelinin araştırılması hedeflenmiştir. Jeotermal enerji aktivitenin yoğun olduğu yerler belirlenerek, muhtemel sıcak alanın sınırları belirlenmeye çalışılmıştır.

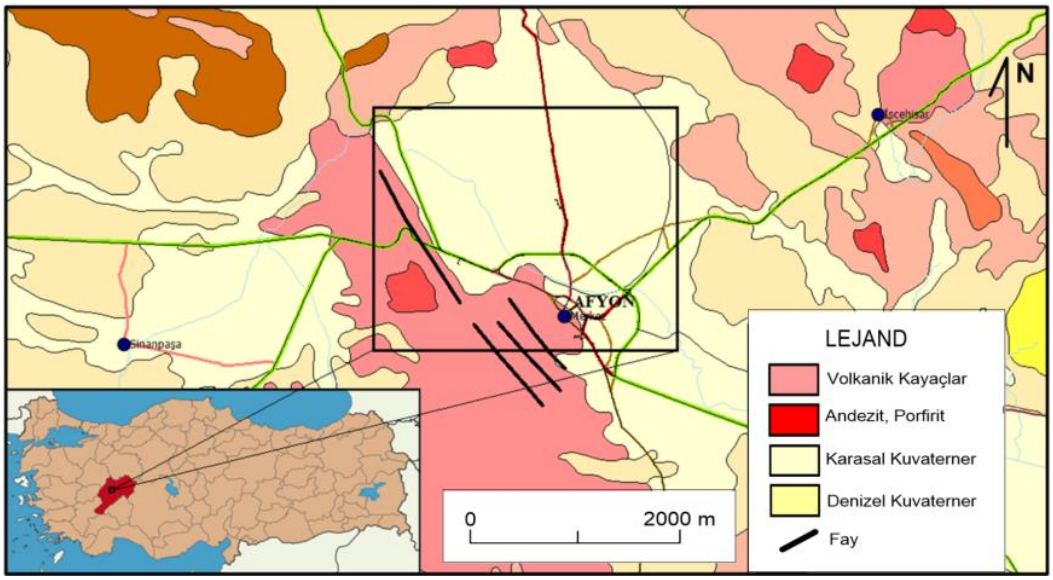
Anahtar Sözcükler: Elektrik, gravite, jeotermal, metamorfit, gravite birinci türev

Giriş

İnceleme alanında Erişen (1972), Karamanderesi (1972), Tatlı (1973), Metin vd. (1987) ve Erkan vd. (1996) tarafından ayrıntılı jeolojik incelemeler yapılmıştır. Bu bölümde, çalışma alanı ve yakın çevresinin jeolojisi bu çalışmalardan yararlanılarak özetlenmiştir. Çalışma alanında Paleozoik yaşlı Afyon metamorfitleri temeli oluşturmaktadır. İnceleme alanında Pliyosen, gölsel ve volkanik kayaçlar ile temsil edilmektedir. Gölsel çökeller alttan üste doğru birbiriyle geçişli dört farklı birimden oluşmaktadır. Afyon civarında Jeotermal sisteminin elemanları; sıcak su akiferi, bunun üzerinde yer alan geçirimsiz bir örtü kayaç, ısı kaynağı ve beslenme bölgesinden oluşmaktadır. Çalışma bölgesinde sıcak suların akifer kayacın Paleozoyik yaşlı Afyon Metamorfitleri'ne ait mermer ve şistler ile Pliyosen yaşlı bazaltlar oluşturmaktadır. Permeabilite değeri düşük olan ve oldukça kırıklı ve çatlaklı bir yapı gösteren bu birim eklem, kırık ve çatlakları içinde sıcak yeraltı suyu bulundurmaktadır. Sıcak su akiferinin örtü kayacını ise Neojen yaşlı birimler (Miyosen yaşlı konglomera ve marn üyesi ile Pliyosen yaşlı marn, konglomera, kireçtaşı ve üst marn üyesi) oluşturmaktadır. İnceleme alanın batı kesiminde KB-GD yönlü büyük bir fay yer almakta ve bu fay nedeniyle meydana gelen kırılma sonucunda sıcak su akiferi derinlere gömülmekte, buna bağlı olarak örtü kalınlığı artmakta ve basamaklı bir yapı oluşmaktadır. Ayrıca bu faylara bağlı olarak oluşmuş çok miktarda tali faylar, tüy çatlakları ve açılma çatlakları da vardır (Erkan vd.,1996). Afyon civarında oluşmuş volkanik etkinliğin son safhasını bazalt akıntıları meydana getirmektedir. Bu volkanik kayaçları oluşturan magma ceplerinin Jeotermal sistemin ısı kaynağını oluşturduğu düşünülmektedir. Şimşek (1993) ve Ercan vd. (1994) de, bölgede yaptıkları incelemeler sonucunda Afyon jeotermal alanında yer alan sıcak suların meteorik kökenli olduğunu bildirilmiştir.

Yöntem

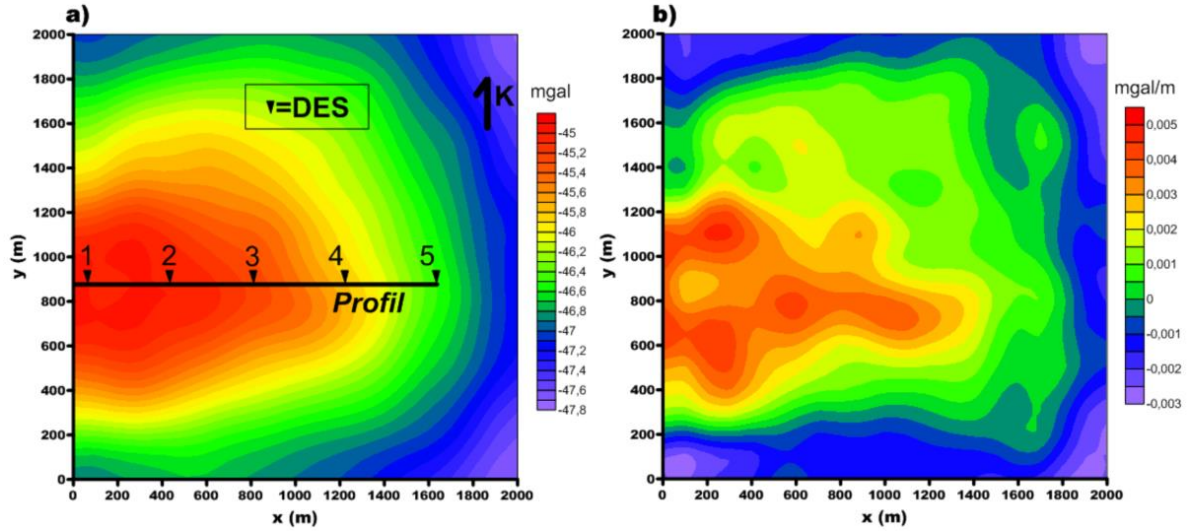
Öncelikle Şekil 1'de görülen çalışma alanının gravite ve düşey türev anomalileri nitel olarak değerlendirilmiştir (Şekil 2. a, b). Pozitif gravite anomalisi veren, metamorfik kayaç olabilecek yerlerde özdirenç ölçümleri yapılmıştır ve sonuçlar nicel olarak değerlendirilmiştir. Özdirenç yöntemi, Schlumberger elektrot dizilimi ile yapılmıştır. Etüt sahasında, Jeofizik etüt kapsamında toplam 5 lokasyonda DES ölçümleri yapılmıştır. DES uygulamalarında AB/2=1200 metrelik teorik derinliğe kadar araştırma yapılmıştır.



Şekil 1. Çalışma alanı (http://deivil.comu.edu.tr/bolgemiz.html).

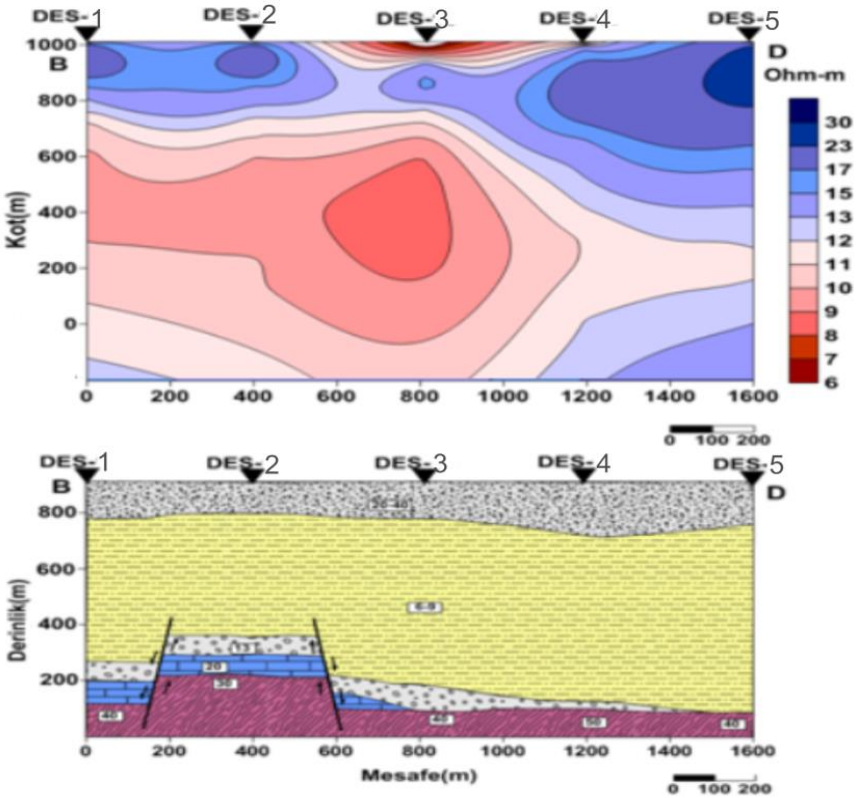
MTA tarafından Afyon ve çevresinin jeotermal akışkan olanaklarını araştırmak amacıyla Gravite etüdü yapılmış ve raporlanmıştır. Bu raporda çizilen Bouguer Anomali kontur haritasından konturlar digitize edilerek Bouguer dataları elde edilmiş ve yeniden değerlendirilmiştir. Elde edilen gravite anomalisine göre, düşük yoğunluklu tersiyer sedimanların çalışma alanının kuzeydoğusunda ve güneyinde daha kalın olduğu, orta kısımlarında ise yüksek yoğunluklu birimlerin olabileceği düşünülmüştür (Şekil 2a). Elde edilen düşey türev anomali haritasında da görüldüğü gibi tamamen alüvyonla örtülü olan alan içinde olası metamorfik kayaç dağılımını yansıtan pozitif anomali belirlenmiştir (Şekil 2b).

Şekil 1'de görülen sahada özdirenç ölçüsü alınan tüm lokasyonlarda, bütün seviyelerin görünür özdirenç değerleri arazi uygulamaları sırasında saptanmıştır. Görünür özdirenç değerleri derinliğin fonksiyonu olarak log-log grafiklere aktarılmıştır ve her DES noktası için bir grafik oluşturulmuştur. DES grafikleri 1B ters çözüm yöntemiyle değerlendirilmiştir. Yapılan tüm değerlendirmelerin sonucunda ölçü alınan lokasyonların tamamında yüzeyden derine doğru geçilen tabaka ve katmanların gerçek özdirençleri, kalınlıkları ve derinlikleri belirlenmeye çalışılmıştır.



Şekil-2. a) Çalışma alanına ait Bouguer anomali haritası. b) Gravite düşey türev anomali haritası.

Profil özdirenç kesiti, profil doğrultusu boyunca, üzerinde bulunan tüm DES ölçülerinin bütün seviyelerindeki görünür özdirenç verilerinden hazırlanmıştır. Böylece, özdirencin düşey değişiminden yararlanılarak sahadaki muhtemel stratigrafik istifin, tektonik yapının ve olası sıcak su içeren alanların teorik derinlik boyutunda izlenmesi amaçlanmıştır. Profile ait görünür özdirenç ve jeoelektrik yapı kesiti aşağıda ayrıntılı olarak açıklanmıştır (Şekil 3).



Şekil - 3. Elektrik özdirenç profiline ait görünür özdirenç ve jeoelektrik yapı modeli

Üst seviyelerde değişik kalınlıklarda alüvyonal çökeller modellenmiştir. Yer yer değişik kalınlık sunabilen bu çökeller taban topografyasına ve faylara uygun olarak kalınlaşıp incelmektedir. Alüvyonun altında olası jeotermal sisteme örtü görevi olabilecek kalın bir neojen istif vardır. Profilin orta seviyelerinde düşük özdirenç dağılımı jeotermal aktivite ile izah edilmiştir. En altta ise yüksek özdirence sahip Afyon metemorfitleri ve mermer modellenmiştir. Kırık, çatlak ve gözeneklerinde sıcak su bulunduran altere olmuş metamorfikler yüksek yoğunluklu ve düşük özdirençlidirler.

Sonuçlar

Sıcak su üretilebilecek potansiyel alanların lokasyonu belirlenirken, gravitenin yüksek, özdirencin düşük olduğu kalın örtülü yerler dikkate alınmıştır. Çalışma sonunda olası jeotermal akışkanın, alterasyona sahip metamorfik kayaçların içinde olduğu düşünülmüştür. Jeotermal kuyu lokasyonları önerisi yapılırken; gravitenin yüksek olduğu, elektrik özdirencin düşük olduğu ve ısı kaybını önleyici özellikte olan kalın örtü tabakasının bulunduğu yerler göz önünde bulundurulmuştur.

Teşekkür

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ASSESSMENT OF THE ROUTE OF THE ANCIENT OTTOMAN AQUEDUCT WITH THE AID OF GEODESIC AND ROBOTIC METHODS

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Kabakan Mühendislik

Abstract: In this paper, we present a novel approach to assess the route of the ancient Ottoman Aqueducts. The approach we present is based on the use of an autonomous mobile robot and a set of geodesic methods. While the mobile robot is responsible for exploring and mapping of the route, geodesic methods are used to improve the route assessment process and minimize possible mapping errors. A set of performance evaluations is presented to prove the efficiency of the proposed approach.

Keywords: Aqueduct, route, surveying, mapping, mobile robot

ESKİ OSMANLI SU YOLUNUN GÜZERGÂHININ JEODEZİK VE ROBOTİK YÖNTEMLERLE DEĞERLENDİRİLMESİ

Özet: Bu bildiride, antik Osmanlı su yollarını değerlendirmek için yeni bir yaklaşım önermekteyiz. Sunmakta olduğumuz yaklaşım, otonom bir gezgin robot ve jeodezik yöntemler setinin kullanımına dayanmaktadır. Gezgin robot rota keşfetme ve haritalamadan sorumluyken, rota değerlendirme yöntemini geliştirmek ve olası haritalama hatalarını en aza indirmek için jeodezik yöntemler kullanılmaktadır. Önerilen yaklaşımın etkinliğini kanıtlamak için bir dizi performans değerlendirmesi sunulmaktadır.

Anahtar Sözcükler: Su yolu, güzergâh, ölçme, haritalama, gezgin robot

Giriş

Topluluklar halinde yaşamış ve toprağı işlemiş olan insan ırklarında su yönetimi, bir toplumun refahı için önemli bir faktör olmuştur. Tatlı su kaynaklarının yakınlarına yerleşmiş olan topluluklar, yeraltı sularını kullanmışlar ve bazen de yağmur sularını daha sonra kullanılabilmek için sarnıçlar oluşturmuşlardır. Su yolları, suyun bir yerden başka yere taşınmasında çok önemli bir rol üstlenmişti. Su yolları sayesinde yeterli su alamayan bölgelere düzenli ve kontrollü su temini sağlanmış, böylece su kaynaklarından uzakta yaşamış olan toplulukların su ihtiyacı karşılanmış ve tarım için kullanılamayacak olan araziler kullanılabilmiştir (Mays, 2010). Tarihte su yolları, yer altı tünelleri, yüzey kanalları, kapalı borular veya anıtsal köprüler şeklinde çeşitli biçimlerde inşa edilmiştir (Gargarin, & Fantham, 2010).

Antik su yolları, bir zamanlar Roma İmparatorluğu olan Almanya'dan Kuzey Afrika'ya kadar olan bölgede su akışı sağlayan mühendislik şaheserleriydi (Gargarin, & Fantham, 2010). Su sayesinde nüfusu çok kalabalık olan Roma gibi bir şehirde çok az salgın vakaları yaşanmıştır. Çünkü Roma'da kent için, halk için hizmet anlayışı vardı (Gargarin, & Fantham, 2010). Bu, temiz su tedarikinin hijyenin sağlanabilmesi için temel bir hizmet olduğunu ortaya koymaktadır.

Toprak üstündeki su yollarının eğer zarar görmemişse haritalanması emek gerektiren ancak nispeten daha kolay bir işlem olduğu için çok uzun yıllar önce antik su yollarından ayakta kalanlar haritalanmıştır. Öte yandan yer altı tünelleri şeklinde olan su yollarının haritalanması, oldukça yoğun emek ve uzun zaman gerektirmesi yanında, uzman ekipler ve yüksek maliyetli teçhizat kullanımı da gerektirmektedir.

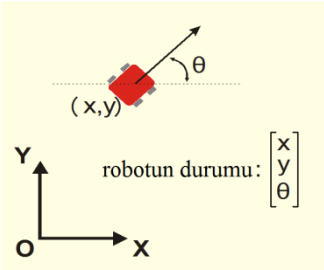
Bu çalışmada, farklı türden mesafe algılayıcıları ile donatılmış bir otonom, gezgin robot ve Küresel Konumlandırma Sistemi (Global Positioning System: GPS) teknolojisi kullanımıyla yer altı su yollarının

güzergâhlarının tespiti için yenilikçi bir yaklaşım önerilmekte ve önerilen yaklaşımın etkinliği benzetim çalışmalarıyla irdelenmektedir. Gerçek saha çalışmalarında benzetim çalışmalarında öngörülmeyen birçok sorun yaşanabilmesine rağmen, gerçekleştirilen benzetim çalışmaları önerilen yaklaşımın gerçek saha da uygulanabilirliği konusunda fikir vermesi açısından önem taşımaktadır.

Yöntem

Bir gezgin robotun anlamlı bir görevi tamamlayabilmesi için ortamdaki konumunu tanımlayabilmesi ve kontrol edebilmesi gerekir. Bu bağlamda bir robotun yerini bulmak için algılayıcı bilgilerini kullanması robotik alanında en çok irdelenen problemlerden birisidir (Cox, 1991; Thrun vd., 2005). Bir ortam haritası, bir dizi algılayıcı ölçümü ve kontrol girişleri göz önüne alındığında robotun konumu ve açısı hesaplanabilmektedir. Bu sorunun çözümü için yaygın olarak kullanılan yaklaşımlardan birisi, robotun kontrol girişlerini ve gözlemleri bir Markov Zinciri kullanarak modellemektir. Markov varsayımı, gezgin robotun mevcut durumu biliniyorsa, geçmiş ve gelecek durumların koşullu olarak birbirinden bağımsız olduğunu bildirmektedir (Thrun vd., 2005). Bu yaklaşımda, bir gezgin robotun hareket modeli, önceki poz ve kontrol girdilerinin bir fonksiyonu olarak robot pozunu tanımlar. Gözlem modeli, robotun algılayıcı ölçümlerini, robotun konumunun ve döngüsel konumun bir fonksiyonu olarak tanımlar. Genişletilmiş Kalman Filtresi (EKF), Bayes tahmin yöntemlerini robot lokalizasyonu ve haritalama için kullanmanın bir yoludur (Julier, & Uhlmann, 2004; Thrun vd., 2005). Kalman filtresi doğrusal bir Gauss sisteminin En iyi En Küçük Ortalama Kareler tahmincisidir (Kalman, 1960). EKF, modelin yakınlaştırılmasıyla doğrusal olmayan modellerle Kalman filtresinin kullanılmasının bir yoludur. EKF'nin uygulaması hızlıdır ve normal şartlar altında tutarlıdır. Gerçek dünyada, model, başarısızlığı azaltmak ve iyileştirmek için ayarlanabilir.

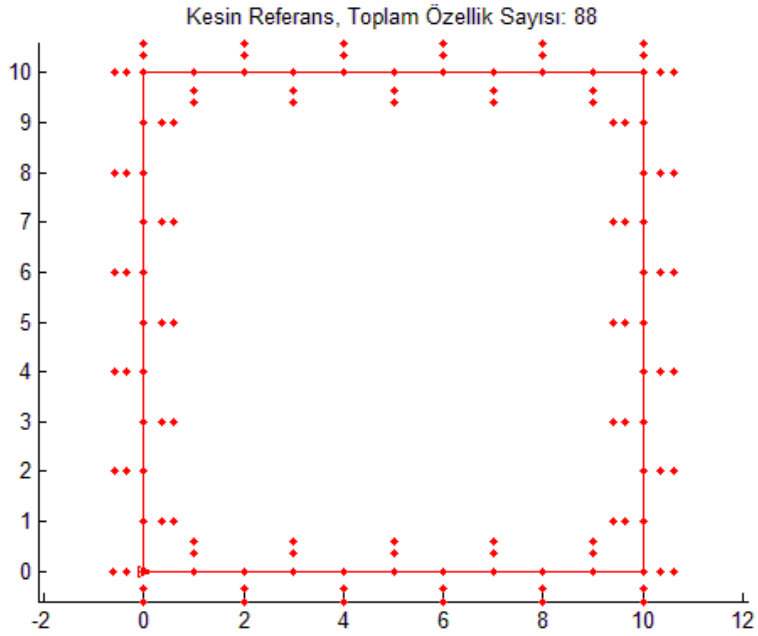
Robotun başlangıç pozu, $x_r = \begin{bmatrix} x \\ y \\ \theta \end{bmatrix}$, kontrol girişleri $u_{0:t} = \{u_0, u_1, \ldots, u_t\}$, gözlemler $z_{1:t} = \{z_1, z_2, \ldots, z_t\}$, harita özelliği ve simgeleri m ile gösterilirse, Şekil 1'de gösterilen tahmini robot pozu elde edilebilir.



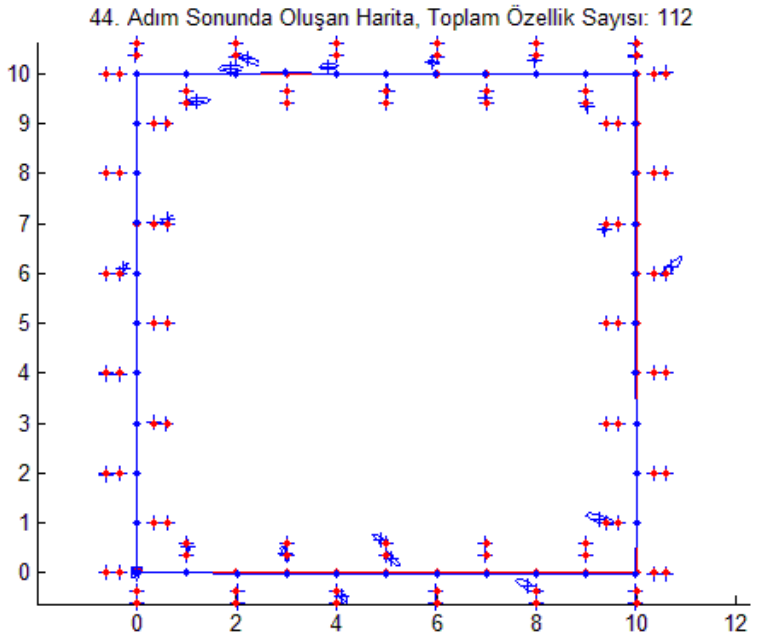
Şekil 1. Tahmini robot pozu

MATLAB üzerinde gerçekleştirilen benzetim çalışmaları sırasında robot geri beslemeli doğrusallaştırması yöntemiyle kontrol edilmiştir. Benzetim çalışmasının amacı bir robotun gerçek konum bilgisine sahip olmadan çeşitli referans noktalarını tespit ederek bir güzergâh izlemesidir. Bir GPS alıcısı ve lazer mesafe bulucu ile donatılmış olan robotun gerçek saha çalışmalarında kullanılacağı tünel yer altında bulunduğu için GPS alıcısının devrede olmadığı kabul edilmiştir. Robot üzerinde bulunan tarayıcılar sayesinde engelleri tespit edecektir. Hem GPS alıcısı ve hem de lazer tarayıcı gürültülü veriler iletir. Açık alan uygulamalarında kullanılsaydı GPS konumları ve lazer taramaları filtrelenecek ve her ikisi de geçerli konumumu tahmin etmek için kullanılacaktı. Ham GPS ve lazer verilerini filtrelemek için uygulaması nispeten kolay ve kanıtlanmış bir yöntem olan EKF kullanılacaktı. Benzer şekilde benzetim çalışmasında da EKF kullanılmıştır. Sürecin gürültüsü ve ölçümü Gauss dağılımı sergilemektedir. Gerçekleştirilen benzetim çalışmasında, veri eşleştirme probleminin çözümü için the Joint Compatibility Branch and Bound (JCBB) testi (Neira, & Tardos, 2001) kullanılmıştır.

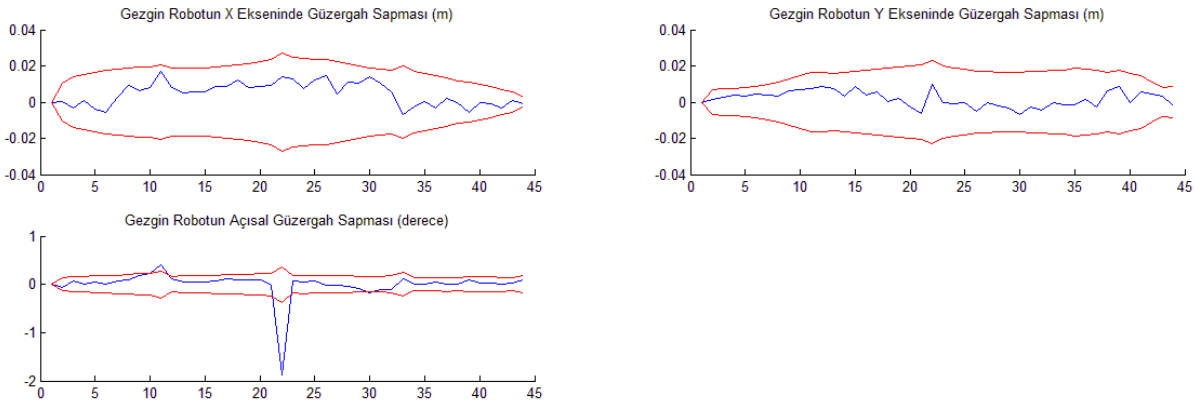
Benzetim çalışmalarının sonuçları Şekil 2, 3, 4 ve 5'te gösterilmektedir. Şekil 2 haritalanacak tüneldeki referans noktalarının gerçek konumlarını, Şekil 3 referans noktalarının robot tarafından tespit edilen konumlarını, Şekil 4 gezgin robotun güzergâh tespiti sırasında yaşadığı sapmaları, Şekil 5 ise referans noktaları tespiti sırasındaki hataları göstermektedir. Robotun güzergâh tespiti sırasındaki sapmalar 2 cm ve altında kalmıştır. Robotun açısal sapması ise 1° altındadır. Robotun referans noktalarının tespiti sırasındaki hataları oldukça küçüktür. Elde edilen sonuçlar robotun benzetim çalışmasındaki su yolu güzergâhını başarılı olarak haritaladığını göstermiştir.



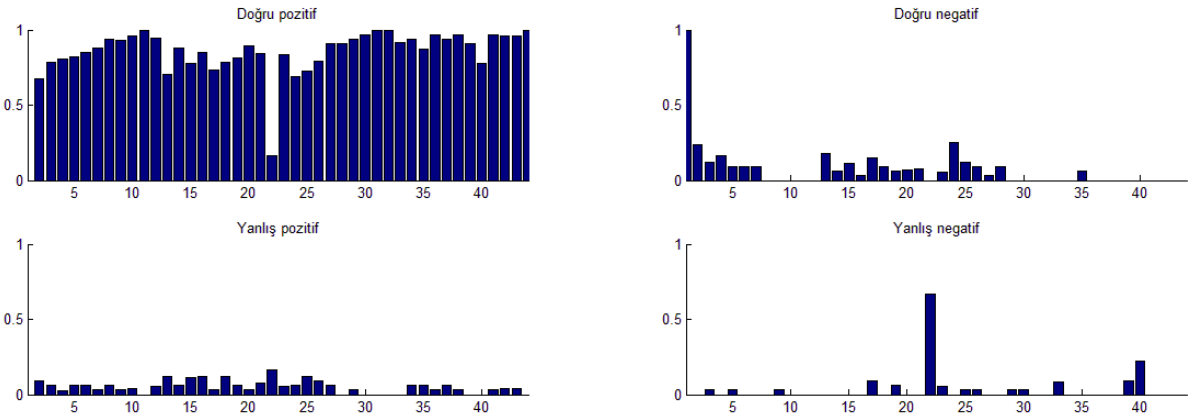
Şekil 2. Haritalanacak tüneldeki referans noktalarının gerçek konumları



Şekil 3. Referans noktalarının robot tarafından tespit edilen konumları



Şekil 4. Robotun güzergâh tespiti sırasında yaşadığı sapmalar



Şekil 5. Referans noktaları tespiti sırasındaki hatalar

Sonuç

Bu çalışmada, antik Osmanlı su yollarını değerlendirmek için yeni bir yaklaşım önerilmiştir. Önerilen yaklaşımda, otonom bir gezgin robot ve jeodezik yöntemler seti kullanılmıştır. Gezgin robot, rota keşfetme ve haritalama süreçlerinde kullanılırken, jeodezik yöntemler ise rota değerlendirme yöntemini geliştirmek ve olası haritalama hatalarını en aza indirmek için kullanılmaktadır. Önerilen yaklaşımın etkinliği MATLAB üzerinde gerçekleştirilen bir dizi performans değerlendirmesi ile incelenmiştir. Elde edilen sonuçlar robotun benzetim çalışmasındaki su yolu güzergâhını başarılı olarak haritaladığını göstermiştir.

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ECOTOURISM CITY MODELS USING GEOGRAPHIC INFORMATION SYSTEMS: EXAMPLE OF YILDIZ MOUNTAINS (STRANDZHA MOUNTAINS)

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Abstract: The regions where the historical and cultural values are very high and the tourism potential is high have great importance in terms of protecting, using, providing sectoral development and planned development. In this context, Istirancalar Region, which is one of the five most important natural areas of Europe, located in the province of Kırklareli, is one of the important nature conservation areas to be studied. In this study, it is aimed to accelerate the development of Turkish tourism by integrating it with the new tourism trends in the world with the help of the analysis made using geographical information system technologies and by introducing its own building norms in the region and the constraints of the plans. The main objective of this framework is to determine the tourism planning policy of the country with a holistic and sustainable approach to all elements covered by sectoral development.

Keywords: Geographical information systems, ecotourism cities, Kırklareli, Yıldız mountains, protection and development zone.

COĞRAFİ BİLGİ SİSTEMLERİ KULLANILARAK EKO-TURİZM KENT MODELLEMELERİ ISTIRANCALAR (YILDIZ DAĞLARI) ÖRNEĞİ

Özet: Tarihî ve kültürel değerlerin çok bulunduğu ve turizm potansiyelinin yüksek olduğu yöreleri korumak, kullanmak, sektörel kalkınmayı ve plânlı gelişimi sağlama açısından büyük bir öneme sahiptir. Bu bağlamda Kırklareli ilinde bulunan ve Avrupa'nın en önemli beş doğa alanından biri olan Istırancalar Bölgesi incelenmesi gereken önemli doğa koruma alanlarından biridir. Bu çalışmada, coğrafi bilgi sistemi teknolojileri kullanılarak yapılan analizler yardımıyla, bölgede kendine özgü yapılaşma normlarının getirilmesi ve yapılaşmalarda planın öngördüğü kısıtlamalar sayesinde Türk turizminin gelişiminin, dünyada yaşanan yeni turizm eğilimleri ile bütünleşmesinin sağlanarak daha da hızlandırılması amaçlanmıştır. Bu çerçevede ülkeye ilişkin turizm planlaması politikalarıyla sektörel gelişmenin kapsadığı tüm unsurların bütünsel ve sürdürülebilir bir yaklaşım ile belirlenmesi çalışmanın ana amacını oluşturmaktadır.

Anahtar Sözcükler: Coğrafi bilgi sistemleri, ekoturizm kentleri, Kırklareli, Istırancalar, koruma ve gelişim bölgesi.

Giriş

Kültürel mirasın geniş bir ölçeğe yayıldığı, turizm potansiyelinin yüksek olduğu bölgeleri korumak, plânlı gelişimi sağlamak amacıyla günümüzde karşımıza çıkan en önemli öğelerden biridir. Ülkemizde 1980'lerden sonra alınan turizm üst politika kararları ve bu kararların sorunsuz ve etkin bir şekilde devreye alınmasını sağlayacak yaklaşımlar ile sağlanan Türk turizminin gelişiminin, yeni küresel turizm trendleri ile bütünleşmenin sağlanarak daha da hızlandırılması amacı ile ilgili Bakanlık tarafından yoğun çalışmalar gerçekleştirilmektedir. Bu bağlamda, Bakanlığın yetki ve denetimi altında bulunan turizm planlaması politikaları ışığında sektörel gelişmenin kapsadığı kültürel, sosyal ve doğal çevre gibi her türlü unsurun bütünleştirilmiş ve sürdürülebilir bir yaklaşım ile ele alınması gerekmektedir.

Ekonomik, kültürel ve tarihsel verilere dayalı beklentileri içeren eko turizm, eko sistemin korunmasına katkıda bulunan veya en azından ekosistemle uyumlu bir şekilde gerçekleştirilen, yerleşik toplumların bütünlüğüne ve varlıklarına saygılı olmayı gerektiren bir doğa seyahat deneyimidir. Gezme-görme alanları, deniz, güneş, turistik

alanların doğal ve kültürel dokusunu muhafaza edecek programlar ve ziyaretçilerin taleplerini karşılayacak turistik istasyonlar eko turizmin bir parçası durumuna gelmişlerdir (Özbey, 2002).

Kültür ve turizm koruma ve gelişim bölgelerinin sınırları Bakanlığın önerisi ve Bakanlar Kurulu kararıyla tespit ve ilân edilen bölgeleri ifade etmektedir (KTKGB ve Turizm Merkezleri, 2016). Bu bölgelerin içinde veya dışında yer alabilen turizm merkezleri ise turizm faaliyetleri yönünden önemli ve geliştirilmesi düşünülen yerler olup; yeri, mevkii ve sınırları Bakanlığın önerisi ve Bakanlar Kurulu kararıyla tespit ve ilân edilir. Öte yandan, kültür ve turizm koruma ve gelişim alt bölgeleri ise her tür turizme ilave olarak eğlence, kültür, eğitim, konut, ticaret ve her türlü sosyal ve teknik alt yapı alanlarından bir veya birkaçını kapsayan ve kendi içinde alt bölgelere ayrıştırılabilen alanlardır.

Tarihi alanların ve doğal güzelliklerin tespitinin önem kazandığı günümüzde gerçekleştirilmesi gereken bu doğrultudaki çalışmaların başlangıç noktası, bu alanlara sahip çıkılması ve Coğrafi Bilgi Sistemi (CBS) tabanında değerlendirilerek yönetiminin düzenli ve sorgulanabilir bir biçime dönüştürülmesidir (Ayrancı, 2007). Coğrafi bilgi sistemlerinin kullanılması bilgi teknolojilerindeki değişimlere bağlı olmakla birlikte, harita işlemlerinin daha hızlı ve doğru yapılabilmesi için kuşkusuz önemlidir (Yomralıoğlu, 2005). Bu çalışmada, Kırklareli bölgesi çalışma alanı olarak seçilerek, bölgenin mülkiyet, altyapı ve çevre gibi konuları için çözüm önerileri getirilmesi amaçlanmaktadır. Bu bağlamda, coğrafi bilgi sistemleri teknolojileri kullanılarak akıllı harita üretimine olanak sağlayan sözel-sayısal veri entegrasyonu sağlanmıştır.

Yöntem

Yöntemin ilk aşamasında planlama sınırının belirlenmesi gerekmektedir. Bu da kuşkusuz günümüz kurumlarında karmaşık bir yapıda olan veri sistemlerinin tek bir sisteme dayalı, birbirleri ile koordinat bütünlüğü sağlayabilen ve gerektiğinde üst üste konularak analiz edilebilen tek bir sisteme dönüştürülmesi ile mümkündür.

Çalışma kapsamında sağlıklı bir modellemenin yapılması için bazı veri kaynaklarının eksiksiz temin edilmesi gerekmektedir. Bu bağlamda ilk aşamada bölgeye ilişkin 1/25000 ölçekli topoğrafik haritaların temini sağlanmıştır. Ayrıca veri tabanı üretimi amaçlı bölgedeki belediye isimlerinin, il özel idare yetki alanı sınırlarının, belediye yetki alanı sınırlarının sayısallaştırılması yapılmıştır. Yine bu amaçla tüm belediye alanlarında imar planları temin edilerek bir imar fonksiyon altlığı oluşturulmuştur. Bölgedeki mülkiyet bilgilerinin kadastro ile bütünleşik çalışması yapılarak, taşınmazlara ilişkin kadastral paftalarının birer kopyası temin edilmiş ve bunların sayısallaştırması yapılmıştır.

Bu aşamadan sonra eldeki verilerin analizi kısmına geçilmiştir. Bu analizler Arcgis yazılımı ile harita formlarına dönüştürülmüştür. Genel anlamda analiz haritalarına bakıldığında bunların; planlama alanının yerini gösteren harita, idari bölünüş sınırları haritası, jeolojik durum, kaynak koruma alanları, nehirler, taşkın alanları, yeraltı ve yüzeysel su kaynakları haritaları, tarım alanları, tarımsal arazi kullanımı haritaları, sulama alanları haritaları, afet verileri ve afete maruz alanlar haritaları, korunması gerekli kültür tabiat varlıkları ve alanları haritaları, kanunlarla belirlenmiş çevre ve doğa koruma alanları haritaları, orman alanları haritaları, demografik yapı, sosyal yapı, ekonomik yapı haritaları, teknik altyapı haritaları, arazi kullanımı haritaları, askeri alan haritaları, mülkiyet yapısı haritaları olduğu görülmektedir. Bu aşamada üretilen haritala aslında kamu kurum ve kuruluşlarından gelen verilerin sisteme entegresi ile oluşturulmuştur.

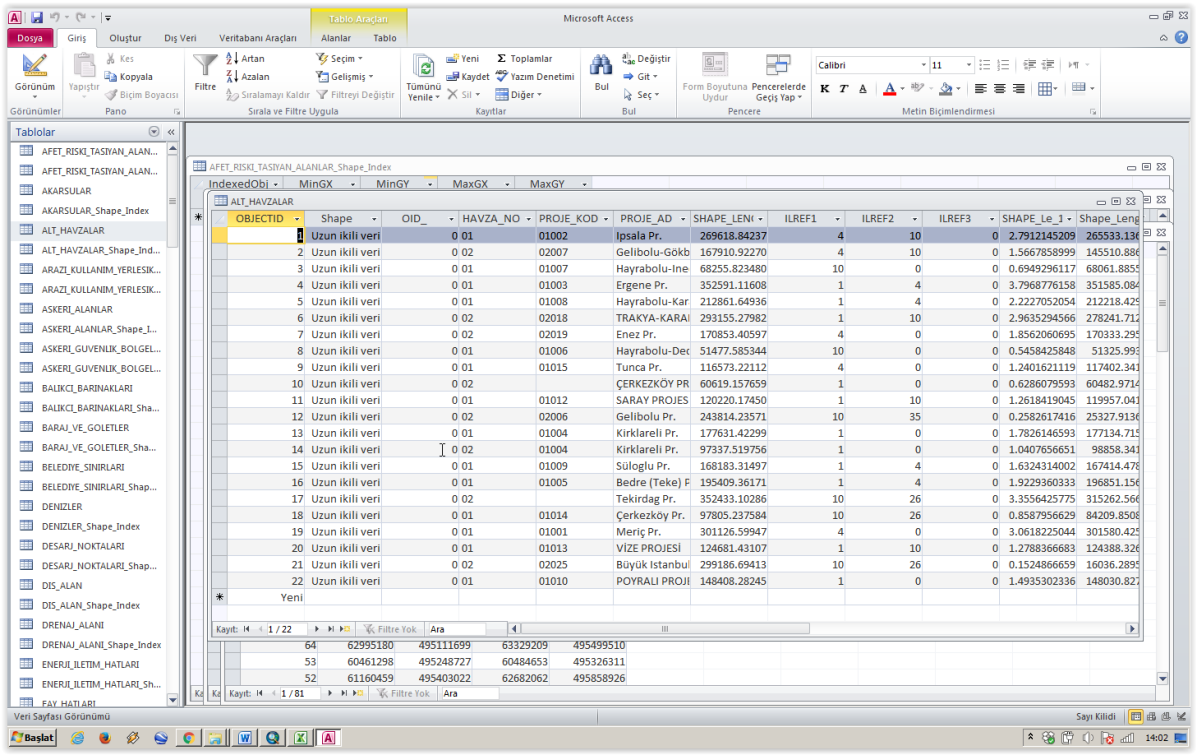
Plan sentez paftalarının oluşturulmasından sonra planların ve planlara ait notların hazırlanması gerekmektedir. Bu aşamada, planlamayı direkt olarak ilgilendiren kamu kurum ve kuruluşlarının görüşleri alınmalıdır. Plan onayından sonraki sürece bakıldığında ise onaylı planlar plan kapsamında bulunan ilgili idarelere ve kuruluşlara gönderilir ve planlar ilgili idarece 1 ay süre ile ilan edilir. Belediye ve belediyenin kontrol ve mesuliyeti altındaki alan sınırları içindeki planlar ilgili belediye tarafından, bu sınırlar dışındakiler ise ilgili valilik tarafından incelenir ve görüşler gerekçeleri ile birlikte 30 gün içinde Bakanlığa bildirilir. Eğer bu süre sonunda cevap alınmazsa olumlu görüş verilmiş kabul edilir. Bakanlık tarafından onaylanan planlar onaylandıkları tarihten itibaren 1 ay içinde ilgili valilik veya belediyenin duyuru alanlarında 1 ay süre ile ilan edilir. Tüm işlemlere ilişkin olarak düzenlenecek tutanaklar muhafaza edilir.

Çalışma kapsamında, ilgili alanlarda üretilecek verilere altlık oluşturmak amacıyla, 1/1000, 1/5000, 1/25000 vb. ölçekteki harita ve planların, bilgisayar destekli tasarım yazılımları yardımıyla, raster veri formundan vektör veri formuna aktarılması (sayısallaştırma) sağlanmış, sayısallaştırma işleminde, ortak bir koordinat sistemi tanımlanması açısından (Büyük Ölçekli Harita ve Harita Bilgileri Üretim Yönetmeliği, 2005); çalışmalara ait tüm altlıklar Universal Transverse Mercator (UTM) (Buchroithner ve Pfahlbusch, 2016) projeksiyonunda, European Datum 1950 (ED50) datumunda (CRS EU, 2016), Hayford Elipsoidinde ve 3 veya 6 derecelik dilim genişliğinde hazırlanmıştır.

Veri Tipleri ve Tematik Haritalarin Üretimi

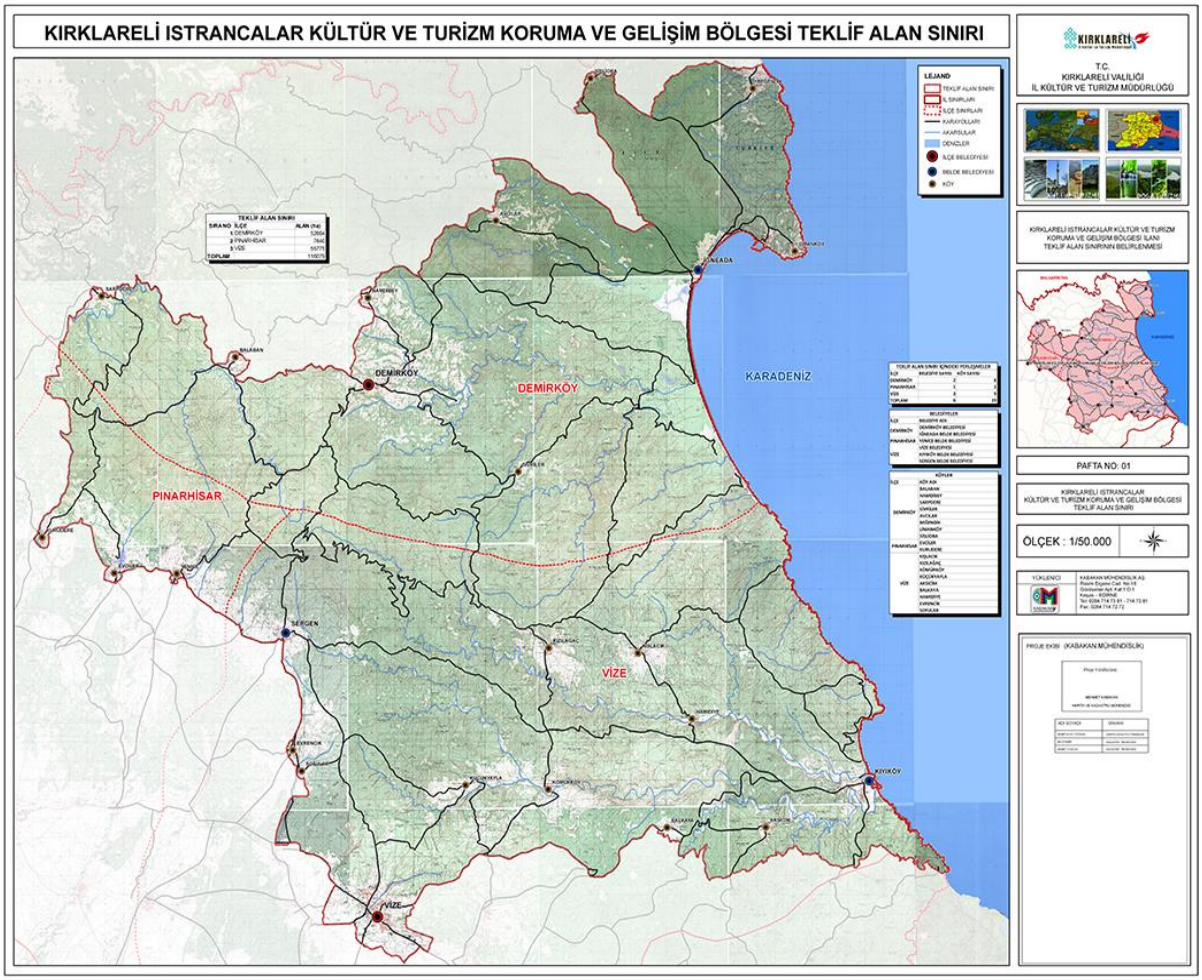
Noktalara bağlı olarak temsil edilen veri olarak tanımlanan vektör verilerden olan konumsal verilerin, nokta, çizgi ve alan özellikleri (x,y) koordinat çiftlerine ait değerlerle saklanmaktadır. Elektrik direkleri, yangın muslukları ve kuyu noktaları gibi nokta özellikleri tek bir koordinat çifti ile temsil edilirken, yol, dere ve elektrik hatları gibi çizgi özelliği taşıyan veriler ise bir başlangıç ve bir bitiş noktası olan koordinat dizisi ile temsil edilmektedir. Örnek olarak verilebilir. Parsel, bina ve arazi gibi alan özellikleri ise, başlangıç ve bitiş noktası aynı olan koordinatlar dizisi ile temsil edilmektedir ("ArcGIS", 2016). Bu bağlamda vektör verilerin oluşturulması amacıyla eldeki raster görüntülerin sayısallaştırılması sağlanmıştır.

Çalışma kapsamında İl ve İlçe Belediye Başkanlıkları, İl Özel İdare, Çevre ve Şehircilik İl Müdürlüğü, İl Kültür Turizm Müdürlüğü, Milli Emlak Müdürlüğü, İl Afet ve Acil Durum Müdürlüğü, Orman İşletme İl Müdürlüğü, Çevre ve Şehircilik İl Müdürlüğü, Gıda Tarım ve Hayvancılık İl Müdürlüğü, Türkiye İstatistik Kurumu, Enerji ve Tabii Kaynaklar Bakanlığı, Orman ve Su İşleri Bakanlığı,Ulaştırma Denizcilik ve Haberleşme Bakanlığı, Trakya Elektrik Dağıtım A.Ş., Boru Hatları ile Petrol Taşıma A.Ş. ve Türk Telekomünikasyon A.Ş.'den veri talep edilmiştir. Şekil 1'de gösterildiği gibi toplanan tüm veriler Access veri tabanında birleştirilmiş ve düzenlenmiştir.



Şekil 1. Access veri tabanında verilerin hazırlanması

Coğrafi bilgi sistemi teknolojileri sayesinde sözel verilerin sayısal veriler ile tek tip koordinat sisteminde birbiri ile uyumlu farklı katmanlarıyla entegrasyonu sağlanmış ve Şekil 2'de gösterildiği gibi bir teklif alan sınırı ortaya çıkarılmıştır. Oluşturulan veri tabanında afet riski taşıyan alanlar, akarsular, alt havzalar, arazi kullanımları, askeri alanlar, askeri güvenlik bölgeleri, balıkçı barınakları, barajlar ve göletler, belediye sınırları, denizler, deşarj noktaları, drenaj alanları, enerji iletim hatları, fay hatları, fidan üretim yerleri, geçiş yapıları, göl alanları, havza mutlak koruma alanları, içme suyu isale hatları, ikinci öncelikli tarım alanları ve il ve ilçe sınırları bulunmaktadır.



Şekil 2. Gelişim bölgesi teklif alan sınırı

Sonuç

Doğal güzelliklerimizin ve tarihi değerlerimizin gelecek nesillere zarar görmeden aktarılabilmesi için bu güzelliklere ve değerlere sahip çıkılması yanında sağlıklı bir haritalama sisteminin kurulması gerekmektedir. Ayrıca bu güzellik ve değerlerimizin bulunduğu bölgede yaşayan halkımızın, yerel yönetimler, özel sektör ve sivil toplum kuruluşları tarafından eko turizm konusunda bilgilendirilmesi önem taşımaktadır. Bu çalışmada, önerilen yaklaşım sayesinde yaklaşık 30 farklı kurumdan gelen verilerle sorgulanabilir bir görünüme dayalı bütünleşik bir sistem kurulabildiği ve böylece toplanan verilerin edilebildiği gösterilmiştir. Ayrıca, gerçekleştirilen çalışmalar ışığında, çalışmanın gerçekleştirildiği alana ait görüntüleri içeren fotoğraf ve video gibi görsel öğelerin de eklenebilmesi mümkündür. Önerilen yaklaşım ve gerçekleştirilen sistem sayesinde çok kolay bir şekilde verilere ulaşmak mümkün olmakta ve sorgulama özellikleri sayesinde istenilen analizler kolayca ve hızlı bir şekilde yapılabilmektedir.

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SMALL BUSINESSES IN CYPRUS ACCORDING TO THE DETAILED CADASTRAL BOOK 64

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Abstract: After the conquest, the cadastral works of the Cyprus State were started on October 9, 1571, and were completed on October 18, 1572. The book that included the cadastral records is the one kept in the General Directorate of Cadastral and Title Deed Works Archives with the number 64. According to the abovementioned book, the small businesses that existed in the Cyprus State were *candy production shops*, *saltworks businesses*, *mills*, *tanneries*, *dyehouses*, and *soap shops*.

The candy production shops in Cyprus were located in Tokyovoli district in Baf County, and in Koloş and Piskopi were located in Limoson district. The ownership of the candy shops belonged to the state, and were run through fiduciary; and then as of 1593, they were run with the uphold system. The annual revenues of these candy shops were 380 000, and nearly all of the candy that were produced here were sent to Istanbul.

The saltwork shops in Cyprus were four in number as three in Baf and one in Tuzla District. The one whose annual revenue was 1950 was located in Baf, the one with 500 annual revenues was located in Lenbe, which was connected to Baf in administrative terms, and Ayayorgi with 40 cash money was located in Isterpoti Hamlet. The other one with an annual revenue of 100 000 was located in Tuzla District. The salt that was produced in the Cyprus State was generally sent to Istanbul. The salt that was more than needed was exported to other countries.

According to the Cadastral Book, there were 206 mills in Cyprus which were distributed as follows; Lefkoşa (19), Mesarye (1), Karpas (6), Girne (8), Pendaye (44), Hırsofu (30), Baf (36), Evdim (15), Limason (37), Mazuto (9) and Tuzla (1). He annual revenue from the mills in Cyprus was 116 255 cash money.

There were tanneries in all of the districts in the Cyprus State -except for Girne and Tuzla. There was one tannery in Lefkoşa, Magosa, Hırsofu, Evdim and Mazuto; two in Mesarye and Karpas; five in Pendaye and Baf; and seven in Limoson, which makes a total of 26 tanneries. The tanneries were run with the uphold system.
According to the Cadastral Book dated 1572, there were three dyehouses in Cyprus State, one of them was in Lefkoşa, the other one was in Magosa Fortress, and the last one was in the city center of Baf. The annual revenue of Lefkoşa Dyehouse was 1500; the revenue of the one in Magosa, which was also the dyehouse of the imperial dynasty, was 4500; and the revenue of the Baf dyehouse was 750 cash money. The dyehouses in Cyprus were run with the uphold system with contracts. It was determined that there were two businesses that dealt with soap production in Cyprus State in the study period. They were run with the uphold system.

Keywords: Cyprus**,** candy shops, tannery, dyehouse, mills.

64 NOLU MUFASSAL TAHRİR DEFTERİNE GÖRE KIBRIS EYALETİNDE KÜÇÜK İŞLETMELER

Özet: Fetihten sonra 9 Ekim 1571'de başlanan Kıbrıs Eyaleti'nin tahriri, 18 Ekim 1572'de tamamlanmıştır. Tahrir kayıtlarını ihtiva eden defter, Tapu Kadastro Genel Müdürlüğü Arşivindeki 64 nolu mufassal tahrir defteridir. Adı geçen deftere göre Kıbrıs Eyaleti'nde tespit edilen küçük işletmeler şekerhaneler, tuzlalar, değirmenler, debbağhaneler, boyahane ve sabunhanelerdir.

Kıbrıs'daki şekerhaneler, Baf nahiyesinde Tokyovoli, Limoson nahiyesinde Koloş ve Piskopi karyelerindedir. Şekerhanelerin mülkiyeti devlete ait olup önceleri eminler vasıtası ile 1593 tarihinden sonra ise iltizam usulü ile işletilmektedir. Bu şekerhanelerin senelik geliri 380 000 akçe olup, üretilen şekerin tamamına yakını İstanbul'a gönderilmektedir.

Kıbrıs'taki tuzlalar, Baf nahiyesinde üç ve Tuzla nahiyesinde bir olmak üzere dört adettir. Bunlar, senelik hasılı 1950 akçe olan Baf, bu nahiyeye bağlı ve geliri 500 akçe olan Lenbe karyesi ve 40 akçelik geliri olan Ayayorgi İsterpoti mezrasındadır. 100 000 akçelik geliri olan diğer tuzla ise Tuzla nahiyesindedir. Kıbrıs Eyaleti'nde üretilen tuz genellikle İstanbul'a gönderilirdi. İhtiyaç fazlası tuzlar ise başka ülkelere ihraç edilirdi.

Tahrir Defteri'ne göre Kıbrıs'ta, Lefkoşa (19), Mesarye (1), Karpas (6), Girne (8), Pendaye (44), Hırsofu (30), Baf (36), Evdim (15), Limason (37), Mazuto (9) ve Tuzla (1) da toplam 206 değirmen bulunmaktadır. Kıbrıs'daki değirmenlerden elde edilen yıllık gelir toplamı 116 255 akçedir.

Kıbrıs Eyaleti'nde Girne ve Tuzla hariç diğer nahiyelerin hepsinde debbağhane vardır. Bu nahiyelerden Lefkoşa, Magosa, Hırsofu, Evdim ve Mazuto'da birer, Mesarye ve Karpas'ta ikişer, Pendaye ve Baf'ta beşer ve Limoson'da yedi olmak üzere toplam 26 debbağhanenin olduğu tespit edilmiştir. Debbağhaneler, iltizama verilerek işletilmektedir.

1572 tarihli Mufassal Defterine göre Kıbrıs Eyaleti'nde, Lefkoşa ve Magosa Kalesi ile Baf şehir merkezinde olmak üzere üç boyahane vardır. Lefkoşa boyahanesinin yıllık geliri 1500 akçe, padişah hassı olan Magosa boyahanesinin 4500 akçe ve Baf boyahanesinin ise 750 akçedir. Kıbrıs'taki boyahaneler mukataa addedilerek iltizam usulü ile işletilirdi.

İncelenen dönmede Kıbrıs Eyaleti'nde sabun üretimi yapan, Lefkoşa, ve Magosa'da bulunan iki işletmenin olduğu tespit edilmiştir. Bu sabunhaneler iltizamla işletilmekte idi.

Anahtar Kelimeler: Kıbrıs, şekerhane, debbağhane, boyahane, değirmen

Giriş: Lefkoşa Kalesi'nin 9 Eylül 1570 tarihinde düşmesiyle birlikte Lefkoşa merkez sancak olmak üzere Girne ve Baf sancakları teşekkül edilerek Ada'da Osmanlı idarî teşkilâtı kurulmaya başlanmıştır.[1] Bunlara, 1 Ağustos 1571 tarihinde Magosa zapt edilip Kıbrıs adası tamamıyla Osmanlı topraklarına fiilen katıldıktan[2] sonra, idarî teşkilatlanma tamamlanmıştır.[3]

Kıbrıs'ın ada olması nedeniyle savunmanın güçlendirilmesi, kendi kendine yeter hale gelmesi ve Ada'nın savunmasında tımarlı sipahilerden istifade edebilmek[4] için Anadolu Beylerbeyliği'nden Alaiye,[5] Karaman Beylerbeyliği'nden İç-il,[6] Dulkadir Beylerbeyliği'nden Sis[7] ve Halep Beylerbeyliği'nden Tarsus[8] sancakları Kıbrıs'a dahil edilmiştir.[9] Yeni fethi tamamlanmış bir bölge olarak ve ada olmasının da rolü ile Kıbrıs, hem Anadolu'nun güney hem de Suriye sahilleriyle bütünleşmiş ilginç bir idari özelliğe sahip olmuştur. Böylece Kıbrıs Beylerbeyiliği diğer Beylerbeyilikleri arasında "ada merkezli" ilk üst idari birim olarak Osmanlı teşkilat tarihindeki yerini almıştır.[10]

Magosa Kalesi'nin düşmesinden yaklaşık iki ay sonra; 9 Ekim 1571'de Kıbrıs Beylerbeyine gönderilen emirde,[11] "... ve cezire-i Kıbrıs'ın tahririne Üsküdar Kadısı dâme fazluhu ta'yin edildi. Senin ve cezire-i mezbûre kadı ve defterdarı ma'rifeti ile tahrir eylemek fermânım olmuşdur. Cezire re'ayâsı tahrirde kendu kanunları üzere mi kabul ederler, 'Arab kanunu veya gayrı kanun üzere mi kabul ederler, bîl-cümle mâl-ı mîrîye ve re'âyâya evlâ olub münâsib görüldüğü üzere tahrir etdüresin ve harâc-ı şer'î takdiri dahi şer'-i şerîf üzere fermânım olmuşdur" denilerek Kıbrıs'ın tahririne başlanmıştır.

Defterin sonundaki "Bu bende-i Ahkar ve efkende-i kemter Mehmed-i defterî kulları ve vilayet-i Cezâirun tezkere emini Halil Bendeleri" kaydından tahririn Kıbrıs Defterdarı Mehmed Çelebi zamanında bitirildiği ve bunun adamlarından Tezkire Emini Halil'in 18 Ekim 1572'de yazım işini tamamladığı anlaşılmaktadır.[12] Bu tahrirde Ada'nın önceki hâkimleri Venediklilerden kalan kayıtlardan yararlanıldığı gibi yerli ahalinin verdiği bilgilerden de istifade edilmiştir.[13]

Sayım sonuçlarını ihtiva eden Kıbrıs'ın ilk tahrir defteri Tapu ve Kadastro Genel Müdürlüğü Kuyud-ı Kadime Arşivi'nde 64 numarada kayıtlıdır. Bu defter; "*mufassal*" ve16x45 cm ebatlarında olup yazısı divanidir. 441 varak olan defterin başlangıcında on iki nahiyenin gösterildiği "*fihrist-i nevahi*" yer almaktadır. Daha sonra "*suret-i emr-i şerif-i Sultanî*", "*Kanunname-i Cezire-i Kıbrıs*", II Selim'e ait tuğra ve dua vardır. Fihristte verilen nahiyelerin mahalle ve köyleri ile birlikte teferruatlı bir şekilde dökümü yapılmıştır. Defterin sonunda "evkâf-ı selâtin" kayd edilmiştir.

TD. 64 nolu deftere göre Kıbrıs Eyaleti'nde tespit edilen işletmeler üç şekerhane, 26 debbağhane, üç boyahane, iki sabunhane ve 206 değirmenden ibarettir. Bu işletmelerin işleyiş tarzları, sayıları ve eyalet hazinesine sağladığı gelirler aşağıda sırasıyla verilmeye çalışılacaktır.

Şekerhaneler

Kıbrıs Eyaleti arazisi şeker üretiminde kullanılan şeker kamışı yetiştirilmesi bakımından verimli topraklardır.[14] Nitekim Venedikliler zamanından itibaren, kurulan işletmelerde şeker üretimi yapılmakta idi.[15] Kıbrıs'taki şeker

tasfiyehâneleri Baf ve Limoson nahiyelerindedir. Baf'taki şeker tasfiyehânesi, Tokyovoli karyesindedir. Limoson 'daki şeker tasfiyehâneleri ise Koloş ve Piskopi karyelerindedir.[16] Adı geçen şeker tasfiyehanelerinde işlenecek olan şeker kamışı üretimi, bu işletmelere tahsis edilmiş mirî topraklarda yapılmakta idi. Bu topraklarda çalışacak olan insan gücü, mirî hizmetlerde haftada bir gün çalışmaya tahsis edilen "parikoz" taifesinden temin edilirdi.[17] Şekerhanelerde çalışmaya tayin edilen parikoz taifesinden çifti ile gelenler senede yirmi beş gün, çiftsiz gelenler ellişer gün çalışmak zorunda idiler. Zaman zaman bu uygulamada suistimaller yapılmıştır. Şekerhane görevlileri, işletmeye ait toprakları kendi tasarruflarına geçirip, parikoz taifesini kendi işlerinde istihdam ettiklerinde merkez tarafından sert bir dille ikaz edilmişlerdir. Kıbrıs'da şeker üretimi için Antalya ve Trablus'dan şeker fidanı getirtilirdi.[18]

Kıbrıs'a uğrayan seyyahlar, Osmanlıların şeker kamışı üretimi ve şeker istihsalinde büyük bilgi birikimine sahip olduklarını belirtirler.[19] Mesela Kıbrıs'ta Osmanlı döneminde üretilen şekerin kalitesi hakkında Pegolotti'ye[20] dayanarak bilgi veren H. Sahillioğlu; Kıbrıs şekerinin Kahire ve Şam şekerinden daha az kaliteli fakat daha beyaz olduğunu, istihsal edilen toz şekerin konik kalıplar içinde döküldüğünü, külahın tepesine doğru zanbur denilen tortu biriktiğini ve piyasaya sürüldüğünde zanbur kısmının koparıldığını, bu külah şekerlerinden on altı kalıbın bir sandık teşkil ettiğini açıklamaktadır.[21] Kıbrıs'ta üretilen şekerin Anadolu'ya pek satılmadığı söylenebilir. Çünkü adada Osmanlı idaresinin kurulmasının ilk yıllarına ait şekerhane hesaplarının incelenmesinden, buradan elde edilen şekerin tamamının İstanbul'a gönderildiği ve çoğunun da Saray'da tüketildiği anlaşılmaktadır.[22] Saray bu zamana kadar şeker ihtiyacını Mısır'dan ve Şam'dan tedarik ederdi. Şeker tasfiyehaneleri hesabına göre 1571-1575 yılları arasında İstanbul'a gönderilen toz şeker miktarı ve kıymeti aşağıda verilmiştir.[23]

Yıllar	Kantar	Kıymeti (akça)
1571-1573	382	658315
1574	241	381520
1575	261	424295
Toplam	884	1. 464. 130

Kıbrıs'ın ilk Mufassal Tahrir Defteri'nde iki nahiyeye bağlı olan üç köyde bulunan şekerhanelerin senelik hasılı 380. 000 akçe[24] olduğuna göre, yukarıda verilen ve İstanbul'a gönderilen şekerin, Kıbrıs'ta istihsal edilen şekerin tamamına yakın olduğu söylenebilir. Eldeki vesikalar yukarda beyan edilen görüşü teyit etmektedir. Kıbrıs'ta istihsal olunan şeker İstanbul'dan gelen talep üzerine Rodos bağlantılı veya doğrudan deniz yolu ile, bazen de Silifke Limanı üzerinden karayolu ile develerle gönderilirdi.[25] Silifke iskelesi üzerinden karayolu ile develerle[26] veya denizyolu ile gemilerle gönderildiğinde develerin ve gemilerin masrafı maliye tarafından ödenirdi. Gönderilen şekerin miktarı için Kıbrıs'tan hüccet ve temessük alınıp, dersaadette tasdik ettirilirdi.[27]

1580-1587 yılları arasında Kıbrıs'ta üretilen şekerin İstanbul'a gönderilmesinde aksamalar olduğu anlaşılmaktadır. Zira 25 Haziran 1583 tarihli Kıbrıs Beylerbeyi'ne ve Defterdarı'na gönderilen hükümde,[28] Kıbrıs'taki şekerhaneden Kilâr-ı Âmireye fazlasıyla şeker gönderilirken üç seneden beri gelmediği ve icabının yapılması için maliyeden gönderilen müfettiş ve emr-i şerife göre hareket edilmesi bildirilmektedir. 5 Şubat 1587 tarihli Kıbrıs Beylerbeyi'ne ve Defterdarı'na gönderilen bir başka hükümde ise, daha önceki Beylerbeyiler zamanında fetihten itibaren çok şeker gönderildiği belirtilerek ada idarecileri suçlanmaktadır. Ayrıca birkaç seneden beri şeker gönderilmediği, 1582 yılında 68 kantar, 1585'te ise hiç şeker gelmediği belirtilirken ve 1587 yılı için 500 kantar şeker istenmekteydi.[29] Aynı tarihli bir başka hükümde, adı geçen yıllar arasında Kıbrıs'tan İstanbul'a şeker gönderilmemesinin nedenlerini bulmak mümkündür. Buna göre, Kıbrıs'ta şeker kamışı ekilen yerlerin suyunun gelmemesinden dolayı işlenemediği ve şekerhanelerin harap olduğu bildirilmekte, suyunun temin edilerek, eskisi gibi fazlaca şeker gönderilmesi için Beylerbeyi ve Defterdar uyarılmaktadır.[30] Ayrıca Kıbrıs Eyaleti'nde Baf ve Limoson şekerhanelerinde üretilen şekerler çam ağacından yapılan sandıklar ile İstanbul'a gönderilirdi. Fakat şekerin koku alma ihtimaline karşı bu uygulamadan vazgeçilerek, Halep'ten getirtilecek tomruklardan yapılan kasalarla gönderilmesi istenmiştir.[31]

Fetihten sonra, gelirleri kimseye dirlik olarak verilmediği ve mirî arazi rejiminin tatbik edildiği Kıbrıs Eyaleti'nde Şekerhanelerin mülkiyeti devlete ait idi. Devlet Şekerhâne mukataaları gelirlerini tayin edilen "emir" ler vasıtası ile veya "iltizâm" usulü ile toplardı. Kıbrıs'taki Şekerhâneler 1576 yılına kadar emanet usulü ile idare edilmiştir. Aralık 1576 tarihli Kıbrıs Defterdarı'na, Lefkoşa ve Gülnar kadılarına gönderilen hükümde "... sen ki defterdarsın, mukataa sureti gönderüb mukataa-i sükkerhâne-i Limoson ve hasha-i karye-i piskopi ve koloş şimdiye degin bervech-i emanet virülüp ... " denilerek devamla senede altı bin filoriden fazla varidat görülmediği halde, Hüseyin nazır ve Yahudi Şaban emin olmak üzere 16. 000 filori ziyadeye verildiği belirtilerek, bu tarihe kadar idare edenlerin Kapıkulu veya Beylerbeyi adamı olmasına bakılmayarak farkın bunlardan tazmin edilmesi istenmiştir.[32]

Şekerhanelerin eminler tarafından idare edilmesi bir takım usulsüzlüklere sebebiyet vermiştir. Nitekim 1576 tarihli bir belgede sabık beylerbeyi olan Cafer Paşa'nın Frengistan'dan gelen kişilere üçer bin akçelerini aldıktan sonra bunlara defterdarın rızası olmamasına rağmen mukataalar verdiği ve Şekerhane mukataasını defterdar üç buçuk seneliğini 36. 000 filoriye sattığı halde, adı geçen beylerbeyinin kendi adamlarına senede 5000 filori üzerinden emanetle verdiği belirtilerek, Lefkoşa ve Gülnar kadıları tarafından beylerbeyi ve adamlarının bütün hesaplarının teftiş edilmesi istenmiştir.[33]

1593 tarihinden itibaren şekerhanelerin iltizam ile mültezimler tarafından idare edildiği anlaşılmaktadır. Bilindiği üzere mukataaların iltizama verilmesi, mukataanın bulunduğu kadılıkta iltizam işi müzayedeye konulur ve devlet hazinesine en yüksek parayı ödemeyi teklif ve taahhüt eden kişi mukataayı iltizama alırdı. Mart 1593 tarihli Piskopi ve Kukla kadılarına gönderilen tezkire emrinden anlaşıldığına göre, bundan önce Piskopi ve Koloş mukataasına senede 450 kantar pamuk ve iki kantar şeker vermek üzere mültezim olan Luyize, Silvestire ve İsak isimli zimmiler divana gelip adı geçen mukataaların iltizamı için üç senede 230 kantar fazla pamuk vermeyi, zengin ve güvenilir kefiller taahhüt etmeleri üzerine 260 kantar fazla vereceğini beyan etmiştir. Buna rağmen Piskopi ve Koloş mukataasının Silvestire ve İsak tarafından tasarrufları için tezkire verilmiştir.[34] Görüldüğü üzere mukataayı iltizama alanlar ödemeyi taahhüt ettikleri gibi zengin ve güvenilir kefiller göstermek mecburiyetinde idiler.[35] Ayrıca mukataayı iltizam eden mültezim, bir dahaki müzayede de tekrar talip olursa önceki hesabında devlete borcunun olmaması gerekirdi.[36]

Mültezimler iltizama aldıkları şekerhâne mukataası karşılığını devlete belirli miktarda pamuk veya şeker olarak öderdi. Yukarıda verilen belgede de görüldüğü gibi, 1598 yılında Piskopi ve Koloş şekerhaneleri "... Kıbrıs kantarı ile 1800 kantar çigitlü penbe ve İstanbul kantarı ile 1200 kantar şeker, eğer penbe ve şeker olmazsa penbenin her kantarına 1800 akçe ve şekerin kantarına 3000 akçeye ... " şeklinde altı yıllığına iltizama verilmiştir.[37] Peşin olarak pamuk ve şeker vermek şartıyla uygulanan iltizam usulü hakkında mültezimler ve Balyos İstanbul'a arzuhal sunup şikayette bulunmuşlardır. Temmuz 1598 tarihli bir sicil kaydında bu şikayetle ilgili olarak; her sene hasıl olan pamuğun beylerbeyiler ve defterdarlar tarafından cari olan fiyattan satmayıp tüccara vererek kendilerine fayda sağlamışlardır. Bundan dolayı reayanın çok zarara uğradığı ve Kıbrıs'tan Venedik'e firar ettiği bildirilerek bu uygulamadan vazgeçilmesini istemişlerdir.[38]

Temmuz 1593 sonlarına doğru Kıbrıs Beylerbeyi'ne ve Defterdarı'na gönderilen emr-i şerifle[39] "... husus-u mezbur sene isneyn ve elf Ramazan-ı mübarekenin gurresinden arz olundukda vech-i meşru' üzere amel olunmak emr idüb buyurdum ki, hükm-ü şerif vacib'ül ittibaım ile Kıbrıs Kethüdası Mustafa Kethüda oldukda bu babda sadır olan ferman-ı hümayunum mucibince amel idüb göresiz filvâki vech-i meşru' üzere olması malıma ve reayaya enfa' ise malıma ve reayaya enfa' ile amel idüb malıma zarar ve reayaya zulm ve hayf olmadan hazer idüb hak üzere amel idüb ve muhtac-ı arz olan mevaddi vukuu üzere yazub arz eyleyesiz müsellimi olan kapucılardan Ali Ağa ve müşarünileyh defterdar efendi hazretlerinin huzur-u şeriflerine ümena ve ammal ihzar olunub sual olunduk da cümlesi ... cümle mukataat penbe ile füruht olunmak mal-ı mirîye ve fukaraya ziyade zulumdur taaddiyeye her vecihle din ve dünyaya enfa'dır didiklerinde ... " denilerek mültezimlerin ve Kıbrıs'ta bulunan Balyosun yukarıda verilen şikayetleri haklı bulunarak şekerhanelerin ve diğer mukataatın pamuk veya şeker karşılığı iltizama verilmesi uygulamadan kaldırılmıştır.

Koloş, Tovyokoli ve Kukla şekerhânelerinin gelirlerini Kıbrıs Eyaleti Bütçelerinden de takip etmek mümkündür. Aşağıdaki tabloda 1605-1609 (1014-1018) yılları arasında adı geçen şekerhanelerin mukataa gelirleri verilmiştir.

Tablo 1. Şekerhanelerin mukataa gelirleri

Şekerhaneler	**1605**[40]	**1607**[41]	**1608**[42]	**1609**[43]
Sükkerhâne-i Karye-i Tovyokoli	408690	200000	927845	716847
Sükkerhâne-i Karye-i Koloş	120978	-	-	-
Sükkerhâne-i Karye-i Kukla	236335	22666	281481	272685

Tabloda yıllara göre verilen şekerhane gelirlerindeki farklılıklar bütçe dönem uzunluğu ile ilgilidir. Çünkü 1605 yılına ait bütçe altı aylık (Muharrem-Cemaziyelahir), 1607 yılına ait olan dört aylık (Receb-Şevval), 1608 yılı bütçesi tam yıl ve 1609 yılı bütçesi de (Receb-Şevval) dört Aylıktır. Ayrıca şekerhane gelirleri mültezimlerden taksitle alındığından[44] ilgili bütçelerin dönemlerinde alınmış veya alınmamış olabilir. Koloş şekerhanesinin 1607, 1608 ve 1609 yıllarında gelirinin görünmemesinin nedeni Kukla şekerhânesi gelirleri ile beraber verilmiş olmasından kaynaklanmaktadır.

Tuzlalar

Osmanlı Devleti'nde madenler, taş ocakları, bir kısım ormanlar, iskeleler, dalyanlar, çeltik sahaları ve boyahaneler, mumhaneler gibi bir kısım endüstriyel faaliyetler ve darphanelerde olduğu gibi en verimli tuzlaların mülkiyeti devlete ait idi. Devlet, tuz istihsaline müsait sahiller, göller ve yer altı tuz yataklarına el koymak suretiyle, kaynağından itibaren tuzu bir devlet malı haline getirmiş ve tuzlaların mülkiyetini üzerine geçirmiştir.[45]

Osmanlı Devleti iklim şartlarına ve toprağın jeolojik yapısına tâbi bulunan tuz istihsali bakımından zengin bir memleket olup, sahillerinde, bir kısım göllerinde ve yer altı tuz yataklarında tuz istihsal edilen yerleri şu şekilde sıralamak mümkündür: Akdeniz sahillerinde, Kıbrıs, Ayas, Beçin (Menteşe Livası), Patnos (Aydın Livası), İzmir, Menemen, Rodos, Çandarlı, Midilli, Kızılcatuzla, Enez, Gümülcine, Selânik, Ağriboz, Mora, İnebahtı'da, Adriyatik sahillerinde Avlonya ve Delvine'de, Karadeniz bölgesinde Ahyolu, Tekfurköyü'nde, Anadolu'da, Koçhisar Gölü'nde, Hacıbektaş ve Divriği'de, Rumeli'de İzvornik'de, tabî devletlerden Boğdan, Eflâk ve Raguza'da tuz istihsal edilmekte idi.[46]

1572 tarihli Mufassal Tahrir Defterine göre Kıbrıs Eyaleti'ndeki tuzlalar, Baf nahiyesinde üç ve Tuzla nahiyesinde bir olmak üzere dört adettir. Bunlar, senelik hasılı 1950 akçe olan nefs-i Baf,[47] Baf nahiyesine bağlı olan ve geliri 500 akçe olan Karye-i Lenbe[48] ve 40 akçelik hasılı olan mezra-i Ayayorgi İsterpoti[49] ile 100. 000 akçelik geliri olan Nahiye-i Tuzla memlehalarıdır.[50] Görüldüğü üzere Kıbrıs Eyaleti'nde üretimi yapılan tuzun, senelik gelir itibariyle çoğunluğunu Tuzla memlehanesi karşılamaktadır. 1571-1572 yılı eyalet bütçesine göre ise Tuzla memlehasından elde edilen mukataa geliri 72. 553 akçedir.[51] Venedikliler zamanında ise Tuzla gelirleri ve "mete du sel" denilen tuz vergisinden[52] 300. 000 duka, yani 18. 300. 000 akçelik gelir sağlanmakta idi. Venedik dönemindeki tuz gelirinin bu kadar fazla olmasının sebebi, tuzla gelirlerinin yanında, Parikoz denilen köle sınıfındaki işçilerin angarya olarak, yani ücretsiz ve zorla tuz çıkarma ve depolarına taşıma işlerinde çalıştırılmaları ve kendileri ile çocukları için tuz hakkı diye beşer akçe vermelerinden kaynaklanmaktadır. Osmanlı Devleti Kıbrıs'ta Türk yönetimini tesis ettikten sonra Venedikliler zamanında haftada iki gün beylerine hizmet etmekle yükümlü olan Parikoz taifesi, haftada bir gün mîri sükkerhanelerde çalıştırıldıkları gibi tuz vergisini de kaldırmıştır.[53]

Osmanlı döneminde, devlet tekelinde olan tuz çıkarma, depolama ve satışı "emin" veya "mültezim" denilen görevliler tarafından yürütülürdü.[54] Osmanlı Devleti'nde tuzlalar, maden ocakları, çeltik tarlaları gibi, üretim faaliyetlerinin yürütülmesi gereken sahalarda bir kısım kimseler bu hizmete tayin olmuşlardır. Tuzlalardaki üretim faaliyetlerini yürütmekle görevlendirilen kimselere "tuzcu" denilmekteydi. Tuzcuların, deniz suyunun tuz üretim bölgelerine akıtan kanallara bakmak, buharlaşma havuzlarından tuz elde etmek, bu tuzu ambarlara taşımak ve gerektiğinde tuzlanın aslî ve talî tesisatını temin etmek gibi vazifeleri vardı.[55] Kıbrıs Eyaleti'ndeki tuzlalarda, tuz üretiminde çalışmak üzere Osmanlı öncesi parikoz denilen gayrimüslim reayadan bazıları vilayet muharriri tarafından yazılarak görevlendirilmişlerdir. Fakat daha sonraları bazı emin ve mültezimler fazla tuz çıkarmak için tuzlalarda çalıştırmak üzere yazılanların haricinde bazı reayayı da görevlendirmişlerdir.[56] Bu durum reaya tarafından merkez nezdinde şikayetlere konu olmuştur. Mesela, Ayademne karyesi reayası tuzla hizmeti ve sair vergilerden muaf oldukları ve bu hususta ellerinde Kıbrıs Beylerbeyi tarafından verilen mektup olduğu halde tuzlalarda görevlendirildiklerini merkeze bildirerek muaf tutulmalarını istemişlerdir. Bunun üzerine 1589 tarihli Lefkoşa Kadısına gönderilen hükümle bu kanunsuz uygulamanın önlenmesi emredilmiştir.[57]

Tuzlalarda hizmet veren karyeler ahalisi de birer yolla emir ve Beylerbeyinden tezkire alıp mîrî hizmetten muaf olmak istemişlerdir. 1594 tarihli Kıbrıs Beylerbeyine, Defterdarına ve Lefkoşa kadısına gönderilen emirle,[58] bu durumun önlenmesi için fetihten bu yana mîrî memleha hizmetine tayin olunan karyeler ahalisinin ellerinde bulunan emir ve tezkirelerine bakılmayarak mîrî tuz ihracında çalıştırılmaları gerektiği bildirilmiştir.

Kıbrıs Eyaleti'nde mîrî tuz üretiminde görevlendirilen karye ve şahısların isimleri mevcut değildir. Tuz üretim zamanının gelmesi üzerine bu işle görevli bir şahıs merkezden gönderilirdi. Ayrıca ilgili bölgelerin kadılarına gönderilerek, tuz üretiminde görevli şahısların ve taşımacılıkta kullanılan merkeplerin tuzlalara gönderilmesi, bu işler yapılırken usulsüzlük yapılmaması, yapıldığı takdirde veya tuz ihracındaki gecikmeden doğacak zararın kendilerinden tazmin edileceği bildirilirdi.[59] Bu bölgedeki ve Kıbrıs'taki ticari faaliyete katılma girişimleri "Levant Kumpanyası" ile sınırlı kalmayıp, kişisel faaliyetlerle de devam etmekte idi. İngiliz tüccarlardan biri olan Mr. Pervis, 1603 yılında Türk yönetiminden Larnaka'daki Tuz gölünü işletme izni almış ve çıkardığı tuzu Venedik'e ihraç etmişti.[60]

Kıbrıs Eyaleti'nde üretilen tuz genellikle İstanbul'a gönderilirdi.[61] İhtiyaç fazlası tuzlar ise başka ülkelere ihraç edilirdi. Nitekim, 7 Ocak 1577 tarihli Kıbrıs Beylerbeyi'ne gönderilen bir hükümle, tuz almak için Kıbrıs'a gelecek olan Dubrovnik gemilerine ücreti karşılığında istedikleri miktarda tuz vermeleri istenmiştir.[62] Yalnız bu dönemde Kıbrıs tuzlalarından ne miktar tuz üretildiği hakkında bilgi bulunmamaktadır. Ama 1634 tarihi

itibariyle tuz fiyatı konusunda bilgi mevcuttur. Bu tarihe ait bir sicil kaydında, Kıbrıs'da Beytü'l-mal-ı amme ve hassa nazırı olan Perviz Bey, ölen beylerbeyi Ahmed'in adamlarından olan Tuzla didebanı Mahmud Bey'in şikayetinden tuz fiyatı hakkında bilgi edinebilmekteyiz.[63] Buradaki kayıtta yer alan bir yük araba ortalama 300 okka[64] farz edilirse tuzun 300 okkasının bir "*riyal guruş*" itibar edildiği sonucuna varabiliriz. 300 okkanın, bir okka 1282 gram[65] hesabı ile 384. 6 kilograma tekabül ettiğini, bir riyal guruşun da 100 akça[66] kabul edildiğini dikkate alırsak, bir kilogram tuzun 3. 846 akçeye geldiğini söyleyebiliriz.

Değirmenler

Kır iskân merkezlerindeki işletmelerin en mühimini değirmenler teşkil etmektedir. Umumiyetle tahılın öğütülerek un haline getirildiği değirmenler, tahrir defterlerinde çalışma şekillerine ve faaliyet çeşitlerine göre belirtilmektedir.[67] Değirmenlerin işletilmesi devlet için bir gelir kaynağı teşkil etmekteydi. Devlet değirmenin işleme süresine göre resm-i asiyab ismi verilen bir vergi alırdı. Osmanlı Devleti'nde "değirmen resmi", "asiyab resmi" adları altında su ile veya yel ile dönen un değirmenleri ile zeytinyağı değirmenlerinden muhtelif yerlerde ve muhtelif zamanlarda, farklı miktarlarda alınan vergiler kastedilmiştir.[68]

Kıbrıs Eyaleti'nde, Magosa hariç, bütün nahiyelerde mevcut olan değirmenler, 1572 tarihli Mufassal Tahrir Defteri'ne göre, "resmi asiyab", "asiyab-ı seyl", "asiyab-ı mevkuf", asiyab-ı hassa" ve şahıs değirmenleri (asiyab-ı Meluço veled-i Yakamo) olarak verilmiştir. Adı geçen deftere göre, Kıbrıs'ta, Lefkoşa'da 19, Mesarye'de 1, Karpas'da 6, Girne'de 8, Pendaye'de 44, Hırsofu'da 30, Baf'ta 36, Evdim'de 15, Limason'da 37, Mazoto'da 9 ve Tuzla'da bir olmak üzere toplam 206 değirmen bulunmaktadır. Değirmen sayısı itibariyle Pendaye, Hırsofu, Baf ve Limason nahiyelerinin ön plana çıkması, şüphesiz bu nahiyelerin Kıbrıs buğday üretiminin % 52'sine sahip olmalarından ileri gelmektedir.[69]

Osmanlı Devleti'nde genel olarak değirmen resminin, bütün yıl çalışandan 60, altı ay çalışandan 30, üç ay çalışandan ve su gelince yürüyen sel değirmenlerinden 15 akça[70] alınmasına rağmen, yukarıda da belirtildiği üzere muhtelif yerlerde ve muhtelif zamanlarda değişik miktarlarda alınmıştır. Kıbrıs Eyaleti'nde, tabloda da görüldüğü üzere asiyab resmi, değirmende dönen taş sayısına ve çalıştığı zamana göre alınmaktadır. 1572 tarihli kanunnamede bu konuda herhangi bir açıklama olmamasına rağmen, tablodaki bilgilere göre su ve sel suları ile çalışan ve şahıs değirmenlerinden taş başına, altı ay çalışanlardan 60 akça, tam yıl çalışanlardan 120 akça, vakıf değirmenlerden ise taş başına 150-200 akça alındığı söylenebilir. Burada dikkati çeken bir husus hassa değirmenlerden alınan verginin çok yüksek oluşudur. Bu değirmenlerde dönen taş sayısı başına 100 akça ile 100 arasında değişen vergiler alınmıştır. Mesela Lefkoşa nahiyesi Pano Hrişide ve Kato Hrişide karyelerinde olup 1580 yılında Sultan Selim Han'ın Magosa'daki camiine vakf olunan[71] değirmen 33 taşlı olup yıllık vergisi 30. 000 akçadır. Bu durum, hassa değirmenlerden resm-i asiyab değil, belki de işletilmelerinde ortakçılık usulü uygulanıldığı şeklinde açıklanabilir.[72]

Kıbrıs'daki değirmenlerden devletin elde ettiği vergi gelirleri ise; Lefkoşa'daki değirmenlerden 38. 100 akça, Mesarye'dekilerden 360 akça, Karpas'dakilerden 6. 800 akça, Girne'dekilerden 10. 030 akça, Pendaye'dekilerden 21. 630 akça, Hırsoho'dakilerden 7. 210 akça, Baf'takilerden 15. 200 akça, Evdim'dekilerden 2. 700 akça, Limosa'dakilerden 13. 095 akça, Mazoto'dakilerden 1. 100 akça ve Tuzla'dakilerden 30 akça olmak üzere toplam 116. 255 akçadır. Kıbrıs Eyaleti'nin yukarıda verilmeye çalışılan değirmen gelirleri bununla sınırlı değildir. Kıbrıs'da değişik nahiyelerde bulunan yirmi manastırdaki değirmenlerden de belirli oranlarda vergi alınmaktadır. Bu manastırlardaki değirmen gelirleri "an hububat ve adet-i ağnam ve resm-i asiyab ve resm-i kevvare ve resm-i meyve ve sair mahsulat" şeklinde diğer vergi çeşitleri ile birlikte verildiğinden miktarları hakkında bilgi sahibi olmak mümkün değildir.[73]

Kıbrıs Eyaleti'ndeki değirmenler işletilme şekillerine ve faaliyet çeşitlerine göre, aşağıdaki icmal tabloda verilmiştir.

Tablo 2. Kıbrıs eyaleti'nde işletilme şekillerine ve faaliyet çeşitlerine göre değirmenler

Nahiyeler	**Asiyab**	**Hassa**	**Mevkuf**	**Seyl**	**Şahıs**	**ab**	
Lefkoşa	4	6	3	6	-	-	19
Mesarye	-	-	-	1	-	-	1
Karpas	1	2	-	-	2	1	6
Girne	2	2	3	1	-	-	8
Pendaye	11	22	1	5	5	-	44
Hırsofu	4	5	-	5	16	-	30
Baf	16	10	1	9	-	-	36
Evdim	4	2	-	3	6	-	15
Limason	15	9	1	8	4	-	37

Mazuto	1	2	-	5	1	-	9
Tuzla	-	-	-	-	1	-	1
TOPLAM	58	60	9	43	35	1	206

Tabloda görüldüğü üzere Kıbrıs Eyaleti'ndeki 206 değirmenin 58'i resm-i asiyab olarak kaydedilmiş olup, 60'ı hassa, 9'u vakıf, 43'ü sel ve 35'i de raiyyet değirmenleridir.

Debbağhâneler

Debbağhâne (Tabakhâne), koyun, keçi ve sığır derilerinin işlenip (tabaklanıp), ayakkabı, giyim eşyası, hayvan koşumları vs. yapımına elverişli hale getirildiği ve renklendirildiği atölyelerdir. Klasik devirler sanayisinin en mühim unsurlarından olan debbağhâneler, ülke sathına yayılmıştır.[74] Derinin tabaklanıp kullanılması Türkçenin deri eşya ve tabaklama ile ilgili kelimeler bakımından zengin bir dil oluşunun da gösterdiği gibi Türk'lerde de çok eskiye dayanır. Bugün dahi derinin Yörüklerin hayatında önemli bir yeri vardır. Özellikle kışın giyilen çarık ve gocuklarda,, dağarcık olarak bilinen bazı eşyanın konulmasında, peynir, tereyağı, bal ve pekmez tulumlarının yapılmasında, su taşınmasında ve yağ elde edilmesinde kullanılmaktadır.[75]

Debbağhâneler şehir ve kasabaların dışında, deniz kıyısı veya akarsuların yerleşim alanından çıktığı kesimlerde inşa edilirdi. Debbağhânede işlene deri miktarı, yani iş hacmi, o çevredeki hayvancılık konusunda da bir fikir verebilir.[76] Kıbrıs Eyaleti'nde, 1572 tarihli Mufassal Tahrir Defteri'ne göre mevcut on iki nahiyeden on'unda yirmi altı debbağhâne vardı. Bu debbağhânelerin bulundukları nahiye ve köyler ile yıllık gelirleri aşağıda tabloda verilmiştir.

Tablo 3. Debbâğhaneler

Nahiye	Karye	Fi Sene	Bab	Resm	Açıklamalar
Lefkoşa	Termisa	50	2	100	
Magosa				500	Hass-ı Şahi
Mesarye	Senkiras	30	4	120	
	Terminoşa	50	5	250	
Karpas	Milya	50	3	150	
	Elisni			120	
Pendaye	Module			500	
	Terzalis			300	
	Pilatanistase			50	
	Dirima Potami			90	
	Balyahori			75	
Hırsofu	Kiritodre	150	2	300	
Baf	Ahitime			150	
	Dale			100	
				360	Hassa
		240	4	960	Reaya
	Ayarilbo			40	
Evdim	Arço			300	
Limason	Kolos			200	
	Piskopi			100	
	Logare			75	
	Argi			150	
	Gilan			1000	Mahsul-ı debbağhane ve meyhane ve kasabhane
	Belindiriye			100	
	Siliku			150	
Mazuto	Pano Lefkara			150	

Kıbrıs Eyaleti'nde Girne ve Tuzla hariç diğer nahiyelerin hepsinde debbağhâne vardır. Bu nahiyelerden Lefkoşa, Magosa, Hırsofu, Evdim ve Mazuto'da birer, Mesarye ve Karpas'ta ikişer, Pendaye ve Baf'ta beşer ve Limosa'da yedi olmak üzere toplam 26 debbağhânenin olduğu görülmektedir. Bunlardan Magosa Kalesi'nde olanı şehir gelirleri içerisinde verilmiş olup padişah haslarına tahsis edilmiştir.[77] Padişah hassına ait olan diğer bir debbağhâne de Baf nahiyesinde Listefani karyesindedir.[78] Altı debbağhâne bab ve bab başına alınan vergi ile yıllık toplam hasıl verilerek[79], diğerleri de yıllık toplam vergi miktarları ile kaydedilmiştir. Baf nahiyesi Listefani karyesindeki bir debbağhâne de reayaya aittir.[80] 1572 tarihi itibariyle debbağhâne gelirleri 4670 akçedir. Bu

meblağa Gilan karyesindeki debbağhânenin geliri dahil değildir. Çünkü adı geçen yerde debbağhâne geliri meyhane ve kasaphane gelirleri ile birlikte 1000 akçe olarak verilmiştir.[81]

Kıbrıs'ta bulunan debbağhânelerin iş hacmi konusunda herhangi bir tahminde bulunamıyoruz. Çünkü debbağhâne geliri konusunda 1572 tarihli kanunnamede bilgi mevcut değildir. Debbağhânelerin bu kadar çok olması ve Kıbrıs'ın ikisi hariç bütün nahiyelerine dağılması hiç şüphesiz Ada'nın her bölgesinde hayvancılığın yaygın olması ile açıklanabilir.

Debbağhâneler iltizama verilerek işletilmektedir. Şubat 1607 (Zilkâde 1016) tarihli sicil kaydına göre nefs-i Lefkoşa'de ve Apsimolo ve Termisa karyelerinde olan debbağhâneler Elhac Piyale ve Yasine 35. 000 akçeye iltizama verilmiştir.[82] Debbağhâne gelirleri hakkında Kıbrıs Eyaleti bütçe kayıtlarında da bilgi bulmak mümkündür. Bütçe bilgilerine göre debbağhâne mukataasından 1605 yılında 72. 666 akçe[83], 1607 yılında 49. 386 akçe[84], 1608 yılında 65. 197 akçe[85], 1609 yılında 44. 812 akçelik[86] gelir elde edilmiştir.

Boyahaneler

Boyahaneler, XVI. yüzyılda en önemli sanayi kolu olan dokuma sanayinde kullanılan ipliklerin renklendirilmesi ve kumaşların boyanması için faaliyet göstermektedirler.[87] 1572 tarihli Mufassal Deftere göre Kıbrıs Eyaleti'nde, Lefkoşa Kalesi'nde[88] Magosa Kalesi'nde[89] ve Baf şehir merkezinde[90] olmak üzere üç boyahane vardır. Lefkoşa boyahanesinin yıllık geliri 1500 akçe, padişah hassı olan Magosa boyahanesinin 4500 akçe ve Baf boyahanesinin ise 750 akçedir. Kıbrıs'ta yapılan ilk tahrir öncesi Girne'de bir boyahane bulunmakta idi. Fakat fetih sonrası bu boyahane Lefkoşa boyahanesine dahil edilerek birlikte iltizama verilmiştir.[91]

Kıbrıs'taki boyahaneler mukataa addedilerek iltizam usulü ile işletilirdi. Lefkoşa boyahane mukataası ihtisap mukataasına dahil idi. Mayıs 1607 tarihli bir sicil kaydında, ihtisap mukataasına tabi olan Lefkoşa boyahane mukataası 28 Mayıs 1607'de bir seneliğine Mehmed Beşe'ye iltizam şartları gereği 28. 000 akçeye iltizama verilmiş olup bunun 7. 000 akçesi peşin alındığı görülmektedir.[92]

Lefkoşa boyahanesinin mevacibi 18 filori olup, iltizam şartları dahilinde Hasan ve Fetullah'a, Ekim 1607 tarihinde iltizama verilmiştir.[93] Boyahanenin Lefkoşa boyahanesine ilhak edilmiş olmasından dolayı bu yanlışlık düzeltilerek, burası da yukarıda bahsedilen Mehmed Beşe'ye iltizama verilmiştir.[94]

Sabunhaneler

İncelenen dönmede Kıbrıs Eyaleti'nde sabun üretimi yapan, Lefkoşa ve Magosa'da bulunan iki işletmenin olduğu tespit edilmiştir. Bu sabunhaneler iltizamla işletilmekte idi. Haziran 1594 tarihli bir sicil kaydına göre, sabunhaneler için gerekli olan hammaddenin, Kıbrıs'ta üretilen zeytin yağını kullanması ve Anadolu'dan da gelmemesi nedeniyle, zeytinyağı kıtlığı ve fiyatlarda yükselme baş göstermiştir. Ayrıca buralarda üretilen sabunların kötü kokulu olması ve gayrimüslimlerin başka kimsenin kullanmaması nedeniyle Lefkoşa esnafları ve pazarbaşı divana gelip şikayet etmişlerdir.

Lefkoşa ve Magosa'da bulunan sabunhanelere kontrole tayin olunan Yeniçeri Ağası Lütfullah marifetiyle, bu işletmelerin mühürlenerek, sahiplerine bir daha sabun işletmeleri yasaklanacak ve mevcut zeytinyağların narh-ı cari üzere satılması sağlanacaktır.[95]

Sonuç

Fetihten sonra 9 Ekim 1571'de başlanan Kıbrıs Eyaleti'nin tahriri, 18 Ekim 1572'de tamamlanmıştır. Tahrir kayıtlarını ihtiva eden defter, Tapu Kadastro Genel Müdürlüğü Arşivindeki 64 nolu mufassal tahrir defteridir. TD. 64 nolu deftere göre Kıbrıs Eyaleti'nde tespit edilen işletmeler üç şekerhane, 26 debbağhane, üç boyahane, iki sabunhane ve 206 değirmenden ibarettir. Kıbrıs'ta Venediklilerden intikal eden bu işletmeler Osmanlı hakimiyeti döneminde faaliyetlerine devam ettirilmiştir. Bunu Kıbrıs bütçe defterlerinden ve diğer arşiv belgelerinden takip etmek mümkündür.

Kıbrıs'daki şekerhaneler, Baf nahiyesinde Tokyovoli, Limoson nahiyesinde Koloş ve Piskopi karyelerindedir. Venediklilerden devralınan şeker mirasının XIX. yüzyılın ilk yarısına kadar, Osmanlılarca düzensiz de olsa korunduğunu belgeleriyle ortaya koymaktadır. Katip Çelebi eserinde, XVII. yüzyıl ortalarında Kıbrıs şekerinden hala söz etmektedir. Öyle anlaşılıyor ki bu gelenek XIX. yüzyılın ilk yarısına kadar adada devam etmiştir.[96]

Kıbrıs'taki tuzlalar, Baf nahiyesinde üç ve Tuzla nahiyesinde bir olmak üzere dört adettir. Bunlar, senelik hasılı 1950 akçe olan Baf, bu nahiyeye bağlı ve geliri 500 akçe olan Lenbe karyesi ve 40 akçelik geliri olan Ayayorgi İsterpoti mezrasındadır. 100 000 akçelik geliri olan diğer tuzla ise Tuzla nahiyesindedir. Kıbrıs'taki tuzlalarda üretilen tuz gelir getiren ekonomik bir kaynak olarak kalmaya devam etmiştir. Tuzun çıkarılması, satılması ve taşınmasında Osmanlı yöneticilerinin gayri-kanuni davranışları olduğu kolaylıkla belgelenmektedir. Fetihten sonra imparatorluğun başka yerlerinde bol miktarda tuz çıkarıldığı için Kıbrıs tuzu, uluslararası ticari bir emtia olmaktan çıkmıştır.[97]

Kıbrıs'ta Magosa hariç, bütün nahiyelerde olmak üzere 206 değirmen bulunmaktadır. Kır iskân merkezlerindeki işletmelerin en mühimini oluşturan değirmenlerin Kıbrıs'ta bu kadar fazla olması tahıl üretimi ile doğru orantılıdır. Kıbrıs Eyaleti'nde, 1572 tarihli Mufassal Tahrir Defteri'ne göre mevcut on iki nahiyeden on'unda yirmi altı debbağhânenin olması da hayvancılığın yaygın olması ile açıklanabilir. Ayrıca dokuma sanayinin önemli yan kolu olan boyacılıkla ilgili Lefkoşa ve Magosa Kalesi ile Baf şehir merkezinde olmak üzere üç boyahane tespit edilmiştir.

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[3] BOA. MD. 16, s. 18, Hüküm 33; BOA. MD. 27, s. 386, Hüküm 924 ve BOA. MD. 43, s. 158, Hüküm 285
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[6] BOA. MAD. 563, s. 129; BOA. MD. 12, s. 447, hüküm 865; Şenol Çelik, **Osmanlı Taşra Teşkilatında İçel Sancağı (1500-1584)**, (Basılmamış Doktora Tezi), İstanbul 1994.
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[9] BOA. MD. 16, s. 64, hüküm 133
[10] Feridun M. Emecen, "Kıbrıs'ta İlk Osmanlı İdari Yapılanması", **Dünden Bugüne Kıbrıs Meselesi**, (Yayına Hazırlayanlar: Ali Ahmetbeyoğlu-Erhan Afyoncu), İstanbul 2001, s. 56
[11] Bkz. BOA. MD. 16, s. 18, hüküm 33
[12] Bkz. TK. KKA. TD. 64; Ayrıca bkz. H. Sahillioğlu, a.g.m., s. 6
[13] Bkz. George Hill, **A History Of Cyprus IV, The Ottoman Provence The British Colony 1571-1948**, (nşr. H. Luke), Cambridge 1940-1952, s. 27; TK. KKA. TD. 64, Vrk. 2A
[14] Osmanlı Devleti fetihten sonra Kıbrıs'a Türk nüfusunu iskan etmek üzere çıkardığı sürgün hükmünde, Anadolu insanını özendirmek için ada topraklarının verimliliğinden ve özellikle şeker kamışı üretiminin bol miktarda yapıldığından bahsetmektedir. Bkz. BOA. MD. 19, s. 334-335
[15] XIV. yüzyılın ikinci yarısından itibaren Cenevizliler ve özellikle Venedikliler döneminde Kıbrıs'da Psikopi, Koloş ve Kukla gibi yerlerde şeker üretimi yapılmakta idi. Şeker kamışı ekiminde kölelerin kullanılması, sulama ve işletme tekniklerinin birleşmesi ile daha iyi üretim ve ucuz şeker elde edilmekteydi. Bkz. Ronald Jennings, **Chiristians and Muslims in Ottoman Cyprus and the Mediterranean World 1571-1640**, New York University Press 1993, s. 240
[16] TK. KKA. TD. 64, fihristi
[17] 1572 tarihli Kanunnamede "... Küffâr-ı hâkisâr zamanında ... cezire-i mezbûrede parikoz demekle ma'ruf taife beğlerine her haftada iki gün beglerine ve sipahilerine hizmet ede-gelüb ..." denilerek Venedikliler zamanındaki uygulama hakkında bilgi verilmiş olup, devamla "... Cezire-i mezbûre re'ayası hakkında mezîd-i inayetim mukârin olmağın zikr olunan parikoz taifesi her haftada bir gün mirî sükkerhânelere ve ekinliklere ve ekinliklere ve sair lâzım haftada gelen hidemât-ı hümâyûnuma hizmet" edileceği belirtilerek Osmanlı hakimiyetinde bu uygulamanın haftada bir güne indirildiği izah edilmektedir. Bkz. TK. KKA. TD. 64, Vrk. 5; Ayrıca bkz. M. Akif Erdoğru,"Osmanlı Döneminde Kıbrıs Şekerhaneleri", **Kıbrıs'ta Osmanlılar**, Lefkoşa 2008, s. 270
[18] Bkz. KŞS. Defter I, s. 124
[19] R. Jennings, a.g.e., s. 321
[20] F. B. Pegolotti, **La pratica della Mercatura**, (nşr. Allan Evans), Massachusetts 1936, s. 362
[21] H. Sahillioğlu, a.g.m., s. 11
[22] S. Faroghı**, Osmanlı'da Kentler ve Kentliler, Kent Mekânında Ticaret ve Gıda Üretimi 1550-1650**, (nşr. N. Kalaycıoğlu), İstanbul 1994, s. 108
[23] H. Sahillioğlu, a.g.m., s. 12

[24] 1572 tarihli Mufassal Tahrir Defteri'ne göre Baf nahiyesi Tovyokoli karyesindeki şekerhaneden 85. 000 akçe, Limasol'daki Kolos şekerhanesinden 109. 600 akçe ve Psikopi şekerhanesinden 185. 400 akçe gelir kaydedilmiştir. Bkz. TK. KKA. TD. 64, Vrk. 6-15

[25] 31 Temmuz 1577 tarihli Kıbrıs Beylerbeyi'ne gönderilen hükümde: "Südde-i saadetime gönderilecek şekeri Kıbrıs'ta olan gemilere tahmil edüb Rodos'a gönderilmek emr edüb buyurdumki, vardukda anda ne mikdar şeker varsa sanduklara koyup dahi emrim üzere gemiler üzere Rodos'a gönderüb beyine teslim eyleyesin" denilerek şeker talep edilmiş [Bkz. BOA. MD. 31, s. 117, Hüküm 281] ve aynı tarihli Rodos Beyi'ne gönderilen emirle de gelecek şekerin İstanbul'a getirilmesi istenmiştir. [Bkz. BOA. MD. 31, s. 117, Hüküm 282. Ayrıca bkz. BOA. MD. 23, s. 307, Hüküm 673; BOA. MD. 24, s. 90, Hüküm 243] 10 Temmuz 1574 tarihli Kıbrıs Beylerbeyi'ne ve Defterdarı'na gönderilen hükümde "cezire-i mezbûrede bilfiil mevcut olan sükker muaccelen dergah-ı muallâma gönderilmek emredüb buyurdum ki vusul buldukda emrim mucebince eğer anda bu canibden varan kadırgalar ve mirî gemiler var ise tahmil eyletüb gönderesin ..." denilmektedir. Bkz. BOA. MD. 26, s. 76, Hüküm 194

[26] BOA. MD. 26, s. 163, Hüküm 432 (28 Rebiül-ahir 982)

[27] KŞS. Defter I, s. 103 (Şaban 1002)

[28] Gönderilen hükümde "... cezire-i Kıbrıs'ta olan sükkerhâneden kilar-ı âmireye küllî şeker gelirken üç seneden berü gelmeyüb aslı ve hakkı ile görülüb tedarik olunmak için maliye tarafından müfettiş ve emr-i şerifim gönderilmiştir. Ol emir mucebince amel olınmak emr idüb buyurdum ki, vusûbuldukda bu babda her birinüz bizzat mukayyed olub maliye tarafından emr mucebince ol vecihle dikkat ve ihtimam idüb ..." denilmektedir. Bkz. BOA. MD. 53, s. 96, Hüküm 264

[29] BOA. MD. 62, s. 215, Hüküm 484

[30] BOA. MD. 62, s. 217, Hüküm 487

[31] Bkz. BOA. MD. 31, s. 99, Hüküm 240; 5 Temmuz 1577 (15 Cemaziyelevvel 985) tarihinde Halep Beylerbeyi'ne ve Defterdarı'na gönderilen hükümle 200 pajlık tomruğun Kıbrıs'a gönderilmesi emredilmiştir. Bkz. BOA. MD. 31, s. 99, Hüküm 241

[32] BOA. MD. 29, s. 57, Hüküm, 135

[33] Bkz. BOA. MD. 29, s. 47, Hüküm 110

[34] Tezkire emrinde: "bundan akdem Piskopi ve Koloş ve tevabii mukataasına bervech-i iltizâm mül-tezim olan Luyize her senede 450 kantar penbe ve iki kantar şeker vermek üzere mültezim olup ve haliya Silvestire ve İsak nam zımmiler divana gelüb ayttılar ki, zikrolunan mukataaların iltizamı muayyenesinden üç senede 230 kantar penbe ziyade iderüz ve yarar ve maldar kefiller dahi virirüz dimekle ellerinden kefiller alınmak için tezkire virülüp badehu emin-i sabık Luyize nam zımmi dahi divana gelüb dedi ki: mukataa-i mezbure ben dahi anlarun eyledükleri 230 kantar penbelerinden otuz kantar penbe dahi ziyade iderim. Cümle ziyadelerimiz ikiyüz altmış kantar penbe olur. Zikrolunan ziyadeler ile piskopi ve Koloş ve Kukla mukataalarının Silvestire ve İsak ve dahi müşterekler olup . . . bervech-i meşrû üzere deruhde olunub tasarrufları içün tezkire verildi" denilerek iltizama veriliş şekli detaylı bir şekilde açıklanmaktadır. Bkz. KŞS. Defter I, s. 97

[35] 1590 tarihli bir sicil kaydında bu konu ile ilgili olarak "... yarar ve maldar kefilleri alındıktan sonra tasarruf ettirile deyu emr edüb buyurdum ki, bu babda sadır olan ferman-ı kadim mucebince amel eyleyüb bunların yarar kefillerin alub mahalline kayd ettirdiklerinden sonra vech-i meşru ve şartı merkum üzere mukataa-i bunlara zabt ve tasarruf ettirüb ..." şeklinde bilgi verilmektedir. Bkz. KŞS. Defter I, s. 124

[36] "... sabıka olan mültezimlerden biri ziyade ile mukataaya talib olursa bi-has biş,şer vel kanun zimmetlerinde olan mal-ı mirîyi bittamam eda etmeyince mukataa virilmeye ...". Bkz. KŞS. Defter I, s. 123

[37] Bkz. KŞS. Defter I, s. 123

[38] Belgede: "... Haliya her sene hasıl olan penbeyi beylerbeyiler ve defterdarlar narh-ı cari üzere beyi itmeyüb kendülerine nef'i içün tüccara tevzi edüb akçelerin narhdan ziyâde zem edüb fukara ve zuafa nice yıldan berü beymal olub Venedik'e firar etmişlerdir. Zikrolunan mukataat şart-ı sabık akçaya füruht olup yine ref' olunursa mal-ı mirîye külli nef'i olduğundan gayrı fukara asude hâl olunub mültezimler narh-ı carî üzere penbenin bahasını vermeğe kabul ve iltizam iderler ve mukataata dahi zarar olmaz bu zulm ref' olunub mukataat akçeye füruht olunmak babında emr-i şerif ricasına ilâm eylemeğin ..." denilerek uygulamanın değiştirilmesi istenmiştir. Bkz. KŞS. Defter I, s. 115

[39] Bkz. KŞS. Defter I, s. 286

[40] Bkz. BOA. MAD. 323, s. 2

[41] Bkz. BOA. MAD. 434, s. 4

[42] Bkz. BOA. MAD. 434, s. 30

[43] BKZ. BOA. MAD. 434, s. 38

[44] Bkz. KŞS. Defter I, s. 124'de : "... ve sene be sene muhasebelerin görüb ve her altı ayda bir kıst'ül-yevm hesabı üzre mal-ı mukataayı dahl-i hazine itdirüb ..." denilmektedir.

[45] Lütfi Güçer, "XV-XVII. Asırlarda Osmanlı İmparatorluğu'nda Tuz İnhisarı ve Tuzlaların İşletme Nizami", **İktisat Fakültesi Mecmuası, 23/1-2**, (İstanbul 1963), s. 98. Memleket dahilinde istihsal tuzlara daha membaından itibaren el koyan Osmanlı hazinesinin, ithal edilmekte olan tuzlar muvacehesinde bigâne

kalmayacağı gayet tabiidir. Nitekim Kıbrıs'ın fethinden evvel, Venedik'in Akdeniz ticaretinde mühim bir rol oynamış olan Kıbrıs tuzlasının bir kısım mahsulü Venedikli ve diğer Avrupa tüccarları tarafından Suriye sahilindeki limanlara getiriliyordu. Hemen Kıbrıs'ın karşısında sıralanmış bulunan Trablus, Lazkiye, Cebele, Banyas ve Autratos iskelelerine gelen bu tuzlar, devlet namına bir âmil tarafından satın alınıyordu. Arap memleketlerinin fethinden iki sene sonra tedvin edilip mer'iyyete konmuş bir kanunnamede yer almış bulunan "... ol tuzu âmiller satın alıp Müslümanlara bey' itmek kanun-ı kadimdir" hükmünün ifadesine bakılacak olursa ithal edilen tuz üzerine konmuş olan devlet inhisarının mevcudiyeti anlaşılmaktadır. Bkz. Ö. L. Barkan, **XV. Ve XVI. Asırlarda Osmanlı İmparatorluğu'nun Ziraî Ekonominin Hukukî ve Malî Esasları, Kanunlar,** İstanbul 1943, s. 214

[46] L. Güçer, a.g.m., s. 97

[47] TK. KKA. TD. 64, Vrk. 271b

[48] TK. KKA. TD. 64, Vrk. 301b

[49] TK. KKA. TD. 64, Vrk. 323a

[50] TK. KKA. TD. 64, Vrk. 11a

[51] H. Sahillioğlu, a.g.m., s. 21; Tuzla memlehasından elde edilen gelir, Osmanlı Devleti'nde faaliyette bulunan bir kısım tuzlaların senelik geliri ile mukayese edildiğinde, Midilli (32. 000), Teke (40. 000), İnebahtı (3200), Delvine (40. 000) ve Divriği (45. 000) tuzlalarından ileride, Adana (400. 000), Menemen (540. 000), Aydın (844. 000) ve Menteşe (513. 000) gibi yerlere nazaran düşük olduğu görülür. Bkz. L. Güçer, a.g.m., s. 130-131; A. Sinan Bilgili, a.g.t., s. 365

[52] Kıbrıs'ta ilk tuz vergisinin Kral James I (1382-98) tarafından uygulandığı bilinmektedir. James, Cenevizlilerin eline düşen oğlunu kurtarmak için istenilen fidyeyi ödeyebilmek için tuz vergisini ihdas etmişti. Bu vergi, bir çok suistimale neden olmuş ve sıkıntıda kalan köylüler adadan kaçmaya çalışmışlardır. Venedikliler döneminde de devam eden bu vergi on beş yaşın altındaki kız ve erkek çocuklardan da alınarak devam ettirilmiştir. Bkz. H. İnalcık, "Ottoman Policy And Admınıstratıon In Cyprus After The Conquest", **Milletlerarası Birinci Kıbrıs Tetkikleri Kongresi, (14-19 Nisan 1969) Türk Heyeti Tebliğleri,** Ankara 1971, s. 70

[53] TK. KKA. TD. 64, Vrk. 5

[54] A. C. Gazioğlu, **Kıbrıs'ta Türkler (1570-1878) 308 Yıllık Türk Dönemine Yeni Bir Bakış**, Lefkoşa 1994, s. 226

[55] L. Güçer, a.g.m., s. 101

[56] BOA. MD. 48, s. 24, Hüküm 683 (22 Zilhicce 990); Ayrıca bkz. M. Akif Erdoğru,"Osmanlı Kıbrıs'nda Tuz Üretimi ve Sorunları", **Kıbrıs'ta Osmanlılar**, Lefkoşa 2008, s. 273-285

[57] Lefkoşa Kadısına gönderilen hükümde: "Taht-ı kazanuza tabi Ayademne nam karye reayası bu canibe gelüb şöyle arz eylediler ki, şimdiye dek tuzla hizmetiyle ve sair tekalife sürülmeyüb şehir efendilerine tayin olunub muaf olunugelmişizdir deyu bildirüb ve mirimiran-ı sabıkdan ellerinde mektupları olmağın olıgelen adet ve kanun üzere sizin hidmetinize mukayyed olub tuzla hizmetine ve sair tekalife sürülmeyüb dahi minval-i sabık üzere muaf olmaları içün mektup rica eyledikleri ecilden tahrir olunup ısdar kılındı. Gerekdirki mademki hizmetinizde olanlar adet-i kadim üzere tuzla hizmetinden ve sair tekalifden muaf olup merkeb sürücülere ve gayrilere minbad dahl ve taarruz ittirmeyüb hilaf-ı adet ve kanun karye-i mezbure halkını kimesne rencide ve remide eylediklerine asla rızamız yoktur. Men ve def idesiz" denilmektedir. Bkz. KŞS. Defter I, s. 102

[58] KŞS. Defter I, s. 114

[59] Lefkoşa ve Tuzla ve Mesarye kadılarına gönderilen tezkirede: "Memleha ve gümrük ve tevabii mukataatına emin olan Perviz Bey'in bildirmesiyle bu seneye ait mîrî tuz ihracının zamanı gelmesi üzerine bir görevli Kıbrıs'a gönderilmiştir. " Vardukda gerekdirki bu babda dikkat ve ihtimam ile mukayyed olub taht-ı kazalarınızda vaki mütekaddemden hidmet idegelen merkebleri ve piyade keferesin ihrac ve mahalli mezbura bervech-i istimal irsal itduresiz ki varub adet-i kadime üzere mîr-î milhi zamanı geçmeden ihraç eyleyeler amma bu babda bir ferde himayet ve siyanet itdirmeyüb eğer zuamma ve erbab-ı tımar ve sair kul taifesi tımarları reayasıdır ve eger havas-ı hümayun reayası ve merkebleridir kanun-u kadim üzre cidden muhalefet itdirmiyesiz- şöyleki milh-i mirinin ihracı babında ihmal ve tekasül olmağla zarar ..... ola veyahud zamanı geçürüle bais olunan tazmin itdirilmek mukarrerdir. Ama göre mukayyed olub bu husus da dakika fevt olınmıya ve eger bir tarik ile muafnameler ibraz iderlerse mademki katib-ül vilayet defterinde veyahud der-devlet-i meabdan varid olan evamir-i şerifeyn tuzla hizmetinden muaf itdim deyu kayd itmeyince mücerred olasın dimekle ve Beglerbegiler ve defterdarlar tezkiresiyle ve mektubuyla muaf ve müselleh olmaz ol makule emirlerin alub kiseleyüb ve mühürleyüb ashabı ile bu canibe gönderesin ki cevabı virile ve şöyle ki merkeb ihracına varan kimesneler bu bahane ile akçe aldukları veyahud raaya taifesi akçe virüb halas oldukların istima' idüb dahi bu canibe arz itmeyesin ol hususda sizler mes'ul ve muatab olmak mukarrerdir ve şöyleki anın gibileri isim ve resimleri ile yazub ilam eyleyesiz" bunu görmek mümkündür. Bkz. KŞS. Defter I, s. 116 (evahir-i zilkade 1003)

[60] A. C. Gazioğlu, a.g.e., s. 188

[61] Kıbrıs Beylerbeyine gönderilen 25 Receb 984 tarihli hükümde "İstanbul'da tuz babında ziyade müzâyaka olmağın Rodos gemileri ve kadırgalarla tuz getürdülmek içün Rodos Beyine hükm-ü şerif gönderilmiştir. Buyurdum ki, müşarüniley varup tuz taleb ettikde ne miktar tuz verilürse defter idüb yazub bildiresin" denilmiştir. Bkz. BOA. Md. 28, s. 105, Hüküm 257; Rodos Beyine gönderilen hüküm için bkz. BOA. MD. 28, s. 105, Hüküm 256

[62] Bkz. BOA. MD. 29, s. 128, Hüküm 316: Bu hükümde Kıbrıs Beylerbeyine hitaben "halâ Dubrovnik begleri tarafından arz-ı hal sunulub tuz babında müzayakaları olub Kıbrıs ceziresinde olan Tuzladan gemileri varub kifayet miktarı akçe ile tuz almalu olduklarında kimesne mani olmak babında hükm-ü şerifim taleb eyledikleri ecilden buyurdum ki, vusûl buldukda anun gibi Dubrovnik gemileri ol caniblere varub akçe ile tuz almalu olduklarında akçe ile kifayet kadar tuz virüb mâni olmıyasın ... " denilmektedir.

[63] KŞS. Defter IV, s. 20: Burada "... mukaddema Haremeyn mütevellisi Kapucu Halil Ağa'dan mevacib içün Haremeyn-i muhteremeyn malından istikraz ettiğim akçe mukabelesinde bey' ettiğim milhden Paşa-yı mumaileyhe' iki yüz araba ve kırk araba divan katibine ve elli araba kethüdasına ve otuz araba etbama olmak üzere üç yüz yirmi araba tuz rüşvet ikrar etmekle Haremeyn-i mezbureyn akçesi içün verdiğüm tuzdan mezbur El-hac Mahmud'a arabasın birer riyal guruşa üç yüz yirmi araba tuz bey' edüb akçesin kendisi kabz etmişdir. Zikr olunan tuz Haremeynin olduğundan öşrü bigayri hakkın alunub rüşvet olduğu cihetden taleb ederim ..." denilmektedir.

[64] A. C. Gazioğlu, a.g.e., s. 215

[65] M. Z. Pakalın, "Okka", **Tarih Deyimleri ve Terimleri Sözlüğü II**, İstanbul 1983, s. 723

[66] Bekir Sıtkı Baykal,, "Osmanlı İmparatorluğu'nda XVII. ve XVIII. Yüzyıllar Boyunca Para Düzeni İle İlgili Belgeler ", **Belgeler, XIII/17**, Ankara 1988, s. 97.

[67] F. Emecen, **XVI. Asırda Manisa Kazası**, Ankara 1989, s. 258

[68] N. Çağatay, "Osmanlı İmparatorluğu'nda Reayadan alınan Vergi ve Resimler", **DTCFD, V/5,** (Kasım-Aralık 1947)**,** s. 503

[69] Bkz. Recep Dündar, **Kıbrıs Beylerbeyliği (1570-1670)**, (İnönü Üniversitesi Sosyal Bilimler Enstitüsü, Basılmamış Doktora Tezi), Malatya 1998, s. 226 vd.

[70] F. Emecen, a.g.e., s. . 259; H. İnalcık, **Sûret-i Defter-i Sancak-i Arvanid**, s. XXXI

[71] Bkz. TK. KKA. TD. 64, Vrk. 26a

[72] H. İnalcık bu değerlendirmeyi Arvanid Sancağındaki hassa değirmenler için yapmış olup, uygulamanın, Bosna'da ve Ağriboz'da, hassalığın bakımsızlığa ve harabeye yol açtığından kaldırıldığını beyan etmektedir. Bkz. **Sûret-i Defter-i Sancak-ı Arvanid**, Ankara 1987, s. XXXI

[73] Girne, Pendaye, Hırsoho, Baf, Evdim ve Limosa nahiyelerindeki manastırlara ait asiyab resmi için bakınız: TK. KKA. TD. 64, Vrk. 186b, 235b-236a, 266b, 322b-323ab, 411b

[74] Bilindiği üzere Anadolu ahiliğinin kurucusu olarak bilinen ve asıl şahsiyetinin Şeyh Nasıruddîn el-hayî (1175-1262) olduğu tahmin edilen Ahi Evren 1205'te Kayseri'ye yerleşerek burada bir debbağhâne kurmuştu. Şeyhi Evhadüddîn Kirmanî ile birlikte bütün Anadolu'yu dolaşarak ahi teşkilatını kuran Ahi Evren şeyhinin ölümünden sonra bu teşkilatın önderi oldu. Bkz. A. Tabakoğlu, **Türk İktisat Tarihi**, İstanbul 1994**,** s. 167

[75] N. Bozkurt, "Deri", **TDVİA. IX,** İstanbul 1994, s. 174: Osmanlı Türklerinde büyük gelişme gösteren dericilik XV. ve XVI. yüzyıllarda kasabalara kadar yayılarak diğer esnaf kollarının arasında önemli bir yere sahip oldu ve özellikle İstanbul, Edirne, Kayseri, Ankara, Bursa, Manisa, Tokat ve Konya gibi şehirlerin ticari hayatına canlılık getirdi. XVI. yüzyılda Pierre Belon Türk dericiliğini ve deri işletmeciliğini överken Avrupa'daki dericilikten "yamacılık" şeklinde bahsetmektedir. Joseph Pitton de Tournefort ise Türk terliklerinin bile kendi ayakkabılarından daha temiz dikildiğini, basit yüzlü olmakla birlikte özellikle İstanbul'da yapılanların uzun zaman dayandığını ve burada Doğu Akdeniz'in en iyi ve en hafif derisinin kullanıldığını kaydetmektedir. Aynı şekilde Tavernier Diyarbekir'de kırmızı, Musul'da sarı ve Urfa'da siyah maroken üretildiğini, bunların en güzellerine ise XV. yüzyılın ortalarından itibaren kalabalık derici esnafının toplandığı merkezlerden biri olan Tokat'ta rastlandığını söylemektedir. 1660'ta Diyarbekir'i ziyaret eden M. Poullet de Anadolu'ya gelen İranlı, Mısırlı, Kafkasyalı, Rus ve Polonyalı tüccarların buradan sahtiyan götürdüklerini belirtmektedir. Manisa'da imal edilen sahtiyan ise saray ayakkabıcıları tarafından kullanıldığı gibi İstanbul piyasasında da çok rağbet görüyordu. Bkz. Zeki Tekin, "Türkler'de Dericilik", **TDVİA, IX**, İstanbul 1994, s. 177; Manisa'daki sahtiyan imalatı hakkında bkz. F. Emecen, a.g.e., s. 257 vd

[76] M. Ali Ünal, **XVI. Yüzyılda Harput Sancağı (1518-1566)**, Ankara 1989, s. 145

[77] Bkz. TK. KKA. TD. 64, Vrk. 73a

[78] Bkz. TK. KKA. TD. 64, Vrk. 315b

[79] Bkz. TK. KKA. TD. 64, Vrk. 36a, 83a, 112a, 135a, 246b, 315b

[80] Bkz. TK. KKA. TD. 64, Vrk. 315b

[81] Bkz. TK. KKA. TD. 64, Vrk. 387b

[82] KŞS. Defter II, s. 43,71

[83] BOA. MAD. 323, s. 2

[84] BOA. MAD. 434, s. 4

[85] BOA. MAD. 434, s. 30

[86] BOA. MAD. 434, s. 38
[87] M. Ali Ünal, a.g.e., s. 143
[88] TK. KKA. TD. 64, Vrk. 24b
[89] TK. KKA. TD. 64, Vrk. 73a
[90] TK. KKA. TD. 64, s. 271b
[91] KŞS. Defter II, s. 9,16
[92] İlgili belgede: "... ihtisap mukataasına tabi olan nefs-i Lefkoşa'da vaki olan boyahâne mukataası gurre-i Safer'in 1016 (28 Mayıs 1607)'sından bir sene tamamına dek hamil'ül huruf Mehmed Beşe'ye iltizam-ı sabık üzre 28. 000 akçeye iltizama virüb meblağ-ı mezburdan halâ ... 7000 akçe peşin alub kabz eyledik ..." denilmektedir. Bkz. KŞS. Defter II, s. 61
[93] KŞS. Defter II, s. 9
[94] KŞS. Defter II, s. 16
[95] Bkz. KŞS. Defter I, s. 136
[96] M. Akif Erdoğru,"Osmanlı Döneminde Kıbrıs Şekerhaneleri", s. 273
[97] M. Akif Erdoğru,"Osmanlı Kıbrıs'nda Tuz Üretimi ve Sorunları", s. 285

INVESTIGATION OF TURBINE VARIABLES USED FOR WAVE, TIDAL AND FLOW ENERGY FROM HYDROKINETIC ENERGY TRANSFORMATION SYSTEMS

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Abstract: Ocean energy from renewable energy sources is an alternative energy source to other energy sources. Events such as wave, tidal, and flow that are present in the ocean can be converted to electricity by hydrokinetic energy conversion systems. Although hydrokinetic conversion systems are often in the early stages of development, it seems appropriate to use energy from such renewable sources. Two types of turbines, horizontal and vertical, are used in these conversion systems. In horizontal axis turbines, the rotation axis is parallel to the current and the wings are perpendicular. In the vertical axis turbine types, the rotation axis is perpendicular to the flow direction and the wings are parallel. The kinetics and efficiencies of these turbine types differ from each other. In this study, detailed classifications of horizontal and vertical axis turbines and comparisons related to classification are given. This article summarizes current and future transformation schemes and their application areas, starting from a set of basic definitions related to this technology.

Keywords: Hydrokinetic energy, wave energy, tidal energy, flow energy

HİDROKİNETİK ENERJİ DÖNÜŞÜM SİSTEMLERİNDEN OLAN DALGA, GEL-GİT VE AKINTI ENERJİSİ İÇİN KULLANILAN TÜRBİN ÇEŞİTLERİNİN İNCELENMESİ

Özet: Yenilenebilir enerji kaynaklarından olan okyanus enerjisi diğer enerji kaynaklarına alternatif bir enerji kaynağıdır. Okyanus içinde var olan dalga, gel-git ve akıntı gibi olaylar hidrokinetik enerji dönüşüm sistemleriyle elektrik enerjisine çevrilebilmektedir. Hidrokinetik dönüşüm sistemleri, çoğunlukla gelişiminin ilk safhasında olmasına rağmen, bu gibi yenilenebilir kaynaklardan gelen enerjiyi kullanmada uygun görülmektedir. Bu dönüşüm sistemlerinde yatay ve dikey olmak üzere iki tip türbin çeşidi kullanılmaktadır. Yatay eksenli türbinlerde dönme ekseni akıntıya paralel, kanatlar ise dik olacak şekilde yerleştirilmiştir. Düşey eksenli türbin tiplerinde ise dönme ekseni akıntı yönüne dik, kanatlar ise paraleldir. Bu türbin çeşitlerinin birbirlerine göre kinetik ve verimlilikleri farklılık göstermektedir. Bu çalışmada, yatay ve dikey eksenli türbinlerin ayrıntılı sınıflandırması ve sınıflandırma ile ilgili karşılaştırılmaları verilmiştir. Bu makalede, bu teknoloji ile ilgili bir dizi temel tanımdan yola çıkarak, mevcut ve gelecek dönüşüm şemaları ve bunların uygulama alanlarının gözden geçirilmesi özetlenmektedir.

Anahtar Sözcükler: Hidrokinetik enerji, dalga enerjisi, gel-git enerjisi, akıntı enerjisi

Giriş

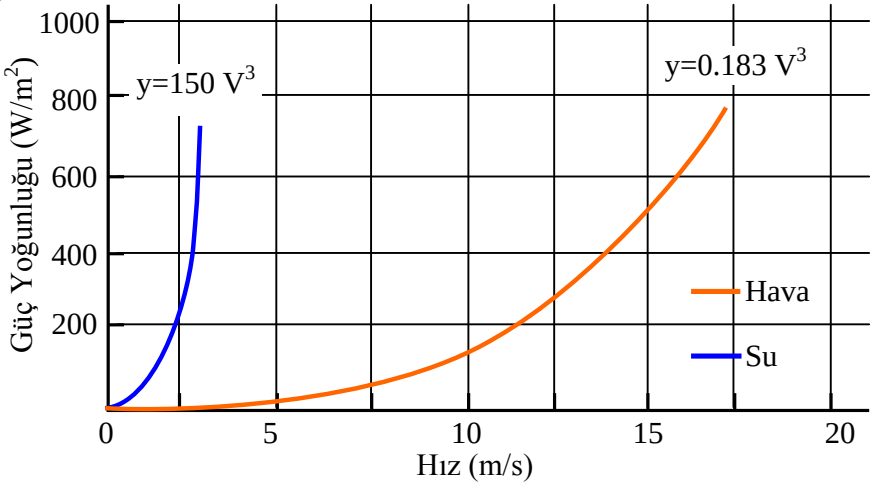
Artan enerji talebi, konvansiyonel enerji üretim teknolojilerinin zararlı çevresel etkileri, maliyetin artırılması ve fosil yakıt rezervleri, iklim değişikliği, sağlık sorunlarının yayılması ve sosyal baskının azaltılması, bilim insanlarını ve mühendisleri, alternatif olmayan, zararsız, daha ucuz ve sürdürülebilir enerji üretim yöntemleri bulmaya yöneltmektedir. Yenilenebilir enerji teknolojileri, konvansiyonel enerji kaynakları üzerine birçok çevre kazanımları sunmaktadır.

Hidroelektrik enerji, dünyanın en büyük ve en ucuz yenilenebilir enerji kaynağıdır. Aynı zamanda elektrik üretmenin en etkili yoludur. Dünya elektriğinin yaklaşık % 18'i hidroelektrik enerjisinden sağlanmaktadır. Tahmin edilebilirlik, düzenlilik ve dünya çapında yaygınlaşan kaynaklara sahip olan hidroenerji, enerji üretiminin en cazip seçeneklerinden biridir.
Sudan enerji almak için, hidrostatik ve hidrokinetik yöntem olmak üzere iki yaklaşım vardır. Hidrostatik yaklaşım, basınç noktası oluşturmak ve suyun potansiyel enerjisini uygun turbo makineler vasıtasıyla

rezervuarlara su depolayarak elektrik üretmenin geleneksel yoludur [Yuce, M.I. & Muratoglu, A.]. Hidrokinetik yaklaşımda suyun içindeki kinetik enerji, suyu depolamadan ve bir basınç noktası olmaksızın nispeten küçük ölçekli türbinlerle doğrudan elektrik enerjisine dönüştürülür. Hidrokinetik enerji dönüşüm sistemleri, nehirler, gelgit nehirleri, okyanus akıntıları, dalgalar, insan yapımı suyolları gibi doğal akışlara ve diğer akış su tesislerine kurulmaktadır.

Hidrokinetik enerji teknolojileri, geleneksel hidroelektrik üretim yöntemlerine göre bazı avantajlara sahiptir. Hidrokinetik sistemler minimum düzeyde inşaat işi gerektirir. Suyu toplamak için bir baraj ya da bir rezervuar inşa etmek için ek bir maliyet yoktur. Kinetik enerji akım ve dalgalar şeklinde su hareketi temel alınarak kullanılır. Hidrokinetik türbinlerin nispeten küçük ölçekli güç üretimi olmasına rağmen, enerji üretimini artırmak için rüzgâr çiftlikleri gibi çok birimli diziler halinde kurulabilirler [Guney, M.S. & Kaygusuz, K.]. Hidrokinetik sistemler, rüzgâr ve güneş cihazlarından daha değerli ve öngörülebilir enerji sağlar. Özellikle nehir dereleri ve gel-git akıntıları oldukça öngörülebilirdir.

Aynı derecede büyüklükte rüzgâr türbini ile karşılaştırıldığında, akışkan bir hidrokinetik türbinden önemli miktarda güç elde edilebilir. 2-3 m/s'lik bir nominal devirde çalışan bir hidrokinetik türbin benzer şekilde derecelendirilmiş rüzgâr türbininin dört katı enerjiye sahip olabilir. Su ve rüzgâr için yaklaşık akış yoğunluğu sırasıyla 1000 kg/m^3 ve 1.223 kg/m^3'dür. Rüzgar türbinleri genellikle 11-13 m/s nominal rüzgar hızında çalışacak şekilde tasarlanmıştır. Aksine, hidrokinetik türbinler için nominal hız 1.5 ile 3 m/s arasındadır. Su ve rüzgâr türbinleri için güç yoğunluklarının karşılaştırılması Şekil 1'de verilmiştir. 2 m/s serbest akış hızı ile çalışan bir hidrokinetik türbinin güç yoğunluğu, yaklaşık 16 m/sn akış hızı ile çalışan rüzgâr türbinininki ile aynıdır [Yuce, M.I. & Muratoglu, A.].



Şekil 1. Su ve rüzgâr türbinleri için güç yoğunluklarının karşılaştırılması

Hidrokinetik enerji kaynağından üretilebilecek elektrik miktarı su kaynağının hacmine ve hızına bağlıdır. Bu güç üretim sistemleri, 0.5 m/s ve üzeri su hızlarına sahip bir akışa kurulmaktadırlar. Bu enerjiyi kullanmak için birçok yöntem vardır, ancak türbin yapısına sahip dönüştürücü sistemleri en yaygın ve kanıtlanmış yöntemlerdir. Rüzgâr enerjisi dönüştürücülerine benzer şekilde hidrokinetik türbin tarafından yakalanan toplam kullanılabilir güç P_a (watt), Denklem 1'de gösterildiği gibi yoğunluk, kesit alanı, hız ve türbin katsayısına bağlıdır. Bu türbin sistemlerinde en büyük avantaj, suyun yoğunluğunun yaklaşık olarak havadan 800 kat daha yoğun olmasıdır. Bu basitçe bir hidrokinetik türbin tarafından üretilen enerjinin, eşit rüzgâr ve suyun eşit hızda eşit çaplı bir rüzgâr türbini tarafından üretilen enerjiden çok daha fazla olduğunu göstermektedir.

$$P_a = \frac{1}{2} \times A \times \rho \times V^3 \times C_P \quad (1)$$

Buradaki; A türbin alanı (m^2), ρ su yoğunluğu (1000 kg/m^3), V su akış hızı (m/s) ve C_P türbin güç katsayısı veya verimi olan 16/27=0.592 (teorik olarak elde edilebilecek maksimum güç). Rüzgâr türbine benzer şekilde, güç katsayısı (C_P), hidrokinetik türbinlerin, verilen kayıplardan dolayı toplam kinetik gücün sadece bir kısmını kullanabileceğini gösterir. Bu katsayı, Betz kanunuyla 16/27=0.59 ile sınırlıdır. Fakat küçük ölçekli bir nehir türbininin kendi kayıpları vardır ve bu da güç katsayısını yaklaşık olarak 0.25'e düşürmektedir. Üst limit, düşük mekanik kayıpları olan yüksek verimli makineler içindir [Vermaak, H.J. & Kusakana, K.].

Okyanus Enerji Çeşitleri

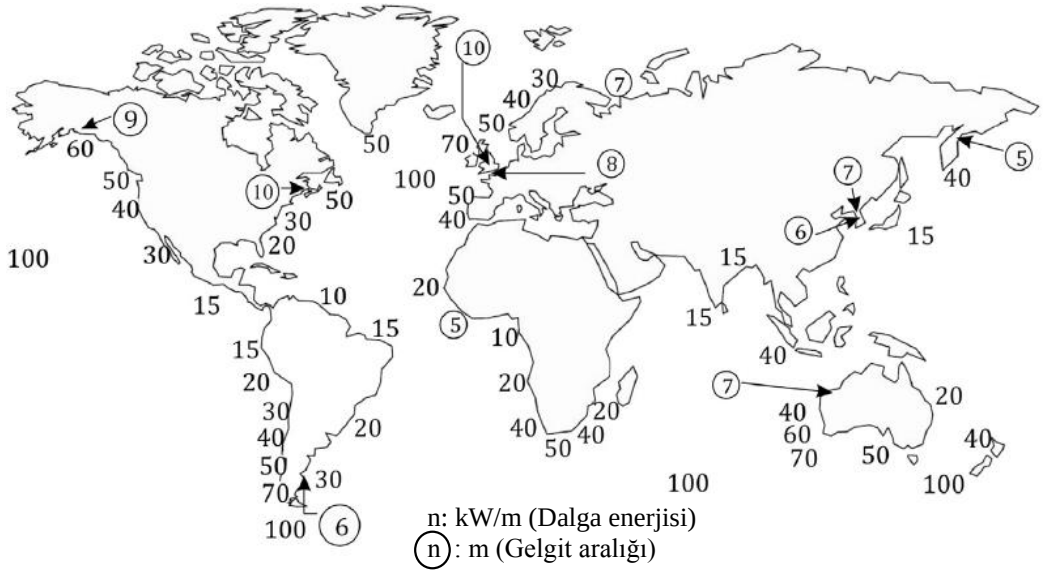
Bu bölümde okyanustan elde edilen potansiyel enerji çeşitleri açıklanmaktadır. Okyanusta bulunan yenilenebilir enerji kaynağı, her biri farklı enerji dönüşüm teknolojileri gerektirmektedir.

Dalga Enerjisi

Okyanus dalga enerjisi (iç dalgalar veya tsunamilerden ayrı olarak), rüzgârdan okyanusa aktarılan enerjidir. Rüzgâr okyanusa çarptığında, hava-deniz etkileşimi rüzgâr enerjisinin bir kısmını suya aktarır ve dalgalar oluşturur. Bu enerji, potansiyel enerji olarak (ortalama deniz seviyesinden yer değiştiren suyun kütlesinde) ve kinetik enerji olarak depolanır (su parçacıklarının hareketi). Ortaya çıkan dalgaların boyutu ve periyodu, rüzgâr hızının bir fonksiyonu olan, rüzgârın esme süresine ve rüzgârın oluştuğu okyanusun uzunluğuna bağlıdır ve bu parametreler dalga enerjisi türünden elde edilebilecek enerji miktarını belirlemektedir. Dalgalar, enerji transferinde çok etkilidir ve fırtına alanının ötesinde okyanus yüzeyinde uzun mesafeler ilerleyebilir ve bu dalga sürekliliği kabarma olarak isimlendirilir. Yeryüzündeki en enerjik dalgalar, ekstra tropik fırtınalarla 30º ve 60º enlemlerde üretilir. Dalga enerjisinin meydana gelmesi mevsimsel olarak ve daha kısa periyotlarda değişir; mevsimsel değişim genellikle kuzey yarım kürede daha fazladır. Dalga ikliminde yıllık değişiklikler, genel olarak, modellemede uzun dönemli ortalamaların kullanılmasıyla ve oldukça uzun geçmişli küresel veritabanları kullanılarak tahmin edilmektedir [Lewis, A. & Estefen, S.].

Gelgit Enerjisi

Gelgitler, merkezkaç ve atalet kuvvetleri ile birlikte, Dünya, Ay ve Güneş arasındaki yerçekimi ve dönme kuvvetleri tarafından tahrik edilen okyanusun yüksekliğinde düzenli ve öngörülebilir değişimdir. Birçok kıyı bölgesi, kabaca iki yüksek gelgit ve günde iki düşük gelişim görülür ve buna yarım-günlük gelgit denir; bazı yerlerde günde yalnızca bir gelgit vardır bunlar da günlük gelgit olarak adlandırılır. 24 saat ve 50 dakika ay günü, her geçen güne takiben yüksek ve alçak gelgit gelişmeleri oluşmasını sağlar. Günlük ve yarım günlük gelgitler, Dünya'daki farklı yerlerde farklı zamanlarda da görülür. Şekil 2'de dalga gücünün küresel dağılımı ve küresel gelgit aralıkları verilmektedir [Yuce, M.I. & Muratoglu, A.].



Şekil 2. Dalga gücünün küresel dağılımı (kW/m) ve küresel gelgit aralıkları (m)

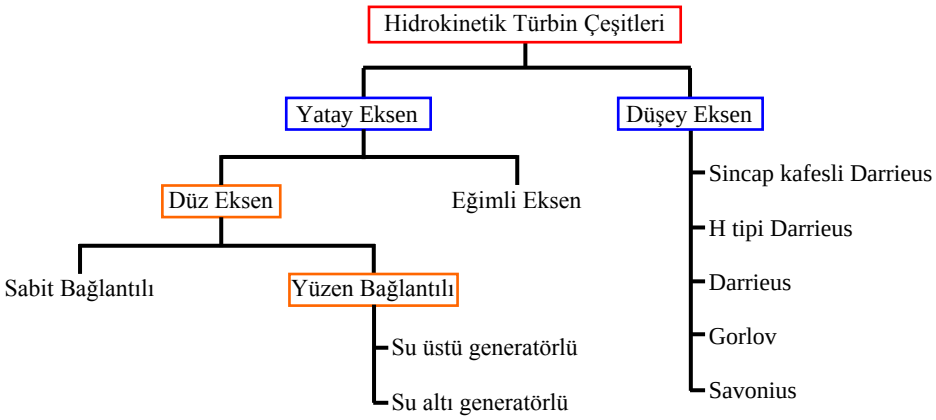
Akıntı Enerjisi

Yakın kıyılardaki gelgit akımlarına ek olarak, açık okyanusta önemli akımlar da var. Bu akımlar sürekli aynı yönde akar ve değişkenliği düşüktür. Okyanusların büyük ölçekli dolaşımı, çeşitli bölgelerde yoğunlaşmıştır. Özellikle batı sınırı akımları, rüzgâr enerjisiyle meydana gelen dolaşımlarla ilişkilidir. Bunların bazıları günümüz teknolojilerini kullanmaya yetecek kadar akım hızları (~2 m/s) sunmaktadır. Türbin sistemlerinde iyileşme sağlandığı için diğer okyanus akıntıları da gelişme potansiyeline sahip olabilmektedir [Soerensen, H. C. & Weinstein, A.].

Okyanustan elde edilebilen diğer enerji kaynağı olan termal enerji dönüşümü, üst okyanus katmanlarında ısı olarak depolanan güneş enerjisi ile genellikle 1000 m'nin altında olan daha soğuk deniz suyu arasındaki sıcaklık farklılıklarından türetilmiş bir enerji kaynağıdır. Tuzluluk dereceleri (ozmotik güç) ile üretilen enerji çeşidi ise, nehir ağızlarındaki taze su ve okyanus suyu arasındaki tuzluluk farklılıklarından türemiştir [Lewis, A. & Estefen, S.].

Okyanus Enerjisinde Kullanılan Yatay ve Dikey Türbin Çeşitleri

Okyanus enerjisinde kullanılan türbinler, su akış yönüne göre dönme eksen yönelimleri ile karakterize edilebilir. Hidrokinetik türbinlerin sınıflandırılması temel olarak yatay eksen ve dikey eksen olarak yapılabilir. Yatay eksenli türbinler iki gruba ayrılabilir. Yatay tip türbin ekseni su akışı yönüne paraleldir. Dikey tip türbin çeşidinde ise dönme ekseni su akışı yönüne diktir. Türbin rotor konfigürasyonunun seçimi, teknik ve ekonomik faktörler gibi birçok açıdan ele alınmasını gerekmektedir. Enerji dönüşümünün yeni ortaya çıktığı bir alan olarak, bu konular hidrokinetik türbinler için daha baskın hale gelmektedir. Bu türbinlerin fiziki düzenlemelerine dayanan genel sınıflandırması Şekil 3'te verilmektedir [Khan, M.J. & Bhuyan, G. (Eds.)].



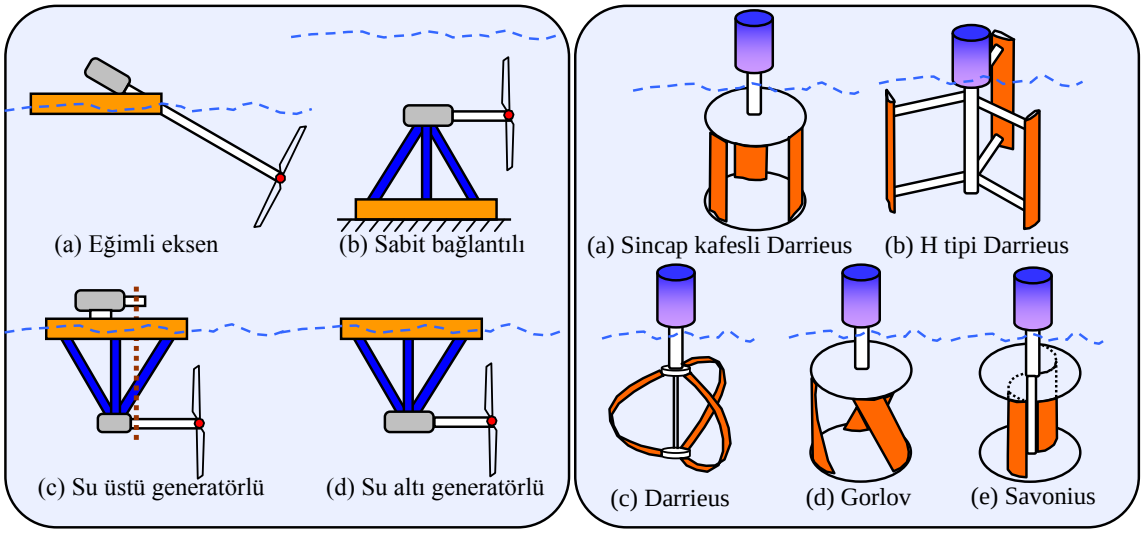
Şekil 3. Hidrokinetik türbin çeşitleri

Rotor ekseninin su akışına göre hizalanmasına dayanarak, yatay eksenli ve dikey eksenli türbinler olmak üzere iki genel sınıf oluşturulabilir. Yatay eksenli türbin çeşidine alternatif olarak eksenel akış olarak da adlandırılır. Türbin eksenleri akışkana paraleldirler ve pervaneli tip rotorlar kullanır. Okyanus ve su akışının olduğu ortamda kullanılmak üzere yatay eksenli türbinlerin çeşitli uygulama topoloji resimleri Şekil 4.I'de verilmektedir.

Eğimli eksen türbinleri, çoğunlukla küçük nehir enerjisi dönüştürücülerinde kullanılmakladır. Tasarım ve performans analizi hakkında literatürde birçok uygulama alanı bulunmaktadır. Bu tür topolojileri kullanan birkaç ticari üründe mevcuttur. Bu cihazların çoğu nehir derelerinde test edilmiş ve sınırlı ölçekte ticarileştirilmiştir. Eğimli eksenli türbin sistemleri genellikle su pompalama için kullanılırken, diğerleri ise uzakta bulunan evsel elektrik ihtiyacını karşılamak için kullanılmaktadır. Bununla birlikte, bu enerji dönüştürme sistemleri üzerinde hem bilimsel hem de ticari çalışmalar devam etmektedir [Ladokun, L.L. & Ajao, K. (Eds.)].

Yatay eksenli türbinler, gelgit enerji dönüştürücülerinde yaygın olarak kullanılır ve konsept, tasarım açısından günümüz rüzgar türbinlerine çok benzerdir. Sabit bağlantılı tip yapılarına sahip türbinler generatör ünitesinin nehir yatağına veya deniz tabanına yakın olmasını gerektirir. Sabit bağlantılı tip gelgit/nehir türbinleri ile ilgili birçok uygulama ve çalışmalar mevcuttur. Yatay eksenli türbin çeşitlerinden bir diğeri, yüzen bir demirleme mekanizmasına sahip olup dalgıç olmayan bir generatörün su yüzeyine daha yakın yerleştirilmesi ile yapılır. Su altı generatör sistemleri ile ilgili bilgiler bulunmakta olup, su üstü generatörlü türbin çeşidine benzer yapısal özellikler göstermektedir.

Dikey eksenli türbinlerin çeşitli uygulama topoloji resimleri Şekil 4.II'de verilmektedir. Dikey eksen alanında Darrieus türbinleri en belirgin çeşitlerindendir. H tipi Darrieus veya Sincap kafesli Darrieus (düz kanatlı) türbin kullanımı çok yaygın olmakla birlikte, hidroelektrik uygulamalarda kullanılan Darrieus türbin örnekleri (kavisli veya parabolik kanatlı) mevcut değildir. Düz kanatlı Darrieus türbinleri ile ilgili geniş bir dizi tasarım, uygulama ve performans alanı gibi birçok çalışma mevcuttur. Gorlov türbin kanatları sarmal yapıdadır, Savon türbini ise düz veya eğik kanatlardan oluşabilen sürükleyici tip özelliğine sahip dikey eksenli türbin çeşitlerindendir [Khan, M.J. & Bhuyan, G. (Eds.)].



(I) Yatay eksenli türbin tipleri (II) Dikey eksenli türbin tipleri

Şekil 4. Yatay ve düşey eksenli türbin çeşitlerinin uygulama topoloji resimleri

Türbin Çeşitlerinin Karşılaştırılması

Darrieus tipi türbinler, düşey eksen alanlarında nehir enerjisi uygulamalarında kullanımı yaygındır. Düz kanatlı Darrieus türbinleri (H tipi veya sincap kafesi tipi) hidro uygulamalar için uygulanabilir bir seçenek olarak düşünülebilir.

Literatürde, elektrik şebekesine uzak olan bölgelerde elektrik enerjisi üretmek için küçük eksenel akış hidrokinetik türbinleri içeren çalışmalar yapılmaktadır. Ayrıca, uygulamadaki sorunların üstesinden gelmek için iyileştirme çalışmaları yapılmıştır ve yapılmaya devam etmektedir. Okyanus veya deniz üzerinde duba, şamandıra, nehir kıyılarına veya iskelelere bir eksen üzerinde dönebilen kollar kullanılarak monte edilen veya askıya alınan türbin tasarımları yapılabilmektedir. Elektrik şebekesine uzak evler için uygun olan bu türbin çeşitleri yaklaşık 1-2 kW'lık elektrik enerjisi üreterek elektrik enerji ihtiyacını karşılamaktadır.

Literatürde yapılan bir diğer çalışma da, akıntı türbin tasarımındaki son gelişmeleri gözden geçirilerek akıntı türbinlerinin bazı potansiyel avantajlarını incelenmiştir. Bu çalışmalar, güvenlik, dış etkilerin türbine vereceği zararın azaltılması, üretilen gücün arttırılması, dişli kutusu boyutunun azaltılması sayılabilir [Guney, M.S.].

Nispeten küçük sığ nehir ve kanallar için ideal yeni bir kinetik hidro-generatör jeneratörünü yapılmıştır. Tasarımda, cihaz etrafında hareket eden dikdörtgen hidroplane (yelken) kullanılmaktadır. Cihaz, yatay düzlemde dönen cihazın üstünde ve altındaki iki kemer arasında bir dizi yelkenin monte edildiği, uzunlamasına bir dikey eksenli türbin kullanarak bir su akış enerjisi meydana getiriyor. Bu kavram, nispeten sığ nehirler ve kanallar için idealdir, çünkü standart bir deniz tipi türbin veya türbin dizisinin dairesel rotorundan daha fazla kanadın kesit alanını dolduracak şekilde tasarlanmalıdır. Dikey hidrokinetik nehir türbini ile makro-türbülanslı akış yapılarının etkileşimi arasında araştırmalar yapılmıştır. Bunun sonucunda, türbülanslı akış yapılarının hidrokinetik enerji üretimi üzerindeki etkisini anlamak için nehirlerdeki akışların karakteristiğinin belirlenmesi gerektiği anlaşılmıştır. Ayrıca, türbülanslı bir akışın ölçeği ve yoğunluğu önemli bir rol oynayabileceğinden, güç spektrumu ölçümleri dikey türbinlerin yorulma ömrü tahmini için önemli bir veri sağlayacaktır [Guney, M.S.].

Çeşitli sarmal ve düz kanatlı Darrieus tipi hidrokinetik türbinlerde, dinamik davranışlarını ve verimlerini incelemek için bazı testler gerçekleştirmiştir. Değişken adımlı kanadın, başlangıç torkunu ve verimliliğini arttırdığı gözlenmiştir. Ayrıca, sabit tork üretmek ve güç çıkışını artırmak için sarmal şeklinde kanatların kullanılması önerilmiştir. Bu testler, Avustralya'nın Nerang Nehri ve Kanada'daki Campbell Nehri'nde 1 m/sn'den daha az ve 5 m/s'ye kadar olan hızlarda gerçekleştirilmiştir. Sarmal şeklindeki kanatların verimlilik ve başlatma torku bakımından çok az fark meydana getirdiği ancak, sabit adımlı düz kanatların aksine türbinin sorunsuz bir şekilde çalıştığı gözlemlenmiştir. Yatay ve dikey türbinlerle ilgili teknik avantajları ve dezavantajları Tablo 1'de verilmektedir [Vermaak, H.J. & Kusakana, K. (Eds.)].

Tablo 1. Yatay ve dikey türbinlerle ilgili teknik avantajları ve dezavantajları

Türbin yapısı	Avantajları	Dezavantajları
Yatay eksenli türbinler	Kendinden başlama kabiliyeti vardır. Bir mil kullanılarak dişli kutusu çıkartılabilir. Daha yüksek rotor hızı ile optimum performans sağlanır, (deniz/gelgit dönüşümü); böylece dişli kutusu azaltılmış olur. Aşırı hızda ve etkin korumada kanat adımının hareketi sayesinde daha esnek olmasını sağlanır .	Sualtı yerleşimi nedeniyle generatör bağlantı maliyeti yüksektir. Dökülerek akan su kanallarında uygulaması kolay değildir.
Düşey eksenli türbinler	Suyun üzerine yerleştirildiğinden dolayı generatör bağlantı maliyetleri düşüktür. Kanat ucundaki kayıplarının azalması nedeniyle daha az ses çıkartır. Çift yönlü akışta bile tek yönlü dönüş yapabilir. Darrieus türbininin silindir yapısından dolayı, çeşitli kanallara kolaylıkla monte edilmesine olanak tanır. Değişken su hızı ve düşük su debili sığ kanallarda ve sığ kanalların altında çalışmak için daha uygundur.	Düşük başlatma torku nedeniyle, başlangıçta ayrıca çalıştırma mekanizması gerektirebilir. Çıkıştaki generatör torku dalgalıdır. Düşük verimlidir.

Sonuç

Hidrokinetik enerji, yenilenebilir enerji teknolojilerinden biri olarak yeni ortaya çıkan olan bir alandır. Okyanus akıntı, gelgit ve dalga enerji dönüşüm cihazlarından, minimum çevresel etkiyle azami miktarda enerji üretilmesi istenilmektedir. Hidrokinetik enerji dönüşüm teknolojileri nispeten düşük verimlilik, kavitasyon ve ağır okyanus/deniz ortamı, hidrokinetik teknolojilerin en büyük dezavantajlarındandır [Borg, M. & Shires, A. (Eds.)]. Hidrokinetik türbinlerin verimleri konvansiyonel hidrostatik dönüşüm sistem verimlerine göre azdır. Barajlarda kurulan hidrokinetik dönüşüm sistemlerinin verimleri %80 ile %90 civarında iken, hidrokinetik türbin teknolojileri ancak %35'e ulaşabilmektedir. Mevcut enerji dönüşüm sistemlerinde, türbin güç çıkışı akış hızının kübik gücü ile doğru orantılıdır. Bu nedenle hidrokinetik sistemlerde daha yüksek akış hızı ile daha yüksek bir güç sağlamaktadır [Borg, M. & Collu, M. (Eds.)].

Betz kanundaki sınır değer hidrokinetik türbinlerin verimleri üzerinde en büyük engeli oluşturmaktadır. Bununla birlikte, teorik sınır olan Betz değerine türbin kanatlarının uygun tasarım ve üretim şekliyle yaklaşılabilir. Literatürde yapılan çalışmalar doğrultusunda, düz kanatlı Darrieus türbininin güç katsayısının, tasarım ve üretim yöntemi ile geliştirilmesi ile 0,72'ye kadar arttığı gözlenmiştir. Benzer şekilde sarmal kanat tasarımları, üretilen enerjinin daha fazla olacağını gösteren bir teknoloji sunmaktadır. Sarmal ve kanallı türbinler üzerine yapılan diğer bilimsel araştırmalar, hidrokinetik dönüşüm teknolojinin genel verimlerini artıracaktır. Öte yandan, performans ve verimi arttırmak için, değişken hız ve değişken açılı kanat tasarımları daha fazla araştırılmalıdır [Borg, M. & Collu, M.].

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AN APPLICATION ON THE DETERMINATION OF THE MAIN CONTRACTOR IN DEFENCE INDUSTRY PROJECTS

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Abstract: In the defence industry sector, where large-scale projects are carried out, it is very important for the project managers to decide the most suitable main contractor considering the administrative, financial and technical criteria. In this study, the proposals received from six defence companies on the market for a project with open tender procedure were analyzed with the TOPSIS method in terms of four main criteria.

Keywords: Defence industry, defence projects, TOPSIS

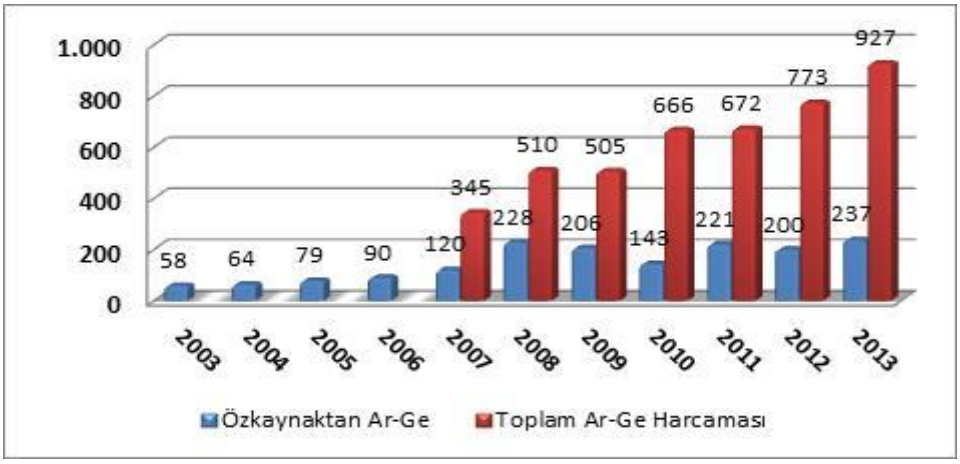
SAVUNMA SANAYİİ PROJELERİNDE ANA YÜKLENİCİNİN BELİRLENMESİ ÜZERİNE BİR UYGULAMA

Özet: Büyük bütçeli projelerin yürütüldüğü savunma sanayi sektöründe proje yöneticilerinin idari, mali ve teknik kriterleri göz önünde bulundurarak en uygun ana yükleniciye karar vermeleri büyük önem arz etmektedir. Bu çalışmada, açık ihale usulü ile teklife çıkılan bir proje için piyasadaki altı savunma şirketinden alınan teklifler dört ana kriter açısından TOPSIS Yöntemi ile analiz edilmiştir.

Anahtar Sözcükler: Savunma sanayi, savunma projeleri, TOPSIS.

Giriş

Savunma sanayi bir ülkenin gelişimi ve uluslararası platformlarda söz sahibi olabilmesi için çok önemli unsurdur. Türk savunma sanayiinin temeli Osmanlı İmparatorluğu'nun yükselme devrine kadar uzanmakta olup, top ve savaş gemileri gibi çağın en önemli harp araç ve gereçleri tamamen yerli imkânlarla üretilmiştir.Bununla birlikte, Türk savunma sanayii 18. yüzyıldan itibaren Avrupa'daki teknolojik gelişmelerin dışında kalmaya başlamış ve Birinci Dünya Savaşı sırasında etkinliğini büyük ölçüde yitirmiştir.1985 yılına kadar çeşitli sebeplerle süregelen bu durumun çıkarılan kanunlarla değişmeye başladığı görülmüştür. Örneğin,1985 yılında çıkan 3238 sayılı savunma sanayii hakkında kanun'un amacı "modern bir savunma sanayiinin geliştirilmesi ve Türk Silahlı Kuvvetleri'nin modernizasyonunun sağlanması" şeklinde ifade edilmektedir (SSM, 2017).1985 yılından itibaren bu ve buna benzer kanunlarla birlikte Türkiye'nin savunma sanayii alanına olan yatırımlarının ve AR-GE faaliyetlerinin gün geçtikçe arttığı görülmektedir.



Şekil 1. Türkiye'nin savunma sanayii AR-GE harcamaları (Kaynak: SSM, 2017)

Şekil1'de 2003-2013 yılları arası Türkiye'nin savunma sanayii alanında AR-GE harcamalarının (milyon $) yıllara göre dağılımı gösterilmektedir. Buna göre 2007 yılından başlamak üzere Türkiye'nin son yıllarda önemli bir atılım gerçekleştirdiği görülmektedir. Türkiye'nin içerisinde bulunduğu coğrafya ve bölge şartları düşünüldüğünde bu durumun artarak devam etmesi gerekliliğinin olduğunu söylemek mümkündür.
Bu çalışma, amacı doğrultusunda dört bölümden oluşmaktadır. Birinci bölümde, konu hakkında genel bilgiler verilmiştir. İkinci bölümde, TOPSİS metodolojisi anlatılmıştır. Üçüncü bölümde, örnek uygulamaya ve hesaplamalara yer verilmiş, son bölümde ise bulunan sonuç değerlendirilmiştir.

Yöntem

TOPSIS yöntemi (Technique for Order Preference by Similarity to Ideal Solution) Hwang ve Yoon (1981) tarafından çok kriterli karar verme problemlerinin çözümü için geliştirilmiştir. Yöntem ele alınan karar probleminin çözümünü, pozitif-ideal çözüme en kısa mesafe ve negatif-ideal çözüme en uzak mesafedeki alternatifi seçmeye dayalı olarak gerçekleştirmektedir (Özcan vd, 2016). Örneğin, pozitif ideal çözüm işlevselliği en üst düzeye çıkarıp maliyeti en aza indirirken, negatif ideal çözüm ise maliyeti en üst düzeye çıkarmakta ve işlevselliği en aza indirmektedir (Hanine et al. 2016). TOPSIS yöntemi birçok alanda kullanılmaktadır. Bu alanlardan bazıları; tedarik zinciri yönetimi, tedarikçi seçimi, lojistik, mühendislik, üretim sistemleri, işletme ve pazarlama uygulamaları, insan kaynakları yönetimi, finansal uygulamalar, enerji yönetimi, kimya mühendisliği, su kaynakları yönetimi gibi birçok farklı sektörden oluşan alanları kapsamaktadır.

TOPSIS çözüm sürecinin aşamaları aşağıda sıralanmıştır. Bu çalışmanın uygulama kısmında Excel kullanılarak hesaplamalar gerçekleştirilmiştir (Özcan vd, 2016).

Adım 1: Karar matrisinin oluşturulması
Adım 2: Normalize karar matrisinin oluşturulması
Adım 3: Ağırlıklandırılmışnormalize karar matrisinin oluşturulması
Adım 4: Pozitif ve negatif ideal çözümün hesaplanması
Adım 5: Her bir alternatifin pozitif ve negatif ideal çözümden uzaklıklarının hesaplanması
Adım 6: Göreli yakınlığın hesaplanması
Adım 7: Göreli yakınlığa göre alternatiflerin sıralanması

Bulgular

Savunma projelerinin gizliliğigereği çalışmada kullanılan veriler tamamen kurgusal olup herhangi bir bilgi sisteminden alınmamıştır. Alternatifler ve kriterler, dolayısıyla bunlara verilen öncelikler senaryo kapsamında belirlenmiştir.

Amaç ve Kriterlerin Belirlenmesi

Savunma Sanayii Müsteşarlığı Muhabere ve Elektronik Bilgi Sistemleri (MEBS) Dairesinin açık ihale usulü ile teklife çıktığı bir askeri teçhizat alımı projesi için sektördeki 6 firmadan teklifler alınmıştır.

Amaç

Bir askeri teçhizat alımı projesi için ihaleye katılan 6 firmadan ihale kapsamında en uygun firmayı belirlemeye çalışmaktır.

Kriterler

- Fiyat
- Garanti Süresi
- Sanayi Katılımı/Offset (SKO) Oranı (Proje bedelinin en az %70'i kadar olmalıdır.)
- Teslimat Süresi

Tablo 1. Karar matrisi oluşturulması

Firma	Fiyat (TL)	Garanti Süresi (Yıl)	SKO Oranı	Teslimat Süresi (Ay)
A Firması	310.000	5	0,75	6
B Firması	285.000	4	0,70	12
C Firması	420.000	4	0,80	9
D Firması	350.000	5	0,85	7
E Firması	480.000	5	0,70	4
F Firması	370.000	4	0,80	5

Normalize Karar Matrisinin Oluşturulması

Normalize karar matrisi oluşturulurken, öncelikle her bir alternatife karşılık gelen karar kriter değerlerinin kareleri alınır. Daha sonra her bir sütuna ait değerler toplanarak karekökü alınır ve aşağıdaki tablo elde edilir. İlgili hücrelere ait formüller aşağıda verilmiştir.

Tablo 2. Normalizasyon işlemi

Firma	Fiyat	Garanti Süresi (Yıl)	SKO Oranı	Teslimat Süresi (Ay)
A Firması	96.100.000.000	25	0,56	36
B Firması	81.225.000.000	16	0,49	144
C Firması	176.400.000.000	16	0,64	81
D Firması	122.500.000.000	25	0,72	49
E Firması	230.400.000.000	25	0,49	16
F Firması	136.900.000.000	16	0,64	25
$\sqrt{\sum_{i=1}^{m} {}^{2}_{ij}}$	918.436,17	11,090	1,88	18,73

Daha sonra her bir hücre için $\frac{a_{ij}}{\sqrt{\sum_{i=1}^{m} a_{ij}^2}}$ işlemi gerçekleştirilir. Aşağıdaki tablo elde edilir:

Tablo 3. Normalize edilmiş matris

Firma	Fiyat	Garanti Süresi	SKO Oranı	Teslimat Süresi
A Firması	0,34	0,45	0,40	0,32
B Firması	0,31	0,36	0,37	0,64
C Firması	0,46	0,36	0,43	0,48
D Firması	0,38	0,45	0,45	0,37
E Firması	0,52	0,45	0,37	0,21
F Firması	0,40	0,36	0,43	0,27

Ağırlıklandırılmış Normalize Matrisin Oluşturulması

İdari ve teknik olmak üzere iki ayrı heyetten oluşan Teklif Değerlendirme Heyeti, firma tekliflerini daha önce kurum tarafından onaylanmış olan bir kriter ağacına göre değerlendirir. Bu kriter ağacına göre her bir kriter için birer ağırlık belirlenir. Verilen ağırlıklar proje türüne göre değişiklik göstermekte olup genelde fiyat ve teslimat

takvimine daha fazla ağırlık verilir. Bu çalışmada, Teklif Değerlendirme Heyeti'nin kriterlere vermiş olduğu ağırlıklar şu şekildedir:

- Fiyat (w1): 0,45
- Teslimat Süresi (w2): 0,30
- Garanti Süresi (w3): 0,15
- Sanayi Katılımı Offset Oranı (w4): 0,10

Tablo 4'teki değerler normalize edilmiş değerlerin ağırlıkları ile çarpılması sonucunda elde edilmiştir:

Tablo 4. Ağırlıklandırılmış normalize matrisin oluşturulması

Ağırlık	0,45	0,15	0,10	0,30
Firma	**Fiyat**	**Garanti Süresi**	**SKO Oranı**	**Teslimat Süresi**
A Firması	0,152	0,068	0,040	0,096
B Firması	0,140	0,054	0,037	0,192
C Firması	0,206	0,054	0,042	0,144
D Firması	0,171	0,068	0,045	0,112
E Firması	0,235	0,068	0,037	0,064
F Firması	0,181	0,054	0,042	0,080

İdeal ve Negatif İdeal Çözüm Değerlerinin Elde Edilmesi

İdeal ve negatif ideal çözüm değerlerini belirlerken dikkat edilmesi gereken en önemli husus, ilgili kriterin maksimize mi yoksa minimize mi edilmek istendiğidir. Hatırlanacağı üzere Adım 4'te her bir sütunun en büyük değerinin ideal çözüm değerlerini; en küçük değerin ise negatif ideal çözüm değerlerini oluşturduğuna değinilmişti. Buna göre problemin çözümü için ideal ve negatif ideal çözüm değerleri aşağıda gösterildiği gibidir.

- A* : {0.139, 0.067, 0.045, 0.063}
- A- :{0.234, 0.054, 0.037, 0.192}

"Fiyat" ve "teslimat süresi" kriterlerinde ideal çözüm değeri o sütun için en büyük değer değil, en küçük değer olmuştur. Çünkü SSM (Savunma Sanayii Müsteşarlığı)'nin daha az para ödemesi ve ürünü daha kısa sürede teslim alması beklenen ve olağan bir durumdur.

İdeal ve İdeal Olmayan Noktalara Uzaklık Değerlerinin Elde Edilmesi

Bu adımda, $S_i^* = \sqrt{\sum_{j=1}^{n}(V_{ij} - V_j^+)^2}$ ve $S_i^- = \sqrt{\sum_{j=1}^{n}(V_{ij} - V_j^-)^2}$formülleri kullanılarak uzaklıklar hesaplanmış hesaplanan bu değerler Tablo 5,Tablo 6, Tablo 7 ve Tablo 8'de gösterilmiştir.

İdeal Uzaklıkların Hesaplanması

Tablo 5. İdeal uzaklıkların hesaplanış formülleri

Firma	**Fiyat**	**Garanti Süresi**	**SKO**	**Teslimat Süresi**
A Firması	$(0,153 - 0,139)^2$	$(0,067 - 0,067)^2$	$(0,040 - 0,045)^2$	$(0,096 - 0,063)^2$
B Firması	$(0,139 - 0,139)^2$	$(0,054 - 0,067)^2$	$(0,037 - 0,045)^2$	$(0,192 - 0,063)^2$
C Firması	$(0,207 - 0,139)^2$	$(0,054 - 0,067)^2$	$(0,043 - 0,045)^2$	$(0,144 - 0,063)^2$
D Firması	$(0,171 - 0,139)^2$	$(0,067 - 0,067)^2$	$(0,045 - 0,045)^2$	$(0,111 - 0,063)^2$
E Firması	$(0,234 - 0,139)^2$	$(0,067 - 0,067)^2$	$(0,037 - 0,045)^2$	$(0,063 - 0,063)^2$
F Firması	$(0,180 - 0,139)^2$	$(0,054 - 0,067)^2$	$(0,043 - 0,045)^2$	$(0,081 - 0,063)^2$

Tablo 6. İdeal uzaklıkların hesaplanması

Firma	**Fiyat**	**Garanti Süresi**	**SKO**	**Teslimat Süresi**	**S^***
A Firması	0,00015004	0	0,00003	0,001025641	0,034697115
B Firması	0	0,000182927	0,00006	0,016410256	0,129060656

C Firması	0,004375167	0,000182927	0,00001	0,006410256	0,104763553
D Firması	0,00101427	0	0,00000	0,002307692	0,057636471
E Firması	0,009128434	0	0,00006	0	0,095874417
F Firması	0,001734463	0,000182927	0,00001	0,00025641	0,046699591

Negatif İdeal Uzaklıkların Hesaplanması

Tablo 7. Negatif ideal uzaklıkların hesaplanış formülleri

Firma	Fiyat	Garanti Süresi	SKO	Teslimat Süresi
A Firması	$(0,153 - 0,234)^2$	$(0,067 - 0,054)^2$	$(0,040 - 0,037)^2$	$(0,096 - 0,192)^2$
B Firması	$(0,139 - 0,234)^2$	$(0,054 - 0,054)^2$	$(0,037 - 0,037)^2$	$(0,192 - 0,192)^2$
C Firması	$(0,207 - 0,234)^2$	$(0,054 - 0,054)^2$	$(0,043 - 0,037)^2$	$(0.144 - 0,192)^2$
D Firması	$(0,171 - 0,234)^2$	$(0,067 - 0,054)^2$	$(0,045 - 0,037)^2$	$(0,111 - 0,192)^2$
E Firması	$(0,234 - 0,234)^2$	$(0,067 - 0,054)^2$	$(0,037 - 0,037)^2$	$(0,063 - 0,192)^2$
F Firması	$(0,180 - 0,234)^2$	$(0,054 - 0,054)^2$	$(0,043 - 0,037)^2$	$(0,081 - 0,192)^2$

Tablo 8. Negatif ideal uzaklıkların hesaplanması

Firma	Fiyat	Garanti Süresi	SKO	Teslimat Süresi	S^-
A Firması	0,00693785	0,000182927	0,00001	0,009230769	0,127900736
B Firması	0,009128434	0	0,00000	0	0,09554284
C Firması	0,00086423	0	0,00003	0,002307692	0,056569705
D Firması	0,004057082	0,000182927	0,00006	0,006410256	0,103507173
E Firması	0	0,000182927	0,00000	0,016410256	0,12881453
F Firması	0,002904775	0	0,00003	0,012564103	0,124487292

İdeal Çözüme Göreli Yakınlığın Hesaplanması

İdeal çözüme göreli yakınlık$C_i^* = \frac{S_i^-}{S_i^- + S_i^*}$ formülü ile hesaplanmıştır. Her bir alternatif için hesaplanan göreli yakınlık değerleri aşağıda gösterildiği gibidir:

- $C_1^* = \frac{0,127900736}{0,127900736+0,034697115} = 0,78660779$
- $C_2^* = \frac{0,09554284}{0,09554284+0,129060656} = 0,425384474$
- $C_3^* = \frac{0,056569705}{0,056569705+0,104763553} = 0,35063883$
- $C_4^* = \frac{0,103507173}{0,103507173+0,057636471} = 0,642328611$
- $C_5^* = \frac{0,12881453}{0,12881453+0,095874417} = 0,573301587$
- $C_6^* = \frac{0,124487292}{0,124487292+0,046699591} = 0,727201114$

Sonuç

Hesaplamalar sonucunda ihaleye giren firmaların tekliflerine ait göreli yakınlık katsayıları arasında $C_1^* > C_6^* > C_4^* > C_5^* > C_2^* > C_3^*$ gibi bir sıralama ortaya çıkmıştır. Yani teklif değerlendirme heyetinin seçmesi için en uygun firmanın A Firması olduğu değerlendirilmiştir. A Firmasının teklifi aşağıda belirtildiği gibidir:

- Fiyat: 310.000

- Garanti Süresi: 5 yıl
- SKO Oranı: 0.75
- Teslimat Süresi: 6 ay

Bu tekliflere göre A firmasının fiyat, garanti süresi, SKO oranı ve teslimat süreleri bir arada değerlendirildiğinde ihaleye katılan firmalar arasında en uygun firma olarak ön plana çıktığı görülmüştür. Bu çalışmada da kullanılan TOPSİS vb. çok kriterli karar verme tekniklerinin karar durumlarında karar vericilere önemli katkılar sağlayacağı düşünülmektedir.

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A MULTIPLE CRITERIA DECISION MAKING APPROACH TO DETERMINE THE COMPANY TO BE AWARDED

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Abstract: It is often encountered with the problem of making the most effective use of the budget in the public service sector where social, environmental, structural, political factors are involved and the limited budget is to be used in the best way. From multi-criteria decision making techniques, Analytic Hierarchy Process (AHP) and TOPSIS are two of the decision-making methods used to solve such problems with multiple criteria. In this study, the selection of the company that will receive the SME Grand Award, which is held annually and the winners receive various awards, are examined. The weights of the criteria were determined by the AHP method. And then the model created using the TOPSIS method was used to solve the problem.

Keywords: Company choice, AHP, TOPSIS.

ÖDÜL ALACAK İŞLETMENİN AHP VE TOPSİS YÖNTEMİYLE BELİRLENMESİ

Özet: Sosyal, çevresel, yapısal, politik faktörlerin olduğu ve kısıtlı bütçenin en iyi şekilde kullanılmasının zorunlu olduğu kamu hizmet sektöründe bütçenin en etkin kullanılacağı seçimin yapılması problemiyle sık sık karşılaşılır. Çok kriterli karar verme tekniklerinden, Analitik Hiyerarşi Prosesi (AHP) ve TOPSIS, birden çok kriter içeren bu tür problemlerin çözümünde kullanılan karar verme yöntemlerinden ikisidir. Bu çalışmada, her yıl yapılan ve sonucunda kazanan işletmelere çeşitli ödüller verilen KOBİ Büyük Ödülü'nü alacak işletmenin seçimi incelenmiştir. Kriterlerin ağırlıkları AHP yöntemi ile belirlenmiştir. Ardından TOPSIS Yöntemi kullanılarak oluşturulan model problemin çözümünde kullanılmıştır.

Anahtar Sözcükler: İşletme seçimi, AHP, TOPSIS

Giriş

KOBİ'ler, esnek, yeniliğe açık ve dinamik yapıları sayesinde değişen piyasa koşullarına hızla uyum sağlayabilme kabiliyetine sahiptir. Bu esnek yapıları, KOBİ'lere süratli karar alma ve uygulama konusunda üstünlük sağlamaktadır. Bununla birlikte bütün bu özellikleri sayesinde KOBİ'ler tüketici isteklerine daha hızlı cevap verebilmekte ve rakiplerinin önüne geçerek küresel ölçekte rekabet şartlarına dayanabilmektedir. KOBİ'lerin öneminin anlaşılmasıyla ülkeler ekonomik kalkınma stratejilerini KOBİ'ler üzerine şekillendirmeye başlamışlardır.

Ülkemizde KOBİ'lerin tanımlanmasında kullanılan esaslar, "Küçük ve Orta Büyüklükteki İşletmelerin Tanımı, Nitelikleri ve Sınıflandırılması Hakkında Yönetmelik" ile belirlenmiştir. 4 Kasım 2012 tarihli ve 28457 sayılı Resmi Gazete'de yayınlanan "Küçük ve Orta Büyüklükteki İşletmelerin Tanımı, Nitelikleri ve Sınıflandırılması Hakkında Yönetmelikte Değişiklik Yapılmasına Dair Yönetmeliğe göre; ikiyüzelli kişiden az yıllık çalışan istihdam eden ve yıllık net satış hasılatı veya mali bilançosundan herhangi biri kırk milyon Türk Lirasını aşmayan ekonomik birimler veya girişimler Küçük ve Orta Büyüklükteki İşletmeler (KOBİ)" olarak ifade edilmiştir. Ülkemizde ekonomik ve sosyal kalkınmada önemli rolleri bulunan KOBİ'lerin ekonomideki payları, Türkiye İstatistik Kurumu (TÜİK) tarafından yürütülen çeşitli çalışmalar aracılığıyla belirlenebilmektedir.

TÜİK Küçük ve Orta Büyüklükteki Girişim İstatistikleri 2016 sonuçlarına göre KOBİ'ler 2014 yılında;
- Toplam girişim sayısının %99,8'ini,
- İstihdamın %73,5'ini,
- Maaş ve ücretlerin %54,1'ini,
- Cironun %62,0'sini,
- İhracatın %56,4'ünü gerçekleştirdi.

Verilen istatistiklerden de anlaşılacağı üzere ülke ekonomisine katkısı büyük olan KOBİ'lerin desteklenmeleri ve teşvik edilmeleri önemlidir. Bu amaçla, son 5 yıldır ülkemizde üç ana kategoride verilen toplam dokuz KOBİ ve Girişimcilik Ödülleri; Yılın Başarılı KOBİ Büyük Ödülü, Yılın Başarılı KOBİ Ödülleri ve Yılın Başarılı Girişimci Ödülleri olmak üzere sahiplerini bulmaktadır. Ödüle ilişkin işlemler "KOBİ ve Girişimcilik Ödülleri Uygulama Esasları" ile düzenlenmektedir.

"KOBİ ve Girişimcilik Ödülleri Uygulama Esasları"na göre; ödül alacak işletmelerin belirlenmesinde ilk aşama sistem üzerinden başvuruların alınmasıdır. Her yıl ilan edilen tarihler arasında işletmelerden başvurular alınır. Yapılan başvurular, ilk olarak, belirlenen kriterler üzerinden sistem tarafından değerlendirilir ve puanlanır. Sistem tarafından yapılan ön elemeyi geçen işletmeler Değerlendirme Komisyonları tarafından, her kategoride 5 KOBİ olmak üzere toplamda 45 finalist olarak belirlenir. Özel sektör, kamu kurum/kuruluşları, ekonomi alanında öne çıkmış yazarlar ve üniversitelerden akademisyenler olmak üzere toplam 7 kişiden oluşan jürinin değerlendirmesi sonucu kategori birincileri belirlenir.

Çalışma kapsamında yalnızca KOBİ Büyük Ödülü seçimi incelenmiştir. Sistem tarafından yapılan ön elemeden geçen ve finale kalan 5 işletme, belirlenen kriterler çerçevesinde incelenmiştir. Seçim kriterlerinin ağırlıklarının belirlenmesi için AHP yöntemi, alternatiflerin sıralanması için TOPSIS yöntemi kullanılmıştır. AHP yöntemi ile kriter ağırlıklarının belirlenmesi sırasında Super Decisions 2.0.8. programı kullanılmıştır. Bu program yardımı ile kriter ağırlıkları ve tutarsızlık katsayısı elde edilebilmektedir. TOPSIS yönteminin hesaplamaları için ise Microsoft Excel 2013'te oluşturulan tablolardan yararlanılmıştır.

Bu çalışma, amacı doğrultusunda dört bölümden oluşmaktadır. Birinci bölümde, konu hakkında genel bilgiler verilmiştir. İkinci bölümde, AHP ve TOPSİS metodolojisi anlatılmıştır. Üçüncü bölümde, örnek uygulamaya ve hesaplamalara yer verilmiş, son bölümde ise bulunan sonuç değerlendirilmiştir.

Yöntem

AHP Yöntemi

Analitik Hiyerarşi Süreci (AHP) 1970'li yılların sonlarında Thomas L. Saaty tarafından geliştirilen ölçme ve karar verme için kullanılan matematiksel bir teoridir (Supçiller ve Çapraz, 2011). Çok kriterli karar verme (ÇKKV) yöntemlerinden biri olan AHP, son 20 yıldır çok kriterli karar alma ile ilgili uygulamaların neredeyse tamamında çok geniş ve yaygın bir şekilde kullanılmıştır. AHP, öğeleri arasında karmaşık ilişkiler sergileyen sistemlere ait karar problemlerinde; sistemi alt sistemleriyle ilişkili, hiyerarşik bir yapıda oldukça basitleştirerek ifade edip, sezgisel ve mantıksal düşünceyle irdeleyebilen bir yaklaşımdır (Akça vd., 2015). Bu yaklaşımda, amaçları, nitelikleri ve paydaşları hiyerarşik olarak düzenlemek iki amaca hizmet eder. Bunlardan birincisi; duruma özgü olan karmaşık ilişkilerin genel bir görünümünü sağlamak ikincisi ise; karar verici açısından her seviyedeki konuların aynı önemde olup olmadığının değerlendirilmesine yardımcı olarak karar vericinin homojen unsurları doğru bir şekilde karşılaştırmasını sağlamasıdır (Saaty, 1990). Bundan dolayı karar vericiler tarafından kolay anlaşılması sebebiyle oldukça yaygın bir şekilde birçok alanda kullanılmaktadır (Akça vd., 2015).
AHP yönteminin adımları şunlardır (Özcan vd., 2016):
1. *Adım:* Amacın, alternatif ve kriterlerin belirlenmesi,
2. *Adım:* Karar vericilerden veya ilgili kaynaklardan veri toplanması,
3. *Adım:* Kriter ağırlıklarının ilişkisinin belirlenmesi,
4. *Adım:* Tutarlılık skorlarının hesaplanması,
5. *Adım:* Alternatiflerin skorlarının hesaplanması.

İkili karşılaştırma matrislerinin oluşturulması ve önem ağırlıklarının belirlenmesinde Saaty tarafından önerilen ve tablo 1'de verilen 1-9 önem skalası kullanılmaktadır.

Tablo 1- İkili karşılaştırmalarda kullanılan önem skalası

Önem Düzeyi	Değer İfadeleri
1	Eşit önemli
2	Az önemli
3	Orta derece önemli
4	Orta üstü önemli
5	Önemli
6	Daha önemli
7	Çok önemli
8	Çok daha önemli
9	Mutlak önemli

Kaynak: Saaty, 2008

TOPSİS Yöntemi

TOPSIS yöntemi (Technique for Order Preference by Similarity to Ideal Solution) Hwang ve Yoon (1981) tarafından çok kriterli karar verme problemlerinin çözümü için geliştirilmiştir. Yöntem ele alınan karar probleminin çözümünü, pozitif-ideal çözüme en kısa mesafe ve negatif-ideal çözüme en uzak mesafedeki alternatifi seçmeye dayalı olarak gerçekleştirmektedir (Özcan vd., 2016). Örneğin, pozitif ideal çözüm işlevselliği en üst düzeye çıkarıp maliyeti en aza indirirken, negatif ideal çözüm ise maliyeti en üst düzeye çıkarmakta ve işlevselliği en aza indirmektedir (Hanine vd., 2016).

TOPSIS çözüm sürecinin aşamaları aşağıda sıralanmıştır (Özcan vd., 2016).
1. Adım: Amaçların belirlenmesi ve değerlendirme kriterlerinin tanımlanması.
2. Adım: Sıralama için karar matrisi (A) oluşturulur. Burada, m alternatiflerin sayısını, n ise kriterlerin sayısını ifade eder.

$$A_{ij} = \begin{bmatrix} a_{11} & \cdots & a_{1n} \\ \vdots & \ddots & \vdots \\ a_{m1} & \cdots & a_{mn} \end{bmatrix}$$

3. Adım: Normalize edilmiş karar matrisi aşağıdaki eşitlik yardımıyla elde edilir (R).

$$r_{ij} = \frac{a_{ij}}{\sqrt{\sum_{k=1}^{m} a_{kj}^2}} \quad i = 1,2,\dots,m; j = 1,2,\dots,n$$

$$R_{ij} = \begin{bmatrix} r_{11} & \cdots & r_{1n} \\ \vdots & \ddots & \vdots \\ r_{m1} & \cdots & r_{mn} \end{bmatrix}$$

4. Adım: Normalize edilmiş karar matrisi ilgili ağırlıklar ile çarpılarak ağırlıklı normalize edilmiş karar matrisi oluşturulur (V).

$$V_{ij} = \begin{bmatrix} w_1 r_{11} & \cdots & w_n r_{1n} \\ \vdots & \ddots & \vdots \\ w_1 r_{m1} & \cdots & w_n r_{mn} \end{bmatrix}$$

5. Adım: Pozitif ideal çözüm (A^+) ve negative ideal çözüm (A^-) tanımlanır.

$$A^+ = \left\{ \left(\max v_{ij} \middle| j \epsilon J \right), \left(\min v_{ij} \middle| j \epsilon J' \right) \right\} = \{ v_1^+, v_2^+, \dots, v_n^+ \}$$

$$A^- = \left\{ \left(\min v_{ij} \middle| j \epsilon J \right), \left(\max v_{ij} \middle| j \epsilon J' \right) \right\} = \{ v_1^-, v_2^-, \dots, v_n^- \}$$

6. Adım: Her bir alternatifin pozitif ve negative ideal çözüme olan öklid mesafesinin belirlenmesi.

$$S^+ = \sqrt{\sum_{j=1}^{n} \left(v_{ij} - v_j^+ \right)^2} \quad i = 1,2,\dots,m$$

$$S^- = \sqrt{\sum_{j=1}^{n} \left(v_{ij} - v_j^-\right)^2} \quad i = 1,2,\dots,m$$

7. Adım: İdeal çözüm için i'ninci alternatifin göreli yakınlık katsayısının hesaplanması.

$$C_i^* = \frac{S^-}{S^- + S^+} \; i = 1,2,\dots,m$$

8. Adım: Yakınlık katsayılarına göre alternatiflerin sıralanması ve en optimal olanının seçilmesi.

Bulgular

Kriterlerin Belirlenmesi

Probleme ilişkin 5 kriter belirlenmiştir. İşletmelerin son 3 yıllık verileri göz önüne alınmıştır.

1. Ciro Bazlı Büyüme Oranı (maksimizasyon)
   İşletmenin son 3 (üç) mali yıl içinde istikrarlı bir büyüme sağlaması beklenir. Yüzde olarak hesaplanmıştır.
2. Pazar Payı (maksimizasyon)
   İşletmenin yüksek bir pazar payına sahip olması beklenir. Pazar payı yüzde olarak yazılmıştır.
3. İhracat Oranı (maksimizasyon)
   Son üç yılın ihracat rakamlarında oluşan artışa bakılarak hesaplanmıştır. Yüzde olarak yazılmıştır.
4. İstihdamdaki Artış Oranı: (maksimizasyon)
   İşletmenin sağladığı istihdam sayısında meydana gelen artış yüzde olarak hesaplanmıştır.
5. Marka Bilinirliği: (maksimizasyon)
   İşletmenin markasının faaliyet gösterdiği alanda bilinir olması beklenir. Marka tanınırlığı, fiyat satış oranları arasındaki farklar ve işletmelerin piyasa değerlerine bakılarak 5'li likert ölçeği ile derecelendirilmiştir. (1-en düşük, 5-en yüksek)

Kriterlerin Ağırlıklandırılması

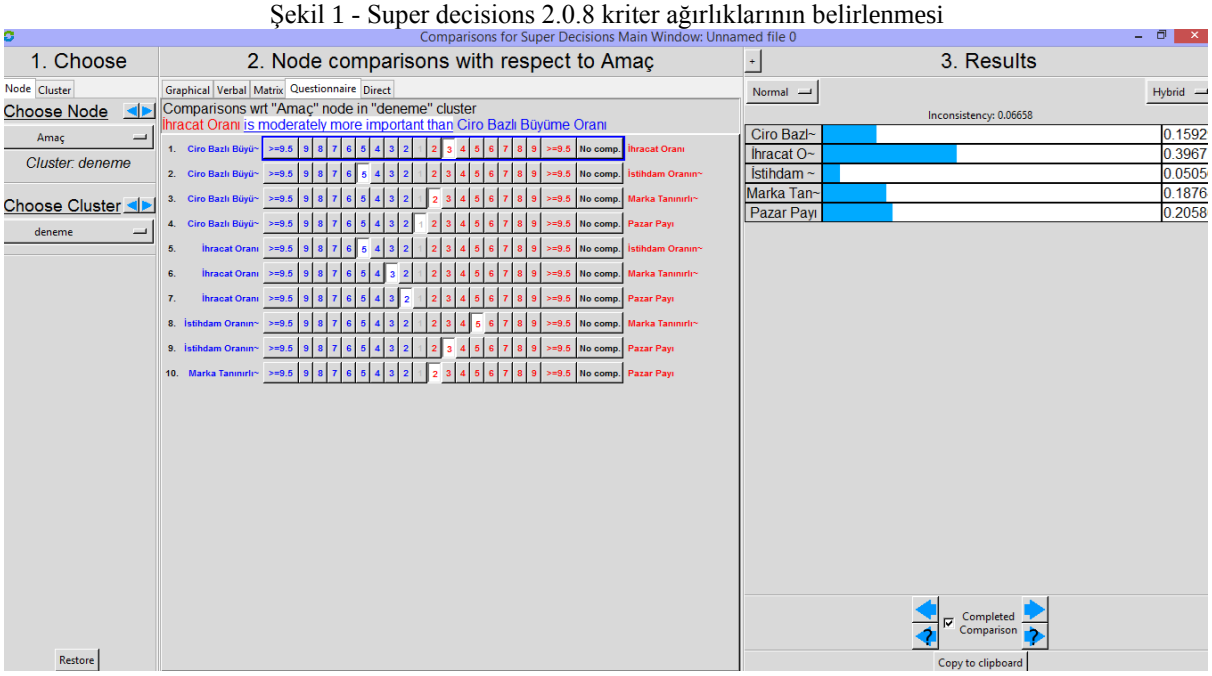
Ödül alacak işletmenin belirlenmesi için belirlenen 5 kriterin ağırlıkları belirlenirken AHP yöntemi kullanılmıştır. Buna göre kriterler arası ikili karşılaştırma matrisi Tablo 2'de görüldüğü şekilde oluşturulmuştur.

Tablo 2 - Kriterler arası ikili karşılaştırma matrisi

	Ciro Bazlı Büyüme Oranı	**İhracat Oranı**	**Pazar Payı**	**İstihdam Oranında Artış**	**Marka Bilinirliği**
Ciro Bazlı Büyüme Oranı	1	0,33	1	5	0,5
İhracat Oranı	3	1	2	5	3
Pazar Payı	1	0,5	1	3	2
İstihdam Oranında Artış	0,2	0,2	0,33	1	0,2
Marka Bilinirliği	2	0,3	0,5	5	1

Oluşturulan "Kriterler Arası İkili Karşılaştırma Matrisi"nde yer alan veriler Super Decisions 2.0.8 programına girilmiş ve ağırlıklar belirlenmiştir. Programa ait ekran görüntüsü Şekil 1'de verilmiştir.

Şekil 1 - Super decisions 2.0.8 kriter ağırlıklarının belirlenmesi



Sonuç olarak kriterlere ait ağırlıklar Tablo 3'de gösterilmiştir. Ayrıca programdan alınan verilere göre tutarlılık oranı 6,6% çıkmıştır. Tutarlılık oranının 0,10'dan küçük olması beklendiğinden sonuç tutarlı sayılır.

Tablo 3 - Kriter ağırlıkları (Wj)

Kriter	Ağırlık
Ciro Bazlı Büyüme Oranı	0,15929
İhracat Oranı	0,39671
Pazar Payı	0,2058
İsstihdam Oranında Artış	0,05056
Marka Bilinirliği	0,18174

Karar Matrisinin Oluşturulması

Sistem tarafından yapılan ön eleme sonucunda finale kalan 5 işletmeye ait veriler Tablo 4'te görünmektedir.

Tablo 4 - Karar matrisi

İşletmeler	Ciro Bazlı Büyüme Oranı	İhracat Oranı	Pazar Payı	İstihdam Oranında Artış	Marka Bilinirliği
K1	0,55	0,70	0,20	0,38	4
K2	0,62	0,41	0,20	0,52	4
K3	0,8	0,27	0,18	0,65	3
K4	0,58	0,62	0,29	0,28	5
K5	0,65	0,36	0,15	0,56	3

Normalize Karar Matrisinin Oluşturulması (Aij)

Yapılan hesaplamalar sonucunda normalize edilmiş karar matrisi Tablo 5'te gösterilmiştir.

Tablo 5 - Normalize karar matrisi

İşletmeler	Ciro Bazlı Büyüme Oranı	İhracat Oranı	Pazar Payı	İstihdam Oranında Artış	Marka Bilinirliği
K1	0,380825795	0,627355001	0,427373843	0,342732000	0,461880215
K2	0,429294533	0,367450786	0,427373843	0,469001685	0,461880215
K3	0,553928430	0,241979786	0,384636459	0,586252106	0,346410162
K4	0,401598112	0,555657287	0,619692073	0,252539369	0,577350269
K5	0,450066849	0,322639715	0,320530382	0,505078737	0,346410162

Ağırlıklı Normalize Karar Matrisinin Oluşturulması(Vij)

Normalize edilmiş değerlerin, ağırlıkları ile çarpımı neticesinde oluşan, Ağırlıklı Normalize Karar Matrisi (V Matrisi) Tablo 6'daki gibidir.

Tablo 6 - Ağırlıklı normalize karar matrisi

İşletmeler	Ciro Bazlı Büyüme Oranı	İhracat Oranı	Pazar Payı	İstihdam Oranında Artış	Marka Tanınırlığı
K1	0,060661741	0,248878002	0,087953537	0,01732853	0,086667204
K2	0,068382326	0,145771401	0,087953537	0,023712725	0,086667204
K3	0,088235260	0,095995801	0,079158183	0,029640906	0,065000403
K4	0,063970563	0,220434802	0,127532629	0,01276839	0,108334005
K5	0,071691148	0,127994401	0,065965153	0,025536781	0,065000403

Pozitif İdeal (A*) ve Negatif İdeal (A^-) Çözüm Kümelerinin Oluşturulması

A^* ve A^- çözüm kümeleri aşağıdaki şekilde oluşmuştur.

$A^* = \{ 0.088, 0.249, 0.128, 0.030, 0.108\}$
$A^- = \{ 0.061, 0.096, 0.066, 0.013, 0,065\}$

Uzaklıkların Hesaplanması

Pozitif ideal uzaklıklar Tablo 7'de gösterilmiştir.

Tablo 7 - Pozitif ideal uzaklıklar

İşletmeler	Ciro Bazlı Büyüme Oranı	İhracat Oranı	Pazar Payı	İstihdam Oranında Artış	Marka Tanınırlığı	Si^*
K1	0,000760299	0,000000000	0,001566504	0,000151595	0,000469450	0,054
K2	0,000394139	0,010630971	0,001566504	0,000035143	0,000469450	0,114
K3	0,000000000	0,023372968	0,002340087	0,000000000	0,001877801	0,166
K4	0,000588775	0,000809016	0,000000000	0,000284682	0,000000000	0,041
K5	0,000273708	0,014612845	0,003790554	0,000016844	0,001877801	0,143

Negatif ideal uzaklıklar Tablo 8'de gösterilmiştir.

Tablo 8 - Negatif ideal uzaklıklar

İşletmeler	Ciro Bazlı Büyüme Oranı	İhracat Oranı	Pazar payı	İstihdam Oranında Artış	Marka Tanınırlığı	Si^-
K1	0	0,023372968	0,000483489	2,07949E-05	0,00046945	0,156
K2	5,96074E-05	0,00247761	0,000483489	0,000119778	0,00046945	0,060
K3	0,000760299	0	0,000174056	0,000284682	0	0,035

K4	1,09483E-05	0,015485065	0,003790554	0	0,001877801	0,145
K5	0,000121648	0,00102391	0	0,000163032	0	0,036

İdeal Çözüme Göre Yakınlığın Hesaplanması

İdeal çözüme göre yakınlıklar (C_i^*) aşağıda gösterildiği şekilde hesaplanmıştır.

$$C_1^* = \frac{0,156}{0,054 + 0,156} = 0,742$$

$$C_2^* = \frac{0,06}{0,114 + 0,06} = 0,344$$

$$C_3^* = \frac{0,035}{0,166 + 0,035} = 0,174$$

$$C_4^* = \frac{0,145}{0,041 + 0,145} = 0,780$$

$$C_5^* = \frac{0,036}{0,143 + 0,036} = 0,201$$

Sonuç

Yapılan hesaplamalar sonucunda K4>K1>K2>K5>K3 sıralaması ortaya çıkmıştır. K4 ve K1 işletmelerinin sonucu birbirine çok yakın çıkmakla birlikte bu sonuçlara göre KOBİ Büyük Ödülünü K4 işletmesinin alması önerilmektedir. Tablo 9'a bakılarak K4 işletmesine ait veriler incelendiğinde, K4 işletmesinin pazar payı, marka tanınırlığı kriterlerinde en yüksek değerlere, istihdam oranında görülen artış kriterinde ise en düşük değere sahip olduğu görülmektedir.

Tablo 9. Sonuç tablosu

İşletmeler	Ciro Bazlı Büyüme Oranı	İhracat Oranı	Pazar payı	İstihdam Oranında Artış	Marka Tanınırlığı
K1	0,55	0,70	0,20	0,38	4
K2	0,62	0,41	0,20	0,52	4
K3	0,8	0,27	0,18	0,65	3
K4	**0,58**	**0,62**	**0,29**	**0,28**	**5**
K5	0,65	0,36	0,15	0,56	3

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PROFESSION IDENTIFICATION DECISION SUPPORT SYSTEM

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Abstract: There are preemptive alternatives in our lives, and we need to decide something based on these alternatives. But some causes make it difficult for us to decide. Accordingly, we are looking for 'support' that will help us decide with us in this process. One of these processes is to decide in which field you will work after you become a profession. In this decision-making process, there are now criteria for alternative work areas and work areas for each occupation. In this process, the Analytical Hierarchy Process (AHP) based Profession Identification Decision Support System (PIDSS) is designed to facilitate decision making. At the end of this application, the person who wants to decide which working area to work and will find the working area proposal suitable for his/her chosen occupation.

Keywords: Decision support system, analytic hierarchy process, profession, multiple criteria decision making

ÇALIŞMA ALANI BELİRLEME KARAR DESTEK SİSTEMİ

Özet: Hayatta önümüze alternatifler çıkar, bu alternatiflere bağlı olarak bir şeye karar vermemiz gerekir. Ama bazı nedenler karar vermemizi zorlaştırır. Buna bağlı olarak bu süreçte yanımızda karar vermemizi sağlayacak 'destek' ararız. Bu süreçlerden biri de, bir meslek sahibi olduktan sonra hangi alanda çalışacağına karar vermek. Bu karar verme sürecinde, önümüzde her meslek için alternatif çalışma alanları, çalışma alanı için kriterler mevcuttur. Bu süreçte karar vermeyi kolaylaştıracak, Analitik Hiyerarşi Süreci (AHP) tabanlı çalışan Çalışma Alanı Belirleme Karar Destek Sistemi (ÇABKDS) tasarlanmıştır. Bu uygulamanın sonunda, hangi çalışma alanında çalışacağına karar vermek isteyen kişi, belirlediği mesleğe uygun çalışma alanı önerisini bulacaktır.

Anahtar Sözcükler: Karar destek sistemi, analitik hiyerarşi süreci, çalışma alanına, çok kriterli karar verme

Giriş

Ülkemizde ilkokuldan başlayıp üniversite giriş sınavına kadar tüm öğrenciler kendilerine uygun alan mesleği seçme konusunda tereddüt yaşamaktadır. Verilecek bu karar yaşamlarının geri kalanında önemli bir yere sahip olacağı için oldukça zordur. Meslek seçimi önemli bir karar verme süreci sonucunda ortaya çıkmaktadır. Bu karar sürecinde farklı meslekler söz konusu iken aynı zamanda farklı değerlendirme kriterleri de söz konusu olmaktadır. Kişiler için önem arz eden bu kriterleri dikkate alan en uygun meslek seçimi ve çalışacağı alanın belirlenmesi problemi bir çok kriterli karar verme problemi haline dönüşür. Bu tür problemlerin çözümü için geliştirilecek olan bir karar destek sistemi sayesinde karar vericilere kolaylık sağlanmış olur. Kişilere göre değişiklik gösterebilecek kriterleri hızlıca dikkate alıp uygun meslek ve çalışma alanı seçimi kolaylıkla sağlanmış olur. Bu çalışmanın amacı, eline mesleğini almış, gerekli adımları tamamlamış, hangi alanda çalışacağına karar veremeyen kişiler için bir karar destek sisteminin tasarlanmasıdır.

Literatür Araştirmasi

Çok kriterli karar verme teknikleri ile teorik ve pratik çalışma alanında yüzlerce çalışma bulunmaktadır. Yakın zamanda gerçekleştirilmiş çalışma alanı seçimini dikkate alan bazı çalışmaklar ise şu şekildedir: Karadeniz bölgesindeki meslek yüksekokullarında muhasebe bölümünde eğitim alan öğrenciler (Dinç, 2008). Trabzon ili lise öğrencileri için bir uygulama çalışması(Şahin ve ark., 2015), Bülent Ecevit Üniversitesi İİBF son sınıf öğrencileri (Korkmaz ve Çevik, 2014), yurt dışında eğitim veren bir üniversitenin mühendislik öğrencileri (Mishkin ve ark., 2016).

Çalışma Alanı Belirleme Karar Destek Sistemi (ÇABKDS), çok kriterli karar verme yöntemi olan AHP üzerinden kişiye karar vermesine yardımcı olmayı amaçlayan bir uygulamadır. AHP ile yapılmış olan bazı çalışmalar ise Hung ve ark., (2005) Divahar ve Sudhahar (2012), Göktolga ve Gökalp (2012), Önder ve Önder (2013) Ağaç ve Baki (2015), Xi ve ark. (2016) tarafından uygulama çalışmaları olarak ele alınmıştır.

Araştırma Soruları

Bu çalışmayı yapmadan önce, çalışma alanının belirlenmesi için önce kişinin kendisine sorması gereken soruları incelememiz gerekir. Bu konuda aşağıdaki bilgiler dikkate alınabilir.

- *"Öncelikle ne istediğinizi bulun.*
- *Sadece işinizi değil, tüm hayatınızı düşünerek geleceğinizi tasarlayın.*
- *Gerçekten motive olduğunuz alanda meraklı olursunuz. Bırakın bu merakınız size birçok yeni şey öğretsin, yeni insanlarla tanışmanıza vesile olsun. Bu "öne çıkmanın" en iyi yoludur.*
- *Kendinizi iyi tanıyın. Bununla da yetinmeyin, kendinizi nasıl daha iyi anlatabileceğinizi de çalışın.*
- *Hayal kurmaktan çekinmeyin. Hayalinizi kurduktan sonra gerçeklikle de karşılaştırın. O hayali yaşayanlarla konuşun. Her şey hayalinizdeki gibi olmayabilir, nelerin farklı olduğunu öğrenip yolunuza devam etmek iyi bir stratejidir.*
- *Hayalleriniz sözde kalmasın: detaylı bir plan yapın. Hatta detaylı birkaç plan yapın.*
- *Planlarınızın somut adımları olsun. Ve en önemlisi o adımları atın!"*(Sepici, 2014).

Bu değerlendirmeler ışığında, kişinin hangi çalışma alanında çalışacağını karar verebilmesi için şu soruyu sorması gerekir: Benim alternatiflerim hangisi, kriterlerim nedir? Bu sorulara verilecek cevaplar yapılan çalışmada ön planda tutarak, Analitik Hiyerarşi Sürecinden (AHP) yararlanarak bir karar destek sistemi tasarlandı. Kişinin sorduğu bu temel soruya, sistem kişinin önem değerlerini ön planda tutarak karar vermesini sağlıyor olacak.

Verilerin Toplanmasi

Çalışma Alanı Belirleme Karar Destek Sistemi (ÇABKDS) için AHP yöntemi kullanıldı. Sistem oluşturulmadan önce çalışma alanları için alternatifler, karşılaştırma yapılması için kriterler belirlenmesi gerekiyordu. Bu konuda yazılmış makalelerden ve insan kaynakları firmalarından araştırma yapıldı. Çalışma alanı alternatifleri çok geniş yelpazede olması nedeniyle "kariyer.net" internet sitesinden yararlanarak meslekler için en popüler çalışma alanları seçilerek veritabanına kaydedildi.

Meslek seçiminde çok sayıda kriter dikkatimizi çekmekte. Bu konuda hem yurt içinde hem yurt dışında yapılmış araştırma var. Burada meslek seçiminde kullanılacak kriterler, Ahmadive ve ark. (1995)'nın muhasebecilerin mesleklerini seçiminde belirleyici olduğunu düşündükleri 27 değişken faktör analizi içerisinden 5 tane olarak seçilmiştir.

Bu alternatifleri ve kriterleri içeren bir tablo üzerinden gerçek kişilere uygulanarak, kişilerin mesleklerine göre hangi alanda çalışacaklarını belirlemelerine yardım ediyor. Çalışan sistem AHP yönetiminin algoritmasını kullanarak size belirlediğiniz alternatiflere göre hangisini seçmeniz konusunda fikir vermektedir.

Tablo 1. Çalışma alanı belirlemede kullanılan kriterler (Pekkaya ve Çolak, 2013)

	Kriterler
Kariyer İmkanı	Meslekte ilerleme, uzmanlaşma ve eğitim fırsatları, işin çeşitliliği, işin prestiji.
İş Güvencesi	İş güvencesi, işteki istikrar, profesyonelleşerek meslekte kalıcı olma imkânı.
Meslek Kazançları	Emekli programı, maaş, özel-kamu arası karşılıklı geçiş fırsatları, promosyon/teşvik avantajları.
Meslek Elastikiyeti	Çalışma saatleri ve yerindeki esneklik, 40 saatlik çalışma haftası, işin yaratıcı davranışa olanak sağlaması.
Kişisel Konular	Ailenin düşüncesi ve etkisi, bireyin yaşı, eş /eş adayının mesleği veya etkisi.

Analitik Hiyerarşi Süreci (Ahp)

Alternatifin birden fazla olduğu ve değerlendirme için birden fazla kriterin söz konusu olduğu durumlarda karar vericilerin karar verme sürecine çok kriterli karar verme adı verilmektedir. AHP (Analytical Hierarchy Process), ANP (Analytic Network Process), TOPSIS (Technique for Order Preference by Similarity to Ideal Solution), ELECTRE (Elimination et Choix Traduisant la Realite), PROMETHEE (Preference Ranking Organization Method for Enrichment Evaluation) vb. yöntemler bazı çok kriterli karar verme tekniklerindendir. AHP yöntemi, Saaty (1980) tarafından geliştirilmiştir ve günümüzde yapılan birçok çalışmada yaygın olarak kullanılmaktadır. AHP metodundaki adımları, aşağıdaki gibidir.

1. Problemin tanımlanması.
2. Alternatifler için karar hiyerarşisi oluşturulur.
3. Her bir kriter çifti için ikili karşılaştırma matrisleri oluşturulur.
4. İkili karşılaştırma matrisleri kullanılarak kriter ağırlıkları hesaplanır.
5. Kriter ağırlıklarının tutarlıkları hesaplanır.

Tablo 2. Analitik hiyerarşi sürecinde önem değerleri

Puan	**Tanım**	**Açıklama**
1	Eşit derecede önemli	Her iki kriter de amaca eşit etkide bulunur.
3	Orta derecede önemli	Bir kriter diğerine göre biraz daha fazla tercih edilebilir.
5	Güçlü derecede önemli	Bir kriter diğerine göre çok daha fazla tercih edilebilir.
7	Çok güçlü derecede önemli	Bir kriter diğerine göre çok güçlü şekilde tercih edilebilir.
9	Son derece önemli	Bir kriter diğerine göre mümkün olan en yüksek derecede tercih edilir.
2,4,6,8	Ara değerlerdir.	

AHP yönteminde önce alternatifler belirlenir ve ilgili kriterler seçilir. Alternatifler ve Kriterler önem değerlerine göre ikili olarak karşılaştırılarak değerlendirilir. Yukarıda verilen AHP adımlarına göre işlemler gerçekleştirilir.

Expert Choice firması, tasarımını yaptığı Analitik Hiyerarşi Süreci uygulama yazılımı ile HP, IBM, NASA, NATO gibi müşterilerine profesyonel hizmet vermektedir (Baltalar, 2008). Bu çalışmada AHP sonuçları için çokça kullanılan Expert Choice yazılımı kullanılacaktır.

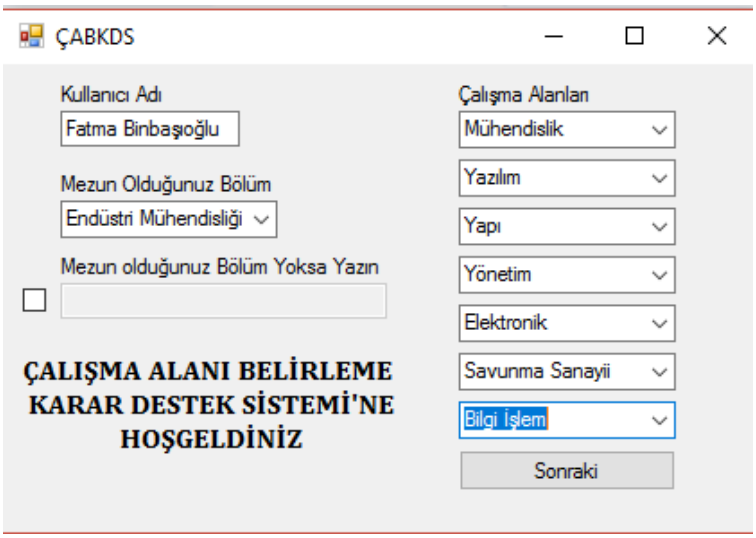
Çalişma Alani Belirleme Karar Destek Sistemi Uygulamasi

Bu analizi gerçekleştirmek için kişinin öncelikle bir mesleğinin belirlemiş olması ve mesleğindeki iş alanları hakkında genel bilgi sahibi olması gerekir. Gerekli analizi yapmak için Visual Studio programında hazırlanmış temel bir program kullanılmıştır.

ÇABKDS, Windows işletim sisteminde çalışan bir uygulamadır. Uygulamanın ÇABKDS.exe dosyasıyla çok kolay bir şekilde çalışmaktadır. Fakat, uygulama veritabanına bağlı çalışan bir uygulama olduğu için çalıştırılacak bilgisayarda MSSQL Server kurulu olmalı ve ÇABKDS veritabanı çalışıyor olmalı. Uygulama, veritabanına erişemediği takdirde veya MSSQL Server kurulu değilse, yine de çalışacaktır fakat açılır menüler boş gelecektir. Kullanıcı isterse, elle yazarak gerekli boşlukları doldurup sistemi kullanabilir. Boyut olarak ÇABKDS uygulaması kilobyte'lar seviyesinde yer kaplamakta. Bunun yanında ÇABKDS veritabanı, veri girildikçe büyüyecektir.

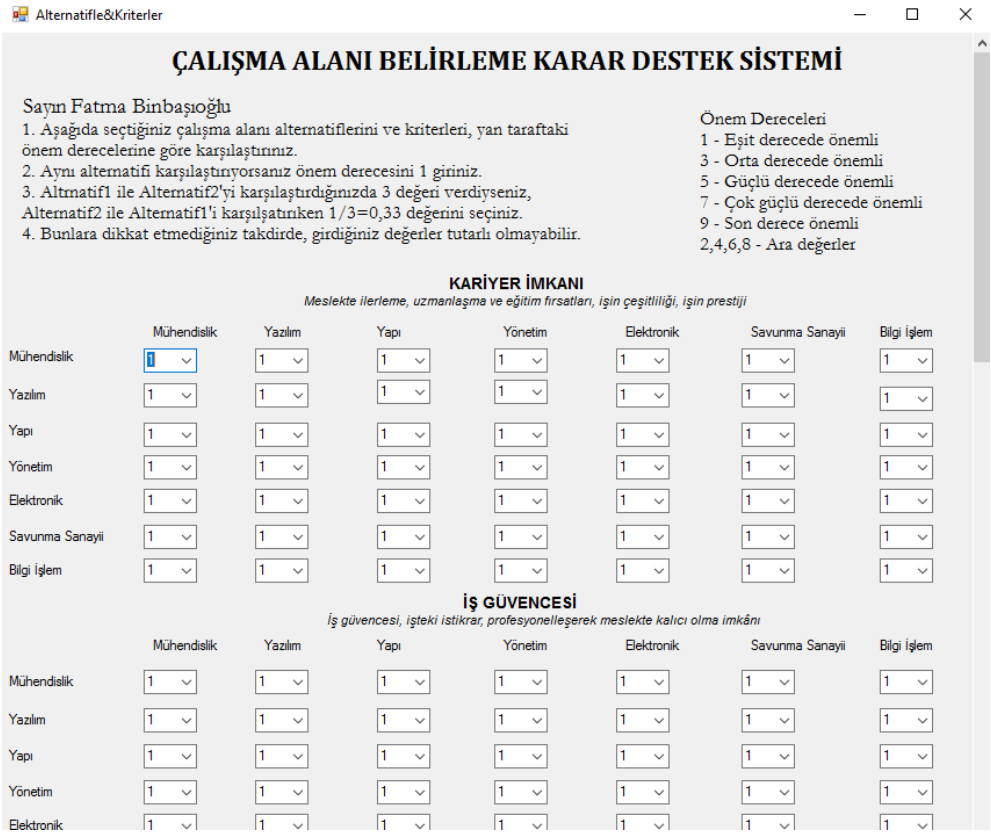
ÇABKDS.exe uygulamasına tıklandığında Şekil 2'deki gibi bir pencere açılacaktır. Öncelikle ilk gelen pencerede, kişinin adı, mezun olduğu bölüm ve çalışma alanları seçilmesi istenir. Eğer mezun olduğu bölüm listede yoksa üçüncü satırda bulunan sekmeden mezun olduğu bölüm eklenebilir. Listede olmayan çalışma

alanının listeye eklenmesini şu an için program imkan sağlamamaktadır. Fakat kullanıcı isterse veritabanına kaydetmeden istediği çalışma alanını elle yazarak uygulamada görebilir. Uygulamayı kapattığında elle yazdığı çalışma alanı kaybolacaktır.



Şekil 1. ÇABKDS uygulamasında açılan ilk pencere

Sonraki butonuna tıklayarak ikinci adıma geçilir. Yeni açılan pencerede, seçilen çalışma alanları, her bir kritere (Kariyer İmkanı, İş Güvencesi, Meslek Kazancına vd.) göre önem değerleri dikkate alınarak değerlendirilir.



Şekil 2. Uygulamada alternatiflerin karşılaştırılması

Bu pencere doldurulurken bazı kurallara dikkat edilmesi gerekmekte:

- Aynı alternatifi karşılaştırırken önem değeri ‘1’ seçilir. Örneğin; Mühendislik ile Mühendislik karşılaştırılırken değer ‘1’ seçilir.
- Farklı alternatifler karşılaştırılırken, hangisinin önemi ne derece fazla ise ‘3,5,7,9’ den biri seçilir, aynı derecede önem değeri varsa ‘2,4,6,8’ den biri seçilir. Kişi için önemsiz olan alternatif için, önem değeri ondalıklı ifade seçilir. Örneğin Yazılım ile Mühendislik alternatiflerini karşılaştıralım. Yazılım çalışma

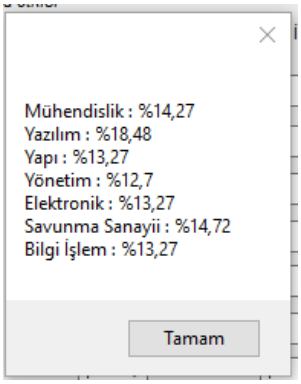
alanı, Mühendislik çalışma alanına göre oldukça önemli olduğunu düşünüyorsak, Mühendislik sütunundaki Yazılım hücresini '2' seçeriz, Yazılım sütunundaki Mühendislik hücresini '0,5' seçeriz.

- İki farklı alternatifi karşılaştırırken Alternatif1'e göre Alternatif2'ye "5" değeri seçilmişse, Alternatif2'ye göre Alternatif1'e "1/5=0.2" değeri seçilir.

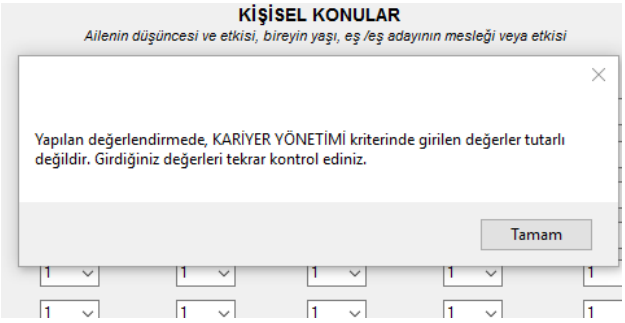
Yukarıdaki şartlara göre, seçilen her bir alternatif ve kriter AHP yönteminin önerdiği Tutarlılık Oranı göz önünde bulundurularak karşılaştırılır.

Şekil 3. Kriterlerin karşılaştırılması ve sonucun hesaplanması

Bu yapılan değerlendirmenin aynısı kriterlere göre yapılır. Kriterler, kişinin önem değerlerine göre tablodan seçilir. "HESAPLA" butonuna basılmasıyla ÇABKDS, kişinin hangi çalışma alanını seçmesi hakkında fikir verecektir. Çıkan değerlendirmede yüzdesi en yüksek olan çalışma alanı, kişinin hangi çalışma alanında çalışabileceğini gösterecektir.



Şekil 4. ÇABKDS sonuçları



Şekil 5. ÇABKDS uygulamasının yaptığı tutarlılık oranı kontrolü

Sonuç Ve Öneriler

İnsan, hayat boyu karar verme süreçlerinden geçmektedir. Belli bir yaşa kadar karar vermede yanındaki etkenlerden destek bulabiliyorken, belli bir yaştan sonra profesyonel hayatta tek başına karar vermesi gerekiyor. Bu kararlardan biri de, mezun olduktan sonra hangi alanda çalışacağına karar vermek. Önümüze çıkan alternatifleri kriterlerle karşılaştırarak karar vermeye çalışıyoruz. Yapılan araştırmalar sonucu, Analitik Hiyerarşi Süreci var olan alternatifleri kriterlerle kişinin belirlediği önem değerlerine bağlı olarak analiz etmemizi sağlıyor. Hazırladığımız Çalışma Alanı Belirleme Karar Destek Sistemi (ÇABKDS), AHP algoritmasını kullanarak hangi çalışma alanını seçebileceğiniz konuda öneride bulunuyor. Bu karar verme sürecinde, sizin önem değerlerinize bağlı olarak bir sonuç çıkarıyor.

Visual Studio'da hazırlanmış olan bu program, temelde istenileni vermesinin yanında daha geliştirilebilir ve kullanıcı dostu bir arayüzle zenginleştirilebilir. İlerleyen süreçte girilen verileri analiz edip, kişisel özelliklere bağlı olarak kişinin hangi alana yatkın olduğunu tahmin edebilen bir sisteme dönüştürülebilir.

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NEW INDUSTRIAL REVOLUTION INDUSTRY 4.0

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Abstract: Today's developing technologies have led to the reshaping of consumers' aims and expectations, which has forced manufacturers and service providers to keep up with this evolution and change in order to be able to compete and survive. With the use of steam power the 1st Industrial Revolution, 2nd Industrial Revolution with the use of electricity by taking the energy source instead of steam and with the information and telecommunication technologies that developed after World War II, 3rd Industrial Revolution were realized. Industrial revolutions have emerged in response to the needs and expectations of the period with specific solution models. This was a concept that emerged from this expectation and need in the 4th Industrial Revolution called Industry 4.0. In this study, the concept of Industry 4.0 and the necessary information and technological infrastructure and application areas are discussed.

Keywords: Industry 4.0, digital factories, smart manufacturing

YENİ SANAYİ DEVRİMİ ENDÜSTRİ 4.0

Özet: Günümüz gelişen teknolojileri, tüketicilerin amaç ve beklentilerinin yeniden şekillenmesine neden olmuş, bu durum üretim ve hizmet veren firmaların rekabet edebilmek ve yaşamlarını sürdürebilmek için bu gelişime ve değişime ayak uydurmalarını zorunlu kılmıştır. Buhar gücünün kullanılmasıyla 1. Sanayi Devrimi, enerji kaynağı olarak, buharın yerini elektriğin almasıyla 2. Sanayi Devrimi, 2. Dünya Savaşı sonrası gelişen bilişim ve telekominikasyon teknolojileri ile 3. Sanayi devrimi gerçekleşmiştir. Sanayi devrimleri ihtiyaç ve beklentiler karşısında dönemine özgü çözüm modelleri ile ortaya çıkmışlardır. İşte Endüstri 4.0 adı verilen 4. Sanayi Devrimi de bu beklenti ve ihtiyaçtan doğan bir konsept olmuştur. Bu çalışmada Endüstri 4.0 kavramı ve gerekli bilgi ve teknolojik altyapı ve uygulama alanları konu edilmiştir.

Anahtar Sözcükler: Endüstri 4.0, dijital fabrikalar, akıllı imalat

Giriş

Gelişen teknolojiler, değişen müşteri beklentileri ve rekabet koşulları ürün ve hizmet sağlayıcılarını her dönem farklı çözümler aramaya itmiştir. Buna en iyi örnek olarak Sanayi Devrimleri verilebilir.
Sanayi devrimi olarak bilinen ilk endüstrileşme süreci 18. ve 19. yüzyıllar arası gerçekleşmiştir. Enerji kaynağı olarak kömür ve buharın kullanıldığı bu dönemde makine kullanımı yaygınlaşmaya başlamıştır. 2. Sanayi devriminde enerji kaynağı olarak elektrik ve üretiminde su, petrol ve kimyasal maddeler kullanılmaya başlanmış, sanayi gelişiminin büyük bir ivme kazandığı bu dönemde Henry Ford ilk seri üretim montaj bandını hayata geçirmiştir. 3. Sanayi devrimi ise 1970'li yıllardan günümüze kadar sürmüştür. 2. Dünya Savaşı sonrası dönemde elektronik, bilgi ve iletişim teknolojilerindeki gelişmeler ile bilgisayar ve PLC'lerin gelişimi üretimde otomasyon devrini başlatmıştır.

Günümüzde 4. Sanayi Devrimi olarak tanımlanan konsept de yine bir ihtiyaçtan ortaya çıkmıştır. Son yıllarda Doğu'nun üretim teknolojisindeki gelişimi, üretim rakamlarındaki artışı ve güçlenen ekonomisi Batı için bir tehdit haline gelmiş, bu tehdit özellikle Almanya'nın başı çektiği Batılı ülkeleri; ürünlerin pazara çıkış hızı daha yüksek olan, daha esnek bir üretim yapısına sahip, kişiselleştirilmiş ürünler üretebilen ve üretimde verimliliği arttıran modelleri aramaya itmiştir. Akıllı imalat ve akıllı fabrikalar işte bu arayışta kullanılan kavramlar olmuştur. Akıllı imalatı; tüm eylemlerin üretkenliği, enerji kullanımını, ekonomik performansını optimize etmeyi amaçlayan, durumsal farkındalığı olan, gerçek zamanlı karar alabilen, esnek davranabilen, kendi erken teşhis ve tedavi yeteneği bulunan, çevresiyle ve diğer sistemlerle bağlantılı çalışan üretim yapısı olarak tanımlarken, Endüstri 4.0 da bu Akıllı İmalatı olanaklı kılan teknolojilerin bütünü olarak tanımlayabiliriz.

Akıllı fabrikalar da, sahadaki endüstriyel bilgisayarlar vasıtasıyla üretimi merkezcil bir yapıdan ve aynı zamanda uzaktan kontrol edebilen, bunun yanı sıra kendi yönetimini kendisi gerçekleştirebilen sistemlerin bütünü olarak

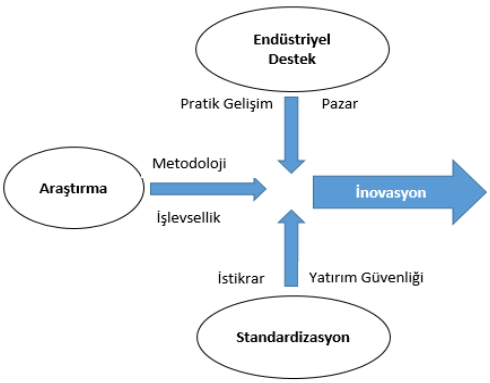
ifade edilebilir. Akıllı fabrikaların geleneksel sistemden en önemli farkı, insan gücü ile gerçekleştirilen manuel operasyonlardaki hataların ortadan kaldırılması, makineler tarafından gerçekleştirilen otomatik kontroller sayesinde, üretimin her safhasında verimliliği yüksek ve üst seviyede kaliteli ürün üretilmesidir. Günümüzde akıllı fabrikalar hızla geleneksel fabrikaların yerini almaya başlamıştır. Etkin robot teknolojilerini daha yoğun kullanırken, insan gücünün tek başına daha az; fakat robotlarla daha fazla işbirlikçi olacak şekilde kullanılması, çalışma alanlarını küçülterek maliyetleri büyük ölçüde azaltarak, üretim ile birlikte karlılığı arttırarak, müşteri memnuniyetini yüksek kalitede ürün üreterek üst seviyede tutulması hedeflemektedir.

Literatür Araştirmasi

Endüstri 4.0 terimi ilk olarak 2011 yılında Hannover Fuarı'nda, Alman imalat sanayinin yeterliliğini güçlendirmek amacıyla bir politika olarak akademik ve ticari temsilciler birliği tarafından ortaya atıldı. 4. Sanayi devrimi olarak da adlandırılan Endüstri 4.0, insanlık tarihinde üç diğer endüstriyel devrimin devamı olarak kabul edildi. İlk sanayi devrimi, su ve buhar gücü kullanan mekanik üretim sistemleri ile 18. yüzyılın ikinci yarısında, ikinci devrimi 1870'li yıllarda Taylorizm olarak işbölümüyle ve elektrik enerjisinin kullanılmasıyla ve seri üretime uygulamalarının hayata geçmesiyle yaşandı. Üçüncü endüstriyel devrim de, üretim süreçlerini daha da otomatik hale getirmek için gelişmiş elektronik ve bilgi teknolojilerinin kullanımı ile karşımıza çıktı. "Dijital Devrim" de denilen 3. Sanayi devrimi de 1970'lerden günümüze kadar geldi (Plattform Industrie 4.0, 2015).
Son yıllarda dile getirilen Endüstri 4.0 fikrini Alman federal hükümeti destekledi ve yüksek teknoloji stratejisi programına entegre etti. Hükümet Ekim 2012'de Endüstri 4.0 Çalışma Grubu'nu kurdu. Çalışma grubunun nihai raporu Nisan 2013'te sunuldu (Kagermann ve ark, 2013). Endüstri 4.0 Çalışma Grubunun nihai raporuna eşzamanlı olarak, 'Endüstri 4.0 Platformu" Bitkom, VDMA ve ZVEI gibi endüstri dernekleri tarafından oluşturuldu. Amaçları, Endüstri 4.0'ın gelecekteki faaliyetlerini koordine etmek olan bu platform son yıllarda Endüstri 4.0 temel fikirlerinin bir referans modeli üzerinde çalışmaktalar. Almanya'daki bu koordinasyon ve fonlama faaliyetleri, Ekonomik İşler ve Enerji (BMWi) ve Federal Eğitim ve Araştırma Bakanlıkları (BMBF) tarafından karşılanmaktadır.

'Endüstri 4.0' terimi Almanya'da ilk olarak öne sürülmüş olmasına ragmen benzer faaaliyetleri diğer ülkelerde de görmek mümkün. Örneğin Amerika Birleşik Devletleri'nde Akıllı Üretim Liderlik Koalisyonu (SMLC) olarak bilinen bir girişim, imalatın geleceği üzerinde de çalışmaktadır (Smart Manufacturing Leadership Coalition, 2015). Bu yapı tedarikçileri, üretim ve teknoloji şirketlerini, devlet kurumlarını, üniversiteleri ve laboratuvarları bir araya getiren kar amacı gütmeyen bir organizasyonudur. ABD hükümeti aynı zamanda endüstriyel internetin araştırma ve geliştirme faaliyetlerini iki milyar dolarlık bir fonla ve General Electric'in üzerinde yoğun olarak çalıştığı 'Endüstriyel İnternet'I de desteklemektedir. Endüstri 4.0'a benzer fikirler, 'Entegre sanayi' (Bürger ve Tragl, 2014) veya 'Akıllı Üretim' (Dais, 2014) terimleri altında da bulunabilir.

Alman Standardizasyon Yol Haritası'na göre (2015), Endüstri 4.0 yenilik, araştırma, endüstri ve standardizasyon arasında yakın bir işbirliği gerektirmekte. Şekil 1'de görülebileceği gibi, araştırma enstitüleri yeni bir yenilik için metodolojik temelleri getirmekte, standardizasyon istikrar ve yatırım güvenliği sağlamakta ve endüstri yeni kavramları pratiklik ve pazarla alakalı olarak test etmektedir.



Şekil 1. Endüstri 4.0 entegrasyon sürecinde işbirliği

Proje yönetiminde, yeni iş modellerinde, ürünler ve hizmetler için kullanılan operasyonel çalışmalarda verimliliği artırma potansiyeline sahip olan Endüstri 4.0'ın çok büyük bir ekonomik etkisinin olacağı tahmin edilmekte (Kagermann ve ark, 2013).

Endüstri 4.0 öncelikle üretim teknolojisi alanındaki bilgisayar altyapısının gelişimini desteklemektedir. Bu sayede kaynak verimliliği ve ergonomik tasarım ile sadece kendine değil aynı zamanda müşterilerin ve iş ortaklarının süreçlerine katma değerler sağlamaktadır. Üretim ortamında zeki davranış yapısını sağlamak için fabrikaların bilgi teknolojisinden gelen fikirlerle genişletilmesi gerekmektedir. Bu yapının gelecekte fabrikaların nasıl oluşturulacağı, organize edileceği, yapılandırılacağı ve mevcut fabrikaların nasıl adapte edilebileceği gibi sorunlara çözüm sağlayacağı öngörülmektedir.

Endüstri 4.0, günümüzde pek çok araştırma kurumu, şirketler ve üniversiteler için büyük önem taşıyorsa da, bu terimin yaygın olarak tanımlanmış ortak bir tanımı henüz mevcut değildir. Bu nedenle, konuyu bir akademik düzeyde tartışmak ve Endüstri 4.0 senaryolarını uygulamak zordur. Hermann ve ark. (2015)'de belirtildiği gibi, şirketler ve uygulayıcılar, Endüstri 4.0 senaryolarını tanımlamak ve uygulamak için belirli bir bilgi sistematiğine ihtiyaç duymaktadır.

Endüstri 4.0 Çalışma Grubu (Kagermann ve ark, 2013) nihai raporunda, Endüstri 4.0 hakkındaki vizyonlar şu şekilde tanımlanmakta; "Geleceğin şirketleri küresel ağlara etkin bir şekilde bağlanacak ve böylece depo sistemlerini, makine ve üretim tesislerini bu ağa dahil edebilecekler. Üretim ortamındaki siber-fiziksel sistemler özerk bilgi alışverişi yapmak, eylemler önermek ve birbirlerini bağımsız olarak denetleyenilmek için akıllı depolama sistemleri, makineler ve üretim tesislerinden oluşacak. Geleceğin ürünlerinde tanımlama, izlenebilirlik, mevcut durumların kontrolü etkin bir şekilde sağlanabilecek. İmalat ortamındaki gömülü sistemler, şebekeleri dikey olarak iş süreçlerine bağladığı gibi aynı zamanda gerçek zamanlı olarak iletişim kurmak ve kararlar alabilmek için yatay olarak birbirine bağlayacak."

Literatürde bazı araştırmacılar Endüstri 4.0'ı farklı perspektiflerden tanımlamışlardır; Örneğin; Konsorsiyum II, Fact Sheet'a (2013) göre, Endüstri 4.0, "karmaşık fiziksel makine ve cihazların ağa bağlı algılayıcılar ve yazılımlarla entegrasyonu, daha iyi iş ve toplum çıktılarını öngörmek, kontrol etmek ve planlamak için kullanılır" dır. Henning ve Johannes (2013), Endüstri 4.0'ı "ürünlerin yaşam döngüsü boyunca yeni bir değer zinciri organizasyonu ve yönetimi seviyesi" olarak tanımlıyor. Hermann ve ark. (2016), Endüstri 4.0'ı "değer zinciri organizasyonu teknolojileri ve kavramları için ortak bir terim" olarak tanımlıyor. Araştırmacılar modüler yapılandırılmış 4.0 endüstrisinin; akıllı fabrikaları'nda, fiziksel süreçleri izlemekte, fiziksel dünyanın sanal bir kopyasını oluşturmakta ve merkeziyetçi kararlar almakta olduğunu belirtmektedirler. Bu yapıda CPS, IoT üzerinde, birbirleriyle ve insanlarla gerçek zamanlı olarak iletişim kurmakta ve işbirliği yapmaktadır,

Endüstri 4.0 İçin Temel Endüstriyel Gereksinimler

Daha öncede açıklandığı üzere kavram olarak Endüstri 4.0' un üzerinde anlaşılan somut standart bir tanımının mevcut değildir. Bu nedenle endüstri, Endüstri 4.0 için belirli ihtiyaç ve altyapılar belirlemiştir. Drath [9] endüstriyel kabul için aşağıdaki şartları tanımaktadır:

***Yatırımın Güvenliği**: Endüstri 4.0 mevcut üretim tesislerine ve ekipmanlarına kademeli olarak getirilmelidir.

***İstikrar:** Endüstri 4.0 (IoS) aracılığıyla sunulan hizmetler hiçbir zaman koordinasyonsuz müdahale ile tehlikeye atılmamalıdır. Üretim sistemleri; kullanılabilirlik, gerçek zamanlılık, güvenilirlik, dayanıklılık, üretkenlik, maliyetler, güvenlik gibi özellikler üzerine artan talepler ortaya koymaktadır. Bu özelliklerle ilgili talepler, Endüstri 4.0 tarafından etkilenmeyecek nitelikte olmalıdır.

***Kontrol edilebilirlik:** Endüstri 4.0'da değer yaratmada ilgili verilere ve hizmetlere erişim ön şarttır, ancak kontrol edilebilir olması gerekir. Özellikle üretimle ilişkili ekipmanlara, makinelere veya sistemlere yazma erişimi, prosedürün toplam üretim bağlamında geçerliliğini garanti eden özel bir inceleme organı gerektirir.

***Güvenlik:** Veri veya hizmetlere yetkisiz erişimin önlenmesi gereklidir.

Dördüncü sanayi devrimi, yani Endüstri 4.0, Radyo Frekansı Tanımlama (RFID), Kurumsal Kaynak Planlaması (ERP), Nesnelerin İnternet'i (IoT), bulut tabanlı imalat ve sosyal ürün geliştirme dahil olmak üzere çok sayıda teknolojiyi ve ilişkili paradigmaları kapsamakta. Endüstri 4.0'ın hedefleri, daha yüksek bir seviyede otomatik verimlilik ve üretkenlik elde etmektir (Thames ve Schaefer, 2016). Roblek ve ark. (2016) ve Posada ve ark. (2015) Endüstri 4.0'un en önemli özelliklerinin; sayısallaştırma, optimizasyon ve üretimin özelleştirilmesi olduğuna işaret ediyor. Bunlarda 5 başlık altında kategorize edilmekte; otomasyon ve adaptasyon, insan makine

etkileşimi (HMI), katma değerli hizmetler ve işletmeler, otomatik veri alışverişi ve iletişim. Katma değerli süreçlere katılan tüm varlıkların entegrasyonu ile mevcut verilerden optimum değer akışını türetme becerisi ile tüm ilgili bilgilerin gerçek zamanlı olarak eldesi otomatik veri alışverişine örnek olarak verilebilir.

Endüstri 4.0, tedarik zincirleri, iş modelleri ve iş süreçlerinde yıkıcı değişiklikler getirmekte (Schmidt ve ark. 2015). Endüstri 4.0 ilkeleri; birlikte çalışabilirlik, sanallaştırma, yerel yönetim, gerçek zamanlı yetenek, hizmet yönelimi ve modülerliktir. Özellikler açısından, Endüstri 4.0 daha fazla esneklik sağlayabilir, teslimat sürelerini kısaltabilir ve maliyetleri düşürebilir (Shafiq ve ark. 2015, Shafiq ve ark. 2016).

Endüstri 4.0'ın kilit temel ilkeleri, bulut/intranet, veri entegrasyonu, esnek adaptasyon, akıllı kendini organize etme, birlikte işlerlik, üretim süreci, optimizasyon, güvenli iletişim ve hizmet yönelimini içerir (Ji ve ark. 2016, Vogel-Heuser ve Hess, 2016). Bu araştırma kategorisindeki bildirilere dayanarak Endüstri 4.0, algoritmalar, büyük veriler ve yüksek teknolojiler ile ilişkili entegre, uyarlanmış, optimize edilmiş, servis odaklı ve birlikte çalışabilir üretim süreci olarak özetlenebilir.

Endüstri 4.0'in Temel Teknolojileri

Endüstri 4.0'ı anlayabilmek için öncelikle bu konsepti oluşturan temel bileşenlerin bilinmesi gerekmektedir.

•Siber-Fiziksel Sistemler: Fiziksel dünyanın sanal yapı ile bütünleşmesi sonucu ortaya çıkan ağlardır. Ağı oluşturan gerçek nesneler dijital iletişim kanalları sayesinde birbirleri ile haberleşir ve etkileşirler. Haberleşme peer-to-peer olabileceği gibi en büyük ağ olan internet üzerinden de gerçekleşebilir.

•Nesnelerin İnterneti (IoT): Benzersiz bir şekilde adreslenebilir nesnelerin kendi aralarında oluşturduğu, dünya çapında yaygın bir ağ ve bu ağdaki nesnelerin belirli bir protokol ile birbirleriyle iletişim içinde olmaları olarak tanımlanabilir. Günlük yaşantımızda; tarım alanında, akıllı şehir ve ev konseptlerinde, enerji, güvenlik ve sağlık gibi alanlarda sıkça kullanılmaktadır. Endüstri 4.0 birbirlerine bağlı otomatik makine ve robotların işbirliği yaptıkları imalat ortamında; kaynakları, tasarım ve lojistik süreçleri etkin kullanmayı ve değer zincirindeki diğer firmalarla da bu yapıyı irtibatlandırılmayı da öngördüğünden IoT bu yapının önemli bir parçası haline gelmektedir.

•RFID Teknolojileri: RFID otomatik nesne tanımlama teknolojisi olarak tanımlanabilir. RFID, mikro işlemci ile donatılmış etiket (tag) taşıyan bir nesnenin, bu etikette taşıdığı bilgiler ile hareketlerinin izlenebilmesi imkanını veren, radyo frekansları ile çalışan otomatik tanıma sistemleridir.

•Robot Teknolojileri: Fabrikaların üretim süreçlerinde hayati önemi olan robotlar, sağladıkları hız ve kolaylıklarla her geçen gün sanayide daha çok rol almış ve günümüzde çok olağan bir işgücü haline gelmiştir. Önceki dönemlerde genelde yalnız çalışan robotların bundan sonraki dönemlerde birbirleriyle konuşur hale geleceği aynı zamanda insanla birlikte çalışan insansı robotların karşımıza düşünülmektedir.

•Sensörler: Sensör ya da algılayıcı, otomatik kontrol sistemlerinin duyu organlarına verilen addır. Sensörler, hem makine hem de üretim süreci hakkında verileri temin etmesi nedeniyle Endüstri 4.0'da anahtar konumundadırlar. Günümüzde sensörlerin uygulanabilirliğinin önünde bazı problemler bulunmaktadır. Mevcut sensörlerin büyük bir çoğunluğu üretim ortamına doğrudan entegre edilememekte ve online veri iletim özelliği bulunmamaktadır. Bu nedenle yapılan ar-ge çalışmaları ile doğrudan algılanan verilerin analiz edilmesini sağlayan, kolay entegre olan ve daha düşük bütçeli Akıllı Sensörler (IO-Link) üzerinde halen çalışılmaktadır. Akıllı sensörlerin; çift yönlü haberleşme arayüzlerine ve kullanıcı isteğine bağlı yazılım fonksiyonlarına sahip olması, makineye kusursuz bir şekilde entegre olması, otomatik izleme ve yapılandırma özellikleri ile prosesin hızlı, güvenilir, daha kolay bir şekilde işlemesini sağlaması hedeflenmektedir.

•Büyük Veri (Big Data): Ölçülebilen verinin 21.yüzyılın en büyük gücü haline geldiği bir dönemde, Big Data devasa, uçsuz bucaksız, tanımlı veya tanımlı olmayan verilere verilen genel isimdir. Big Data içine; işletmeler arasındaki alışverişler, işlemler, e-mailler, facebook paylaşımları gibi birçok veri girmektedir. İşte tüm bu verilerin analiz edilmesi, anlamlandırılması, belli paternlerin ve trendlerin oluşturulması şirketlerin gelecekleriyle ilgili stratejik planlar yapmalarında, mevcut problemleri etkili bir şekilde çözmelerinde ve ürün/hizmetlerini müşterilerinin ihtiyaç ve tercihleri doğrultusunda geliştirmelerinde büyük rol oynamaktadır.

•Endüstriyel Büyük Veri (Industrial Big Data): Günümüzde akıllı makinelere bağlı sensörlerden milyonlarca bit'lik veri akışı gerçekleşmekte. Toplanan bu veriler anlamlandırılmadığı sürece veri yığınından öteye geçemediğinden, işletmeler için toplanan bu verinin hızlı bir şekilde analiz edilebilmesi büyük önem tanışmaktadır. Fabrikadan toplanan bu verilerle üretim planlaması, bakım planlaması, maliyet analizi, verimlilik

gibi birçok konuda kararlar alınmaktadır. En önemlisi de plansız fabrika duruşlarının önüne geçilmekte, geriye dönük analizlerle birçok sorunun nedenlerine ışık tutulmakta ve bu veriye dayalı kestirimler birçok sorunun gerçekleşmeden önce yakalanabilmesine olanak sağlamaktadır. Bu denli geniş analizlerin etkin uygulanması işletmelere zamandan ve maliyetten tasarruf kazandırabileceğinden Endüstriyel Büyük Veri Endüstri 4.0'ın önemli bir parçasını oluşturmaktadır.

•Bulut Bilişim (Cloud Computing): Bulut Bilişim dosya saklama ve dosyalara ulaşım gibi problemlerin ortadan kalkmasını sağlayan bir teknolojidir. Hayatımıza giren akıllı teknolojilerin daha aktif ve verimli kullanılmasını mümkün kılmakta, dosya ve veri kayıplarının ortadan kalkmasını verilere kesintisiz olarak 7/24 ulaşılabilmesi, üstelik bunun herhangi bir cihaza bağımlı olmadan yapılmasını sağlamaktadır. Public Cloud veya Private Cloud diye ayrılan bilişim bulut hizmetleri, bilgilerin herkese açık olmasını sağladığı gibi, tam tersi bir şekilde yalnızca yetkili kişilerin ulaşabildikleri yapıya da sahip olabilmekte.

•Siber Güvenlik: Günümüzde Endüstriyel Nesnelerin İnterneti (IIoT) veya başka bir değişle Endüstri 4.0 uygulamalarının yaygınlaşmaya devam etmesi, bunun sonucunda gittikçe artan sayıda cihazın ağlara bağlanmasını artık kaçınılmaz hale getirmiştir. Bu trendin itici gücü ise, başta endüstriyel sistem sahiplerinin verimliliği arttırma isteği olmuştur. Ancak, iletişim verimliliğini arttırmak kolayca ulaşılan, sorunsuz bir süreç değildir. IIoT, siber güvenlik tehditlerinin yol açtığı risklerin dikkate alınmasını zorunlu kılmıştır. Temmuz 2016'da Avrupa Parlemantosu siber saldırılara karşı korunmak için izlenmesi gereken adımları öneren bir yönerge yayımlamıştır. Sistem sahihleri de, endüstriyel uygulamalarda güvenli cihaz ve ağlar kurmalarını sağlayacak siber güvenlik çözümlerine ciddi ihtiyaç olduğu konusunda birleşmişlerdir.

•Simülasyon ve Sanal Gerçeklik: Simülasyon, gerçek hayattaki bir sistemin veya sürecin çalışmasının bilgisayar ortamında taklit edilmesidir. Simülasyon, sistemin yapay geçmişinin üretilmesine ve gerçek sistemin karakteristik özelliklerine dair çıkarımlar yapmak üzere bu geçmişin gözlemlenmesine olanak verir. Sanal gerçeklik, kullanıcıların tasarlanan ortamda bulunma hissini yaşadığı bilgisayar kaynaklı 3 boyutlu ortamlar için kullanılan bir terimdir. Endüstri 4.0'da simülasyon ve sanallaştırma akıllı fabrikaların sanal bir kopyalarının oluşturulmasında, sistemlerden gelen sensör verilerinin sanal tesis ve simülasyon modelleri ile bağlanmasıyla oluşur. Yakın gelecekte bu teknolojilerin özellikle fabrika ve depo mimarisini iyileştirmek ve akıllı envanter yönetimi için kullanılacağı öngörülmektedir.

•3D Yazıcı Teknolojileri: Plasik türevleri, metal, mantar, reçine ahşap gibi birçok farklı maddeyi yapım malzemesi olarak kullanabilen 3D yazıcılar; uzay ve havacılıkta, askeri uygulamalarda, endüstriyel imalat, tıp ve sağlık alanlarında, enerji, mimarlık, makine imalatı, gıda imalatı gibi birçok alanda kullanılabilmekte. Temel mantıkla 3D yazma işlemi kullanılan malzemeye göre örneğin plastiği (filamenti) eriterek yüksek hassasiyetle bir tabla üzerine katman katman yazma işlemi olarak tanımlanabilir. 3D yazıcılar yüksek bedelli projelerde asıl üretimden önce prototipin üretilerek olası hataların minimize edilmesini sağlamaktadır. Örneğin ortopetik cerrahi operasyonlarda ameliyat öncesi 3D yazıcı ile üretilen modeller ile operasyon demoları yapılarak riskler minimize edilebilmektedir. Endüstri için örneğin otomotivde ön kalıpların yerini 3D yazıcıdan çıkan parçalar alabildiği gibi kalıplara gelen revizyonlar daha hızlı ve daha düşük maliyetlerle mevcut kalıplara işlenebilmekte. Yine üretimde kullanılan kritik ekipmanlar 3D yazıcılar sayesinde her an üretilebilmektedir.

Endüstri 4.0'in Potansiyel Etkileri

Endüstri 4.0 girişimi büyük potansiyele sahiptir, bu potansiyeller şu şekilde tanımlanabilir;
• Bireysel müşteri ihtiyaçlarını karşılamak: Endüstri 4.0; tasarım, yapılandırma, sipariş etme, planlama, üretim ve işletme aşamalarında bireysel müşteriye özel ölçütlerin dahil edilmesini sağlarken son dakika değişikliklerinin yapıya etkin ve hızlı bir şekilde yansıtılmasına olanak verir.
• Esneklik: CPS tabanlı geçici ağ, kalite, zaman, risk, sağlamlık, fiyat ve çevre dostu olma gibi iş süreçlerinin farklı yönlerinin dinamik yapılandırılmasını sağlar. Bu, malzemelerin ve tedarik zincirlerinin kesintisiz olarak düzenlenmesini ve düzeltilmesini kolaylaştırır. Aynı zamanda bu yapı, mühendislik süreçlerinin daha esnek ve etkin hale getirilebileceği, imalat süreçlerinin değiştirilebileceği, geçici arz sıklığının (örneğin tedarik sorunları nedeniyle) telafi edilebileceği ve çıktıda büyük artışların kısa bir zaman dilimlerinde sağlanabileceği anlamına gelmektedir.
• Optimize edilmiş karar verme: Global bir pazarda başarılı olmak için, doğru kararları çoğunlukla kısa sürede alabilmek kritik öneme sahiptir. Endüstri 4.0, mühendislik alanında tasarım kararlarının erken onaylanmasına ve üretim alanındaki tüm şirketlerin değişime ve küresel optimizasyona hem daha esnek yanıt vermesine olanak tanır ve gerçek zamanlı olarak şeffaflığı uçtan uca sağlar.
• Kaynak verimliliği ve verimlilik: Endüstriyel üretim süreçleri için kapsamlı stratejik hedefler, belirli bir kaynak hacminden (kaynak verimliliği) mümkün olan en üst düzeyde çıktı ürününü sunmak ve belirli bir çıktı (kaynak verimliliği) sağlamak için mümkün olan en düşük miktarda kaynağı kullanmak için Endüstri 4.0 için halen

geçerlidir. CPS, üretim süreçlerinin tüm değer ağında vaka bazında optimize edilmesini sağlar. Üstelik üretim durdurmak zorunda kalmak yerine, üretim sırasında kaynak ve enerji tüketimi açısından veya emisyonlarını azaltmak için sistemler sürekli olarak optimize edilebilir.

• Yeni hizmetler çeşitleri yeni değerler oluşturma fırsatları yakalamak: Endüstri 4.0 değeri ve yeni istihdam biçimleri yaratmanın yeni yollarını, örneğin aşağı akışlı hizmetler yoluyla açmaktadır. Akıllı algoritmalar, yenilikçi hizmetler sunmak için akıllı cihazlar tarafından kaydedilen büyük miktarda farklı verilere (büyük veri) uygulanabilir. KOBİ'lerin ve girişimlerin Endüstri 4.0 için B2B (iş dünyasından) hizmetlerini geliştirmeleri için özellikle önemli fırsatlar mevcuttur.

• Çalışma ortamında demografik değişikliğe tepki verebilme: İş organizasyonu ve yetkinlik geliştirme girişimleri ile birlikte, insanlarla teknolojik sistemler arasındaki etkileşimli işbirliği, işletmelere demografik değişikliği avantajlı hale getirmenin yeni yollarını sağlayabilecektir. Endüstri 4.0, vasıflı işçilerin yetersizliği ve işgücünün artan çeşitliliği (yaş, cinsiyet ve kültürel geçmişe bakıldığında) karşısında insanların daha fazla çalışmaya devam etmesine ve daha uzun süre verimli kalmasına olanak sağlayacak çeşitli ve esnek kariyer yollarına olanak tanıyacaktır.

• İş yaşam dengesi: Siber fiziksel sistemleri (CPS) kullanan şirketlerin daha esnek çalışma organizasyon modelleri, çalışanların mesleki yaşamları ile kişisel yaşamları arasında ve kişisel gelişim ile devam eden mesleki gelişim arasında daha iyi bir denge kurmak için ve artan çalışan ihtiyacını karşılamak için iyi yerleştirilmiş oldukları anlamına gelmektedir. Örneğin, akıllı yardımcı sistemler, şirketlerin gereksinimlerini ve çalışanların kişisel ihtiyaçlarını karşılamak için yeni bir esneklik standardı sağlayan bir şekilde çalışmak için yeni fırsatlar sağlayacaktır. İşgücünün büyüklüğü azaldığında, CPS şirketlerine en iyi çalışanları seçmek konusunda net bir avantaj sağlayacaktır.

Sonuç ve Öneriler

Son yılların en önemli gelişmelerinden biri olan Endüstri 4.0 henüz ortak bir tanımlamaya sahip olmaması sebebiyle bu konseptle alakalı bazı soru işaretleri hala mevcuttur. Akademik kuruluşlar, platformlar ve endüstri kuruluşları kendi ihtiyaçları ve vizyonları ölçüsünde kendi tanımlarını ve yol haritalarını oluşturmaya çalışmaktadırlar. Birçok teknolojiyi entegre bir biçimde içinde barındıran Endüstri 4.0'ın yakın gelecekte yeni sistemleri, çalışma konseptlerini ve iş tanımlarını beraberinde getireceği öngörülmektedir. Sosyal hayatta da önemli etkileri olacağı düşünülen bu yeni konsept zamanla bir standart hale dönüşebileceği düşünülmekte.

Bu süreçte özellikle hizmet ve ürün sağlayıcılarının mevcut durumlarını analiz ederek hangi yol haritasının kendileri için en iyi sonucu vereceğine karar vermeleri veya kendilerine en uygun yol haritasını oluşturmaları önemli bir başlangıç adımı olarak görülebilir. Eğitim kurumlarının da 4. Sanayi devriminin getireceği yenilikçi üretim ve hizmet stratejilerinin farkında olarak mevcut eğitim planlarında güncellemeye gitmesi şarttır. Bu sayede yakın gelecekte sektörün ihtiyacı olacak iş alanlarında yetişmiş personel ihtiyacı belirli ölçüde giderilebilecektir. Devlet kurumları, platform, dernek ve sivil toplum kuruluşlarının da bu değişime hazırlanması ve bu konuda etkin bir katılım göstermeleri önemlidir.

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A REVIEW OF LOCALIZATION PROBLEM AND LOCALIZATON ALGORITHMS IN WIRELESS SENSOR NETWORKS

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Abstract: In wireless sensor networks, there may be a number of fixed sensors whose locations are initially known and a number of other sensors at unknown locations. Sensor nodes can be either stationary or moving. When working on the localization problem, a suitable model is formed by the measurements taken between sensor nodes. Measurements can be made between nodes with known location and unknown location and also between nodes with unknown locations. Localization algorithms aim to determine the locations of the nodes whose locations are unknown. In this study, which examines the localization problem in wireless sensor networks, the localization algorithms in the literature are discussed and the localization problem is approached from different angles.

Keywords: Wireless sensor networks, localization, measurement models, localization algorithms

KABLOSUZ ALGILAYICI AĞLARINDA KONUMLANDIRMA PROBLEMİ VE KONUMLANDIRMA ALGORİTMALARININ İNCELENMESİ

Özet: Kablosuz algılayıcı ağlarında, başlangıçta konumu bilinen sabit algılayıcı düğümleri ile konumu bilinmeyen diğer düğümler bulunabilir. Algılayıcı düğümleri sabit konumlandırılmış ya da gezgin olabilir. Kablosuz algılayıcı ağlarında konumlandırma problemi üzerinde çalışılırken, algılayıcı düğümler arasından alınan ölçümler ile uygun bir model oluşturulur. Bu ölçümler, konumu bilinen ve konumu bilinmeyen düğümler arasında yapılabilirken; konumu bilinmeyen düğümler arasında da yapılabilir. Konumlandırma algoritmaları konumu bilinmeyen düğümlerin konumlarının belirlenmesini amaçlar. Kablosuz algılayıcı ağlarında konumlandırma problemini inceleyen bu çalışmada, literatürdeki konumlandırma algoritmaları ele alınmakta ve konumlandırma problemine farklı açılardan yaklaşılmaktadır.

Anahtar Sözcükler: Kablosuz algılayıcı ağları, konumlandırma, ölçüm modelleri, konumlandırma algoritmaları

Giriş

Günümüzde teknolojide meydana gelen gelişmeler pek çok alanda küçük boyutlu algılayıcı düğümlerinin kullanımına olanak sağlamaktadır. Algılayıcı düğümleri günlük hayatta ve askeri alanda gözlem, kontrol ve takip de dâhil olmak üzere birçok amaca hizmet etmektedir. Kablosuz algılayıcı ağlarının yaygın uygulama alanlarına, askeri, tıbbi ve güvenlik uygulamaları örnek olarak verilebilir (Akyildiz vd., 2002a; Akyildiz vd., 2002b). Örneğin, bir hasta hakkındaki bazı veriler doktoru tarafından uzaktan izlenebilir. Böylece doktorun hastanın mevcut durumunu sürekli olarak izleyebilmesi ve daha yerinde kararlar verebilmesi sağlanabilir. Algılayıcı ağlarının yenilikçi uygulamalarından birisi ise sudaki ya da havadaki kimyasal bileşenlerin tespit edilmesidir. Böylece kirlilik tipi, yoğunluğu ve bölgesi tespit edilebilir ve analizler gerçekleştirilebilir. Kolay dağıtım ve devreye alma özellikleri nedeniyle birbirinden yönetimsel olarak bağımsız ancak ortak bir amaç doğrultusunda çalışan algılayıcı düğümlerin oluşturduğu kablosuz algılayıcı ağları geniş bir uygulama yelpazesi sunmakta ve farklı mekânlardaki fiziksel ya da çevresel koşulları etkin bir şekilde izleyebilmektedir (Gungor & Hancke, 2009).

Kablosuz algılayıcı ağları bilgi alışverişi yapan yüzlerce hatta binlerce düğümden oluşabilir. Bu ağlarda, her bir algılayıcı düğüm kendine yakın olan diğer bir algılayıcı düğüm veya veri toplayıcısı olan merkez düğüm ile kablosuz iletişim kurar. Kablosuz algılayıcı ağlarında düğümlerin birbiriyle iletişimi yanı sıra düğümlerin

yerleştirilmesi de son derece önemlidir. Çünkü algılayıcı düğümleri yapıları gereği dış ortam koşullarına bağlı olarak konum değiştirmeye yatkındırlar (Akyildiz vd., 2002a; Akyildiz vd., 2002b; Gungor & Hancke, 2009). Çeşitli nedenlerle konumları değişebilen düğümler dışında bazı uygulamalarda hareket edebilme yeteneği olan gezgin algılayıcı düğümleri de bulunabilir. Gezgin algılayıcı düğümleri bazı uygulama senaryoları için esneklik sağlayabilmesine rağmen konum saptama zorlukları ortaya çıkabilmektedir.

Konum bilgisi, kablosuz algılayıcı ağları için işlev olarak amaçlanan önemli bir gerekliliktir. Konum bilgisi, Global Positioning System (GPS) gibi küresel bir konumlandırma sistemine uygun alıcılar ile algılayıcı düğümlerinin donatılmasıyla ya da konumu bilinen referans düğümlerini temel alan konumlandırma gibi farklı yaklaşımlarla sağlanabilir (Gholami vd., 2010; Cheng vd., 2012; Pal, 2010; Han vd., 2013). Ancak algılayıcı düğümlerin küçük boyutlu olması ve kablosuz algılayıcı ağlarında yüzlerce hatta binlerce düğüm bulunabildiği için düğüm maliyetlerinin oldukça düşük olması beklentisi nedenleriyle GPS alıcılarının algılayıcı düğümlere eklenmesi deneysel çalışmalarda mümkün olmakla birlikte gerçek saha uygulamalarında pratik bir yaklaşım değildir (Wang & Xu, 2010). Ayrıca algılayıcı düğümlerinin genelde enerji ihtiyacını pillerden sağlamaları nedeniyle bu düğümlere eklenecek her türlü ilave bileşen düğüm ömrünü kısaltacaktır.

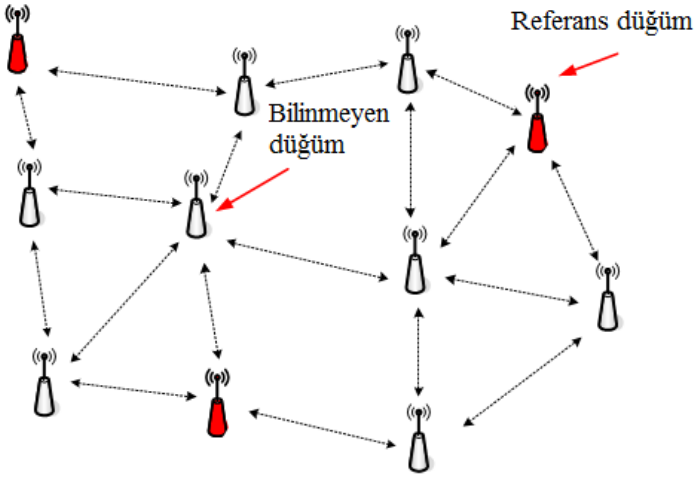
Çalışmanın ikinci bölümünde kablosuz algılayıcı ağlarında konumlandırma problemi incelenmiş ve konumlandırma probleminin çözümü için ele alınması gereken hususlar değerlendirilmiştir. Üçüncü bölümde, literatürde mevcut olan kablosuz algılayıcı ağları konumlandırma algoritmaları sınıflandırılarak merkezi ve dağıtık konumlandırma algoritmaları olarak ayrılmış ve ilgili algoritmalar önemli özellikleri göz önünde bulundurularak incelenmiştir. Saptama teknikleri listelenmiş ve bölüm olarak sunulmuştur. Dördüncü bölümde, kablosuz algılayıcı ağlarında kullanılan konumlandırma algoritmaların başarımlarının incelenmesinde kullanılabilecek olan kriterler incelenmiş ve bu kriterler ışığında literatürdeki mevcut konumlandırma algoritmaları uygulama senaryolarına bağlı olarak değerlendirilmiştir. Beşinci bölüm sonuç bölümü olup, elde edilen sonuçlar yanında bu çalışmanın gelecekte yapılacak olan çalışmaları hakkında bilgiler vermektedir.

Konumlandirma Problemi

GPS kullanımı ile konum belirleme, algılayıcı konumlarının belirlenmesindeki çevresel zorluklar, konumu bilinen referans bir düğüm kullanımı da dâhil olmak üzere konumlandırma problemi üzerinde literatürde birçok çalışma bulunmaktadır. Konumlandırmayı konumu bilinen referans düğümleri temel alarak yapma pratik uygulamalarda en çok tercih edilen yaklaşımdır. Bu yaklaşımda konumu elle belirlenmiş ya da GPS alıcılarıyla donatılmış bir dizi sabit algılayıcı düğüm vardır. Konumu bilinmeyen algılayıcı düğümlerin konumlarının belirlenebilmesi için referans düğümler ile bu düğümler arasında gerçekleştirilen mesafe ve açı ölçümleri kullanılır (Wang & Xu, 2010).

Kablosuz algılayıcı ağlarında algılayıcı düğümler arası mesafe ölçümlerinin tip ve kalitesinin konumlandırma algoritmasının performansı üzerinde etkili olduğu bilinmektedir (Li, Ding, & Yang, 2015; Nazir vd., 2012). Düğümler arası mesafeleri belirlerken kullanılan yöntemlerden, alınan sinyalin gücüne göre mesafe ölçümünü gerçekleştiren Received Signal Strength Indicator (RSSI) yöntemi hava şartlarına bağlılığın daha az olduğu ortamlarda kullanıma uygundur (Vaghefi, 2011). Buna karşın, sinyalin ulaşma süresini ölçen Time of Flight (TOF) yöntemi zaman sayacındaki programlama zorluğuna rağmen ses üstü alıcı vericilerin çalıştığı kısa mesafelerde daha iyi sonuçlar vermektedir (Gholami, Gezici, & Ström, 2012). TOF yönteminde algılanan parametre olan zaman aralığı, yayılma hızıyla çarpılarak mesafeye dönüştürülür. Eğer algılayıcı düğüm bir dizi anten kullanıyorsa varış açısı ölçümü yapılabilir. İki düğüm arasındaki mesafeyi hesaplamak bir düğümden diğerine giden sinyalin harcadığı zamana dayanır.

Yaygın olarak kullanılan konumu bilinen referans düğümler ve düğümler arası ölçümler dışında kablosuz algılayıcı ağlarında konumlandırma problemine çözüm getirebilmek için algılayıcı düğümler arasında alınan ölçümler için uygun bir modele ihtiyaç vardır. Genellikle konumu belirlenecek hedef düğümlerin konumları Şekil 1'de gösterildiği gibi bir dizi referans düğümünün bilinen konumlarına ve algılayıcı düğümleri arasında alınan bazı ölçümlerin kullanılmasına dayanarak tahmin edildiği için ölçümler konumu belirlenecek olan hedef düğümler ve referans düğümler arasında yapılmakla birlikte bazı durumlarda ölçümler hedef düğümler arasında da yapılabilir.



Şekil 1. Kablosuz algılayıcı ağlarda konumlandırma problemi

Kablosuz algılayıcı ağları, konumlandırma probleminde hedef düğümler arasındaki etkileşime göre iki grupta sınıflandırılabilir: işbirlikçi ağlar ve işbirlikçi olmayan ağlar. İşbirlikçi ağlarda, hedef düğümler arasındaki ölçümler, hedef düğüm ve referans düğüm arasındaki ölçümlerde olduğu gibi konumlandırma işleminde kullanılır (Gholami vd., 2010; Gholami vd., 2011). İşbirlikçi olmayan ağlarda ise ikinci tip ölçümler kullanılır. Sınırlı sayıda referans düğüm olduğunda, işbirliği gerçekleştirilmesi konumlandırma algoritmalarının performansını etkili bir şekilde geliştirir (Gholami vd., 2010).

Konumlandırma problemi bir tahmin problemi olarak düşünülebilir. Bu nedenle farklı tahmin yöntemleri problemin çözümünde kullanılabilmektedir. Konumlandırma probleminde amaç hedeflerin konumlarını mümkün olduğunca doğru tahmin etmektir. Hedef düğümleri konumlandırmak için soruna yönelik bir sistem modeline ihtiyaç vardır.

Konumlandirma Algoritmalari

Genel olarak bakıldığında konumlandırma problemine cevap vermedeki en kolay ve açık yol GPS alıcılarını kullanmaktır. Çünkü son yıllarda teknolojideki gelişmelerle birlikte GPS alıcıları, 1-3 metre aralığında hata payına sahip sonuçlar vermektedir (Drawil, Amar, & Basir, 2013; Mageid, 2016). Öte yandan, uygulama kolaylığı açısından pratik bir yaklaşım olan GPS teknolojisi, kablosuz algılayıcı ağlarındaki düğüm maliyetlerinde artışa neden olacağı için ağı oluşturan tüm düğümlerde tercih edilmemekte ve sadece konumlandırma işleminde yardımcı olan referans düğümlerde tercih edilmektedir (Wang & Xu, 2010).

Konumlandırma algoritmaları genelde bir dizi referans düğümünün konumunu ve referans düğümleri ile hedef düğümler arasındaki bazı ölçümleri esas alır. Böylece hedef düğümler için konumlandırma bilgisi elde edilir. Referans düğümler, konumu bilinmeyen hedeflerden alınan sinyallere dayanarak varış zamanı, varışlardaki zaman farkı, alınan sinyal kuvveti veya bu değerlerin bir bileşimi olan ölçümleri elde ederler ve bu ölçümler kullanılarak hedef düğümler için konum tahmini gerçekleştirilir (Cheng, 2012; Han, 2013). Konumlandırma algoritmalarının düğümler arasındaki mesafe ölçümünde kullandığı temel teknikler aşağıda verilmekte olup, bu tekniklerin bir kıyaslaması Tablo 1'de sunulmaktadır.

- **Alınan Sinyal Gücü Göstergesi:** Alınan sinyal gücü değerinin işlenmesine dayalı olan RSSI tekniği üç aşamalıdır. Birinci aşama ağın radyo frekansı haritalaması olup, bu aşamada, ağ vasıtasıyla farklı güç seviyelerine küçük paketler iletilir ve bellek tablosunda alınan paketlerin ortalama RSSI değerleri tutulur (Cheng, 2012; Maddumabandara, Leung, & Liu, 2015). İkinci aşama, değişen modelin oluşturulması olup, iki hedef arasındaki bütün çok öğeli kayıtların modeli düzeltilir ve doğrusalsızlığın karşılaştırılması merkezdeki birimde gerçekleştirilir. Üçüncü aşama, merkezi konumlandırma modeli olup, eniyileme probleminin çözülmesiyle düğümlerin konumları bulunur. İç ortamda radyo frekans sinyallerini tahmin etmek mümkün olmadığı için bu yöntemin dış ortamda uygulanması mümkündür.
- **Varış Zamanı:** Gönderilen sinyalin geri alınma süresine bağlı olan varış zamanı tekniği (TOA: Time of Arrival) TOF prensibine dayalıdır. TOA yöntemi, uzaklığı bulmak için verici ve alıcı arasındaki uçuş süresini doğrudan kullanır (Pal, 2010; Maddumabandara, Leung, & Liu, 2015). TOA'da, konum tahminleri, merkezleri sabit istasyonlarda bulunan dairelerin veya kürelerin kesişme noktalarını belirleyerek bulunur ve yarıçaplar, hedefe olan mesafelere tahmin edilir.

- **Varış Zamanı Farkı:** Gönderilen iki farklı sinyalin geri dönme süreleri arasındaki farkı hesaplama tabanlı varış zamanı farkı tekniği (TDOA: Time Difference of Arrival) TOA gibi TOF prensibine dayalıdır. TDOA yöntemi, hedef ve sabit düğümler arasındaki iletim yollarının çiftleri üzerinde ölçülen varış zamanlarının farklarından konumunu hesaplar (Maddumabandara, Leung, & Liu, 2015). TDOA, hedefi bir çiftin her sabit istasyonunda odaklarla oluşturulan hiperbollerin veya hiperboliklerin kesişim noktalarında bulur.

Konumlandırma algoritmaları, ölçümlerin merkeze gönderilmesiyle merkezi ya da ölçümlerin bölgesel olarak değerlendirilmesiyle dağıtık yapıda çalışabilir.

Tablo 1. Mesafe ölçümlerinde kullanılan temel teknikler (Cheng vd., 2012; Pal, 2010; Hand vd., 2013; Wang & Xu, 2010; Li, Ding, & Yang, 2015; Nazir vd., 2012; Vaghefi, Gholami, & Ström, 2011)

Teknik	Gerçekleştirilme	Avantajları	Dezavantajları
RSSI	Direkt hesaplama ya da parmak izi tekniği	Ek donanım gerektirmeme, ölçeklenebilir olma, düşük ek işlem yükü gereksinimi	Düşük hassasiyet, esneklik sağlamama
TOA	Direkt hesaplama ya da iki yönlü ölçümleme	RSSI'ya göre daha yüksek hassasiyet sağlama, düşük işlem yükü gereksinimi	Yüksek maliyetli donanım gerektirme, hassas zamanlama gereksinimi
TDOA	Konumu bilinen en az üç referans düğüm kullanılarak konumlandırma	Zamanlama hatalarına karşı dayanıklı olma, yüksek maliyetli donanım gerektirmeme, mevcut donanım üzerinde değişiklik gerektirmeme	TOA'dan bir tane daha fazla baz istasyonu gerektirme, referans düğümlerin saatlerinin senkronize edilmesi zorunluluğu

Merkezi Konumlandırma

Bu bölümde, literatürde bulunan merkezi konumlandırma yaklaşımlarından kablosuz algılayıcı ağlarında kullanılabilecek olanlar incelenmektedir.

Çok Boyutlu Ölçeklendirme Haritası Tabanlı Konumlandırma

MDS-MAP (Multidimensional Scaling Map: Çok Boyutlu Ölçeklendirme Haritası) tabanlı konumlandırma yaklaşımında, konumu bilinmeyen noktalar alınır ve her ikili nokta arasındaki mesafeler ölçülür (Shang vd., 2003). MDS-MAP yaklaşımın üç adımı vardır. Birinci adımda, incelenen bölgedeki bütün düğüm çiftleri arasındaki en kısa yol Dijkstra (Dijkstra, 1959) veya Floyd-Warshall (Floyd, 1962; Warshall, 1962) algoritmaları gibi bir yöntemle hesaplanır. En kısa yol mesafesi, MDS mesafe matrisi oluşturulmasında kullanılır. Klasik MDS mesafe matrisine uygulanır. İkinci adımda, tespit edilen en büyük iki öz değer ve öz vektör ile ilişki haritası oluşturulur. Bu harita her bir düğümün konumunu verir. Üçüncü adımda, yeterli hedef düğümün konumuna dayanarak ilişki haritası hedef düğümlerin kesin konumlarının bulunduğu son haritaya dönüştürülür. Nihai amaç, dönüştürülen konumlar ve hedef düğümlerin gerçek konumları arasındaki hataların karelerinin toplamını minimum yapmaktır.

Benzetilmiş Tavlama Tabanlı Konumlandırma

Merkezi konumlandırma yaklaşımlarında, komşuluklar hesaplanırken elde edilen en az hatalı sonuç gerçek komşuluğu vermeyebilir. Çünkü sadece bu hata payı komşuluğu hesaplamak için yeterli olmayabilir. Bu yaklaşım, bölgesel minimuma takılmamak adına geliştirilmiştir ve hesaplama yapılırken rastgele olarak sıçramalar yapılır (Kannan, Mao, & Vucetic, 2006).

Dağıtık Konumlandırma

Bu bölümde literatürde bulunan dağıtık konumlandırma yaklaşımları incelenmektedir.

İşaretçi Tabanlı Dağıtık Konumlandırma

İşaretçi tabanlı dağıtık konumlandırma yaklaşımlarından biri olan difüzyon yönteminde konumlandırılacak düğümün olası konumu komşu düğümlerin kütle merkezidir. Bu kategorideki yaklaşımlardan birisi ve alan tabanlı aralık konumlandırma yöntemi olarak tanımlanabilecek olan Approximate Point in Triangulation (APIT) tekniğidir (Sharma & Malhotra, 2015). Bilinmeyen düğümleri içeren üçgensel bölgelerin çoğulluğuna dayalı olarak karar veren APIT tekniğinde üçgensel bölgelerin kesişimi çokgen oluşturur ve teknik dört aşamalıdır. Birinci aşama konum, kimlik numarası, sinyal gücü derecesi gibi bilinmeyen düğüme yakın çapa düğümünün bilgileri toplanır. İkinci aşama APIT testidir. Bu test ile bilinmeyen düğümün, farklı çapa düğümleriyle birleştirilen üçgenin iç kısmı olup olmadığının test edilir. Üçüncü aşama bilinmeyen düğümleri içeren tüm üçgenlerin çakışan alanını hesaplanır. Dördüncü aşama ile de çakışan alanın merkezi ve bilinmeyen düğümün konumu hesaplanır.

Sınırlayıcı Kutu

Sınırlayıcı kutu yaklaşımlarından birisi olan İşbirlikçi Çok Bölgelik tabanlı yöntemlerde, düğümlerin konumlarını yüksek doğrulukta tahmin etmek için birbiriyle işbirliği yaparak düğümlere konumlarından uzak duraklar bulmayı sağlar (Savvides, Park, & Srivastava, 2002). İşbirlikçi alt ağaç oluşturarak, bilinmeyen düğüm ve işaretçilerin hangisi için doğru konum tahmini yapıldığının belirlenmesini sağlar. Örneğin, C düğümü, A ve B işaretçileri arasında kalan bir bilinmeyen ise, X koordinatlarında C'nin A'dan uzaklığı olana kadar A işaretçisinin sağından ve solundan sınır ayrılır. Aynı işlem B işaretçisine yapıldıktan sonra Y koordinatlarına uygulanır. Elde edilen x ve y koordinasyon değerleri birleştirilerek bir kutu oluşturulur ve bulunan değerler Kalman Filtresi (Kalman, 1960) ile düzeltilir. Bu yöntemlerde, bilinmeyen işaretçiyle doğrudan iletişim kurulmaz, işaretçiler kendi konum tahminlerini bulmak için komşularının başlangıç tahminlerini kullanır.

Değişim Ölçüsü (Gradient) tabanlı yöntemler, bölgesel bilgiyle küresel koordinat sistemini düzenlemek olarak tarif edilebilir (Zhao vd., 2014). Bu yöntemlerde, öncelikle algılayıcı düğümleri iki boyutlu düzleme rastgele dağıtılır. Her algılayıcı, düzlem boyutundan küçük sabit bir r mesafesinde kendisine en yakın algılayıcılarla iletişim kurar, bir dizi algılayıcı ise kök algılayıcı olarak kabul edilir. Her kök algılayıcı bölgesel değişim ölçüsü yayar ve bu diğer algılayıcıların kökten uzaklığının tahmin edilmesini sağlar. Kök algılayıcı başlangıç olarak kendi konumunu mesaj olarak gönderir. Her algılayıcı ise diğerine kendi konumunu gönderir. Eğer değerler çok büyükse mesaja cevap verilmez. Sonuç olarak bulunan en küçük değer algılayıcılar arasındaki en kısa mesafeyi verir.

Gevşetme Tabanlı Dağıtık Konumlandırma

Gevşetme Tabanlı Dağıtık Konumlandırma yaklaşımlarından olan yay modeli, düğümlerin rastgele başlangıç koordinatına atanmasıyla başlar ve sadece bölgesel düğüm hareketlerinde kullanılan tutarlı çözüm için birleşir (Priyantha vd., 2003). Temel olarak iki aşamalı çalışır. Düğümlerin nokta yığınları olduğu varsayılarak, dizi ile bağlanır. Minimum enerji şekline dönmek için güç doğrultulu gevşetme yöntemleri kullanılır. İlk aşama sezgiseldir ve orijinal katmana benzeyen bir şekil katmanı oluşturulur. Daha sonra, yakınlık tahmini yapılarak düğümler arasındaki yayların gerginliği giderilmeye çalışılır.

Performans Değerlendirmeleri

Kablosuz algılayıcı ağları bazı durumlarda sayıca çok az ya da çok fazla düğümden oluşabilir. Küçük bir ağ için tasarlanmış bir algoritma büyük bir ağ için iyi sonuçlar vermeyebilir ya da sonuçları çok uzun bir sürede verebilir (Kaur & Mir, 2016). Bu gibi durumların analizi için ölçeklenebilirlik önemli bir husustur. Konumlandırma algoritmalarının performans değerlendirmeleri, doğruluk ölçümleri, maliyet ölçümleri, kapsama alanı ölçümleri ve bu ölçümlerin birlikte ele alınması olan birleşim ölçümleri ile yapılabilir.

Doğruluk Ölçümleri

Bir konumlandırma algoritmasının bir düğüm konumunu mümkün olduğunca doğru tahmin etmesi oldukça önemlidir. Ancak, gereken doğruluk derecesi uygulamadan uygulamaya değişebilmektedir. Bir konumlandırma algoritmasının doğruluğunun değerlendirilmesi için makul karşılaştırmalar yapılmalıdır. Bunun bir yolu farklı konumlandırma algoritmaların tahmin hataları üzerinde alt sınır karşılaştırması yapılmasıdır. Ancak tahmin hatalarında alt sınır hesaplaması oldukça zordur (Catovic & Sahinoglu, 2004). Bunun için gerekli koşullar

sağlanıyorsa ve ölçüm hatalarının olasılık yoğunluk fonksiyonu biliniyorsa Cramer-Rao Alt Sınırı (Cramer-Rao Lower Bound: CRLB) hesaplanabilir (Shi, Li, & Shang, 2005). Konumlandırma algoritmaları farklı doğruluk ölçümlerine göre karşılaştırılabilir. Doğruluk ölçümlerinde kullanılan tekniklere örnek olarak konumlandırma algoritmasının performansının iç yüzünü anlamayı sağlayan Birikimli Dağılım Fonksiyonu (Cumulative Distribution Function: CDF), kullanılan kestirimcinin yanılmasını modelleyen Yanılma Modeli ile Kök Ortalama Kare Hatası (Root Mean Square Error: RMSE) verilebilir (Slottke & Wittneben, 2015). Kök Ortalama Kare Hatası, bir hedefin tahmini konumu ile gerçek konumu arasındaki farkın karesinin karekökü ile bulunur. N adet hedef olan bir ağda, bu hataların toplamının hedef sayısına bölünmesiyle ağdaki hata elde edilir. Maksimum hata ise bu bulunan hataların arasından maksimum olanın bulunmasına dayanır.

Maliyet Ölçümleri

Güç tüketimi, iletişimde ek işlemler, konum tahmini için harcanan zaman ve konumlandırma süreçleri için gerekli olan ana bellek büyüklüğü gibi farklı parametreler bir konumlandırma algoritmasının maliyetini belirler (Alrajeh, Bashir, & Shams, 2013). *Referans düğüm oranı*, konum belirlemede yardımcı olan referans düğüm sayısının algılayıcı düğüm sayısına bölümü olarak tanımlanır ve konumlandırma algoritmasının doğruluk değişimini araştırmak için kullanılır. *İletişim ek işlemi*, iletilen paketlerin sayısı ya da konumlandırmayı gerçekleştirebilmek gerekli güç tüketimidir. *Güç tüketimi*, algılayıcı düğümün ömrü tarafından belirlenir. *Algoritma karmaşıklığı*, mekânsal ve zaman bağlamında sayısal karmaşıklıktır ve Büyük O gösterim biçimi ile ifade edilir (Mao, Fidan, & Anderson, 2007). *Yaklaşma zamanı*, konumlandırma sırasında gerekli olan ölçümleri toplamak için geçen süre ve konumlandırma algoritmalarının sonuca ulaşması için gereken zamana bağlı olarak tanımlanır.

Kapsama Alanı Ölçümleri

Kapsama alanı ölçümleri, kablosuz algılayıcı ağlarında konumlanan hedef düğümlerin yüzdesinin belirlenmesine dayalıdır. Geometrik yapı ve düğüm yoğunluğu kapsama alanı sonuçlarını etkiler. Bir hedefin başarılı olarak konumlandırılabilmesi için, etrafında yeterli sayıda referans düğümü olmalı ve algılayıcı düğümlerden gerekli ölçümler alınmış olmalıdır (Ghosh & Das, 2008). Yoğunluk değeri, hedef düğümlerin belirli bir doğruluk oranı dikkate alınarak konumlandırılabilmesi için gerekli komşu sayısının belirlenmesini sağlar. Eğer yoğunluğun dağılımı düşükse, hedef düğümler etrafındaki yeterli referans düğümü sayısı eksikliği sebebiyle bir dizi hedef konumlandırılamamış olabilir (Zhu vd., 2012).

Sonuçlar ve Gelecekteki Çalişmalar

Konumlandırma, kablosuz algılayıcı ağlarının potansiyel uygulama alanlarının birçoğunda kritik öneme sahip bir problem olup gerçekleştirilen uygulamaların başarımını önemli ölçüde etkileyebilmektedir. Çünkü bir kablosuz algılayıcı ağında, ağı oluşturan düğümlerin kimlikleri yanında ilgili coğrafi bölgeye yerleştirilmiş olan düğümlerin yoğunluğu, coğrafi yönlendirme bilgisi, kapsama alanları ve düğümlerin yönetimi gibi hususlar oldukça önemlidir. Bu çalışmada, kablosuz algılayıcı ağlarında konumlandırma problemine farklı açılardan yaklaşılarak problem incelenmiş ve literatürdeki konumlandırma algoritmaları ele alınmıştır. Gerçekleştirilen çalışmanın sonraki aşamalarında bu çalışmada ele alınmış olan konumlandırma algoritmaların gerçek bir saha çalışmasını da içeren ayrıntılı performans değerlendirmeleri ile başarımlarının incelenmesi planlanmaktadır.

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USING MOBILE LIDAR SYSTEMS FOR CUT - FILL VOLUME CALCULATION U.A.E.

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Abstract: Today's requirements about land surveying and evaluation of the surveying results are very challenging. To achieve the results in a short time and with high level of efficiency and productivity, mobile lidar and mapping systems can be used. In this project, the details of a field experiment are presented to evaluate the efficiency Mobile Lidar & Mapping Systems in order to calculate cut and fill volumes for a big construction area.

Keywords: Mobile lidar , mobile mapping system, leica pegasus:ii , volume calculation, cut and fill, point cloud

KAZI – DOLGU HACİMLERİNİN HESAPLANMASINDA MOBİL LİDAR KULLANIMI ÖRNEĞİ B.A.E

Özet: Günümüzün yer ölçme ve ölçüm sonuçlarını değerlendirme gereksinimleri oldukça zorludur. Sonuçlara kısa zamanda, yüksek verimlilik ve üretkenlik ile ulaşmak için mobil lidar ve haritalama sistemleri kullanılabilmektedir. Bu projede, büyük bir inşaat sahasında kazı-dolgu hacimlerinin hesaplanması konusunda mobil lidar & haritalama sistemleri kullanılması testlerinin detayları sunulmuştur.

Anahtar Sözcükler: Mobil tarama sistemleri, nokta bulutu, kazı-dolgu, hacim hesabı , leica pegasus:ii

Giriş

Ortadoğu, özellikle Birleşik Arap Emirlikleri tarihin en yüksek binalarına (Burj Khalifa, Almas Tower) ve en büyük kapalı AVM'lerine (Mall of Emirates, Dubai Mall, Ferrari World Abu Dhabi) ev sahipliği yapmaktadır. Dolayısıyla bu bölgelerde kısa zamanda çok büyük miktarlarda hafriyat işlemi yapılmaktadır. Ayrıca iklimin ilkbahardan itibaren yüksek sıcaklıklara ulaşması sebebiyle de çalışma saatleri kısalmakta ve verimlilik düşmektedir. Bu bağlamda inşaat işlerinde ve hafriyat işlerinde makineleşme büyük önem kazanmıştır. Bu örnekte Birleşik Arap Emirliklerinde bulunan 157 hektarlık (Şekil 1) kumluk arazinin mobil tarama sistemi ile ölçülmek suretiyle sayısal arazi modelinin oluşturulması ve o model üzerinden teorik kazı yüzeyi çakıştırılarak ne kadar hafriyat çıkacağına ilişkin hesaplar verilecektir.

Çalışma kapsamında havaalanına ve üniversiteye çok yakın bir noktada bulunan ve önceden askeri bölge olarak kullanılmış, fakat yeni düzenleme ile imara açılan bölgeye, üniversite yararına kullanılmak üzere bir inşaat yapılması gündemdedir (Şekil 2). Spor kompleksi ve çevresindeki yollar, ARCGIS Explorer programında , altlık ESRI Imagery yazılımında değerlendirilmiş veriler en son sayısal olarak NETCAD ("NETCAD", 2016) ve AUTOCAD ("AUTOCAD", 2016) yazılımlarına aktarılmıştır.

Şekil 1. Örnek inşaat sahası

Yöntem

Bu projede kullanılmış olan ölçme cihazı Leica Pegasus:II Mobil Lidar ve Haritalama Sistemi'dir. Mobile lidarlarda ölçme yöntemi temelde "post proses" yöntemlere dayanır.

Mobil sistemlerin bileşenleri,
1- IMU , ataletsel konumlandırma/ölçüm sistemi
2- GNSS anteni ve alıcısı
3- Kameralar (panoramik görüntüler ve nokta bulutu renklendirme için)
4- Lazer tarama sistemi
5- Endüstriyel , güçlü entegre bilgisayar ve kayıtlama ünitesi
6- Batarya güç elemanları
7- Odometre (duruma bağlı kullanım)

Şekil 1. Mobil lidar & haritalama sistem , leica pegasus: ii

Başlıca sistem bileşenlerinin teknik özellikleri aşağıdaki gibi verilebilir.

1- IMU: iMar FSAS

Aletsel konumlandırma / ölçme sistemi, içerisinde ivme ve eğim ölçer sensörlerin bulunduğu , her türlü hareketi 200Hz frekansta algılayıp kaydını tutan ve yüksek hassasiyette rota bilgileri kaydeder. Aracın x,y,z eksenleri ile yaptığı açıları da kaydederek, GNSS anteninin uydulardan konum bulamadığı zorlu koşullarda konum kestirmesi rolünü de üstlenir. Aşağıdaki tabloda ne denli hassas bir kestirme yapabildiği görülmektedir.

Şekil 3. IMU cihazı

PERFORMANCE DURING GNSS OUTAGES[1]

Outage Duration	Positioning Mode	POSITION ACCURACY (M) RMS		VELOCITY ACCURACY (M/S) RMS		ATTITUDE ACCURACY (DEGREES) RMS		
		Horizontal	Vertical	Horizontal	Vertical	Roll	Pitch	Heading
0 s	RTK[9]	0.020	0.050	0.020	0.010	0.008	0.008	0.023
	SP	1.200	0.600	0.020	0.010	0.009	0.013	0.024
	PP[10]	0.010	0.015	0.020	0.010	0.008	0.008	0.012
10 s	RTK[9]	0.130	0.060	0.026	0.010	0.010	0.010	0.025
	SP	1.340	0.670	0.035	0.011	0.014	0.014	0.026
	PP[10]	0.020	0.020	0.020	0.010	0.008	0.008	0.013
60 s	RTK[9]	3.500	0.320	0.135	0.015	0.015	0.015	0.040
	SP	4.440	0.870	0.151	0.015	0.018	0.018	0.040
	PP[10]	0.130	0.050	0.030	0.020	0.010	0.010	0.016

2- GNSS anteni ve alıcısı

Üçlü kanal yapısıyla– L-Band, SBAS, and QZSS for GPS, GLONASS, Galileo, and BeiDou takım uydularını izleyebilen, tek veya iki GNSS antenini aynı anda destekleyebilen, düşük sinyal/gürültü oranına sahip ve sinyallerin etkilerini süzebilen küresel konum belirleme sistemidir.

Şekil 4. GNSS anteni

3- Lidar / Lazer Tarayıcı sistemi

Yüksek hızlı rotasyonel profil lazer tarayıcı, saniyede 1 milyon nokta ölçme kapasitesi ve 200 Hz frekans ile çalışabilen, orta menzilli (180m yarıçap) ölçme kabiliyetine sahiptir. Teknik olarak isabet oranları aşağıda görülebilir.

Şekil 5. Lazer profil tarayıcı

Accuracy			
Target Distance	White (80%) [1]	Grey (37%) [1]	Black (14%) [1]
1 Sigma Range Noise, 0.5 m	0.5 mm	0.8 mm	1.3 mm
1 Sigma Range Noise, 2 m	0.3 mm	0.5 mm	0.8 mm
1 Sigma Range Noise, 5 m	0.3 mm	0.4 mm	0.6 mm
1 Sigma Range Noise, 10 m	0.2 mm	0.3 mm	0.5 mm
1 Sigma Range Noise, 25 m	0.4 mm	0.6 mm	1.1 mm
1 Sigma Range Noise, 50 m	0.9 mm	1.4 mm	3.1 mm

Şekil 6. Lidar / lazer tarayıcı sisteminin teknik olarak isabet oranları

Sistemin tüm bileşenleri ile birlikte uygun GNSS baz mesafesi sağlandığında sağlayabildiği mutlak doğruluk 1.5 cm dir. Bu da Büyük ölçekli harita ve harita bilgileri üretim yönetmeliği (BÖHHBUY, 2005) normlarına uymaktadır. Elde edilen koordinatlar ise UTM (Buchroithner, M. F., & Pfahlbusch, R., 2016) koordinat sistemindedir.

Sonuç

Mobil lidar & haritalama sistemi kullanılarak yapılan bu çalışma göstermiştir ki, geleneksel ölçme yöntemlerine göre çok daha hızlı ve detaylı sonuçlar almak mümkündür. Ayrıca, ölçümde lazer kullanılmasının getirileri olarak analizde çok daha geniş imkanlar sunmaktadır. Ayrıca konumsal hassasiyet olarak da mevcut Kinematik GPS ölçme yöntemlerine kıyasla güvenilirlik bakımından hiç bir eksiği yoktur.

Araç üzerinde olması, renkli görüntüler çekmesi, yüksek hızlı lazer profil tarayıcı sayesinde hiç detay atlamadan güvenilir biçimde veriyi toplayarak nokta bulutu kavramının verimliliğini artırması bakımından da önemlidir .

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INVESTIGATION OF THEORETICAL AND EXPERIMENTICAL SPECTROSCOPIC PROPERTIES OF 3-PHENYL-4-[3-(4-NITROBENZOXY)-BENZYLIDENAMINO]-4,5-DIHYDRO-1H-1,2,4-TRIAZOL-5-ONE

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Abstract: In this study, spectroscopic properties of 3-phenyl-4-[3-(*p*-nitrobenzoxy)-benzylidenamino]-4,5-dihydro-1*H*-1,2,4-triazol-5-one has been compared theoretically and experimentally values. For this purpose, firstly studied compound has been optimized using B3LYP, HF method and 6-311G (d, p) the basic set. ^{1}H-NMR and ^{13}C-NMR chemical shift values according to the method GIAO by obtained optimized structure were calculated using Gaussian G09W computer program in gas phase. Theoretically and experimentally values according to exp=a+b. δ calc Eq. were plotted by the SigmaPlot program. According to obtained conclusions, theoritical and experimental values were seen to be compatible. In the theoretical part of the study, Also, The synthesized compound of values calculated IR frequencies using the same methods and the basic set were calculated in gas phase. Which, founded values are multiplied by appropriate adjustment factors. Theoretical infrared spectrums were obtained according to HF and B3LYP methods. Veda4f program was used for theoretically identification of calculated IR data. Additionally, the molecule was found bond lengths, bond angles, the HOMO-LUMO energy, dipole moments, mulliken charges, total energy of the molecule, ionization potential, electron affinity, molecular softness, molecular hardness and electronegativity with from both methods.

Keywords: B3LYP, GIAO, HF, 4,5-Dihydro-1*H*-1,2,4-triazol-5-one, 6-311G(d,p)

3-FENİL-4-[3-(4-NİTROBENZOKSİ)-BENZİLİDENAMİNO]-4,5-DİHİDRO-1H-1,2,4-TRİAZOL-5-ON'UN TEORİK VE DENEYSEL SPEKTROSKOPİK ÖZELLİKLERİNİN İNCELENMESİ

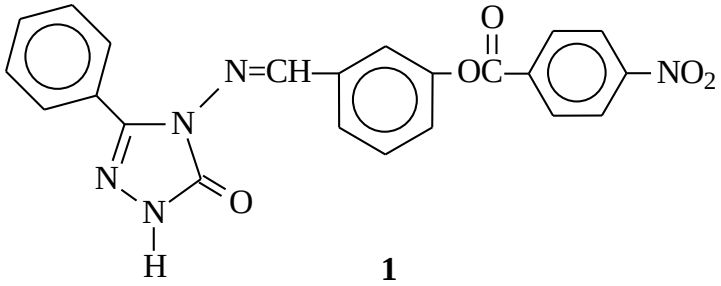
Özet: Bu çalışmada, 3-fenil-4-[3-(*p*-nitrobenzoksi)-benzilidenamino]-4,5-dihidro-1*H*-1,2,4-triazol-5-on bileşiğinin teorik spektroskopik özellikleri incelenerek bazı deneysel verilerle mukayese edilmiştir. Bu amaçla, öncelikle çalışılan bileşik B3LYP, HF yöntemleri ve 6-311G(d,p) temel seti kullanılarak optimize edilmiştir. Elde edilen optimize yapı yardımıyla GIAO metoduna göre ^{1}H-NMR ve ^{13}C-NMR kimyasal kayma değerleri Gaussian G09W bilgisayar programı vasıtasıyla gaz fazında hesaplanmıştır. δ exp=a+b. δ calc. eşitliğine göre teorik değerler ile deneysel veriler SigmaPlot programı kullanılarak grafiğe geçirilmiştir. Elde edilen sonuçlara göre teorik verilerin deneysel verilerle uyumlu oldukları görülmüştür. Çalışmanın teorik kısmında ayrıca, aynı metodlar ve temel set kullanılarak molekülün IR frekans değerleri hesaplanmış, bulunan değerler belirli uyum faktörleri ile çarpılmıştır. Teorik infrared spektrumları HF ve B3LYP yöntemlerine göre elde edilmiştir. Teorik olarak oluşturulan titreşim değerlerinin tanımlanması için Veda4f programı kullanılmıştır. İlaveten, molekülün bağ uzunlukları, bağ açıları, Mulliken atomik yükleri, HOMO-LUMO enerjileri, dipol momentleri, toplam enerjileri, iyonlaşma potansiyeli, elektron ilgisi, moleküler yumuşaklık, moleküler sertlik ve elektronegatifliği aynı metodlar ve aynı set kullanılarak hesaplanmıştır.

Anahtar Kelimeler: B3LYP, GIAO, HF, 4,5-Dihidro-1*H*-1,2,4-triazol-5-on, 6-311G(d.p)

Giriş

Deneysel çalışmaları desteklemek veya çalışma yapmadan önce moleküllerin analiz sonuçlarını tahmin edebilmek için kuantum kimyasal hesaplamaları, moleküler modelleme gibi bilgisayar programları kullanılarak yapılmaktadır. Bu tür hesaplamaların temelini kuantum mekaniği oluşturur. Bu programlar moleküllerin moleküler yapısı, uzaydaki en kararlı durumu olan optimize edilmiş geometrisi , toplam enerji, dipol moment, spektroskopik parametreler (^{1}H-NMR, ^{13}C-NMR ve IR titreşim frekansları) gibi özelliklerinin hesaplanacağı verimli programların oluşturulmasını sağlamaktır. Nitekim, 4,5-dihidro-1H-1,2,4-triazol-5-on türevlerinin spektroskopik (IR ve NMR) ve elektronik özellikleri Hartree-Fock (HF) ve density functional theory (B3LYP) yöntemleri kullanılarak araştırılmıştır (Yüksek ve ark., 2005a; Yüksek ve ark., 2005b).

Bu çalışmada, 4,5-dihidro-1H-1,2,4-triazol-5-on türevi olan 3-metil-4-[3-(*p*-nitrobenzoksi)-benzilidenamino]-4,5-dihidro-1*H*-1,2,4-triazol-5-on **(1)** molekülünün B3LYP/6-311G(d,p) ve HF/6-311G(d,p) temel setleri kullanılarak teorik spektroskopik özellikleri incelenerek bazı deneysel parametrelerle (Gürsoy Kol ve Yüksek, 2010) mukayese edilmiştir (Şekil **1**) (Yüksek ve ark., 2012).



1

Şekil 1. Molekülün (6-311G (d,p)) kimyasal yapısı

Materyal ve Yöntem

Hesaplama Yöntemleri

Bu çalışmada, *ab-initio,* moleküler mekanik ve yarı-deneysel metotları gibi kapsamlı ve çok sayıda temel set seçeneğine sahip bilgisayar destekli hesaplama programı olan Gaussian 09W paket programı kullanılmıştır (Frisch et al., 2009). Bu program ile bileşikler için geometrik optimize işlemi yapılabilir, toplam enerjileri, IR frekans değerleri mulliken atomik yükleri ve indüklenmiş dipol momentleri teorik olarak hesaplanabilir. İlaveten, kimyasal reaksiyonlarda oluşan geçiş durumları ve reaksiyon mekanizmaları da bu program ile taranabilir. Ayrıca, moleküllerin teorik infrared ve UV-vis spektrumları NMR kimyasal kayma değerleri ve manyetik titreşim şiddetleri, kimyasal sertlik, kimyasal yumuşaklık, iyonlaşma enerjileri, elektron ilgisi, elektron yoğunluğu ve hiperkutuplanma gibi birçok özellik hesaplanabilir. Bütün bu teorik hesaplama işlemlerinde moleküllerin veya atomların temel ya da uyarılmış hali kullanılabilir (Frisch et al., 2009; (Atalay, Avcı & Başoğlu, 2008).

Ab-initio metodu, deneysel veriler kullanılmadan Schrödinger dalga denkleminin çözümüne dayanan bir yöntemdir. Buna karşın, yarı deneysel ve moleküler mekanik metotları, Planck sabiti ve elektron kütlesi sabitleri bu denklemle tam bağıntılı değildir (Apaydın, 1991; Jensen, 1999). Schrödinger dalga denklemi tek elektronlu hidrojen atomuyla çözümü mümkündür. Ancak, çok elektronlu sistemlerde çözümü zor olduğundan dolayı Hartree-Fock öz uyumlu alan teorisi (HF-SCF) ve yoğunluk fonksiyonu teorisi (DFT) gibi matematiksel yaklaşımlar kullanılır. Hartree-Fock ve yoğunluk fonksiyonu teorisi metotları ile IR, NMR gibi spektroskopik özellikler ve elektronik özellikler yardımıyla moleküllerin yapıları tayin edilebilir. Teorik kimyanın son yıllarda giderek yaygın olmasının nedenlerinden biri de deneysel verilere ihtiyaç duyulmamasıdır(Apaydın, 1991).

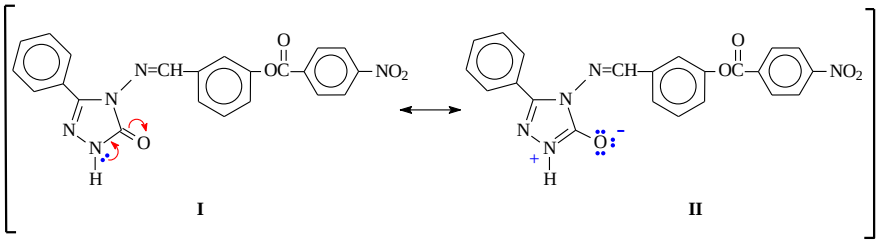
Bu çalışmada, 3-fenil-4-[3-(*p*-nitrobenzoksi)-benzilidenamino]-4,5-dihidro-1*H*-1,2,4-triazol-5-on **(1)** molekülünün yapısını teorik olarak incelenmiş ve elde edilen teorik veriler bazı deneysel verilerle (Gürsoy Kol ve Yüksek, 2010) mukayese edilmiştir (Yüksek ve ark., 2012). Öncelikle, molekülün üç boyutlu geometrisi Gaussview (Dennington et al., 2009) programında çizilerek GAUSSIAN 09W paket programında (Frisch et al., 2009) giriş verisi olarak kullanılarak gaz fazında optimize edilmiştir. Titreşim frekansları, ^{1}H-NMR ve ^{13}C-NMR, kimyasal kayma değerleri, bağ açıları, bağ uzunlukları, mulliken atomik yükleri, HOMO-LUMO enerjileri, toplam enerjileri, dipol momentleri, iyonlaşma potansiyeli, elektron ilgisi, moleküler yumuşaklık, moleküler sertlik ve elektronegatiflik özellikleri Hartree Fock (HF) ve yoğunluk fonksiyonu teorisi (DFT)

(Becke, 1988; Lee et al., 1998) metotları ve 6-311G(d,p) temel seti yardımıyla hesaplanmıştır (Yüksek ve ark., 2012).

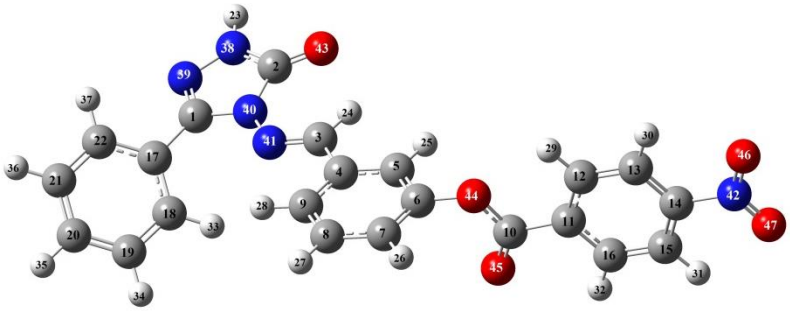
Bulgular ve Tartişma

Geometrik Optimizasyon

Molekülün üç boyutlu görsel olarak yaklaşık geometrisi GaussView 5.0 programında (Dennington et al., 2009) çizilmiştir. Çizilen bu geometriden Gaussian 09W programı kullanılarak Hartree-Fock (HF) ve Yoğunluk Fonksiyonu Teorisi (DFT) metodu ve polarize fonksiyonları içeren 6-311G(d,p) temel seti ile optimize edilerek bileşikteki herbir atomun minimum enerjili, uzaydaki en kararlı yerleşimleri ve uzay yapısı belirlenmiştir (Atalay, Avcı & Başoğlu, 2008) (Şekil **2**). Böylece, bağ uzunlukları (Çizelge **1**), ve bağ açıları (Çizelge **2**) teorik olarak hesaplanmıştır. Teorik olarak hesaplanan bağ uzunluklarının deneysel (Gürsoy Kol ve Yüksek, 2010) verilerle uyumunu incelemek için **1** bileşiğinin C-3'e bağlı fenil halkalarındaki C-C bağ uzunlukları ile C-H bağ uzunluklarının literatürde kayıtlı verilerle karşılaştırılması yapılmıştır. Literatürde benzen halkasındaki tüm C-C bağ uzunlukları 1.397 A^0, C-H bağ uzunlukları ise 1.084 A^0 olarak ölçülmüştür (Gökçe ve ark., 2012;). **1** bileşiğinin yapısında bulunan iki fenil grubu C-C bağ uzunlukları ortalamaları B3LYP 6-311(d,p) 1.392 A^0 ve HF 6-311(d,p) 1.381 A^0 olarak bulunmuştur. B3LYP temel setine göre bulunan ortalama C-C bağ uzunluğunun deneysel değere yakın, fakat biraz düşük olduğu görülmüştür ki bu sonuç literatürle uyumludur (Avcı ve Ark., 2009). Aynı bileşikte aril C-H bağ uzunlukları ortalamaları B3LYP ve HF temel setlerine göre sırasıyla 1.084 A^0 ve 1.073 A^0 olarak bulunmuştur. Yine B3LYP temel setine göre bulunan ortalama C-H bağ uzunluğu literatürdeki değere yakın olduğu görülmüştür. Teorik bağ uzunluklarının incelenmesi sırasında ilginç bir diğer sonuca da varılmıştır. C(2)-NH bağ uzunluğu B3LYP ve HF temel setleri ile sırasıyla 1.369 A^0 ve 1.345 A^0 olarak bulunmuştur (Yüksek ve ark., 2012). Literatürde deneysel C-N tek ve C=N çift bağ uzunlukları sırasıyla 1.49 A^0 ve 1.27 A^0 olarak verilmiştir (İkizler, 1996). B3LYP ve HF metodlarına göre elde edilen ortalama bağ uzunluklarının deneysel C-N tek ve C=N çift bağ uzunluklarının arasında bir değere sahip olduğu görülmektedir. Dolayısıyla 4,5-dihidro-1*H*-1,2,4-triazol-5-on halkasında C(2)-NH bağının kısmi çifte bağ karakteri taşıdığı söylenebilir. Bu durum aşağıdaki rezonans strüktürleri ile açıklanabilir. (Denklem **1**).



(1)



Şekil 2. Molekülün (6-311G (d,p)) gausview görünümü

Çizelge 1. Molekülün B3LYP ve HF yöntemlerine göre teorik olarak elde edilen bağ uzunlukları (A^0)

	Bağ Tipi	B3LYP (A^0)	HF (A^0)		Bağ Tipi	B3LYP (A^0)	HF (A^0)
1	C(1)-N(39)	1.3064	1.2715	25	C(5)-H(25)	1.0829	1.0752
2	C(1)-N(40)	1.3973	1.3885	26	C(5)-C(6)	1.3922	1.3800
3	C(1)-C(17)	1.4699	1.4771	27	C(6)-O(44)	1.3984	1.3850
4	C(17)-C(18)	1.4040	1.3907	28	C(6)-C(7)	1.3915	1.3762
5	C(17)-C(22)	1.4055	1.3905	29	C(7)-H(26)	1.0846	1.0744
6	C(18)-H(33)	1.0822	1.0726	30	C(7)-C(8)	1.3976	1.3883

7	C(18)-C(19)	1.3941	1.3837	31	C(8)-H(27)	1.0855	1.0750
8	C(19)-H(34)	1.0860	1.0754	32	C(8)-C(9)	1.3897	1.3800
9	C(19)-C(20)	1.3953	1.3855	33	C(9)-H(28)	1.0840	1.0733
10	C(20)-H(35)	1.0860	1.0756	34	O(44)-C(10)	1.3656	1.3351
11	C(21)-C(22)	1.3968	1.3851	35	C(10)-O(45)	1.2092	1.1837
12	C(21)-H(36)	1.0859	1.0753	36	C(10)-C(11)	1.4940	1.4955
13	C(22)-H(37)	1.0844	1.0739	37	C(11)-C(12)	1.4021	1.3894
14	N(39)-N(38)	1.3741	1.3665	38	C(11)-C(16)	1.4022	1.3888
15	N(38)-H(23)	1.0072	0.9908	39	C(12)-H(29)	1.0840	1.0728
16	N(38)-C(2)	1.3692	1.3448	40	C(12)-C(13)	1.3900	1.3812
17	C(2)-O(43)	1.2222	1.2018	41	C(13)-H(30)	1.0824	1.0710
18	N(40)-C(2)	1.4198	1.3885	42	C(13)-N(42)	1.4761	1.3826
19	N(40)-N(41)	1.3710	1.3648	43	N(42)-O(46)	1.2296	1.1926
20	N(41)-C(3)	1.2888	1.2593	44	N(42)-O(47)	1.2299	1.1928
21	C(3)-H(24)	1.0876	1.0747	45	C(14)-C(15)	1.3931	1.3814
22	C(3)-C(4)	1.4677	1.4771	46	C(15)-H(31)	1.0824	1.0710
23	C(4)-C(5)	1.4028	1.3878	47	C(15)-C(16)	1.3914	1.3830
24	C(4)-C(9)	1.4063	1.3938	48	C(16)-H(32)	1.0829	1.0720

Çizelge 2. Molekülün B3LYP ve HF yöntemlerine göre teorik olarak elde edilen bağ açıları (^{0})

	Bağ Açıları (°)		**HF**		**Bağ Açıları (°)**		**HF**
1	C(1)-N(39)-N(38)	105,11	105,35	**38**	H(25)-C(5)-C(6)	120,42	119,49
2	C(1)-N(40)-N(41)	122,53	122,08	**39**	C(5)-C(6)-O(44)	122,40	118,90
3	C(1)-N(40)-C(2)	108,26	107,94	**40**	C(5)-C(6)-C(7)	121,42	121,53
4	C(1)-C(17)-C(18)	122,84	122,03	**41**	O(44)-C(6)-C(7)	116,04	119,49
5	C(1)-C(17)-C(22)	117,90	118,30	**42**	C(6)-C(7)-H(26)	119,37	119,92
6	C(17)-C(18)-H(33)	119,85	120,19	**43**	C(6)-C(7)-C(8)	119,07	118,82
7	C(17)-C(18)-C(19)	120,04	119,97	**44**	H(26)-C(7)-C(8)	121,56	121,26
8	H(33)-C(18)-C(19)	120,11	119,83	**45**	C(7)-C(8)-H(27)	119,46	119,50
9	C(18)-C(19)-H(34)	119,45	119,62	**46**	C(7)-C(8)-C(9)	120,53	120,60
10	C(18)-C(19)-C(20)	120,48	120,25	**47**	H(27)-C(8)-C(9)	120,01	119,90
11	H(34)-C(19)-C(20)	120,07	120,13	**48**	C(8)-C(9)-H(28)	120,93	120,59
12	C(19)-C(20)-C(21)	119,70	119,92	**49**	C(8)-C(9)-C(4)	120,04	120,01
13	C(19)-C(20)-H(35)	120,15	120,09	**50**	H(28)-C(9)-C(4)	119,03	119,40
14	H(35)-C(20)-C(21)	120,15	120,06	**51**	C(9)-C(4)-C(5)	119,67	119,51
15	C(20)-C(21)-C(22)	120,19	120,05	**52**	C(6)-O(44)-C(10)	120,84	119,20
16	C(20)-C(21)-H(36)	120,17	120,21	**53**	O(44)-C(10)-O(45)	124,52	123,98
17	H(36)-C(21)-C(22)	120,15	119,75	**54**	O(44)-C(10)-C(11)	111,23	112,16
18	C(21)-C(22)-C(17)	119,65	120,20	**55**	O(45)-C(10)-C(11)	124,25	123,90
19	C(21)-C(22)-H(37)	120,66	120,41	**56**	C(10)-C(11)-C(12)	117,28	122,04
20	H(37)-C(22)-C(17)	118,96	119,39	**57**	C(10)-C(11)-C(16)	122,56	117,52
21	N(39)-C(1)-N(40)	110,70	110,61	**58**	C(11)-C(12)-H(29)	118,75	120,14
22	N(39)-N(38)-H(23)	120,39	120,95	**59**	H(29)-C(12)-C(13)	120,96	119,94
23	N(39)-C(1)-C(17)	122,61	123,40	**60**	C(12)-C(13)-C(14)	118,45	119,91
24	H(23)-N(38)-C(2)	124,97	125,32	**61**	C(12)-C(13)-H(30)	121,96	121,37
25	N(38)-C(2)-N(40)	101,42	102,16	**62**	H(30)-C(13)-C(14)	119,59	120,12
26	N(38)-C(2)-O(43)	129,76	129,37	**63**	C(13)-C(14)-C(15)	122,43	122,52
27	O(43)-C(2)-N(40)	128,82	128,47	**64**	C(13)-C(14)-N(42)	118,81	118,68
28	C(2)-N(40)-N(41)	128,70	129,19	**65**	N(42)-C(14)-C(15)	118,76	118,73
29	N(40)-C(1)-C(17)	126,69	125,75	**66**	C(14)-N(42)-O(46)	117,54	117,56
30	N(40)-N(41)-C(3)	119,20	120,02	**67**	C(14)-N(42)-O(47)	117,55	117,54
31	N(41)-C(3)-H(24)	122,45	122,71	**68**	C(14)-C(15)-C(16)	118,64	118,36
32	N(41)-C(3)-C(4)	119,51	119,73	**69**	C(14)-C(15)-H(31)	119,50	120,17
33	H(24)-C(3)-C(4)	118,04	117,57	**70**	H(31)-C(15)-C(16)	121,86	121,48
34	C(3)-C(4)-C(5)	117,93	118,15	**71**	C(15)-C(16)-C(11)	120,04	120,15
35	C(3)-C(4)-C(9)	122,40	122,34	**72**	C(15)-C(16)-H(33)	120,17	119,91
36	C(4)-C(5)-H(25)	120,31	120,98	**73**	H(32)-C(16)-C(11)	119,79	120,14
37	C(4)-C(5)-C(6)	119,27	119,53	**74**	C(16)-C(11)-C(12)	120,16	120,44

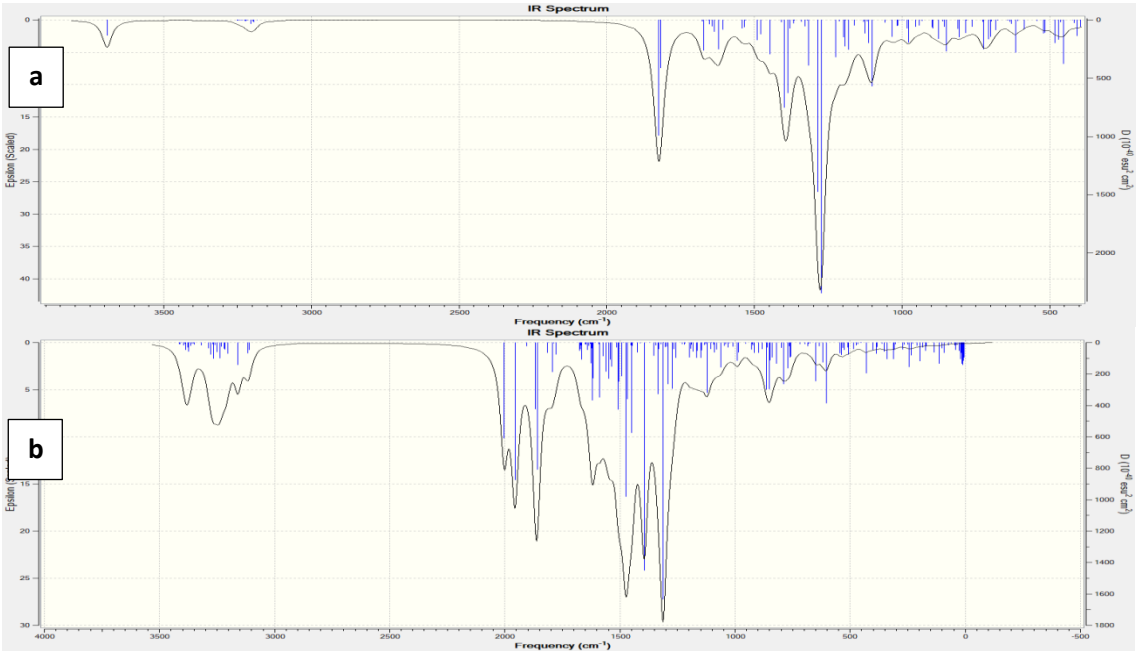
İnfrared Spektrum Analizi

3-fenil-4-[3-(*p*-nitrobenzoksi)-benzilidenamino]-4,5-dihidro-1*H*-1,2,4-triazol-5-on **(1)** bileşiğinin B3LYP ve HF yöntemleri ve 6-311G(d,p) temel setine göre teorik titreşim frekansları gaz fazında hesaplanmıştır. B3LYP ve HF'ye göre elde edilen değerler kullanılarak teorik IR spektrumları çizilmiş (Şekil **3**) ve titreşim frekansları B3LYP/6-311G(d,p) için 0.9516 ve HF/6-311G(d,p) metodu için 0,9905 katsayıları ile çarpılmıştır (Merrick et al., 2007). Teorik IR spektral değerleriyle deneysel IR spektral değerleri (Gürsoy Kol ve Yüksek, 2010) mukayese edilmiştir. Bu karşılaştırma sonucu teorik bulguların deneysel verilerle ve literatürdeki benzer bileşiklerle ilgili yapılan benzer çalışmalarda elde edilen değerlerle uyumlu olduğu görülmüştür (Lee, 1998; Akyıldırım ve ark., 2012; Gökçe ve ark., 2012; Kayalar, 2012). Teorik olarak elde edilen titreşim verilerinin belirlenmesinde veda4f yazılım programından yararlanılmıştır (Jamroz, 2004) (Çizelge **3**).

Çizelge 3. Molekülün deneysel ve seçilmiş teorik frekans değerleri ve titreşim türleri

Titreşim türleri	Deneysel	Skalalı DFT	Skalalı HF
τ HCCC (49),	803	829	839
τ HCCC (94)	841	857	909
ν OC (34), ν CC (13), δ OCO (12)	1264	1306	1343
ν ON (76), δ ONO (10)	1351	1393	1558
ν ON (18), ν CC (47)	1526	1587	1678
ν NC (48)	1577	1608	1777
ν NC (54)	1607	1641	1799
ν OC (67), ν NC (14)	1707	1726	1864
ν OC (88)	1736	1785	1910
ν NH (100)	3159	3352	3738

ν, gerilme; δ, bükülme; δ_s, makaslama; ρ, sallanma; γ, düzlem dışı bükülme τ, dönme



Şekil 3. Molekülün teorik (B3LYP (a) ve HF (b)) IR spetktrumları

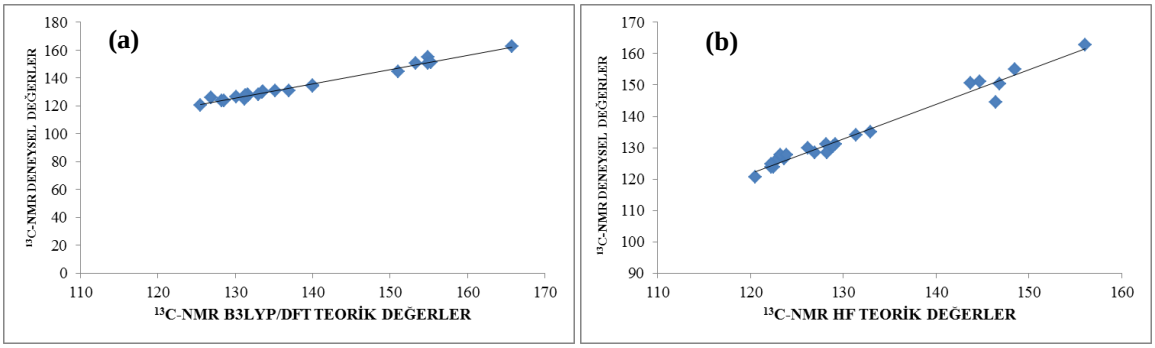
NMR Spektral Analiz

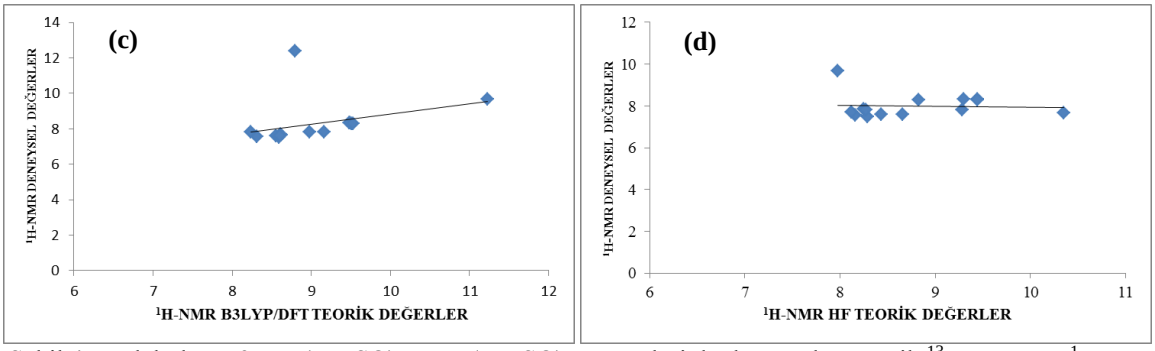
Bu çalışmada, 3-fenil-4-[3-(*p*-nitrobenzoksi)-benzilidenamino]-4,5-dihidro-1*H*-1,2,4-triazol-5-on **(1)** bileşiğinin ^{1}H-NMR ve ^{13}C-NMR, kimyasal kayma değerlerinin hesaplanması için öncelikle en minimum enerjili optimize edilmiş yapılar elde edilmiştir. Bu optimize yapılar sayesinde kimyasal kayma değerleri, HF ve B3LYP metotlarında GIAO NMR yaklaşımı (Wolinski, 1990) ile 6-311G(d,p) temel seti kullanılarak DMSO'da oluşturulmuştur (Çizelge **4**). Deneysel (Gürsoy Kol ve Yüksek, 2010) ve teorik ^{13}C-NMR ve ^{1}H-NMR değerleri regresyon analizi en küçük kareler yöntemine göre yapılarak bulunan R^2 değerlerinin son derece uyumlu olduğu görülmüştür. (Şekil **4**). Elde edilen molekülün elde edilen R^2 değerleri; B3LYP/6-311G(d,p) (DMSO) için; ^{13}C: 0.995, ^{1}H: 0.904 ve HF/6-311G(d,p) için; ^{13}C: 0.992, ^{1}H: 0.876 olarak hesaplanmıştır. δ calc=a δexp+b formülü ile ^{13}C-NMR ve ^{1}H-NMR verilerinin standart hata oranları her iki yönteme göre hesaplanmıştır. ^{13}C-NMR ve ^{1}H-NMR Kimyasal kayma değerleri deneysel ve teorik olarak mukayese edilmiş ve bu oranlar arasında **a**, **b** ve **R**

değerine göre doğrusal bir korelasyon gözlenmiştir (Şekil **4**). Aynı metod ve temel setlere göre DMSO çözücülü ortamda incelenen molekülün deneysel olarak elde edilen (Gürsoy Kol ve Yüksek, 2010) ve teorik olarak hesaplanan değerler arasında bir uyum olduğu görülmüştür. Ancak, 4,5-dihidro-1*H*-1,2,4-triazol-5-on halkasındaki N-H protonunun asidik özellik taşıdığından dolayı (Yüksek, 1992; Bahçeci ve ark., 2002) N-H protonu için elde edilen deneysel değer, hesaplanan teorik değer daha düşük alanda ortaya çıkmıştır (Yüksek ve ark., 2012).

Çizelge 4. Molekülün TMS'ye göre deneysel ve teorik olarak ^{13}C ve ^{1}H-NMR (B3LYP/(DMSO) ve HF/(DMSO)) kimyasal kayma değerleri (δ/ppm)

No	Deneysel	DFT/6-311G(d,p)/DMSO	Fark/DMSO	HF/6-311G(d,p)/DMSO	Fark/DMSO
C1	144,41	151,07	-6,66	146,48	-2,07
C2	150,37	153,29	-2,92	146,83	3,54
C3	155,02	154,91	0,11	148,53	6,49
C4	134,08	139,97	-5,89	131,36	2,72
C5	126,39	130,15	-3,76	123,70	2,69
C6	150,64	154,94	-4,30	143,69	6,95
C7	125,72	126,92	-1,20	122,74	2,98
C8	129,97	133,51	-3,54	126,19	3,78
C9	120,60	125,53	-4,93	120,57	0,03
C10	162,86	165,77	-2,91	156,05	6,81
C11	134,91	140,00	-5,09	132,93	1,98
C12	131,14	136,92	-5,78	128,20	2,94
C13	123,75	128,26	-4,51	122,50	1,25
C14	151,15	155,31	-4,16	144,72	6,43
C15	123,75	128,59	-4,84	122,27	1,48
C16	131,14	135,18	-4,04	129,19	1,95
C17	124,78	131,23	-6,45	122,22	2,56
C18	128,37	131,58	-3,21	128,27	0,10
C19	127,80	131,72	-3,92	123,25	4,55
C20	130,26	133,55	-3,29	128,94	1,32
C21	127,80	131,35	-3,55	123,94	3,86
C22	128,37	133,01	-4,64	126,97	1,40
H23	12,39	8,80	3,59	7,98	4,41
H24	9,67	11,23	-1,56	10,35	-0,68
H25	7,65	8,62	-0,97	8,16	-0,51
H26	7,55	8,31	-0,76	8,12	-0,57
H27	7,70	8,61	-0,91	8,25	-0,55
H28	7,84	9,16	-1,32	8,83	-0,99
H29	8,28	9,51	-1,23	9,30	-1,02
H30	8,34	9,48	-1,14	9,44	-1,10
H31	8,34	9,49	-1,15	9,44	-1,10
H32	8,28	9,53	-1,25	9,28	-1,00
H33	7,80	8,98	-1,18	8,66	-0,86
H34	7,60	8,55	-0,95	8,29	-0,69
H35	7,50	8,59	-1,09	8,43	-0,93
H36	7,60	8,60	-1,00	8,27	-0,67
H37	7,80	8,24	-0,44	8,67	-0,87

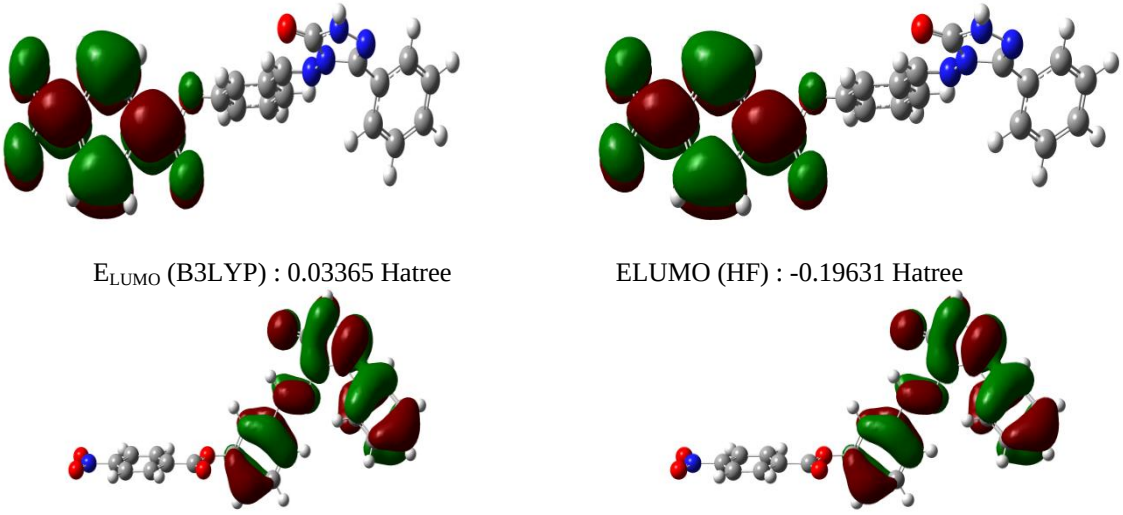




Şekil 4. Molekülün B3LYP(DMSO) ve HF(DMSO) yöntemleriyle deneysel ve teorik ^{13}C-NMR ve ^{1}H-NMR kimyasal kayma değerlerinin karşılaştırılması

Elektronik Özelliklerinin İncelenmesi

Dolu olan en yüksek enerjili orbitaller (E_{HOMO}) ve boş olan en düsük enerjili moleküler orbitaller (E_{LUMO}) reaksiyonların mekanizmasını oluşturan temel orbitallerdir. HOMO enerjisi bu kimyasal reaksiyonlarda elektron verme eğilimi (πdonor), LUMO enerjisi ise elektron alma eğilimi (πacceptor) olarak tanımlanır(Fukui, 1982) (Şekil **5**). Moleküle 6-311G(d,p) polarize temel seti uygulanarak B3LYP ve HF yöntemleriyle elektronik özellikleri hesaplanmıştır. Hesaplanan HOMO-LUMO enerjilerinden moleküler parametreler (**I**; İyonlaşma potansiyeli, **A**; elektron ilgisi, **η**; moleküler sertlik, **S**; moleküler yumuşaklık ve **χ**; elektronegatiflik), toplam enerjiler, dipol moment ve Mulliken atomik yük (Mulliken, 1955) yük değerleri belirlenmiştir (Yüksek ve ark., 2012) (Çizelge **5-7**).



E_{LUMO} (B3LYP) : 0.03365 Hatree ELUMO (HF) : -0.19631 Hatree

E_{HOMO} (B3LYP) :-0.32114 Hatree EHOMO (HF) : -0.28881 Hatree

Şekil 5. Molekülün B3LYP 6-311G(d,p) ve HF 6-311G(d,p)'ye göre hesaplanan HOMO-LUMO enerjileri

Çizelge 5. Molekülün atomlarının B3LYP ve HF'ye göre hesaplanan elektronik özellikleri

	B3LYP	**HF**
I; İyonlaşma Potansiyeli	0.22262 Hatree	0.28881 Hatree
A; Elektron İlgisi	-0.10839 Hatree	0.19631 Hatree
η; Moleküler Sertlik	0.16550 Hatree	0.04625 Hatree
S; Moleküler Yumuşaklık	3.30000 Hatree	10.8000 Hatree
χ; elektronegatiflik	0.05712 Hatree	0.24256 Hatree
Toplam Enerji	-1497.1641 a.u.	-1488.2975 a.u.

Çizelge 6. Molekülün teorik (B3LYP/6-311G(d,p) (a) ve HF/6-311G(d,p) (b)) hesaplanan dipol moment değerleri

Dipol Moment	B3LYP (debye)	HF (debye)
μ_x	4.2479	4.5465
μ_y	-2.5295	-3.3809
μ_z	-0.9183	-0.9542
μ_{Toplam}	5.0286	5.7455

Çizelge 7. Molekülün teorik (B3LYP/6-311G(d,p) ve HF/6-311G(d,p)) hesaplanan mulliken atomik yük değerleri

	B3LYP	HF		B3LYP	HF		B3LYP	HF
C1	0.492	0.616	**C17**	0.092	-0.044	**H33**	0.111	0.183
C2	0.824	1.055	**C18**	-0.095	0.118	**H34**	0.093	0.158
C3	0.119	0.181	**C19**	-0.096	0.159	**H35**	0.091	0.157
C4	0.062	-0.078	**C20**	-0.075	0.135	**H36**	0.091	0.157
C5	-0.110	-0.154	**C21**	-0.101	0.164	**H37**	0.109	0.178
C6	0.311	0.374	**C22**	-0.091	0.108	**N38**	-0.427	-0.562
C7	-0.098	-0.145	**H23**	0.291	0.342	**N39**	-0.345	-0.345
C8	-0.101	-0.156	**H24**	0.163	0.229	**N40**	-0.450	-0.648
C9	-0.092	-0.121	**H25**	0.120	0.181	**N41**	-0.310	-0.319
C10	0.606	0.850	**H26**	0.103	0.174	**N42**	0.391	0.527
C11	0.024	-0.176	**H27**	0.100	0.165	**O43**	-0.537	-0.655
C12	-0.106	-0.119	**H28**	0.117	0.192	**O44**	-0.542	-0.712
C13	-0.096	-0.115	**H29**	0.138	0.209	**O45**	-0.459	-0.540
C14	0.254	0.141	**H30**	0.147	0.226	**O46**	-0.389	-0.464

Sonuçlar

3-Fenil-4-[3-(*p*-nitrobenzoksi)-benzilidenamino]-4,5-dihidro-1*H*-1,2,4-triazol-5-on **(1)** molekülünün geometrik, IR ve NMR gibi spektroskopik özellikleri ve elektronik özellikleri teorik olarak B3LYP/6-311G(d,p) ve HF/6-311G(d,p) method ve temel setleri kullanılarak incelenmiştir. Öncelikle molekülün en kararlı yapısının ve minimum enerjili yapısının bulunabilmesi amacıyla, B3LYP ve HF metodları kullanılarak optimize edilmiştir. Elde edilen minimum enerjili geometrik yapıdan, molekülün bağ uzunlukları ve bağ açıları belirlenmiştir. Molekülün elde edilen en kararlı yapısından titreşim frekansları hesaplanmıştır. Teorik olarak hesaplanan titreşim frekansları uygun uyum faktörleriyle çarpılarak deneysel veriler ile uyumlu hale getirildi ve her iki yönteme göre IR spektrumları elde edilmiştir. Yine optimize yapıdan yola çıkarak ^{1}H-NMR ve ^{13}C-NMR kimyasal kayma dağerleri GIAO metodu kullanılarak hesaplanmış ve elde edilen teorik veriler deneysel değerler ile mukayese edilerek uyumlu olduğu görülmüştür. Ayrıca, **1** tipi bileşiğn moleküler orbital enerjileri ve toplam enerjileri her iki metoda göre hesaplanmıştır. Hesaplanan HOMO-LUMO enerji farkları ve bu enerji farklarından moleküler parametreler (**I**; İyonlaşma potansiyeli, **A**; elektron ilgisi, **η**; moleküler sertlik, **S**; moleküler yumuşaklık ve **χ**; elektronegatiflik) ve Mulliken atomik yük değerleri belirlenmiştir.

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A THEORETICAL INVESTIGATION OF STRUCTURAL, ELECTRONIC, LINEAR AND NONLINEAR OPTICAL PROPERTIES OF 4-CARBOXYPHENYLBORONIC ACID

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Abstract: In the study, theoretical study on molecular structure, electronic and nonlinear optical properties of 4-carboxyphenylboronic acid molecule has been conducted. The geometric parameters (bond lengths, bond and dihedral angles), the dipole moment (μ), mean polarizability (α), the total first-order hyperpolarizability (β), energies of the highest occupied molecular orbital energy (HOMO) and the lowest unoccupied molecular orbital (LUMO) of the molecule in the ground state were calculated by using ab initio Hartree-Fock (HF) and Density functional theory (DFT/B3LYP) using 6-311++G(d,p) basis set. E_{LUMO}-E_{HOMO} energy gap (ΔE), electronegativity (χ), electron affinity (A), global hardness (η), softness (σ) and ionization potential (I) were calculated. Also, ^{1}H NMR and ^{13}C NMR chemical shifts calculations have been performed by using the both models, where the various basis sets were employed. The potential energy surface (PES) of the molecule was calculated by the B3LYP/6-311++G(d,p) method, rotating the OH groups around the C4-C7 and B-C1 sigma bonds. Structural parameters of the working molecule were compared with those given in the literature, and the structure was found to be in agreement with the parameter values. Energy gap (ΔE) value of 4-carboxyphenylboronic acide molecule are calculated at 5.39 and 10.28 eV with DFT/B3LYP/6-311++G(d,p) and HF/6-311++G(d,p) methods, respectively.

Keywords: 4-carboxyphenylboronic acid, E_{LUMO}-E_{HOMO}, Potential energy surface (PES), the total first-order hyperpolarizability

4-KARBOKSİFENİLBORONİK ASİTİN YAPISAL, ELEKTRONİK, ÇİZGİSEL VE ÇİZGİSEL OLMAYAN OPTİK ÖZELLİKLERİNİN TEORİK OLARAK İNCELENMESİ

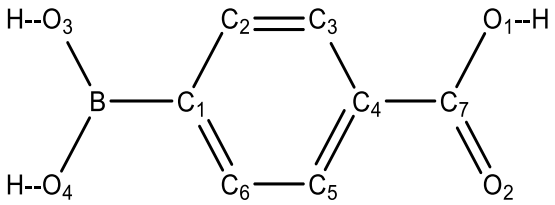
Özet: Bu çalışmada, 4-karboksifenilboronik asit molekülünün moleküler yapısı, elektronik ve doğrusal olmayan optik özellikleri üzerine teorik çalışma yapılmıştır. Molekülün geometrik parametreler (bağ uzunlukları, bağ ve dihedral açılar), dipol momenti (μ), ortalama polarizabilite (α), toplam birinci derece hiperpolarizabilite (β), en yüksek dolu moleküler orbital (HOMO) ve en düşük boş moleküler orbital (LUMO) enerjileri temel durumda *ab initio* Hartree-Fock (HF) ve Yoğunluk fonksiyonel teorisi (DFT/B3LYP) metoduyla 6-311++G(d,p) temel setli kullanılarak hesaplandı. ELUMO-E_{HOMO} enerji gap (ΔE), elektronegatiflik (χ), elektron ilgisi (A), global sertlik (η), yumuşaklık (σ) ve iyonizasyon potansiyeli (I) hesaplandı. Ayrıca, çeşitli temel setler kullanılarak her iki modelde ^{1}H NMR ve ^{13}C NMR kimyasal kaymaların hesapları yapıldı. Çalışılan molekülün yapısal parametreleri, literatürde verilen verilerle karşılaştırıldı ve yapısal parametre değerlerinin uyum içinde olduğu görüldü. 4-karboksifenilboronik asit molekülünün enerji band gap değeri (ΔE) DFT/B3LYP/6-311++G(d,p) metodunda 5.39 ve HF/6-311++G(d,p) metodunda 10.28 eV olarak hesaplanmıştır.

Anahtar Sözcükler: 4-karboksifenilboronik asit, E_{LUMO}-E_{HOMO}, Potansiyel enerji yüzeyi (PES), birinci derece hiperpolarizebilite

Giriş

Borik asit ve türevleri (yapısal gösterimi R-B $(OH)_2$ ((R) alkil veya aril) gibi ifade edilebilen) sentetik organik, materyal, biyoorganik ve tıbbi kimya gibi çeşitli alanlarda kullanımlarından dolayı araştırmacıların dikkatini çekmeye devam etmektedir. Son yıllarda yeni boronik asit türevlerinin sentezlenmesine yoğun bir ilgi vardır. Bu

ilgi biyolojik olarak aktif olan bileşiklerin sentezlenmelerinde boronik asitlerin öneminden kaynaklanmaktadır. Boronik asitler, sentetik kimya alanında, Suzuki reaksiyonlarında (Miyaure ve ark., 1995), Petasis reaksiyonunda (Naskar ve ark., 2003), amino asitlerin asimetrik sentezlerinde (Petatis ve ark., 1998), Diels-Alder reaksiyonlarında (Ishihara ve ark., 1999), karboksilik asit aktivasyonunda (Latta ve ark., 2001;Yang ve ark., 2002) ve organik sentezlerde başlangıç maddeleri olarak yaygın şekilde kullanılmaktadırlar (Currie ve ark., 2000). Ayrıca boronik asit ve türevlerinin karbonhidrat ve glikoza duyarlı fotonik kristal materyallerinin üretiminde kullanıldıkları bilinmektedir (Yoon ve ark., 1992;James ve ark., 1993). Borik asit türevlerinin geniş kullanım alanından dolayı bunlarla ilgili deneysel olarak biyolojik aktivite ve elektrokimyasal özelikleri ile ilgili çalışmalar olmasına rağmen(Ye ve ark., 2013;Wang ve ark., 2013;Guan ve ark., 2012), bu alanda çok az teorik çalışma bulunmaktadır (Vega ve ark., 2010;Das ve ark., 2003;Cuamatzi ve ark., 2009). Fenilboronik asit molekülünün kristal yapısı 1977'de rapor edilmiştir (Rettig ve ark., 1977). Dünyada bor ve borik asit türevleri ile ilgili çalışmalar yaygın bir şekilde artmasına karşılık, bor rezervleri ve cevherlerinin kalitesi ile dünyanın en önde ülkesi olmamıza rağmen yeteri sayıda bilimsel çalışma yapılmadığı, bundan dolayı bu alana yönelik çalışmaların yapılmasına ihtiyaç duyulmaktadır. Bu çalışmanın amacı, Fenilboronik asit ve türevleri olan 4-karboksifenilboronik asit molekülünün yapısal ve moleküler özelliklerini teoriksel olarak belirlemeyi, bilimsel birikime ve bor içeren bileşiklerin kullanım alanlarına katkı sağlamayı amaçlamıştır. Çalışılan 4-karboksifenilboronik asit molekülünün numaralandırılmış moleküler yapısı Şekil 1'de verilmiştir.



Şekil 1. 4-Karboksifenilboronik asit molekülünün numaralandırılmış moleküler yapısı

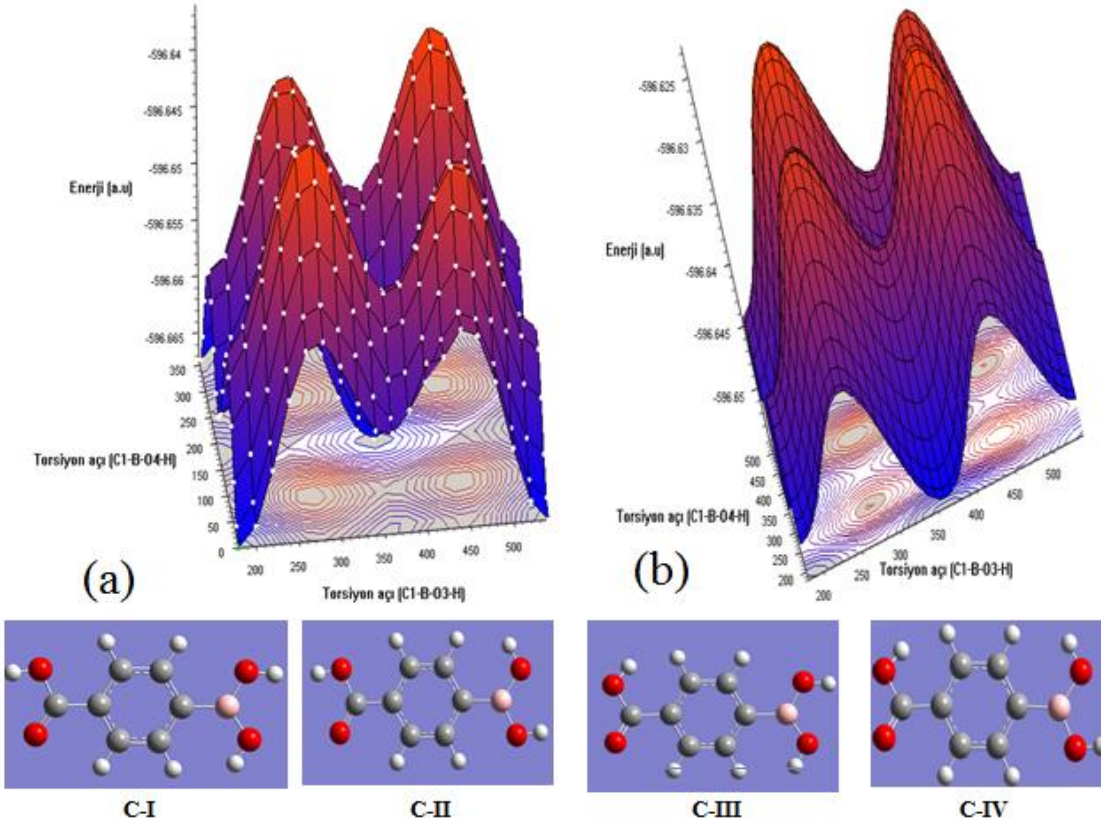
Yöntem

Bu çalışmada, 4-karboksifenilboronik asit molekülünün moleküler yapısı, elektronik ve doğrusal olmayan optik özellikleri üzerine teorik çalışma yapılmıştır. Molekülün geometrik parametreler (bağ uzunlukları, bağ ve dihedral açılar), dipol momenti (μ), ortalama polarizabilite (α), toplam birinci derece hiperpolarizabilite (β), en yüksek dolu moleküler orbital (HOMO) ve en düşük boş moleküler orbital (LUMO) enerjileri temel durumda *ab initio* Hartree-Fock (YF) ve Yoğunluk fonksiyonel teorisi (DFT/B3LYP) metoduyla 6-311++G (d, p) temel setli kullanılarak hesaplandı. Molekülün ^{1}H ve ^{13}C Nükleer Manyetik Rezonans (NMR) kimyasal kaymaları HF / 6-31G(d) ve DFT / B3LYP / 6-311+G(2d,p) yöntemleri kullanılarak hesaplandı. Hesaplamalar GaussView 5.0.9 moleküler görüntüleme programında (Dennington ve ark., 2009) çizilerek, GAUSSIAN 09W paket programına (Frisch ve ark., 2010) yapılmıştır.

Bulgular

Moleküler Geometrisi ve Özellikleri

Molekülün karboksilik asit grubunun yönelimine bağlı olarak iki farklı konformerde C1-B-O3-H ve C1-B-O4-H torsiyon açıları B-O3 ve B-O4 sigma bağı etrafında -180^{o} den 180^{o} ye kadar 10^{o} lik artışlarla değiştirilerek molekülün üç boyutlu potansiyel enerji yüzeyleri (PEY) elde edildi. Elde edilen PEY'ler Şekil 2 (a) ve (b)'de verilmektedir. Potansiyel enerji yüzeylerinin her birinin birden fazla minimum enerji değerine sahip olduğu görüldü. En kararlı durumu bulmak için Şekil 2 (a)'daki potansiyel enerji yüzeyinden en düşük enerji değerlerine sahip beş konformeri, ikinci Şekil 2(b)'deki enerji yüzeyinden ise dört konfermeri Hartree-Fock (HF) ve Yoğunluk Fonksiyonu Teorisi (DFT/B3LYP) metodu ve polarize fonksiyonları içeren 6-311G++(d,p) temel seti ile optimize edildi.Yapılan optimizasyonlar sonucunda; potansiyel enerji yüzeyi (a) ait yapıların konformer C –I ve C-II'ye potansiyel enerji yüzeyi (b) ait yapıların konformer C -III ve C-IV' e dönüştüğü saptanmıştır..Molekülün bu konformerleri potansiyel enerji yüzeyleri ile birlikte Şekil 2 (a) ve (b)'de verilmiştir. Optimize edilen konformerlerin geometrik parametreleri Tablo 3'de verilmiştir. Potansiyel enerji yüzeyleri üzerinde minimum enerjili konformerlerin optimize sonuçlarından molekülün C –I konformerinin en kararlı yapıya sahip olduğu, aynı zamanda potansiyel enerji yüzeyi (a) ait konformer C –I ve C-II potansiyel enerji yüzeyi (b) ait konformer C -III ve C-IV'den daha kararlı olduğu görülmüştür.



Şekil 2. 4- Karboksifenilboronik asit molekülünün potansiyel enerji yüzeyleri

Tablo 1'den görüldüğü gibi; B3LYP/6-311++G(d.p) ve HF/6-311++G(d.p) metotlarından hesaplanan Elektronik Enerji ve Dipol Moment değerlerinde sıralama aynı olup, C-I<C-II <C-III <C-IV şeklindedir. C-I ve C-II konformerleri arasındaki enerji farkı 0.093398 kkal/mol iken, C-III ile C-IV konformerleri arasındaki enerji farkı 0.3717562 kkal/mol olduğu hesaplandı. Konformer C-I,C-II, C -III ve C-IV'ün Polarizabilite, Hiperpolarizabilite, En Yüksek Dolu Moleküler Orbital (HOMO), En Düşük Boş Moleküler Orbital (LUMO) ve E_{LUMO}-E_{HOMO} Enerji Gap (ΔE_g) değerleri B3LYP/6-311++G(d. p) metodu ile hesaplandı. Hesaplama sonuçlarından (Tablo 2) konformerlerin polarizebilite değerleri birbirine yakın iken hiperpolarizabilite değerlerinin çok farklı olduğu görüldü. E_{LUMO}-E_{HOMO} Enerji Gap (ΔE_g) değerleri sıralaması C-I<C-II <C-III <C-IV şeklinde olup, en kararlı yapının enerji gap değerinin en düşük olduğu Tablo 2'den de görülmektedir. Ayrıca, C-I ve C-II konformerleri arasındaki enerji gap değerinin C-III ve C-IV konformerleri arasındaki enerji gap değerinden daha düşüktür. Tablo 1 ve 2, molekülün en kararlı yapısı olan konformer C-I'in en düşük dipol momente ve eneji gap değerlerine sahip olduğunu göstermektedir.

Tablo 1. 4- Karboksifenilboronik asit molekülü konformerlerinin elektronik enerji, dipol momenti (μ), enerji farkı δE değerleri

	B3LYP/6-311++G(d. p)			HF/6-311++G(d. p)		
	Elektronik Enerji (a.u)	ΔE(kkal/mol)	μ (D)	Elektronik Enerji (a.u)	ΔE(kkal/mol)	μ (D)
C-I	-597.03171398	0	1.19	-593.61030314	0	1.18
C-II	-597.03156514	0.093398	2.84	-593.610123609	0.112657318	3.05
C-III	-597.02112981	6.6416619	4.29	-593.59781627	7.835623307	4.43
C-IV	-597.02053738	7.0134171	5.40	-593.59721040	8.215812185	5.54

Tablo 2. 4-Karboksifenilboronik asit molekülünün polarizebilite (α), hiperpolarizebilite (β), En yüksek dolu moleküler orbital (HOMO), en düşük boş moleküler orbital (LUMO), E_{LUMO}-E_{HOMO} Enerji gap (ΔE_g) ve elektronik yapı parametre değerleri

	B3LYP/6-311++G(d. p)									
	α (a.u)	β(a.u)	E_{HOMO} (a.u)	E_{LUMO} (a.u)	ΔE_g (eV)	*I* (eV)	*A*(eV)	χ (eV)	η (eV)	S (1/eV)
C-I	109.77	197.52	-0.275136	-0.079547	5.322172	7.487	2.165	4.244	2.744	0.364
C-II	109.80	206.04	-0.275847	-0.079541	5.341683	7.506	2.164	4.294	2.753	0.363
C-III	109.08	35.97	-0.281539	-0.082661	5.411669	7.661	2.249	4.393	2.831	0.353
C-IV	109.09	45.68	-0.282953	-0.082327	5.459234	7.700	2.240	4.410	2.850	0.351

Tablo 3'de molekülün C –I,C-II, C -III ve C-IV konformerinin B3LYP/6-311++G(d. p) ve HF/6-311++G(d. p) metotlarında hesaplanan seçilmiş bazı yapısal parametreleri görülmektedir. Konformerlerin aynı yöntemde hesaplanan (B3LYP/6-311++G(d,p) veya HF/6-311++G(d,p)) bağ uzunlukları kendi aralarında birbirine yakın iken, B3LYP/6-311++G(d,p) de hesaplanan bağ uzunlukları HF/6-311++G(d,p) yönteminkinden daha uzun hesaplanmıştır. C7-O1 bağ uzunluğu B3LYP/6-311++G(d,p) yönteminde yaklaşık 1.36 Å civarında iken HF/6-311++G(d. p) yönteminde 1.3316 Å hesaplanmıştır. Aynı şekilde C4-C5 bağ uzunluğu B3LYP/6-311++G(d. p) yönteminde yaklaşık 1.399 Å civarında iken HF/6-311++G(d. p) yönteminde 1.388 Å hesaplanmıştır. C3-C4-C5 ve O3-B-O4 gibi bazı bağ açıları her iki yöntemde ve optimize edilen konformerlerde hemen hemen aynı değere sahip iken, bazı bağ açılar hem hesaplama yöntemine hem de konformere göre değiştiği görüldü. İncelenen konformerlerden, C-I ile C-II ve C-III ve C-IV konformerlerinin bazı torsiyon açılarının aynı eğilimde olduğu bazılarının ise her iki hesaplama yönteminde de farklılık gösterdiği saptandı. C-I,C-II, C -III ve C-IV konformerlerinin C2-C1-B-O3 torsiyon açı değerleri B3LYP/6-311++G(d,p) yönteminde 179,96 179.98,175.28 ve 176,30˚ ve HF/6-311++G(d. p)) 179,95, 179.97, 175.85, -173.54˚, C2-C1-B-O4 torsiyon açısı için -0.04,-0.01, -4.78 -3.56˚ ve -0.04, 0.00, -4.24, 6.36˚ değerleri tespit edilmiştir.

Tablo 3. 4- Karboksifenilboronik asit molekülü konformerlerinin yapısal parametreleri

Parametreler	**B3LYP/6-311++G****				**HF/6-311++G****			
Bağ uzunluğu (Å)	**C-I**	**C-II**	**C-III**	**C-IV**	**C-I**	**C-II**	**C-III**	**C-IV**
C1-C2	1.4046	1.4057	1.4042	1.4057	1.395	1.3957	1.3947	1.3961
C1-C6	1.4047	1.4037	1.4036	1.4022	1.3941	1.3934	1.3932	1.392
C2-C3	1.3888	1.3887	1.3891	1.3888	1.3818	1.3819	1.382	1.3818
C3-C4	1.3988	1.3993	1.3985	1.3992	1.3881	1.3888	1.3879	1.3889
C4-C5	1.3997	1.3991	1.4001	1.3995	1.3883	1.3877	1.389	1.388
C4-C7	1.4876	1.4877	1.501	1.5009	1.4903	1.4902	1.5017	1.5017
C5-C6	1.3903	1.3905	1.3909	1.3917	1.384	1.3839	1.3841	1.3847
C7-O1	1.3573	1.3583	1.36	1.3612	1.3274	1.3283	1.3316	1.3326
C7-O2	1.2089	1.2085	1.2016	1.2011	1.185	1.1846	1.178	1.1775
B-O3	1.3659	1.3722	1.3654	1.3718	1.3522	1.3586	1.352	1.3582
B-O4	1.372	1.3656	1.371	1.3646	1.3583	1.3519	1.3574	1.3512
Bağ açısı (º)								
C2-C1-B	122.56	119.74	122.74	119.78	122.61	119.49	122.80	119.55
C6-C1-B	119.74	122.57	119.69	122.65	119.48	122.59	119.46	122.71
C3-C4-C5	119.67	119.67	119.12	119.15	119.90	119.89	119.43	119.46
C3-C4-C7	118.05	118.23	117.69	117.92	118.10	118.26	117.81	118.02
C5-C4-C7	122.28	122.10	123.17	122.92	122.01	121.85	122.75	122.51
C4-C7-O1	113.01	113.00	116.80	116.71	113.43	113.41	116.79	116.68
C4-C7-O2	124.97	125.02	123.37	123.46	124.41	124.48	122.77	122.87
O1-C7-O2	122.02	121.98	119.83	119.83	122.15	122.11	120.44	120.45
C1-B-O3	118.24	124.41	118.05	124.43	118.26	124.12	118.04	124.14
C1-B-O4	124.40	118.22	124.41	118.05	124.12	118.24	124.17	118.07
O3-B-O4	117.36	117.38	117.54	117.53	117.63	117.63	117.78	117.79
Torsiyon açısı (º)								
C2-C1-B-O3	179.96	179.98	175.28	176.30	179.95	179.97	175.85	-173.54
C2-C1-B-O4	-0.04	-0.01	-4.78	-3.56	-0.04	0.00	-4.24	6.34
C6-C1-B-O3	-0.04	-0.02	-5.04	-4.04	-0.06	-0.04	-4.47	6.15
C6-C1-B-O4	179.96	179.99	174.89	176.10	179.96	180.00	175.43	-173.97
C3-C4-C7-O1	179.93	180.00	-158.91	-157.60	179.99	-180.01	-156.11	-154.71
C3-C4-C7-O2	-0.07	0.00	21.01	22.39	0.00	0.01	23.81	25.31
C5-C4-C7-O1	-0.08	0.00	22.45	23.97	-0.01	-0.01	25.24	26.69
C5-C4-C7-O2	179.92	-180.00	-157.62	-156.03	180.00	180.01	-154.84	-153.29

^{1}H ve ^{13}C NMR Kimyasal Kaymaları

4- Karboksifenilboronik Asit Molekülü konformerlerinin ^{13}C ve ^{1}H NMR değerlerinin hesaplanmasında GIAO (Gauge Including Atomic Orbital-Ayar içeren atomik orbital) yöntemi kullanılmıştır**.** B3LYP/6-311+G (2d. p) yöntemi ile hesaplanan C-I,C-II, C -III ve C-IV konformerlerinin^{13}C ve ^{1}H NMR değerleri Tablo 4'de verilmiştir.

Tablo 4. 4- Karboksifenilboronik asit molekülü konformerlerinin ^{1}H NMR ve ^{13}C NMR değerleri

B3LYP/6-311+G (2d. p)									
Atom	C-I	C-II	C-III	C-IV	C-I	C-II	C-III	C-IV	C-I
C7	169.34	169.99	169.25	169.28	H3	8.43	8.47	8.47	8.51
C1	140.32	140.64	140.24	140.25	H6	8.42	7.40	8.48	7.64
C6	140.23	134.92	141.07	135.43	H5	8.33	8.23	7.71	7.64
C4	135.34	135.89	140.21	140.52	H2	7.64	8.39	7.78	8.61

C2	134.93	141.10	137.09	142.70	HO1	5.47	5.77	6.74	6.62
C3	134.62	136.44	135.76	136.78	HO4	4.34	3.88	4.38	3.70
C5	134.25	133.76	128.44	127.41	HO3	3.54	4.46	3.70	4.30

Sonuç

4-karboksifenilboronik asit molekülünün konformasyon analizi teorik olarak gerçekleştirildi ve molekülün enerjileri birbirinden farklı dört (**C-I,C-II, C -III ve C-IV**) konformeri tespit edildi. Bu konformerlerin yapısal parametreleri yapısı *ab initio* Hartree-Fock (HF) ve Yoğunluk fonksiyonel teorisi (DFT/B3LYP) metoduyla 6-311++G(d,p) temel setli kullanılarak hesaplandı. C-I,C-II, C -III ve C-IV konformerlerini elektronik en yüksek dolu moleküler orbital (HOMO) ve en düşük boş moleküler orbital (LUMO) enerjileri, doğrusal (ortalama polarizabilite (α)), doğrusal toplam (birinci derece hiperpolarizabilite (β)) olmayan optik özellikleri (DFT/B3LYP) metoduyla 6-311++G(d,p) temel setli kullanılarak hesaplandı. En yüksek dolu moleküler orbital (E_{HOMO}) ve en düşük boş moleküler orbital (E_{LUMO}) enerjileri dikkate alınarak E_{LUMO}-E_{HOMO} enerji gap (ΔE), elektronegatiflik (χ), elektron ilgisi (A), global sertlik (η), yumuşaklık (σ) ve iyonizasyon potansiyeli (I) parametreleri hesaplandı. Ayrıca, çeşitli temel setler kullanılarak her iki modelde ^{1}H NMR ve ^{13}C NMR kimyasal kaymaların hesapları yapılmıştır. Çalışılan molekülün yapısal parametreleri, literatürde verilen verilerle karşılaştırıldı ve yapısal parametre değerlerinin literatürle uyum içinde olduğu görüldü.

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Ab INITIO HF AND DFT STUDIES ON MOLECULAR STRUCTURE AND VIBRATIONAL ANALYSIS OF 2-PYRAZINECARBOXYLIC ACID

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Abstract: In this study, the structural, electronic, linear, non-linear optical properties and vibrational frequencies of the 2-pyrazinecarboxylic acid molecule were determined by Hartree-Fock (HF) method and Density Functional Theory (DFT / B3LYP) method using the 6-311++G (d, p) basis set. ^{1}H and ^{13}C Nuclear Magnetic Resonance (NMR) chemical shifts values of the molecule in the ground state were calculated using HF/6-31G (d) and DFT / B3LYP/6-311+G (2d, p) methods. The two stable conformers of the studied molecule (cis-conformation (C-I) and trans-conformation (C-II)) were computed. The computational results diagnose more stable conformer of 2-pyrazinecarboxylic acid as the trans-conformer form. Theoretical vibrational spectra have been interpreted by potential energy distribution (PED) by means of the VEDA-4 software package. The calculated vibrational frequencies and the optimized geometric parameters were found in a good agreement with the corresponding reported experimental data in the literature. The dipole moment for cis-conformation and trans-conformation are calculated at 1.69 and 1.86 Debye with DFT/B3LYP level of the theory 6-311++G (d, p) basis set, respectively

Keywords: Linear and non-linear optical properties, 2-pyrazinecarboxylic acid, DFT / B3LYP, vibrational analysis

2-PİRAZİNKARBOKSİLİK ASİT MOLEKÜLÜNÜN YAPISI VE TİTREŞİM ANALİZİ ÜZERİNE *Ab* INITIO HF VE DFT ÇALIŞMASI

Özet: Bu çalışmada, 2-pirazinkarboksilik asit molekülünün (PKA) yapısal, elektronik, lineer, lineer olmayan optik özellikleri ve titreşim frekansları Hartree-Fock (HF) metodu ve Yoğunluk Fonksiyonel Teorisi (DFT/B3LYP) metodu ile 6-311++G (d, p) temel seti kullanılarak incelendi. Molekülün ^{1}H ve ^{13}C Nükleer Manyetik Rezonans (NMR) kimyasal kaymaları temel seviyede HF/6-31G (d) ve DFT/B3LY/6-311+ G (2d, p) yöntemleri kullanılarak hesaplandı. Çalışılan molekülün iki sabit konformerleri (cis-konformasyon (C-I)ve trans-konformasyon(C-II)) hesaplandı. Hesaplama sonuçları, 2-pirazinkarboksilik asit molekülünün trans-konformerinin daha kararlı olduğu görüldü. Teorik titreşim spektrumu, VEDA-4 yazılım paketi programı yardımıyla potansiyel enerji dağılımı (PED) yapılarak yorumlanmıştır. Hesaplanan titreşim frekansları ve optimize geometrik parametrelerin, literatürdeki ilgili deneysel verilerle uyum içinde olduğu görüldü. Cis-konformasyon ve trans-konformasyon için dipol momenti 6-311++G (d, p) temel set teorisiyle DFT/B3LYP seviyesinde sırasıyla 1.69 ve 1.86 Debye olarak hesaplanmıştır.

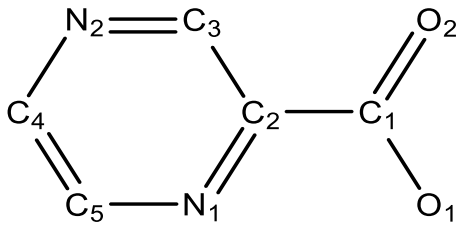
Anahtar Sözcükler: Doğrusal ve doğrusal olmayan optik özellikler, 2-pirazinkarboksilik asit, DFT/B3LYP, titreşim analizi.

Giriş

Pirazinkarboksilik asit ve türevleri önemli biyoloji özellikler gösterdiğinden dolayı birçok araştırmaya konu olmuştur. Aspergillik asit, hidroksiaspergillik asit gibi pirazin türevlerinin çok belirgin farmakolojik etkilere sahip olduğu belirlenmiştir (Schanker ve ark., 1957). Sentetik pirazin türevlerinin bir serisi sentezlenerek

hipoglisemik ve diüretik özellikleri içeren geniş farmakolojik etkileri gözlemlenmiştir (Ambrogi ve ark.,1972; Meurer ve ark., 1992; Ukrainets ve ark.,2012). Pirazinamid ve onun morfolin-metilen türevlerinde pirazin halka substituentlerinin yapısal değişimleri bunların biyolojik aktivitelerinde değişime sebep olduğunu gözlemlemişler (Foks ve ark., 2012; Judge ve ark., 2012).

Pirazinkarboksilik asit molekülün CI ve CII konformerleri için dipol moment, elektronik enerjileri, en yüksek dolu molekül orbital (HOMO), en düşük boş molekül orbital (LUMO), titreşim frekansları, polarizebilite ve hiperpolarizebilite değerleri konformerlerinin denge durumunda Hartree-Fock (HF) metodu ve Yoğunluk Fonksiyonel Teorisi (DFT/B3LYP) metodu ile 6-311++G (d, p) temel seti kullanılarak incelendi. Molekülün ^{1}H ve ^{13}C Nükleer Manyetik Rezonans (NMR) kimyasal kaymaları temel seviyede HF / 6-31G (d) ve DFT / B3LYP/6-311+G(2d, p) yöntemleri kullanılarak hesaplandı. 2-pirazinkarboksilik asit molekülünün numaralandırılmış moleküler yapısı Şekil 1'de verilmiştir.



Şekil 1. 2-Pirazinkarboksilik asit molekülünün numaralandırılmış moleküler yapısı

Yöntem

Bu çalışmada, ilk olarak PKA molekülünün üç boyutta yaklaşık geometrisi moleküler, görüntüleme programında (Gauss View 5.0.9) çizilerek (Dennington ve ark., 2009), GAUSSIAN 09W paket programına (Frisch ve ark., 2010) giriş datası olarak verildi. Bazı hesaplamalar kuantum mekaniksel metodlardan olan Ab-initio metodları Hartree Fock (HF) ve yoğunluk fonksiyoneli teorisi (DFT)/Becke'nin üç parametreli enerji fonksiyoneli hibrid yaklaşımı (Becke, 1988) ile Lee-Yang ve Parr'ın korelasyon fonksiyonelinden (Lee ve ark., 1988) oluşan B3LYP teorisi yöntemleri ile 6-311++G(d,p) temel seti ile gaz fazında yapılmıştır. Molekülün ^{1}H ve ^{13}C Nükleer Manyetik Rezonans (NMR) kimyasal kaymaları HF/6-31G(d) ve DFT/B3LYP / 6-311+G(2d, p) yöntemleri kullanılarak hesaplandı. Çalışılan molekülün potansiyel enerji dağılımı VEDA-4 (Jomroz, 2004) yazılım paketi programı yardımıyla (PED) yapılarak yorumlanmıştır.

Bulgular

Moleküler Geometri

Şekil 1'de görülen 2-pirazinkarboksilik asit molekülünün, $C_5H_4N_2O_2$, taban durumunu bulmak için konformasyon analizi, yoğunluk Fonksiyonu Teorisi (DFT/B3LYP) metodu 6-311G++(d,p) temel seti kullanılarak yapıldı. Molekülün konformasyon analizinde, N1-C2-C1-O1 torsiyon açısı C2-C1sigma bağı etrafında -180^{o} den 180^{o} ye kadar 10^{o} lik artışlarla değiştirilerek molekülün potansiyel enerji yüzeyi (PEY) hesaplandı. Hesaplama sonucu elde edilen PEY Şekil 2' de verilmiştir. Şekil 2'den görüldüğü gibi, potansiyel enerji eğrisinin $\mp$180^{o} ve 0^{o} de min 90^{o} ve 290^{o} de maksimum sahiptir. Potansiyel enerji yüzeyi üzerindeki minimum enerjili yapılar Hartree-Fock (HF) ve Yoğunluk Fonksiyonu Teorisi (DFT/B3LYP) metodu ve polarize fonksiyonları içeren 6-311G++(d,p) temel seti ile optimize edildi.Yapılan optimizasyonlar sonucunda hesaplanan geometrik parametreler, deneysel sonuçlar (Fusao ve ark., 1974) ile karşılaştırmalı olarak Tablo 1'de verilmiştir.

Minimum enerji konformerleri optimize edilerek molekülün düzlemsel yapıya sahip iki optimize olmuş C-I ve C-II konformerleri elde edildi ancak C-I konformerinin C-II konformerinden daha düşük enerjiye sahip olduğunda daha kararlı yapıya sahip olduğu bulundu. Her iki konforme için hesaplanan bağ uzunluklarının deneysel değerlerle uyum içinde olduğu, bağ açılarında ise; C-II konformerinin C2-C1-O1ve C2-C1-O2 bağ açıları hariç diğer bağ açılarıyla uyum içinde olduğu görüldü.

Tablo 1. 2-Pirazinkarboksilik asit molekülünün yapısal parametreleri

Parametreler	**Konformer-I (C-I)**			**Konformer-II (C-II)**	
Bağ uzunluğu (Å)	DFT	HF	Deney[a].	DFT	HF
N1-C2	1.335	1.318	1.341	1.336	1.320
N1-C5	1.331	1.312	1.337	1.329	1.309
C2-C3	1.400	1.388	1.393	1.400	1.386

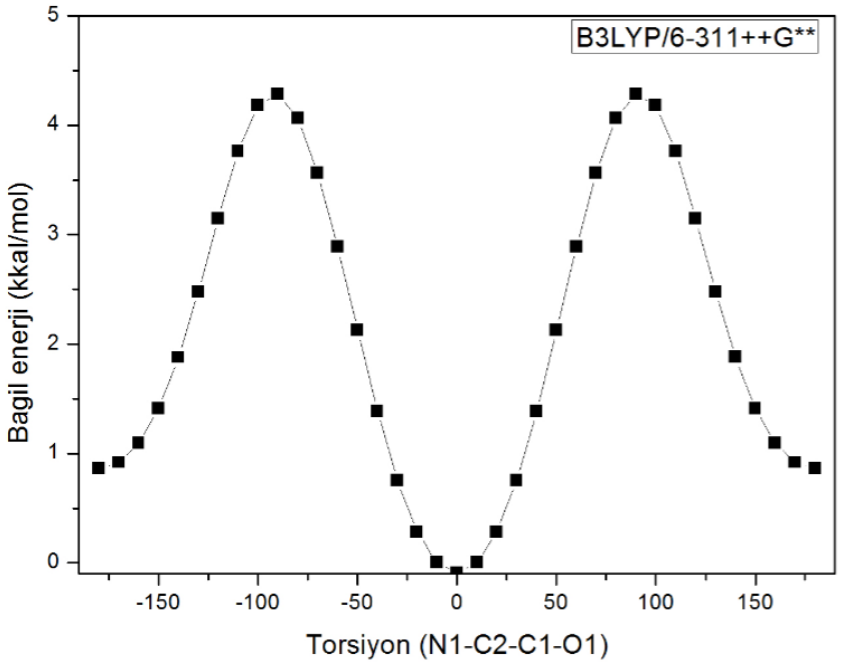
C2-C1	1.500	1.498	1.495	1.503	1.500
C3-N2	1.334	1.318	1.338	1.335	1.321
N2-C4	1.334	1.315	1.339	1.333	1.312
C4-C5	1.397	1.389	1.386	1.398	1.392
C1-O1	1.343	1.316	1.319	1.359	1.330
C1-O2	1.209	1.185	1.215	1.200	1.177
Bağ açısı (°)					
C2-N1-C5	116.32	116.97	116.4	116.53	117.16
N1-C2-C3	121.90	121.75	121.5	121.66	121.50
N1-C2-C1	119.55	119.48	116.8	116.26	116.50
C3-C2-C1	118.54	118.77	121.2	122.08	122.00
C2-C3-N2	121.66	121.30	121.3	121.71	121.37
C2-C3-H10	120.37	120.60	118.0	120.99	121.16
N2-C3-H10	117.97	118.11	117.0	117.31	117.47
C3-N2-C4	116.28	116.80	117.0	116.36	116.87
N2-C4-C5	122.02	121.86	121.3	121.92	121.76
N2-C4-H11	117.11	117.42	121.0	117.15	117.49
N1-C5-C4	121.82	121.33	121.9	121.83	121.35
C2-C1-O1	113.45	113.90	113.1	111.36	111.92
C2-C1-O2	123.10	122.69	122.0	125.53	125.04
O1-C1-O2	123.45	123.41	124.4	123.11	123.04
C1-O1-H13	106.74	108.38		107.04	108.66
Torsiyon açısı (°)					
C5-N1-C2-C3	0.01	0.00		0.00	0.00
C5-N1-C2-C1	180.03	-180.00		-180.00	180.00
C2-N1-C5-C4	-0.01	0.00		0.00	0.00
C2-N1-C5-H12	180.00	180.00		-180.00	180.00
N1-C2-C3-N4	-0.01	0.00		0.00	0.00
N1-C2-C3-H10	180.01	180.00		-180.00	180.00
C1-C2-C3-N4	-180.03	180.00		180.00	-180.00
C1-C2-C3-H10	-0.01	0.00		0.00	0.00
N1-C2-C1-O1	-0.02	0.00		180.01	180.00
N1-C2-C1-O2	-180.02	-180.01		-0.01	-0.01
C3-C2-C1-O1	180.00	180.00		0.01	0.00
C3-C2-C1-O2	-0.01	-0.01		179.99	179.99
C2-C3-N2-C4	0.01	0.00		0.00	0.00
H10-C3-N2-C4	-180.02	-180.00		180.00	-180.00
C3-N2-C4-C5	0.00	0.00		0.00	0.00
C3-N2-C4-H11	-180.00	-180.00		180.00	-180.00
N2-C4-C5-N1	0.01	0.00		0.00	0.00
N2-C4-C5-H12	180.00	-180.00		180.00	-180.00
H11-C4-C5-N1	180.00	180.00		-180.00	180.00
H11-C4-C5-H12	-0.01	0.00		0.00	0.00
C2-C1-O1-H13	-180.01	-180.00		-180.01	180.00
O2-C1-O1-H13	0.00	0.00		0.01	0.00

Deney[a]; Fusao ve ark

Molekülün C-I ve C-II konformerinin optimize durumunda hesaplanan elektronik enerji, dipol momenti (μ), ortalama polarizabilite (α), toplam birinci derece hiperpolarizabilite (β), en yüksek dolu moleküler orbital (HOMO), en düşük boş moleküler orbital (LUMO) ve E_{LUMO}-E_{HOMO} enerji gap (ΔE) moleküler özellikleri Tablo 2'de verilmiştir. C-I konformerinin her iki hesaplama yöntemiyle (B3LYP/6-311++G(d, p) HF/6-311++G(d, p)) hesaplanan toplam birinci derece hiperpolarizabilite (β) ve dipol moment değerinin C-II konformerininkinden daha büyük olduğu Tablo 2'den görülmektedir. Polarizabilite (α) ve E_{LUMO}-E_{HOMO} enerji gap (ΔE_g) değerlerinde bu durumun tersi gerçekleşmektedir.

Tablo 2. 2-Pirazinkarboksilik Asit Molekülünün Elektronik Enerji, Dipol Momenti (μ), Polarizebilite (α), Hiperpolarizebilite (β), En Yüksek Dolu Moleküler Orbital (HOMO), En Düşük Boş Moleküler Orbital (LUMO) ve E_{LUMO}-E_{HOMO} Enerji Gap (ΔE_g) Değerleri

B3LYP/6-311++G(d. p)							
	Elektronik Enerji (a.u)	μ (D)	α (a.u)	β(a.u)	E_{HOMO} (a.u)	E_{LUMO} (a.u)	ΔE_g(eV)
C-I	-453.018261986	1.86	76,40	109,01	-0.27316	-0.09494	4.850
C-II	-453.01674048	1.69	76,50	102.91	-0.270303	-0.088299	4.952
HF/6-311++G(d. p)							
C-I	-450.41670004	2.06	69.08	42.49	-0.3778	0.035598	11.249
C-II	-450.41485229	1.93	69.25	2.37	-0.379418	0.035746	11.297



Şekil 1. 2-Pirazinkarboksilik asit molekülünün potansiyel enerji yüzeyi

^{1}H NMR ve ^{13}C NMR Spektrumu

2-pirazinkarboksilik asit molekülünün 1H-NMR ve ^{13}C-NMR, kimyasal kayma değerleri HF / 6-31G(d) ve DFT / B3LYP / 6-311+G (2d, p) metotlarında GIAO NMR yaklaşımı (Wolinski, 1990) ile her iki konformerin en minimum enerjili optimize edilmiş yapılarda hesaplatıldı. Yapılan hesaplamalar sonucunda elde edilen NMR spektrumlar,Swiderski ve ark.tarafından sunulan deneysel ve teorik sonuçlar ile karşılaştırmalı olarak Tablo 3'te verilmiştir. Tablo 3'den görüldüğü gibi C-I konformerinin HF / 6-31G (d) yöntemi ile hesaplanan NMR spektrumlar deneysel deyerlerle çok iyi bir şekilde uyum gösterdiği görülmektedir.

Tablo 3. 2-Pirazinkarboksilik asit molekülünün ^{1}H-NMR ve ^{13}C-NMR, kimyasal kayma değerleri

	Konformer-I		**Deney[b].**	**Teorik[b]**	**Konformer-II**	
Atom	B3LYP/ 6-311+G (2d. p)	HF/6-31+G(d)		B3LYP/ 6-311++G(d. p)	B3LYP/ 6-311+G (2d. p)	HF/6-31+G(d)
C1	171,38	168,65	165.09	187.90	167,0693	149,94
C3	154,52	156,68	145.52	171.40	154,1063	144,54
C4	153,40	155,41	144.58	170.61	152,6724	143,76
C5	148,63	148,29	147.68	165.89	150,0766	138,48
C2	148,69	148,23	143.89	164.99	148,882	137,64
C3-H3	9,88	9,56	9.19	8.69	9,7444	9,37
C4-H4	8,98	8,74	8.84	8.71	8,9457	8,73
C5-H5	8,88	8,60	8.79	8.83	9,0316	8,68
HO1	5,91	5,27	-	-	6,0041	5,07

Deney[b]. Teorik[b]: Swiderski ve ark.

IR Spektrumu

2-pirazinkarboksilik asit molekülünün titreşim frekansları gaz fazında B3LYP/6-311++G(d,p) yöntemi ile hesaplandı. Yapılan analiz sonucunda hesaplanan frekanslar içerisinde negatif frekansa rastlanmadı. B3LYP/6-311G++(d,p)'den elde edilen titreşim frekansları 0,9684 skala faktörü ile çarpılarak (Tzeng ark., 1998) elde edilen sonuçlar Tablo 4'de verilmiştir.

Tablo 4. 2-Pirazinkarboksilik asit molekülünün titreşim frekansları

IR KBr[b]	**IR ATR[b]**	**Raman[b]**	**IR teorik**	**Titreşim türleri**
3434			3641.80	ν OH (100)
3094	3094	3096	3093.70	ν CH (47)
3065	3063	3069	3072.47	ν CH (93)
3032		3031	3056.47	ν CH (51)
1731			1730.62	ν OC (85) (O=C)

1590		1594	1557.60	ν NC (16), ν CC (28), τHCN (19), τCNC (15)
1532	1531	1534	1530.27	ν NC (82)
			1451.56	ν NC (36), τHCN (48)
			1393.60	τHCN (34), τHCN (12), τCNC(12)
			1336.66	ν OC (17), ν CC (11), τ HOC (24), τHCN (15), τOCO (11)
			1277.57	ν NC (10), τHCN (34)
			1200.10	ν NC (64), τHOC (18),
			1184.09	ν NC (25), ν CC (10), τHOC (30)
			1160.42	ν NC (36), τHCN (22)
			1094.53	ν OC (49), τCNC (14)
			1035.56	ν CC (39), ν NC (23), τHCN (11)
			1002.68	ν NC (11), τCNC (64)
			962.60	γ HCNC (76), γ CNCC (11)
			944.74	τHOC (11), γ HCNC (66), γ CNCC(14)
			855.64	HCNC(44), γ OCOC (12), γ CCNC (10)
			790.89	ν CC (18), τCNC (26), τCNC (15)
			765.68	τHCNC(30), γ CNCC (15), γ OCOC (32)
			724.36	γ CNCC (49), γ OCOC (32)
			653.69	τCNC (25), τOCO (45)
			606.34	τCNC (61),
			580.14	γ HOCC (87)
			485.57	τOCC (52), τCCN (24)
			427.06	γ CNCC (59)
			372.82	νCC (34), τCNC (16), τOCO (22)
			364.61	γ HCNC (10), γ CNCC (27),
			204.41	τOCC (32), τCCN (59)
			142.89	γ CNCC (34)
			49.16	γ OCCC (95)

Raman[b], IR ATR[b]; Swiderski ve ark. ν, gerilme;γ, düzlem dışı bükülme τ, açı bükülme

Sonuç

Bu çalışmada çalışılan moleküle ait bütün olası konformasyon durumları Gaussian09 paket programı yardımıyla belirlendi. Belirlenen konformasyonlar B3LYP/6-311G(d,p) ve HF /6-311G(d,p) hesaplama metodları ile optimize edildi. 2-Pirazinkarboksilik asit molekülün CI ve CII konformerleri için dipol moment, elektronik enerjileri, en yüksek dolu molekül orbital (HOMO), en düşük boş molekül orbital (LUMO), titreşim frekansları, polarizebilite ve hiperpolarizebilite değerleri konformerlerinin denge durumunda, Hartree-Fock (HF) metodu, Yoğunluk Fonksiyonel Teorisi (DFT/B3LYP) metodları ile 6-311++G(d, p) temel seti kullanılarak detaylı bir şekilde teorik olarak incelendi. Ayrıca, molekülün ^{1}H ve ^{13}C Nükleer Manyetik Rezonans (NMR) kimyasal kaymaları temel seviyede HF / 6-31G(d) ve DFT / B3LYP / 6-311+G(2d, p) yöntemleri kullanılarak hesaplandı. 2-Pirazinkarboksilik asit molekülün deneysel yollarla elde edilen verileri teorik olarak hesaplanan veriler ile karşılaştırıldı. Teorik olarak elde edilen verilerin deneysel veriler ile oldukça uyumlu olduğu görüldü. O-H gerilme titreşimi; genel olarak 3550-3700 cm^{-1} bölgesinde gözükürken bu çalışmada, 3641.80 cm^{-1} de gözüktü. Ayrıca HF/6-31G(d) yöntemi ile hesaplanan NMR spektrumlar deneysel değerlerle çok iyi bir şekilde uyum gösterdiği saptandı. 2-Pirazinkarboksilik asit molekülün NMR spektrum değerleri için HF/6-31G(d) metodunun daha uygun olduğu görüldü.

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TYPOLOGICAL SOLUTIONS OF THE REPUBLIC OF KAZAKHSTAN, ATIRAU SIT REGION

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Abstract: A typological analysis was made on the Balgimbayev and Isenov streets in order to reach the typoligical results of the studied buildings. 121 buildings were evaluated in general and 8 buildings were evaluated in detail on these two streets.

Keywords: Architecture, preservation, repair, restoration, conservation area, Kazakhstan, Atyrau

KAZAKİSTAN CUMHURİYETİ, ATIRAU SİT BÖLGESİ YAPILARININ TİPOLOJİK ÇÖZÜMLEMESİ

ÖZET: İncelenen yapıların tipolojik sonuçlarına ulaşabilmek amacıyla, Balgımbayev ve İsenov Cadde'leri üzerinde tipolojik çözümleme yapılmıştır. Bu iki sokak üzerinde bulunan 121 yapı genel olarak, 8 yapı ise detaylı olarak değerlendirilmiştir.

Anahtar Kelimeler: Sivil mimarlık, koruma, onarım, restorasyon, sit alanı, Kazakistan, Atırau.

Giriş

Atırau'un eski Kent merkezi, XIX. yüzyılın sonu – XX. yüzyılın başını yansıtan zengin bir dokuya sahiptir. Kentte bulunan Uspen Ortodoks Kilisesi (1871 y.) Rus geleneksel yapısının yanı sıra geleneksel konut dokusu da büyük ölçüde günümüze kadar ulaşmıştır. Kentin kenarından geçen Cayık Nehri Atırau'ya kendine özgü bir görünüm kazandırmıştır.

Atırau Kenti'nde eski Rus evlerinin mimari yapısı, daha çok yörenin iklim ve malzeme şartları ile birlikte yerleşmelerinin topoğrafik yapısına bağlı olarak şekillenmiştir. Yapıldıkları dönemin üslubunu yansıtan bu evlerin büyük bir kısmı tuğla veya ahşap malzemeden yapıldığı için zaman içerisinde tamirlerle bazı özgün özelliklerini yitirmiştir. Farklı dönem içerisinde yapılara mekan ve eleman (oda, merdiven) eklenmesi, bazı binaların ana giriş kapısının yer değiştirmesi, mevcut birimlerin bölünerek yeni bölümler kazanılması sonucunda yapıların özgün tipolojileri büyük ölçüde bozulmuştur.

Ahşap malzemenin doğal yapısı gereği, yapılar fazla uzun ömürlü olamamaktadır. Balgımbayev ve İsenov Cadde'lerinde ayakta kalabilen geleneksel yapılar, XIX. yüzyılın sonu – XX. yüzyılın başında yapılmış sınırlı sayıdaki örneklerdendir. Ancak böyle bir sürecin ortaya çıkmasında yapılarda kullanılan malzeme kadar, savaşların ve yaşanan bir çok doğal afetin de etkisi büyüktür.

Mevcut alan yapısı incelendiğinde Balgımbayev ve İsenov Cadde'leri için koruma gelişme ikileminin çok hassas dengelere bağlı olduğu görülmektedir. Bu bağlamda, alanın sahip olduğu fiziki yapı ve bu yapıya bağlı olarak ortaya konmak zorunda olan gelişme stratejileri, alan için belirgin olarak ayırt edici nitelik olan tarihi ve kültürel kent dokusunun korunması anlamında büyük önem taşımaktadır.

5 Mayıs 1992'de Atırau Eyaleti Valiliği'nin No: 116 kararı ile Atırau Eyaleti'nin tarihsel ve kültürel mirasının korunması, restorasyonu ve kullanımı için Devlet Müfettişliği kurulmuştur. Müfettişliğin ana faaliyeti bölgenin tarihi ve kültürel mirasının tanımlanması, tescili, korunması ve araştırılmasıdır. Ayrıca, koruma altında olan anıtların kullanımını, yenilenme çalışmalarını kurallara uygun şekilde yapılmasını kontrol etmektedir. Müfettişlik tüm işlemleri 1992'de yürürlüğe giren 1488-XII Sayılı, Tarih ve Kültür Mirasının Korunması ve Kullanımı Kanunu'na dayanarak yapmaktadır [1].

K.C. Hükümeti 2008'de No:279 sayılı kararı ile Atırau Eyaleti'nde 'Ulusal' değerdeki 4 kültürel – tarihi anıtı koruma altına almıştır. Atırau Eyaleti Valiliği 2010'daki No:299 kararında 313 anıtı 'Yerel' koruma altına aldığını belirtmiştir [2]

Yöntem

Çalışma, çevre-davranış bütünlüğü ve çevre-insan beraberliğini temel alan bir yaklaşımla analiz eden ekolojik model bağlamında ele alınmıştır. Bu bağlamda çevre; ortam ve insanın karşılıklı etkileştiği bir sistem olarak ele alınmış, analiz edilmiş ve değerlendirilerek senteze ulaşılmıştır [3].

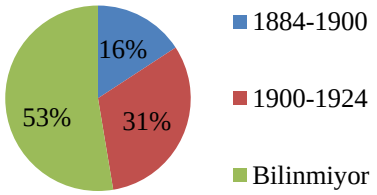
Çalışmada, E. Türkoğlu'nun Gazi Üniversitesi, Fen Bilimleri Enstitüsü, Mimarlık Anabilim Dalı'nda yapmış olduğu "*Amasya İli, Hatuniye Mahallesi Geleneksel Yerleşim Dokusunun Analizi, Değerlendirilmesi ve Koruma Geliştirme Önerisi*" başlıklı tezinde kullanmış olduğu yöntem kullanılmıştır [4].

Bulgular

Yapım Dönemi

Çalışma alanında bulunan yapıların büyük kısmı XIX. yüzyılın sonu – XX. yüzyılın başına aittir. Evlerin kesin yapım tarihini bilenler %47, bilmeyenler ise %53'tir. XIX. yüzyılın sonunda (1884'ten 1900'a kadar) inşa edilen yapılar %16 oranındadır. XX. yüzyılın başına (1900'den 1924'e kadar) ait olan evler ise %31 oranındadır (Şekil 3.1).

Yapım dönemi	Sayısı	%
1884'ten 1900'e kadar	3	16
1900'den 1924'e kadar	6	31
Bilinmiyor	10	53
Toplam	19	100



Şekil 3.1. Yapım dönemi

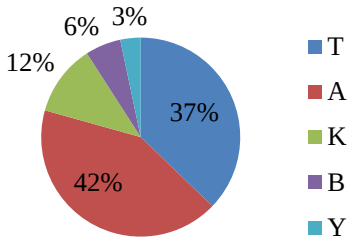
Taşıyıcı Sistem ve Taşıyıcı Elemanlar

Çalışma alanı içindeki geleneksel yapılar tuğla yığma, ahşap yığma, karışık (yüksek zemin veya 1. kat tuğla yığma, 2. kat ise ahşap yığma) ve betonarme olmak üzere dört tür yapım sisteminde inşa edilmiştir. Betonarme sistemi çoğunlukla yeni dönem yapılarında ve geleneksel yapılarda değişik dönemlerde yapılan müdahalelerde kullanılmış olup bozulan ahşap elemanlar yerine ise tuğla kullanılmıştır.

Çalışma alanında bulunan konutların %42'si ahşap yığma sistemde inşa edilmiştir. Tuğla malzeme kullanılan yığma yapılar %37'dir, her iki sistemin birlikte kullanımı ile inşa edilen yapıların oranı ise %12'dir. Betonarme karkas yapım sistemi ise alandaki yeni yapılarda görülmektedir. Özellikle 1980 yıllarından sonra yapılmış 3 ve üzeri katlı yapılar %6 oranda olup betonarme karkas yapım tekniğinde inşa edilmiştir (Şekil 3.2).

Geleneksel yapılarda ana malzeme olarak ahşap ve tuğla, bağlayıcı ve kaplama malzemesi olarak da harç ve çamurlu sıva kullanılmıştır. Ahşap yapılarda kapı ve pencere doğramaları, süsleme öğeleri ahşaptır, tuğladan inşa edilen yapılarda ise bu elemanlar tuğladan yapılmıştır.

Taşıyıcı sistem	Sayısı	%
Tuğla yığma (T)	45	37
Ahşap yığma (A)	51	42
Karışık (K)	14	12
Betonarme (B)	7	6
Belirlenemeyen (Y)	4	3
Toplam	121	100

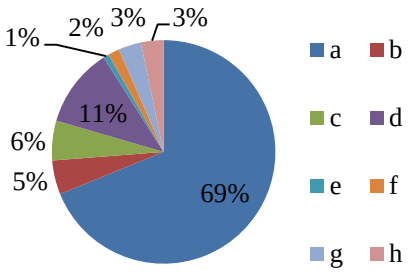


Şekil 3.2. Taşıyıcı sistem

Yapı Kullanımı

Bölgede bulunan yapıların %69'u konuttur. Zamanla şehir büyüdükçe yeni yapılar inşa edilmiş, eskiden kamu binası olarak kullanılan makamlar boşaltılarak yeni yerlerine taşınmış ve dolasıyla boşaltılan bu kamu binaları halka arz edilmiştir. Bu değişik şekillerde (mesela düşük faizli konut kredisi sağlayarak, ipotek v.b.) halkın yararına olacak şekilde sunulmuştur. Fakat bu durum tüm kamu binalarının boşaltıldığı anlamına gelmemektedir. Bunların %11'i kamu binası olarak devam etmektedir. Yapıların kalan kısmı ise ticari alan, ofis, restoran, otel gibi amaçlar için kullanılmaktadır (Şekil 3.3).

Yapı kullanımı	Sayısı	%
Konut (a)	83	69
Konut+ticaret (b)	6	5
Ticari yapı (c)	7	6
Kamu binası (d)	14	11
Otel (e)	1	1
Restoran, kafe (f)	2	2
Terk edilen boş yapı (g)	4	3
Belirlenemeyen (h)	4	3
Toplam	121	100



Şekil 3.3. Yapı kullanımı

Yapısal Durumu

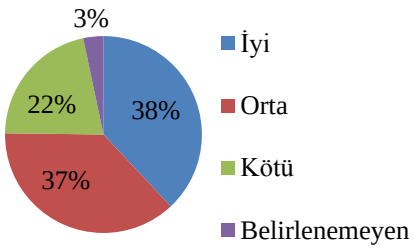
Çalışma alanındaki geleneksel evlerin taşıyıcı ve mimari elemanları incelerek, yapısal analizi iyi, orta ve kötü olmak üzere 3 grupta değerlendirilmiştir. Yeni veya restorasyonu yapılmış yapıların tümü ise iyi durumdadır (Şekil 3.4).

İyi: Taşıyıcı yapı bakımından sorunları bulunmayan, sadece yüzeysel bakım gerektiren 46 (%38) yapı bulunmaktadır.

Orta: Taşıyıcı yapı bakımından sorunları bulunmayan ve çoğunlukla mimari eleman bozulması bulunan veya onarılabilir taşıyıcı yapı bozulması bulunan 45 (%37) yapı bulunmaktadır.

Kötü: Mimari eleman bozulması ile birlikte taşıyıcı yapıda kısmen önemli bozulma bulunan 26 (%22) yapı bulunmaktadır.

Yapısal durumu	Sayısı	%
İyi	46	38
Orta	45	37
Kötü	26	22
Belirlenemeyen	4	3
Toplam	121	100



Şekil 3.4. Yapısal durum

Değişmişlik

Geleneksel konutlardaki değişmişlik dereceleri cephe bazında tespit edilmiştir. Değişim derecelendirmesi ise; çok değişmiş, az değişmiş ve değişmemiş olarak üç grupta ele alınmıştır ve %19 orandaki yeni yapı değerlendirme dışı tutulmuştur.

Geleneksel yapılarda; genelde mimari cephe elemanlarında boyut, biçim, renk ve malzeme değişikliği saptanmıştır. Balgımbayev ve İsenov Caddelerindeki geleneksel konutların en belirgin öğesi olan cephe, saçak, bezeme ve ahşap oyma süslemeleri ve pencere alınları bir çok yapıda yok olmuş yada biçimleri değiştirilmiştir. Restorasyonu yapılan bazı yapılarda bu bezeme ve süslemeler korunmaktadır.

Ayrıca yapıların çatı konstrüksiyonunda, ahşap taşıyıcı kirişlerin zamanla yıpranması nedeni ile yalıtım sorunu yaşayan binalarda yapının üstü sac ile kaplanmış veya çatı malzemesi ahşap olan geleneksel yapılarda çatı kaplama malzemesi atermite dönüştürülmüştür.

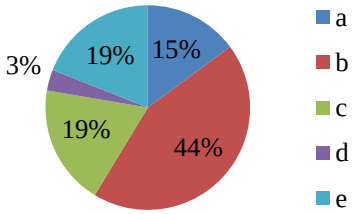
Geleneksel konutların cephelerinde gözlenen değişmişlikler üç grupta değerlendirilmiştir (Şekil 3.5).

Değişmemiş: 23 (%19) yapıda cephesinde hiç değişiklik olmadığı veya sadece eleman bazında değişiklik bulunduğu tespit edilmiştir.

Az Değişmiş: 53 (%44) yapıda renk ve kaplama malzemesi müdahaleleri yapıldığı tespit edilmiştir.

Çok Değişmiş: 18 (%15) yapıda cephenin tipini değiştirecek çapta büyük müdahaleler yapıldığı tespit edilmiştir.

Değişmişlik	Sayısı	%
Çok değişmiş (a)	18	15
Az değişmiş (b)	53	44
Değişmemiş (c)	23	19
Belirlenemeyen (d)	4	3
Yeni yapı (e)	23	19
Toplam	121	100



Şekil 3.5. Değişmişlik

Sonuç

Atırau geleneksel dokusunda (Balgımbayev, İsenov Caddeleri) yapılan detaylı alan çalışmaları neticesinde, alandaki değerlerin korunması, sorunların ise çözülmesi bağlamında ekolojik model kapsamında analiz ve değerlendirme çalışmaları yapılmış ve bu çalışmalar sonucunda elde edilen verilerle öneriler geliştirilmiştir.

Geleneksel dokuda, yıkılmış yapı parsellerine yapılacak yeni yapıların kat yüksekliği alçak, cepheleri ve cephe rengi dokuya uyumlu olmalıdır.

Tüm alan içerisinde yapısal durumu "kötü" olan yapılar dahil, taşıyıcı problemi olan yapılara ender olarak rastlanmaktadır. Bu yapılarda kirişlerin sehim yaptığı, taşıyıcı elemanların yapı yükünü taşıyamaz dayanımda olduğu tespit edilmiştir. Bu anlamda taşıyıcı elemanların güçlendirilmesine öncelik verilmelidir.

Alan içerisinde yeni yapım sistemi ile inşa edilen ve çevreyle uyum sağlamayan çok katlı yapılar, ev sahipleri ile anlaşma karşılığında boşaltılarak, çevreyle uyumlu hale getirilmelidir. Harap yapıların yerine de geleneksel dokuya uygun yapılar inşa edilmelidir.

Alanda ticari yapıların az olması, alış veriş sorununu da beraberinde getirmiştir. Bu bağlamda, tasfiye edilen boş parsellerde inşa edilecek yapıların (market, eczane, kuaför v.b.) ticari işlevde kullanılması uygun görülmüştür.

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INVESTIGATION THE SITUATION OF EXPOSURE OF CARGO SECTOR EMPLOYEES TO MOBBING

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Abstract: Turkey has important advantages such as geopolitical position, young population and potential of economic growth. In addition to these advantages, the interest in the cargo sector has increased day by day as it hasn't a long history. The development of electronic commerce along with the increase in internet usage is one of the important factors affecting the development of the cargo sector. Developments in the Turkish cargo sector have brought along the need for qualified personnel specialized in this area. The importance of human resources in the cargo sector, where competition is intense and customer satisfaction is essential, is great. Due to long working hours and heavy working conditions, personnel turnover rate is quite high in the cargo sector. In order to reduce personnel turnover rate, it is necessary to improve the specified conditions and correct the subordinate - superior relations. In this study, a survey study was conducted with cargo personnel working in Balıkesir province in order to investigate the situation of exposure of cargo sector employees to mobbing.

Keywords: Mobbing, cargo sector

KARGO SEKTÖRÜ ÇALIŞANLARININ PSİKOLOJİK TACİZE (MOBBİNG) MARUZ KALMA DURUMUNUN İNCELENMESİ

Özet: Türkiye jeopolitik konum, genç nüfus ve ekonomik büyüme potansiyeli gibi önemli avantajlara sahiptir. Bu avantajların yanı sıra uzun olmayan bir geçmişe sahip olması kargo sektörüne olan ilgiyi gün geçtikçe artırmaktadır. İnternet kullanımının artmasıyla beraber elektronik ticaretin gelişmesi de kargo sektörünün gelişmesini etkileyen önemli etkenlerden birisidir. Türkiye kargo sektöründe meydana gelen gelişmeler, bu alanda uzmanlaşmış nitelikli personel ihtiyacını da beraberinde getirmiştir. Rekabetin yoğun ve müşteri memnuniyetinin elzem olduğu kargo sektöründe insan kaynağının önemi büyüktür. Uzun çalışma saatleri ve ağır çalışma koşulları nedeniyle personel devir hızı kargo sektöründe oldukça yüksektir. Personel devir hızının düşürülebilmesi için, belirtilen şartların iyileştirilmesi ve ast-üst ilişkilerinin doğru kurgulanması gerekir. Bu çalışmada, kargo sektöründeki çalışanların psikolojik tacize (mobbing'e) maruz kalma durumlarını araştırmak amacıyla Balıkesir ilinde çalışan kargo personelleri ile bir anket çalışması yapılmıştır.

Anahtar Sözcükler: Mobbing, kargo sektörü

Giriş

Dilimize Fransızcadan geçen kargo kelimesi, Türk Dil Kurumu güncel Türkçe sözlüğünde "Uçak, gemi vb. bir taşıtla taşınan eşya, yük" şeklinde (TDK, 2017), 4925 sayılı Karayolları Taşıma Kanununda ise "Tek parçada en fazla yüz kilogramı geçmeyen genellikle ambalaj ve kap içerisinde olan küçük boyutlu koli, sandık, paket gibi parça eşya" (KUGM, 2017) şeklinde tanımlanmıştır. Kargo taşımacılığı ise kargo işletmeciliği yapan firmaların, kargo olarak adlandırılan malların göndericilerinden teslim alınmasından alıcılara teslimine kadarki akışın verimli, tam zamanında ve emniyetli bir şekilde planlanması, yürütülmesi ve kontrol edilmesidir. Kargo işletmeciliği yapan firmalar bu süreç içerisinde malzeme elleçleme, depolama, taşıma gibi faaliyetleri yerine getirmektedir.

Küreselleşme ve teknolojinin ilerlemesi sebebiyle müşteriler her türlü bilgiye kolayca erişebilmektedir. Bu durum müşterilerin geçmişe nazaran ürün ve/veya hizmetler hakkında daha farkında olmalarını sağlamıştır. Böylelikle satış kanallarında değişimler meydana gelmiş ve yerel pazarlara özgü tekil mağazaların birçoğu yerlerini telefondan satış ve e-ticaret ile eve teslim faaliyetlerine bırakmıştır. Satış kanallarındaki bu yöndeki bir eksen kayması özellikle kargo işletmelerinin iş hacimlerinin artmasına yol açmıştır.

Kargo sektöründeki iş hacminin büyümesi, bu sektörde faaliyet gösteren iş gören sayısının artmasına yol açmıştır. Kargo işletmelerinin, kargo sektöründen paylarını alabilmeleri veya paylarını artırabilmeleri için müşteri memnuniyetini sağlamaları ve sürdürülebilir bir hale getirmeleri gerekmektedir. Bunu sağlamak için sunulan hizmetin kalitesinin, maliyetinin, çeşitliliğinin, özelliklerinin ve çevrim süresinin optimal düzeyde olması gerekmektedir. Hizmet sisteminin ana çarkının insan kaynağı olduğu düşünülürse tüm bu kriterlerin sağlanabilmesi için kargo işletmeleri yöneticilerinin görevlendirdikleri iş görenlerinin çalışma koşullarını ideal bir hale getirmeleri gerekmektedir. Çalışma koşullarının uygunluğunun bozulmasına sebep olan faktörlerin birçoğu insan kaynaklıdır. Özellikle günümüzde psikolojik taciz (mobbing) insan kaynaklı problemlerin başında gelmektedir.

Psikolojik Taciz (Mobbing)

Türk iş dünyasında genellikle mobbing olarak geçen kavram, literatürde işyerinde psikolojik taciz, işyerinde psikolojik terör, işyerinde duygusal linç/saldırı, işyerinde zorbalık, yıldırma (İbicioğlu ve ark., 2009) ve bezdiri (Sert ve Wigley, 2015) gibi kavramlara karşılık gelmektedir. Bu çalışmada mobbing kavramı yerine, kavramın Türkçe karşılığı olan psikolojik taciz kavramı kullanılacaktır.

Psikolojik taciz; bir işyerinde birey veya gruplara zarar vermek için leke sürme, rezil etme, ayağını kaydırma, gücünü kötüye kullanma, hakaret etme, gözdağı verme ve saldırma biçiminde görülen her türlü söz, eylem, hareket ve davranışlardır (Karcıoğlu ve Akbaş, 2010). Meydana gelen bir olayın psikolojik taciz olarak nitelendirilebilmesi için; işyerinde gerçekleşmesi, tacizi yapan ya da yapanlar ve hedef kişi arasında düzeysel bir eşitsizlik olması, sistematik ve kasıtlı olarak yapılması, birbiri ardına birtakım evreler geçmesi, uzun süreli olması (en az 6 ay), ayda birkaç kez tekrarlanması, kişiyi işyerinden uzaklaştırmayı amaç edinmesi ve davranış tarzlarının, kişiye kötü muamele şeklinde olması gerekmektedir (Türeli ve Dolmacı, 2013).

Psikolojik taciz uygulayan figürler, genellikle özgüvenleri düşük bireylerdir. Elde ettikleri konumları kaybetmekten korkmaları, öfke kontrolü yapamamaları, kendilerini/çalışmalarını diğer çalışanlardan/çalışmalardan üstün görmeleri, başkalarının yaptıkları işleri sürekli eleştirme eğiliminde olmaları, üst yöneticilerinin dikkatlerini çekme ve önemini kazanma istekleri, geçmişte yaşamış olduğu zorluk ve başarısızlıkları diğer çalışanlarda da görme isteği gibi davranışlar içerisinde olan psikolojik tacizciler, çalışma arkadaşlarının iş tatmininde büyük düşüşlere sebep olmaktadır. Psikolojik tacizcilerden, tacizci ile beraber çalışan her çalışma arkadaşı mağdur olabilir. Ancak çalışma grubu içerisine yeni dâhil olmuş kişiler, gruptaki başarılı kişiler, grubun karakteristiklerinden farklı kişiler ve gruptan kendini soyutlamış kişiler psikolojik tacizden en kolay etkilenebilecek risk grubu içerisindedir.

Psikolojik taciz sürecinin başında mağdurlar özel yaşam alanlarını ihlal eden psikolojik taciz eylemlerini hafife almaktadırlar. Ancak bir sonraki aşamada mağdurların özgüvenlerini düşürücü eylemler uygulanmaya başlar. Bu eylemlere mağdurun yeteneklerinin görmezden gelinmesi, topluluk karşısında küçük düşürülmesi, hak etmediği halde azarlanması ve yaptığı hataların abartılması örnek gösterilebilir. Bu eylemler sonrasında mağdur özgüvenini kaybeder, yeteneklerine olan inancı zayıflar ve işyerine bağlılığında kopmalar başlar. Bir sonraki aşamada mağdur gruptan ötekileştirilir. Ötekileştirme diğer iş görenlerin mağdur ile konuşmaması, sanki ortamda yokmuşçasına davranması ve organizasyonlara dâhil etmemesi şeklinde gerçekleştirilir. Bu eylemler karşısında mağdur kendini diğer çalışanlardan izole edilmiş hisseder ve diğer çalışanların kendisine niçin böyle davrandıklarını sorgulamaya başlar. Bu sorgulama mağdurun iş arkadaşlarına olan güvenini kaybetmesiyle sona erecektir. İlerleyen aşamada mağdurun itibarını zedeleyecek eylemlerde bulunulur. Bu eylemler; mağdurun hakkında asılsız dedikodular yapılması ve mağdurun gülünç hallere düşürülmesidir. Bu eylemlerin sonucunda mağdur imajını zedelenmiş hisseder. Bu aşamalar sonrasında işletme yönetimi mağdura geçmişte verilmiş olan bir takım işleri geri alır, yeteneğine uygun olmayan işler verir ve yeni görevler vermez. Bu yaptırımlara uğrayan mağdur işten ayrılmaya mecbur edilir ve bu kararın mağdurun kendi seçimiymiş gibi lanse edilir. Eğer mağdur işten ayrılmamakta direniyorsa eğer emekliliği geldiyse emekli edilir, emekliliği gelmediyse anlaşma yoluna gidilerek işten alınır.

Psikolojik tacizin mağdurlara etkileri; dikkat dağınıklığı, depresyon, anksiyete, panik atak, ağlama ve sinir krizleri, sürekli endişe ve huzursuzluk gibi psikolojik ve yüksek tansiyon, kalp krizi, baş ve boyun ağrıları ve mide problemleri gibi fiziksel olmaktadır. Psikolojik tacize mağdur olanların bir kısmında da intihara meyil olabilmektedir.

Psikolojik tacizin mağdurlara etkilerinin yanı sıra işletmelere de olumsuz etkileri vardır. Psikolojik tacize maruz kalan birey, işletmede çalıştığı süreç içerisinde işyerindeki kasvetli ortamdan kurtulabilmek amacıyla hastane raporu alma yoluna gider. Raporlu olmadığı zamanlarda da kendisini işe yeterince veremediğinden işgücü verimliliği ve kalitesinde düşüşler meydana gelir. İşletme, iş akdinin sonlanması sonrasında ise mahkeme

masrafları, ihbar tazminatı, yeni işe alınan personelin işe uyumu maliyetleri gibi ekstra maliyetlere katlanmak zorundadır.

Kargo işletmelerinin rekabet edebilirliğini sürdürülebilir, verimli ve karlı olabilmesi amacıyla çalışanlarını olası bir psikolojik tacizden olabildiğince koruması gerekir.

Yöntem

Araştırmanın Amacı

Bu araştırma, kargo sektörü çalışanlarının iş değiştirme tutumlarını ve psikolojik tacize maruz kalma durumlarını belirlemek amacıyla yapılmıştır.

Araştırmanın Evreni

Araştırmanın evreni, Balıkesir ilinde faaliyet gösteren kargo acentelerinin çeşitli kademelerinde görev alan 107 kargo çalışanıdır.

Verilerin Toplanması ve Analizi

Araştırmada veri toplama aracı olarak anket yöntemi kullanılmıştır. Çalışmada kullanılan anket formu, literatürde psikolojik taciz konusunda yapılmış bilimsel çalışmalardan faydalanılması ve kargo çalışanlarına uyarlanması şeklinde elde edilmiştir (Laleoğlu ve Özmete, 2014) (Gerçek ve ark., 2015). Anket, üç bölümden oluşmaktadır. Birinci bölüm, demografik bilgilerle ilgili 8 adet soru, ikinci bölüm işten ayrılma ve iş değiştirme niyetine yönelik tutumlarla ilgili değerlendirmeleri ölçen, 7'li likert ölçeğine göre düzenlenmiş 4 adet önerme, üçüncü bölüm ise çalışanların psikolojik taciz davranışlarına maruz kalma durumlarını ölçen, 7'li likert ölçeğine göre düzenlenmiş 48 adet önermeden oluşmaktadır. 7'li likert ölçeğindeki önermeler "1 – Kesinlikle Katılmıyorum", "2 – Katılmıyorum", "3 – Biraz Katılmıyorum", "4 – Kararsızım", "5 – Biraz Katılıyorum", "6 – Katılıyorum" ve "7 – Tamamen Katılıyorum" şeklinde seçeneklendirilmiştir.

Araştırmadan elde edilen veriler, SPSS 17 for Windows istatistik paket programından yararlanılarak analiz edilmiştir. Çalışma esnasında yapılan istatistiksel analizlerde 0,05 anlamlılık düzeyi ölçüt alınmıştır. Anket soruları karşılığında elde edilen verilerin güvenilirliğinin hesaplanmasında Cronbach's Alpha katsayısından faydalanılmıştır. Bir ölçme aracında yeterli sayılabilecek güvenirlik katsayısı olabildiğince 1'e yakın olmalıdır. Cronbach's Alpha katsayısı 0,40'dan küçük ise ölçme aracı güvenilir değildir, 0,40-0,59 arası düşük güvenirlikte, 0,60-0,79 arası oldukça güvenilir, 0,80-1,00 arası ise yüksek derecede güvenilir olarak değerlendirilir (Tuğut ve Gölbaşı, 2010)**.** Anket formunda çalışanların iş değiştirme niyetine yönelik tutumlarla ilgili değerlendirmeleri ölçmeye yönelik önermeler için yapılan güvenilirlik analizinde Cronbach's Alpha katsayısı %89 (0,89) olarak bulunmuştur. Yine anket formunda çalışanların psikolojik taciz davranışlarına maruz kalma durumlarını ölçmeye yönelik önermeler için yapılan güvenilirlik analizinde ise Cronbach's Alpha katsayısı %85 (0,85) olarak bulunmuştur. Bu değerler, ölçme aracının yüksek güvenilirlikte olduğunu göstermektedir.

Bulgular

Anket yoluyla hesaplanan veriler için veri tipine bağlı olarak frekans, ortalama, standart sapma gibi betimsel istatistik yöntemleri kullanılmıştır. Çalışanların iş değiştirme tutumlarına ve psikolojik taciz davranışlarına maruz kalma durumlarına ilişkin betimsel analiz sonuçları Tablo 1'de gösterilmiştir.

Tablo 1. Çalışanların iş değiştirme tutumlarına ve psikolojik taciz davranışlarına maruz kalma durumlarına ilişkin betimsel analiz sonuçları

	N	Minimum	Maksimum	Ortalama	SS	Çarpıklık	Basıklık
İŞ DEĞİŞTİRME	107	1.00	7.00	2.86	1.60	.785	-.539
MOBBING	107	1.25	3.88	2.40	.51	.150	.327
TOPLAM	107						

Tablo 1'de verilen betimsel analiz sonuçları incelendiğinde ankete katılan 107 kişinin iş değiştirme arzusu içerisinde olmadıkları ve işyerlerinde psikolojik taciz davranışlarına maruz kalmadıkları sonucuna varılabilir.

Çalışanların iş değiştirme tutumlarının ve psikolojik taciz davranışlarına maruz kalma durumlarının cinsiyet açısından farklılık gösterip göstermediğini belirlemek için İlişkisiz Örneklemler t Testi analizi yapılmıştır. Elde edilen analiz sonuçları Tablo 2'de verilmiştir.

Tablo 2. Çalışanların cinsiyetleri açısından t testi sonuçları

	Sınıf	N	Ortalama	SS	Levene Testi		t	p
					F	p		
İŞ DEĞİŞTİRME	Bayan	86	2.85	1.60	.084	.773*	-.097	.923*
	Erkek	21	2.89	1.68				
MOBBING	Bayan	86	2.42	.54	1.871	.174	.174	.367*
	Erkek	21	2.31	.39				

*p>.05

Ankete katılan çalışanların 86'sının (%80,4) bayan, 21'inin (%19,6) ise erkek olduğu Tablo 2'de görülmektedir. Tablo 3'te çalışan kişilerin cinsiyetleri ile işten değiştirme tutumları ve psikolojik taciz davranışlarına maruz kalma durumları arasında anlamlı bir ilişki bulunup bulunmadığı test edilmiş, test sonucunda anlamlı bir ilişki belirlenememiştir.

Çalışanların iş değiştirme tutumlarının ve psikolojik taciz davranışlarına maruz kalma durumlarının medeni durum açısından farklılık gösterip göstermediğini belirlemek için İlişkisiz Örneklemler t Testi analizi yapılmıştır. Elde edilen analiz sonuçları Tablo 3'te verilmiştir.

Tablo 3. Çalışanların medeni durumları açısından t testi sonuçları

	Sınıf	N	Ortalama	SS	Levene Testi		t	p
					F	p		
İŞ DEĞİŞTİRME	Bekâr	50	2.97	1.56	.262	.610*	.542	.589*
	Evli	57	2.79	1,65				
MOBBING	Bekâr	50	2.47	.50	.001	.995*	1.194	.235*
	Evli	57	2.35	.52				

*p>.05

Ankete katılan çalışanların 50'sinin (%46,7) bekar, 57'sinin (%53,3) ise evli olduğu Tablo 3'te görülmektedir. Tablo 3'te çalışan kişilerin medeni durumları ile işten değiştirme tutumları ve psikolojik taciz davranışlarına maruz kalma durumları arasında anlamlı bir ilişki bulunup bulunmadığı test edilmiş, test sonucunda anlamlı bir ilişki belirlenememiştir.

Çalışanların iş değiştirme tutumlarının ve psikolojik taciz davranışlarına maruz kalma durumlarının mesleki kıdemleri açısından betimsel analiz sonuçları Tablo 4'te verilmiştir.

Tablo 4. Çalışanların mesleki kıdemleri açısından betimsel analiz sonuçları

		N	Ortalama	SS
İŞ DEĞİŞTİRME	1-10	27	2.69	1.48
	11-15	39	3.26	1.72
	16-25	22	3.02	1.79
	25- ve üstü	19	2.12	1.03
MOBBING	1-10	27	2.49	.49
	11-15	39	2.37	.58
	16-25	22	2.43	.55
	25- ve üstü	19	2.31	.34

Ankete katılan çalışanların 27'sinin (%25,2) 1-10 yıl arası, 39'unun (%36,4) 11-15 yıl arası, 22'sinin (%20,6) 16-25 yıl arası ve 19'unun (%17,8) 25 yıl ve üstü mesleki kıdeme sahip olduğu Tablo 4'te görülmektedir. Tablo 4'e göre çalışanların mesleki kıdemleri ile iş değiştirme tutumlarının ve psikolojik taciz davranışlarına maruz kalma durumları arasında anlamlı ilişki bulunamamıştır.

Çalışanların iş değiştirme tutumlarının ve psikolojik taciz davranışlarına maruz kalma durumlarının mesleki kıdeme göre farklılık gösterip göstermediğini belirlemek için Tek Yönlü Varyans Analizi İle analiz yapılmadan önce varyansların homojenliği test edilmiştir. Varyanslar homojen olduğundan analiz sonuçları Tablo 5'te verilmiştir.

Tablo 5. Çalışanların mesleki kıdemleri açısından tek yönlü varyans analizi sonuçları

		Kareler Toplamı	**sd**	**Kareler Ortalaması**	**F**	**p***
İŞ DEĞİŞTİRME	Gruplar arası	17.985	3	5.995	2.407	.072
	Grup içi	256.545	103	2.491		
	Toplam	274.529	106			
MOBBING	Gruplar arası	.447	3	.149	.563	.641
	Grup içi	27.278	103	.265		
	Toplam	27.725	106			

*p>.05

Tablo 5'teki tek yönlü varyans analizi sonuçlarına bakıldığında çalışanların iş değiştirme tutumlarının ve psikolojik taciz davranışlarına maruz kalma durumlarının mesleki kıdemlerine göre farklılık göstermediği görülmüştür.

Çalışanların iş değiştirme tutumlarının ve psikolojik taciz davranışlarına maruz kalma durumlarının görevlendirildikleri pozisyonlar açısından betimsel analiz sonuçları Tablo 6'da verilmiştir.

Tablo 6. Çalışanların pozisyonları açısından betimsel analiz sonuçları

		N	**Ortalama**	**SS**
İŞ DEĞİŞTİRME	Eleman	73	2.88	1.56
	Şef	13	2.42	1.44
	Müdür	21	3.07	1.89
	Toplam	107	2.86	1.61
MOBBING	Eleman	73	2.39	.51
	Şef	13	2.54	.60
	Müdür	21	2.38	.47
	Toplam	107	2.40	.51

Ankete katılan çalışanların 73'ü (%68,2) eleman, 13'ü (%12,2) şef ve 21'i (%19,6) de müdür pozisyonundadır. Ortalama değerlere bakıldığında her pozisyonda çalışan kişilerin işlerinden memnun olduğu, iş değiştirme arzusunda olmadığı ve işyerinde psikolojik taciz davranışlarına maruz kalmadığı anlaşılmıştır.

Çalışanların iş değiştirme tutumlarının ve psikolojik taciz davranışlarına maruz kalma durumlarının görevlendirildikleri pozisyonlara göre farklılık gösterip göstermediğini belirlemek için Tek Yönlü Varyans Analizi İle analiz yapılmadan önce varyansların homojenliği test edilmiştir. Varyanslar homojen olduğundan Analiz sonuçları Tablo 7'de verilmiştir.

Tablo 7. Çalışanların pozisyonları açısından tek yönlü varyans analizi

		Kareler Toplamı	sd	Kareler Ortalaması	F	p*
İŞ DEĞİŞTİRME	Gruplar arası	3.450	2	1.725	,662	.518
	Grup içi	271.080	104	2.607		
	Toplam	274.529	106			
MOBBING	Gruplar arası	.298	2	.149	,565	.570
	Grup içi	27.427	104	.264		
	Toplam	27.725	106			

*p>.05

Tablo 7'deki tek yönlü varyans analizi sonuçlarına bakıldığında Çalışanların iş değiştirme tutumlarının ve psikolojik taciz davranışlarına maruz kalma durumlarının görevlendirildikleri pozisyonlara göre farklılık göstermediği görülmüştür.

Sonuç

Bu çalışmada, Balıkesir ilinde faaliyet gösteren kargo acentelerinde görev alan çalışanların iş değiştirme tutumlarının ve psikolojik taciz davranışlarına maruz kalma durumlarının belirlenmesi amacı güdülmüştür. Bu amaç doğrultusunda geçmişte kargo sektöründe tespit edilebilen bir araştırma olmadığından, diğer branşlarda yapılmış olan literatür araştırması sonucunda kargo sektörüne uygun sorular ve önermelerden oluşan bir anket

oluşturulmuş ve Balıkesir ilinde faaliyet gösteren kargo acentelerinde çalışan 107 katılımcı üzerinde uygulanmıştır.

Yapılan analiz sonuçları dikkate alındığında ortaya konulan iş değiştirme tutumu ve psikolojik tacize maruz kalma durumu, Balıkesir ili kargo sektörü çalışanları arasında oldukça sık görülen bir davranıştır hipotezi reddedilerek alternatifi kabul edilmiştir. Yani Balıkesir ili kargo sektörü çalışanlarında iş değiştirme niyetine ve psikolojik tacize maruz kalma davranışına rastlanılmamıştır.

Elde edilen analiz sonuçları çalışanların psikolojik taciz davranışlarını algılama konusunda farkındalıklarının yeterli düzeyde olmaması kaynaklı da olabilir. Bu şüphenin ortadan kaldırılması amacıyla, çalışma yapmadan önce çalışanların psikolojik taciz davranışları hakkında bilgilendirilmesi gerekebilir. Bunun yanı sıra psikolojik taciz üzerine yapılacak yeni çalışmaların yüz yüze görüşmelerle elde edilen verilerle yapılması daha anlamlı sonuçlar elde edilmesi yolunda araştırmacılara avantaj sağlayabilir.

Bundan sonra yapılacak anket çalışmalarında ana kütlenin artırılması bilime katkı konusunda yarar sağlayabilecektir. Ayrıca kargo sektörü çalışanları için psikolojik taciz temalı ülkemizdeki ilk çalışma olmasından dolayı soru ve önermelerin çeşitlendirilmesi ve lojistik sektörünün diğer faaliyet alanlarında görev alan çalışanlar üzerinde uygulanması yine bilime katkı konusunda yarar sağlayabilecektir.

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A DESIGN OF IMAGE COMPRESSION SYSTEM FOR MOBILE DEVICES

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Abstract: In recent years, communication technologies are growing rapidly. Developments in technology is very important for increasing the communication between individuals. This situation requires efficient transmission of information and mean while efficient usage of communication resources such as energy and storage. The aim of this study is to develop a system which compresses the image data and transmits it to the others by using mobile devices.

Keywords: Image compression, mobile programming

MOBİL CİHAZLAR İÇİN GÖRÜNTÜ SIKIŞTIRMA SİSTEM TASARIMI

Özet: Bilgi çağında iletişim teknolojileri hızla gelişmektedir. İnsanlar, aralarındaki iletişimi arttırmak için teknolojiden yararlanmaktadırlar. Bu durum bilginin iletilmesi ve iletilirken kaynakların verimli kullanılmasını zorunlu kılmıştır. Bu kaynaklar enerji, saklama alanı, bant genişliği gibi sürekli kullanılan kaynaklardır. Önerilen çalışmada mobil cihazlarda görüntüyü sıkıştırarak boyutunun düşürülerek enerji tüketiminden kazanç sağlanması amacıyla sistem tasarımının gerçekleştirilmesidir.

Anahtar Sözcükler: Görüntü sıkıştırma, mobil programlama

Giriş

Uluslararası bir ağ haline gelen internet, günümüzde modern insan yaşamının vazgeçilemez bir unsuru haline gelmiştir. Gelişen teknoloji, düşen maliyetler, bilgiye ulaşma, paylaşma ve haberleşme ihtiyacının giderek artması ile hızla yayılmıştır. 21. yüzyılın getirdiği mobilleşme süreciyle internet her yerden her an erişebilir bir duruma gelmiştir. Bu da insanlığın başlıca ihtiyaçlarından biri olan iletişim kurmayı, sohbet etmeyi, mesajlaşmayı hayatın her anına yaymış ve kısa bir süre içinde etkileşimi küresel boyuta getirmiştir. Tüm bu artan mesajlaşma isteği kişisel ve kurumsal bilginin hızlı ve güvenli bir şekilde iletilmesini gerektirmiştir. Mobil cihazların günün her saatinde ihtiyaç dâhilinde veya haricinde kullanılması, görsel içerik bulunan anlık mesajların büyüklüğü gibi durumlar neticesinde giderek artan veri depolama ve enerji ihtiyacını doğurmuştur. Bu ihtiyacı azaltacak başlıca çözüm ise, yazılım ile gerçekleştirilebilecek veri sıkıştırma teknikleri olmuştur.

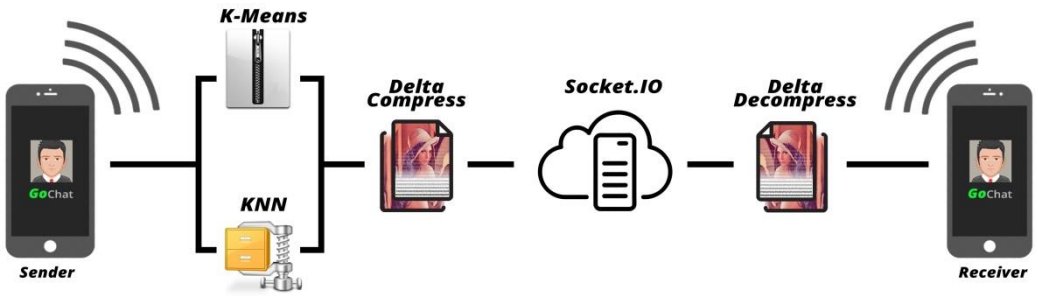
Bu çalışmanın amacı, mobil cihazlarda sohbet etmek ve aynı ortamda sohbet edilen kişilerle görüntü paylaşımı yaparken, görüntüyü sıkıştırarak gönderme imkanı sağlayan bir sistem tasarımı geliştirmektir. Böylece görüntünün hızlı ve enerji etkin bir şekilde gönderimi gerçekleştirilerek, mobil cihazların en büyük kısıtı olan enerji tüketiminden kazanç sağlanmış olacaktır. Çalışmanın devamında ilgili çalışmalardan, önerilen sistem tasarımından ve sonuçlardan bahsedilmektedir.

İlgili Çalışmalar

Mevcut çalışmalar incelendiğinde görüntü sıkıştırma ile ilgili araştırmaların mevcut olduğu gözlemlenmiştir. [1]'de yapay sinir ağlarının dijital görüntü sıkıştırılmasında kullanımı araştırılmıştır. Bant genişliğinin fazla kullanıldığına dikkat çekerek, görüntü sıkıştırmayı kullanıp gereksiz kullanılan bant genişliğinin azaltılması hedeflenmiştir. [2]'te yapay sinir ağları ile görüntü sıkıştırma ve görüntü kütük biçimi ile ilgili bir araştırma yapılmıştır. Bu araştırmada insandaki görme duyusunun yapay zekâ ile taklit edebilme yetisi amaçlanmıştır. [3]'te yapay sinir ağları kullanılarak görüntü sıkıştırma konusu araştırılmıştır. Bu çalışma, sayısal renkli görüntülerin sıkıştırılması için iki yöntem karıştırılarak yeni bir teknik önerilmiştir. Bu çalışmada dalgacık dönüşümü ve yapay sinir ağları birlikte kullanılmıştır. [4]'te öğrenebilen durum makinesi yaklaşımına dikkat çekilmiştir. Öğrenebilen durum makineleri için bir simülatör yapılmıştır. Amaç, öğrenebilen durum makinelerini yaygınlaştırmaktır. Böylece kullanıcılar kendi uygulamalarını bu makinelerde deneme fırsatı yakalayacaklardır. Diğer amaç ise ağlarda kayıpsız sıkıştırma için tek ölçü birimi olan sıkıştırma oranını geliştirmektir. [5]'te fraktal görüntü sıkıştırma üzerinde durulmuştur. Tekrarlamalı fonksiyon sistemlerinin teorisi üzerine kurulu olan fraktal görüntü sıkıştırmasının temel görüşleri tanıtılmıştır.

Önerilen Sistem Tasarımı

Bu çalışmada mobil cihazlar için Socket.io tabanlı olarak mesajlaşma ve aynı zamanda yapay zeka algoritmaları kullanılarak görüntü sıkıştırma ve gönderme uygulamasının gerçekleştirileceği bir sistem tasarımı önerilmiştir.



Şekil 1: Geliştirilen sistemin özet akış şeması

Sohbet esnasında metin mesajı dışında görüntü göndermek istenildiğinde Şekil 1'de görüldüğü gibi bu görüntüyü seçilen iki yapay zeka algoritmasından biri ile sıkıştırmaktadır. Sıkıştırılan görüntüyü Delta Sıkıştırma algoritması ile string'e çevirerek socket.io aracılığı ile diğer kullanıcılara gönderir. Diğer cihazlarda ise Delta Sıkıştırma algoritmasını tersine çevirerek gelen string görüntüyü resim olarak kullanıcıya gösterir. Yapay zeka algoritması olarak K-Means ve KNN algoritmaları kullanıcıya seçenekli olarak sunulmuştur. Kullanıcı istediği algoritmayla resmi sıkıştırabilir. Bunun amacı kullanıcının seçiminden ziyade iki algoritma arasında ki resim bazında performans farkını görebilmektir. Resimler sıkıştırılarak gönderildiğinde ortaya çıkan enerji kullanımı, cihazın ram kullanımı gibi kaynak kullanımların analizi yapılmaktadır.

Uygulamanın işleyişini anlatan ana kod Şekil 2'de görüldüğü gibidir. Kullanıcının hangi adımları uygulayacağını buna karşılık uygulamanın hangi kodları çalıştıracağı mantık olarak Şekil 2'de gösterilmektedir. Geliştirilen sistemin akış diyagramı Şekil 3'te gösterilmektedir. Sistemin kullanıcı tarafında işleyişi akış diyagramından açıkça takip edilebilmektedir.

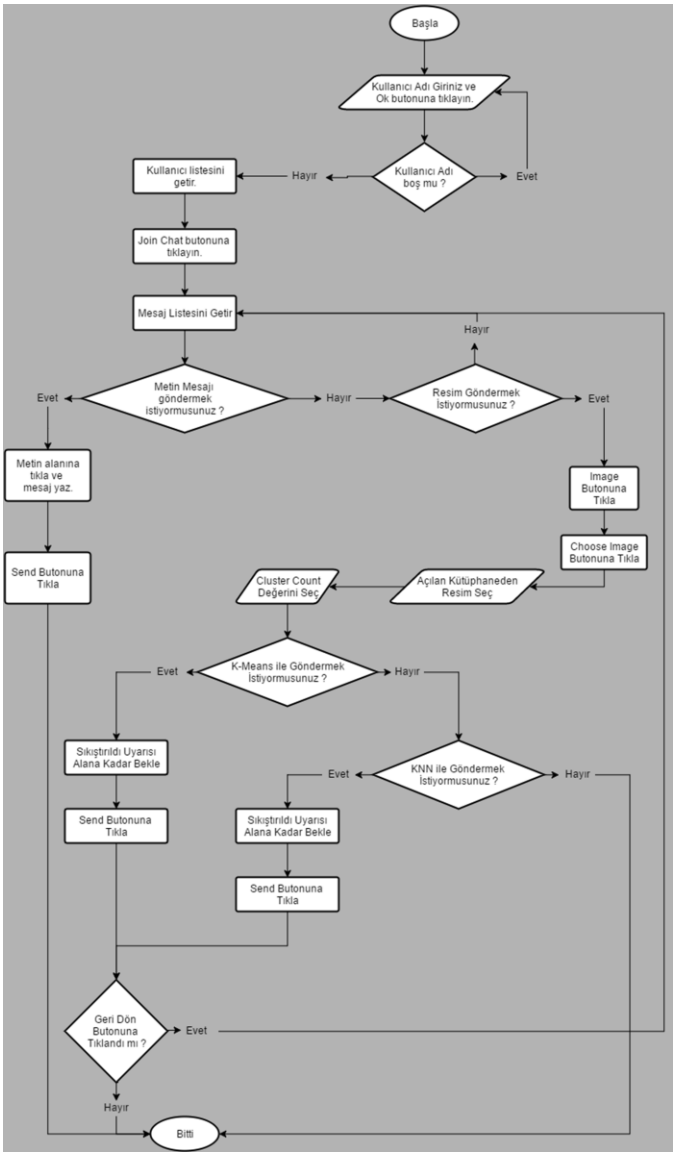
Geliştirilen Sistem

Uygulamayı aç.
kullaniciAd= Kullanıcı adı gir.
İf(kullaiciAd==’’)
Goto “kullaniciAd= Kullanıcı adı gir.“
Endif
Sunucuda kayıtlı kullanıcı listesini getir.
Joinchat butonuna tıkla.
Mesaj listesini getir.

mesaj yaz ve send butonuna tıkla
İf(mesaj!=””)
Mesajı gönder.
Endif

Image butonuna tıkla.
Choose Image butonuna tıkla ve Resim seç.
Cluster Count belirle.
İf(KMeans)
KMeans ile sıkıştır.
Send butonuna tıkla.
Görüntüyü gönder
Else if(KNN)
Knn ile Sıkıştır.
Send butonuna tıkla.
Görüntüyü gönder
Endif

Şekil 2: Geliştirilecek sistemin sözde kodu



Şekil 3: Geliştirilen sisteme ait akış diyagramı

Sonuç

Bu çalışmanın amacı, mobil cihazlarda sohbet etmek ve aynı ortamda sohbet edilen kişilerle görüntü paylaşımı yaparken, görüntüyü sıkıştırarak gönderme imkanı sağlayan bir sistem tasarımı geliştirmektir. Böylece görüntünün hızlı ve enerji etkin bir şekilde gönderimi gerçekleştirilerek, mobil cihazların en büyük kısıtı olan enerji tüketiminden kazanç sağlanmış olacaktır. Çalışma kapsamında önerilen sistemin akış diyagramları ve sözde kodu hazırlanarak, sistemin tasarımı tamamlanmıştır. Gelecek çalışmalarda, bu çalışmadan tamamlanmış olan tasarımın yazılım ortamında gerçekleştiriminin tamamlanması ve performans analizlerinin elde edilmesi planlanmaktadır.

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A DESIGN OF ANDROID BASED CHECK-LIST FOR INCREASING FLIGHT SAFETY AND REDUCING AIRCRAFT ACCIDENTS

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Abstract: In daily life, pilots are required to get all documents related to the flight along with paper maps and checklists and use them if necessary. It is important for the decision-making process to be able to access the right information at the right time, in the right place. Cross-check is the serial and continuous check of inside and outside information by the flight crew during flight. The most important factor that helps pilots is the ability to quickly move their attention-focal point while doing a complex job of flying an aircraft. This scrolling speed is also limited by the pilot's ability. For this reason, it is vital for all flight crews, especially pilots, to keep track of all internal and external information and data related to the aircraft constantly throughout the flight without ever jumping. The application we are working on allows the flight crew to make the flight method easier and more productive.

Keywords: Flight safety, flight check list, android programming

UÇUŞ EMNİYETİNİ ARTIRICI VE KAZA KIRIMLARI ÖNLEYİCİ ANDROİD TABANLI KONTROL LİSTESİ TASARIMI

Özet: Pilotların uçuşa giderken uçuşla ilgili tüm dokümanları, kâğıt haritaları ve kontrol listelerini yanına almaları ve ihtiyacı olması durumunda bunları kullanmaları gerekmektedir. Havacılıkta, doğru zamanda, doğru yerde, doğru bilgilere erişebilmek karar verme süreci için önem arz etmektedir. Çapraz kontrol, uçuş esnasında dâhili ve harici bilgilerin uçuş ekibi tarafından art arda ve sürekli olarak kontrol edilmesidir. Bir hava aracını uçurmak gibi karmaşık bir işi yaparken, pilota yardımcı olan en önemli faktör, dikkat odak noktasını süratle kaydırabilmesidir. Bu kaydırma hızı da pilotun yeteneği ile sınırlıdır. Bu nedenle, başta pilotlar olmak üzere bütün uçuş mürettebatının hava aracı ile ilgili dâhili ve harici tüm bilgi ve verileri hiç atlamadan, uçuş boyunca sürekli takip etmesi hayati öneme sahiptir. Bu çalışmada tasarlanan yazılım sistemi ile uçuş yapan ekibin, uçuş yöntemini daha kolay ve daha verimli olarak kağıt kullanmadan gerçekleştirebilmelerine olanak sağlanması hedeflenmiştir.

Anahtar Kelime: Hava aracı kaza ve olayları, uçuş emniyeti, android uygulama programlama.

Giriş

Havacılık, içerisinde pek çok unsurun bulunduğu, üçüncü boyutta hareket kabiliyetinin kullanıldığı, çok değişik disiplinleri barındıran bir sistemdir. Havacılık, aynı zamanda, içinde çok değişik riskler de bulundurur. Havacılık sektöründe ilk başlarda önemsenmeyen fakat gelişimle beraber ön plana çıkan en önemli unsur uçuş emniyeti olmuştur. Yapılan insan hatalarını telafi etme imkânı olmayan bir sektörde uçuş öncesi alınacak tedbirlerle can ve mal kaybını önleme fikri benimsenerek, teknolojiden mümkün olan en üst seviyede faydalanılmıştır.

Günlük hayatta pilotların uçuşa giderken uçuşla ilgili tüm dokümanları, kâğıt haritaları ve kontrol listelerini yanına almaları ve ihtiyacı olması durumunda bunları kullanmaları gerekmektedir. Havacılıkta, doğru zamanda, doğru yerde doğru bilgilere erişebilmek karar verme süreci için önem arz etmektedir. Kokpitlerin yapısı değerlendirildiğinde, saniyelerle yarışan pilotun ihtiyacı olduğu bilgiye ulaşmasının çok da kolay olmadığı, yeterli esnekliğin sağlanmadığı görülmektedir dahası pilotların ihtiyacı olduğu bilgiye ulaşmada pilotun iş

yükünün artırıldığı ve bu esnada çapraz kontrolü kaybederek istenmeyen kaza kırımların yaşanması ihtimalinin arttığı görülmektedir. Çapraz kontrol, uçuş esnasında dâhili ve harici bilgilerin uçuş ekibi tarafından art arda ve sürekli olarak kontrol edilmesidir. Bir hava aracını uçurmak gibi karmaşık bir isi yaparken, pilota yardımcı olan en önemli faktör, dikkat odak noktasını süratle kaydırabilmesidir. Bu kaydırma hızı da pilotun yeteneği ile sınırlıdır. Hareket çok seri bir şekilde yapılmayı gerektirdiği için pilot bu durumda çok fazla yorulur ve aşırı olarak yüklenir. Pilot, uçuş esnasında birçok şeyi aynı anda görebilmek ve hepsine doğru tepkiyi zamanında göstermek zorundadır. Bu duruma bir de düşman tehdidi eklendiğinde yapılacak en küçük hatanın kötü sonuçlar doğurması kaçınılmazdır. Bu nedenle, başta pilotlar olmak üzere bütün uçuş mürettebatının hava aracı ile ilgili dâhili ve harici tüm bilgi ve verileri hiç atlamadan, uçuş boyunca sürekli takip etmesi hayati öneme sahiptir.

Sahip olunan tüm teknolojik kaynakların etkin ve emniyetli bir şekilde kullanılmasıyla, uçuş ekibinin ihtiyacı olan bilgiye en kolay ve hızlı şekilde ulaşabilmesinin sağlanacağı ve uçuş faaliyetlerinin icrasının çok daha emniyetli ve başarılı bir şekilde yürütülebileceği görülmüştür. Son yıllarda hızla ilerleyen teknoloji, havacılık teknolojisinde olduğu gibi mobil tarafta da etkisini hissettirmiş ve mobil uygulama geliştirme alanında da etkisini göstermiştir. Genel olarak mobil teknolojiler, bireylerin hareket halindeyken bile bilgiye erişebilmesini ve bu bilgilerle ilgili işlem yapabilmesini mümkün kılacak mobil çözümler oluşturmak amacıyla oluşturulmuş teknolojiler bütünüdür. Bu çalışmada "Kontrol Listesi" adı altında Linux tabanlı bir Android uygulaması geliştirilmiştir. Android tabanlı check-list uygulaması ile kitap karmaşasından kurtulup, kağıtsız digital bir ortamda istediği her türlü bilgiyi ve pilotun yapması gerekenleri sırasıyla atlamadan uygulanabilmesi hedeflenmektedir Android Check-List uygulaması, uçuş yapan pilotlar ve uçuşun emniyetli bir şekilde yapılmasını sağlayan yer destek unsurları için hazırlanmış olup, uçuş yöntemini daha kolay, daha hızlı ve daha verimli olarak kağıtsız gerçekleştirebilmelerini sağlar. Bu çalışma ile pilotların bilgiye ulaşmalarının kolaylaşması, muhtemel yaşanabilecek kaza kırımların önüne geçilmesi ve uygulama pilotların daha emniyetli bir şekilde görev icra etmeleri hedeflenmektedir.

İlgili Çalişmalar

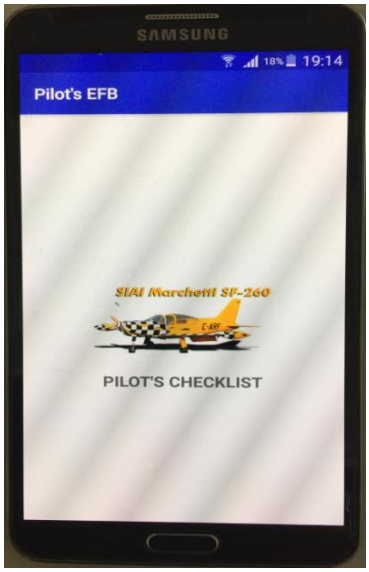
Mevcut çalışmalar incelendiğinde az da olsa uçuş güvenliği için geliştirilmiş cep telefonu uygulamalarının bulunduğu görülmüştür. [1]'de pilotların cep telefonlarında ya da tabletlerinde uygulamayı indirerek, kullandıkları uçakları yerde ve kokpit içinde kontrol listelerini eksiksiz uygulamaları ve havada öğrenmeye devam etmeleri amaçlanmıştır. [2]'de en bilinen uçak tiplerinin uçak içerisinde anlaşılması, basit ve okunması kolay şekilde grafik ara yüzlerininin dört aşamada tasarlanması gerçekleştirilmiştir. Akıllı telefonlar ve bilgisayarlar arasında kolay transfer edilebildiğinden havacılıkta herhangi bir başka amaç içinde kullanılabilmektedir. Uygulamanın birinci arayüzünde uçak tipleri, ikinci bölümünde seçilmek istenen uçak tipine ait tüm kontrol listesi isimleri, üçüncü bölümünde uçuşun istenen safhasının kontrol listesini, dördüncü bölümünde ise de pilotun uygulaması gereken işlem maddeleri sırasıyla listelenmiştir. [3]'te Cessna 152 tipi uçağın kontrol listesi mobil uygulamasını geliştirilmiştir. Uygulamada Cessna 152 uçağının harici ve dahili kontrollerini, motor çalıştırmadan önce, motor çalıştırma, rule esnasında ve kalkıştan önce pilotun yapması gereken işlem maddelerini atlamadan uygulaması amaçlanmıştır. [4]'te Boeing 747 tipi yolcu uçağının pilot kontrol listesi mobil uygulaması geliştirilmiştir. Uygulama kalkıştan öncesi ve sonrası, seyrüsefer esnasında, alçalışta, yaklaşma, hatalı yaklaşma ve iniş esnasındaki prosedürleri içerir. Uygulamayı daha çok simülatör uçuranların kullanması amaçlanmıştır. [5]'te pilotların meydanlardan hangisine ne zaman iniş-kalkış yaptığı, hangi meydana kaç kere alçalma yaptığı ve pist içine teker koyarak hiç durmadan havalanarak kaç kez iniş yaptığı gibi bilgiler girilerek veri tabanı oluşturulmuştur. [6]'da Android GPS alıcısı kullanılarak pilotun uçuş safhasını her anını kaydeden uygulama geliştirilmiştir. Uygulama pilotun uçuş safhası boyunca uçtuğu uçuş başını, irtifasını, istikametini, hızını ve yeryüzüne göre gittiği koordinatları kaydeder.

Geliştirilen Sistem

Önerilen sistemin gerçekleştiriminde Android Yazılım Geliştirme Kiti (SDK) kullanılarak Java dilinde yazılmıştır. SDK hata ayıklayıcı, yazılım kütüphaneleri ve emülatör gibi yardımcı araçlar sunmaktadır. Geliştirilen sistemle ilgili gerçekleştirilen arayüzler ve işlevleri aşağıda sunulmuştur.

Şekil-1 Geliştirilen sistemin kısa yol şekli

Şekil 1'de telefon ekranında uygulama ikonunun görüntüsü verilmiştir. İkona tıklandığında uygulamaya giriş yapılmaktadır.



Şekil-2. SIAI Marchetti firmasına ait SF-260 uçağına ait görsel

Şekil 2'de SIAI Marchetti firmasına ait SF-260 uçağına ait görsel verilmiştir. Görsele tıklandığında pilot kontrol listesi uygulamasının içerisine girilebilmektedir. Uygulamanın adı Pilot's EFB (Pilotlara ait elektronik uçuş çantası) olarak belirlenmiştir. Geliştirilen uygulama ile pilotlar dört hizmetten yararlanabilecektir;

Planlama Hizmeti: Pilotun cep telefonuna kurulan uygulama üzerinden görev planlaması yapılabilmektedir. Uçağın performans bilgileri kullanılarak kalkış-iniş mesafesi, rüzgar bileşenleri tablosundan yan rüzgar hesaplaması ve yakıt hesaplaması yapılabilmesini sağlayan bilgileri içerir.
Harici Kontrol Hizmeti: Pilotun uçağın yanına geldikten sonra uçağın içine girmeden önce uçağın dış fiziki yapısındaki yapması gereken kontrolleri bir sıra dahilinde yapmasını sağlayan bilgileri içerir.
Dahili Kontrol Hizmeti: Pilotun uçağın içine girdikten sonra motor çalıştırmadan önce, motor çalıştırma esnasında, ruleye çıkmadan önce, rule esnasında, piste girmeden kalkıştan önceki hayati kontroller, hemen kalkış sonrası yapması gereken kontrolleri ve inişten sonra motor durdurma esnasında yapması gereken bilgileri içerir.
Emercensi Usuller Hizmeti: Pilotun uçuşun herhangi bir safhasında uçakla ilgili yaşayabileceği bir problem esnasında yapması gerekenleri genel, kalkış, elektrik, yakıt ve iniş ana başlıkları altında toplayan bilgileri içerir.

Şekil-3 Uygulamanın Ana Başlıkları

Şekil-3'te uygulamanın ana başlıkları görülmektedir. Genel, Kalkış, Motor, Elektrik, Yakıt, İniş, Normal ve Performans geliştirilen sistemin ana başlıklarını oluşturmaktadır.

A-Genel: ana başlığı altındaki emercensilerin özellikleri, önlenebilmesi için bir an önce tepki gösterilmesi gereken ve sebebi o esnada tam olarak kestirilemeyen uçak arızalarını kapsar. Rutin uçuş faaliyetlerinin icrası esnasında uygulamanın bu bölümünün açık olması ani herhangi bir problem esnasında pilota yardımcı olması hususunda zaman ve elastikiyet kazandırır.

B-Kalkış: emercensileri ise uçağın park yerinden çıkarak problemsiz pist başına kadar geldiği ve piste giriş yapıp, tam kalkmaya hazır olduğu esnada meydana gelen problemleri kapsar. Pilotun kalkış için piste girerken uygulamanın ilgili bölümünü açması, kendisine kalkıştan herhangi bir problem sebebiyle vazgeçmesi durumunda ne yapması gerektiği hususunda yardımcı olur ve bu sayede daha emniyetli bir kalkış gerçekleştirmesini sağlar.

C-Motor: Uçağı çalıştırdıktan itibaren motor kaynaklı arızaları kapsar. Uçak performansındaki ve göstergelerdeki arızanın motordan kaynaklı bir arıza olduğunun tespit edilmesini sağlar.

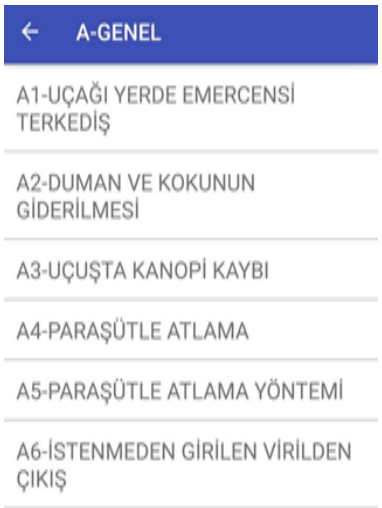
D-Elektrik: Uçak motorunun ilk çalıştırıldığı andan motorun durdurulduğu son ana kadar uçak elektrik kaynağına ihtiyaç duyar. Elektrik ile ilgili çıkabilecek sorunların çözülebilmesi için kontrol listesinden atlamadan yapılması gerekenler ile ilgili bilgi içerir.

E-Yakıt: Uçaklar uçak tipine göre değişik yakıt cinslerine ihtiyaç duyarlar. Fakat hangi yakıt türünü kullanırsa kullansın bu yakıtların uçak üzerinde depolandığı depolardan motora sürekli bir transfer olmaktadır. Uçuş boyunca bu yakıt transferi esnasında herhangi bir arıza nedeninden dolayı motora giden bu akış sağlanamayabilir. Arızanın farkına varıldığı ilk anadan itibaren ilgili kontrol listesi işlem maddelerinin uygulanması uçağın ve pilotun her hangi bir kaza kırıma uğramadan meydana inmesine olanak sağlar.

F-İniş: Uçağı iniş için konfigüre ederken uçak iniş sistemlerinden herhangi birinde yaşanabilecek problem belki de tüm uçak arızalarının içinde en riskli olarak tanımlayabileceğimiz kısmı teşkil eder. İnişe yardımcı olan sistemlerde yaşanan problemler bir nebze tolere edilebilir fakat uçağın piste teker koyduğu esnada yere temas eden iniş takımları sisteminde yaşayabileceği en küçük problem kaza kırım ile sonuçlanabilir. Pilot iniş takımlarının emniyetli bir şekilde açılıp açılmadığını uçak içindeki göstergelerden anlar. Bazı durumlarda iniş takımlarını aşağıya koymamıza yarayan iniş takım kolu ile ya da iniş takım kolunu aşağıya indirdiğimizde iniş takımlarının tam olarak açılmadı ya da hiç açılmadı gibi görsel işarlar alabiliriz. Bu durumlarda doğrudan checklist'in ilgili bölümünden yapmamız gerekenleri yapmak hem milyon dolarlar değerindeki uçağı hem de en önemlisi kendi hayatımızı koruyacaktır.

N-Normal: Uygulamanın bu bölümü en çok ihtiyacımız olan ve en çok kullanacağımız bölümdür. Normal usuller bölümünün içerisinde uçağı kullanacak olan pilotun daha uçağa yaklaşırken yapması gereken kontrollerden başlar. Bu kontroller pilotun yerde iken farkına varıp uçuş esnasında muhtemel yaşayabileceği çok daha büyük problemlerin belirtilerini yerde iken görmesini ve uçağı kullanmaktan vazgeçmesini kapsar. Bu kontrollere harici kontroller denir. Uçağın içine girmeden önce yapılması gereken kontrollerdir. Hiçbir işlem maddesinin atlanmaması gerekir.

P-Performans: Uygulamanın bu bölümü daha önce ki bölümlerden farklı olarak uçuş esnasında yapmamız gerekenlerden ziyade uçuş planlama esnasında pilota yardımcı olmak amacıyla tasarlanmıştır. Bölüm içinde uçağın özellikleri ve limitleri ile ilgili bilgiler bulunmaktadır. Pilot herhangi bir yerde otururken uçak ile ilgili bilgilere en kısa zaman içerisinde ulaşıp bilgilerini tazeleme şansı bulacaktır. Bu da uygulamanın elektronik kitap okuyucu kazanımıdır. Bu sayede pilot birçok kitabı yanında taşımaktansa buradan uçak ile ilgili bilgilere ulaşıp, genel bilgi seviyesini maksimum seviyede tutabilir.



Şekil-4 GENEL ana başlık içeriği

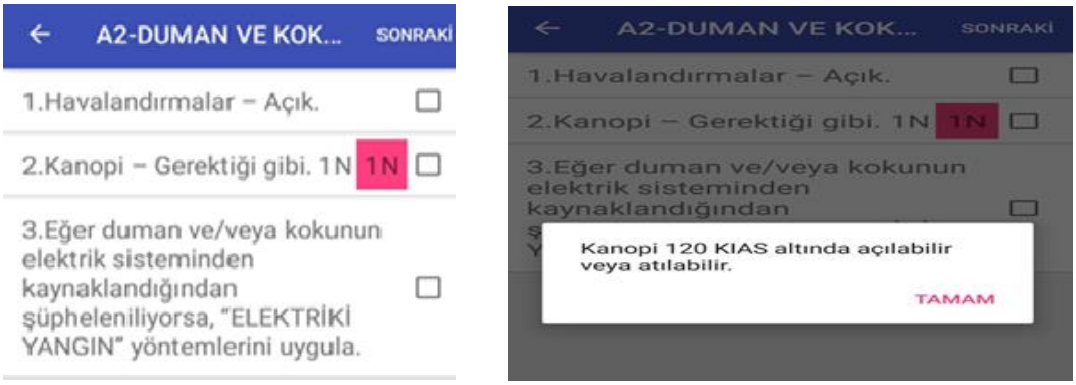
Şekil-4'te GENEL ana başlığı tıklandığında; Uçağı Yerde Emercensi Terkediş, Duman ve Kokunun Giderilmesi, Uçuşta Kanopi Kaybı, Paraşütle Atlama, Paraşütle Atlama Yöntemi, İstenmeden Girilen Virilden Çıkış ana alt

başlıkları altında toplanmıştır. Uçağı Yerde Emercensi Terkediş gerektiren durumlar, pilotun bir an önce uçağın yanması ya da infilak etmesi durumlarına karşı uçağı emniyete alıp uzaklaşması için uygulaması gereken işlemlerdir. Duman ve Kokunun Giderilmesi işlem maddeleri ise uçuş ya da rule esnasında pilotun içinde bulunduğu kokpit içinde bir yanık kokusu gibi tehlikeli bir durumu işaret eden işarlar alması neticesinde uygulanır. Uçuşta Kanopi Kaybı arızası ise uçuş esnasında kokpitin içerisinde pilotun başı üzerindeki cam tavan görünümlü, otomatik açılıp kapatılabilen kısmın, yani kanopinin herhangi bir sebeple uçaktan ayrılması durumunda meydana gelir. Kanopi kaybı durumunda uçak kokpit içerisinde çok fazla gürültü olması nedeniyle hava-hava ve hava-yer muhaberesinde çok büyük problemler yaşanabilir ve bu da problemin çok daha büyük boyutlara ulaşmasına sebebiyet verebilir. Paraşütle Atlama Yöntemi bir pilot için karar vermesi en güç olan anlardan biridir. Bazı arızalar neticesinde uçağı emniyetli bir şekilde yere indirmek imkansız duruma gelmiş olabilir ya da uçak kontrolünün tam olarak sağlanamadığı durumlarda, pilotun son karar olarak uçaktan ayrılması gerekebilir. Atlama kararı vermek her pilot için çok güçtür. Çünkü atlama esnasında uygulamamız gereken işlem maddelerinde yapılabilecek en küçük bir hata, emniyetli bir şekilde kurtulma ihtimalini minimumlara düşürür. İstenmeden Girilen Virilden Çıkış işlem maddesi ise mutlaka eğitimlerde denenmesi gereken durumların en önemlilerinden biridir. Yanlış kumanda tekniği ya da kumanda yüzeylerinde ki herhangi bir problemden dolayı uçuş esnasında uçağımız yere doğru dönerek dalışa geçebilir. Uçağı bu pozisyondan kurtarmak gerçekten çok güçtür ve yapmamız gerekenleri daha önce defalarca tekrar etmemiz gereği kaçınılmazdır. Bu arızanın işlem maddelerini eğitim esnasında defalarca tekrarlayarak bunu refleks haline getirmek gerekir.

(a) Uçağı Yerde Emercensi Terk Ediş (b) Tamamlanan İşlemler

Şekil 5. Geliştirilen sistem arayüzü uçağı yerde emercensi terk ediş

Şekil-5(a)'da Uçağı Yerde Emercensi Terk Ediş başlıklı kontrol listesinin işlem adımları sıralanmıştır. Pilot Uçakta işlem adımlarını atlamadan sırasıyla tamamlamak için her yaptığı işlemden sonra yaptığı işlemin üzerine tıklayarak tamam işaretini gördükten sonra bir sonraki işlem adımına geçiyor. Bu da hiçbir işlem maddesini atlamadan yapmasını ve dolayısıyla daha emniyetli kazaları önleyici yönde katkı sağlıyor. Tüm işlem adımlarını bitirip geri tuşuna bastığında ise, Şekil-5(b)'de görüldüğü üzere tamamlanan işlem maddesinin rengi belirginleşiyor. İşlem maddelerinden herhangi birini atladıysa renkteki bu değişimi takip edemeyecek ve yaptıklarını tekrar gözden geçirmesi gerekecektir.



(a) Duman ve Kokunun Giderilmesi ait kontrol listesi (b) 1N'ye tıklandıktan sonra ki görsel

Şekil-6 Geliştirilen sistem arayüzü- duman ve kokunun giderilmesi

Şekil-6(a) ana alt başlıklardan Duman ve Kokunun Giderilmesi ait kontrol listesidir. Burada daha önceki işlem maddelerinden farklı olan, birinci işlemi tamamlayıp tamam işaretini gördükten sonra ikinci işlem maddesine geçmeden önce okunması gereken nottur. "1N" olarak görünen kırmızı görselin üzerine tıklanarak notun detayını

okuduktan sonra ikinci işlem maddesine tıklıyoruz ve bitirdiğimize dair tamam işaretini gördükten sonra üçüncü işlem maddesine geçiyoruz. 1N'ye tıklandıktan sonra ki görsel Şekil-6(b)'de gösterilmiştir.

Warnıng: Uygulanmaması durumunda personelin yaralanması veya hayatını kaybetmesiyle sonuçlanabilecek kullanma yöntemleri, teknikleri vs. bilgileri içerir.

Cautıon: Uygulanmaması durumunda malzeme hasarı ile sonuçlanabilecek kullanma yöntemleri, teknikleri vs. bilgileri içerir.

Note (N) : Önemli olduğu vurgulanması gereken kullanma yöntemleri, teknikleri vs. bilgileri içerir.

Sonuç

Çalışmada Android Tabanlı Kontrol Listesi tasarlanmış ve gerçekleştirilmiştir. Kontrol Listesi mobil uygulaması kullanıcılarına kağıtsız kokpit ve bilgiye daha çabuk ulaşmalarını sağlamayı hedeflenmiştir. Hafif bir aygıtın bir çok cilde sahip uçuş dokümanlarının yerini almasıyla, uçuş ekipleri istendiği yerde çalışabilecek ve hızlı bilgi ulaşımına sahip olacaktır. Uygulama pilotların her uçuş öncesi kokpite taşıdıkları 20-25 kg ağırlığındaki bir belgeler çantasının yerini almaktadır. Android Tabanlı Kontrol Listesi dijital olarak bu belgelerin yerine geçen bir uygulamadır. Uygulama, ağırlığı 0,5 ile 2,2 kg arasında değişen akıllı telefonlar ya da tablet bilgisayarlar üzerinde kullanılmaktadır. Böylece uçağa sabitlenmiş veya pilotun yanında taşıdığı bir tablet ile geleneksel uçuş çantasının işlevleri yapılabilmektedir. Son birkaç yılda mobil tablet donanımlarının ucuzlamasıyla birlikte mobil uygulamalar daha maliyet etkin olmaya ve askeri havacılık dünyasında yer etmeye başlamıştır.

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Bahar Ozyoruk

Gazi University

Abstract: When regarding today's globalized markets in context of technological developments, it seems the variations are very rapid and efficient and this rapidity and variations also bring along the uncertainty in requests. Under these conditions, companies have to make mostly constituted by cost related and strategically important decisions. Decisions affecting the quality, customer satisfaction and long term sustainability of the company are selection decisions and all of them have to be objective and effective. Generally, supplier selection problems take place in complex problems category. In this study, for a company dealing with research and development projects and producing prototype products, supplier selection problem is considered and the solution based on Axiomatic Design (AD) method is proposed. AD, one of the multi attribute decision methods (MADM), is applied to solve the supplier selection problem including both qualitative and quantitative factors at the same decision process. In this study, an application of selecting the supplier which has minimum information content among the alternative supplier firms by a hierarchical supplier selection model which is designed based on the important criteria for decision maker has done based on the Information Axiom of AD. Since, all of the factors affecting supplier selection process cannot be denoted by numerical values or quantitatively, because of the nature of these factors, the evaluation of the factors belonging to firms has been done by utilizing triangular fuzzy numbers and Fuzzy AD. The effect of the range change of triangular fuzzy numbers on the solution is investigated. Besides, regarding that factors have presidency with respect to each other Weighted Fuzzy AD has been used for evaluation and results of Weighted Fuzzy AD and Fuzzy AD methods have been compared

Keywords: Supply chains, supplier selection, axiomatic design, fuzzy numbers

BULANIK BİLGİ AKSİYOMUNA DAYALI TEDARİKÇİ SEÇİMİ

Özet: Günümüz teknolojik gelişmeleri kapsamında küreselleşen pazarlar dikkate alındığında değişimlerin çok hızlı ve etkin olduğu, bu hızın ve değişimin taleplerde belirsizlikleri de beraberinde getirdiği görülmektedir. İşletmeler bu şartlarda önemli kararlar vermek zorunda kalmakta, bu kararların çoğunluğunu da stratejik açıdan önem taşıyan ve maliyet ilişkili kararlar oluşturmaktadır. Kaliteyi, maliyeti, müşteri memnuniyetini ve firmanın uzun vadede ayakta kalabilmesini etkileyen kararlardan birisi de tedarikçi seçim kararlarıdır ve bu kararların nesnel ve etkin olması gereklidir. Genel anlamda tedarikçi seçimi problemi karmaşık problemler sınıfında yer almaktadır. Bu çalışmada, araştırma-geliştirme faaliyetleri sonucu prototip ürün üretimi yapan bir firma için tedarikçi seçimi problemi ele alınmış ve problemin çözümünde Aksiyomatik Tasarım (AT, Axiomatic Design) yaklaşımı önerilmiştir. AT karar verme sürecinde problemlerin nicel ve nitel kriterler göz önüne alınarak çözüm geliştirilmesi gerektiğinde başvurulabilecek çok ölçütlü karar verme yöntemlerinden birisidir. Bu çalışmada AT'nin ikinci aksiyomu olan bilgi aksiyomuna dayalı olarak karar verici tarafından önem arz eden kriterler baz alınarak oluşturulan hiyerarşik bir tedarikçi seçim modeli kullanılarak alternatif tedarikçiler içerisinden en küçük bilgi içeriği değerine sahip tedarikçi firmanın seçimine ilişkin bir uygulama yapılmıştır. Tedarikçi seçim sürecini etkileyen kriterlerin bir kısmı doğaları gereği niceliksel olarak yani sayısal verilerle ifade edilemediğinden dolayı bu kriterlerin değerlendirilmesi üçgensel bulanık sayılarla gerçekleştirilmiş ve bulanık AT yöntemi kullanılmıştır. Üçgensel bulanık sayıların aralığının değişiminin çözüm üzerindeki etkisi de incelenmiştir. Ayrıca kriterlerin kendi içlerinde önceliklerinin olduğu durum da göz önünde bulundurularak ağırlıklı bulanık AT kullanılmış ve bulanık AT yönteminin sonuçları ile karşılaştırılmıştır.

Anahtar Sözcükler: Tedarik zinciri, tedarikçi seçimi, aksiyomatik tasarım, bulanık sayılar.

Giriş

Günümüz sürekli değişen ve gelişen rekabetçi piyasa şartları, organizasyonların yapısını müşteri isteklerinin çok kısa zaman zarfında değişim göstermesine karşı hızlı tepki vermeye ve bu istekleri karşılamaya yönelik çözümler üretmeye uygun olacak şekilde düzenlemeye zorlamaktadır. Organizasyonlarda söz konusu çetin rekabet ortamında karlılığın arttırılarak devam ettirilmesine yönelik fonksiyonel, nitelikli ve farklı tasarımlara sahip ürünleri üretebilmesine olanak sağlayacak esnekliğin mevcut olması gerekmektedir. Bu esnekliğin sağlanmasında hammaddenin tedarik edilmesinden nihai ürünün müşteriye sevk ve teslim edilmesine kadar süreç içerisinde rol alan malzeme ve bilgi akışlarının kontrol ve idaresini kapsayan tedarik zincirinin etkin yönetilmesi esastır.

Tedarik Zincirinin en önemli elemanlarından biri olan tedarikçilerin, işletmenin belirlediği stratejilere uygun ve hedeflere ulaştırıcı nitelikte olması önemli hususlardan biridir. Bu nedenle tedarikçilerin seçilmesi tedarik zincirinin yönetilmesinde en çok zorlanılan kısım olarak görülebilir. Tedarik zincirinin rekabet gücünün artması, tedarikçinin iyi yönetilen ve iyi tasarlanmış bir tedarik zincirine dahil olması ile gerçekleşir. Doğru tedarikçiyi seçme problemi kurulacak etkin bir tedarik zinciri için en önemli konulardan biri haline gelir. Literatüre bakıldığında tedarikçi seçim problemi için yöneylem araştırmasının konusu olan birçok yöntemin kullanıldığı görülmekte, bazıları tek başına kullanılabilirken bazı durumlarda da beraberce kullanıldığı ve daha etkin çözümler arandığı görülmektedir. Tedarikçi seçiminin etkin ve efektif yapılabilmesi için birçok kriterin aynı anda değerlendirilmesi gerekmektedir. Ve bilindiği üzere bu kriterler çoğu zaman birbirleriyle çelişmekte, problemi daha karmaşık hale getirerek çözüm yollarının farklılaşmasına neden olmaktadır.

Bu çalışma kapsamında tedarikçi seçim probleminde hem nitel hem de nicel faktörlerin birlikte kullanılabilmesine olanak sağlayan birçok kriterli karar verme yöntemi olarak Nam Pyo Suh tarafından geliştirilen Aksiyomatik Tasarım (AT)'ın ikinci aksiyomu olan Bilgi Aksiyomu kullanılarak kriterler için belirlenmiş aralıkların hem sayısal hem de dilsel değişkenlerle ifade edildiği durum göz önüne alınmıştır.

Yöntem

Öncelikle tedarikçi firma seçim sürecini etkileyen kriterlerin belirlenmesi gerçekleşmiştir. Konu ile ilgili firma içinden vakum odası gereksinimi belirleme konusunda bilgili ve tecrübe sahibi aynı zamanda bu vakum odasında sistem ve modül seviyesinde ortam testleri yapacak yetkinlikte uzman mühendislerden oluşan ekip ile birlikte çalışılmıştır. Yapılan çalışma sonucunda tedarikçi firma seçimini etkileyen en önemli kriterler 5 ana başlık altında toparlanmış ve bu ana başlıklar 19 alt kriter seviyesinde detaylı olarak ayrıştırılmıştır. Tablo 1 ile verilen tedarikçi seçiminde kullanılan kriterlerin yıllara göre kullanım oranlarına (Tayyar ve Arslan, 2013) bakılarak; Coğrafi Konum, Karşılıklı Düzenlemeler (Sözleşme Şartlarının Kabulü), Esneklik (Sistem Esnekliği), Güvenilirlik (Sistem Güvenilirliği), Onarım Servisleri, Piyasa İtibarı, İş Yapma İsteği, Teknik Kabiliyet (Teknik Yeterlilik), Fiyat (Birim Fiyat), Kalite, Kalite Standartları, Teslimat (Teslim Süresi), Taahhüt (Zamanında Teslimat), Garanti ve Alacak Politikaları (Garanti Süresi), Uzun Vadeli Bir İlişki kriterleri bu çalışma kapsamına uygun olarak görülmüş ve kullanılmıştır. Bu çalışmada ele alınan kriterlere ilave olarak, seçilecek cihaz ve firmalara özgü, teknik gereksinimlerden yola çıkılarak Bakım Maliyeti, Operasyonel Vakum Seviyesi, Hacim, Elektrik Tüketimi, Teknoloji Seviyesi, Cryo Pompaların Kalitesi seçim kriteri olarak belirlenmiştir.

Tablo 1. Kriterlerin yıllar itibariyle kullanılma oranları (% olarak)

Kriterler	1966-1990(74) Weber vd.	1990-2001(36) Cheraghi vd.	2000-2008(78) Ho vd.	2000-2011(46) Thiruchelvam vd.
Kalite	54	79	87	80
Teslimat	60	77	82	78
Performans Geçmişi	10	10		22
Garanti ve Alacak Politikaları	1	0		11
Üretim Tesisi ve Kapasitesi	31	26	50	44
Fiyat	82	67	81	80
Teknik Kabiliyet	20	28	32	52
Finansal Durum	10	18	30	37
Prosedüre Uyum	3	5		0
İletişim Sistemi	3	10		15
Piyasa İtibarı	11	3	19	17
İş Yapma İsteği	1	0		4
Yönetim Organizasyon	14	18	32	48
Operasyon Kontrol	4	0		0
Onarım Servisleri	10	28	45	24
Davranış-Tutum	8	13		13
İzlenim	3	5		9

Tablo 1. Kriterlerin yıllar itibariyle kullanılma oranları (% olarak) (devam)

Kriterler	1966-1990(74) Weber vd.	1990-2001(36) Cheraghi vd.	2000-2008(78) Ho vd.	2000-2011(46) Thiruchelvam vd.
Paketleme Yeteneği	3	0		9
İşçi-İşveren İlişkileri Kaydı	2	3	4	13
Coğrafi Konum	16	5		26
Geçmiş İş Miktarı	1	0		4
Eğitim Yardımları	2	0		0
Karşılıklı Düzenlemeler	2	5		0
Güvenilirlik		Yeni		24
Tutarlılık		Yeni		
Stok Maliyetleri		Yeni		
Kültür		Yeni		
Esneklik		Yeni	23	41
Kalite standartları		Yeni		
Süreç İyileştirme		Yeni		26
Ürün Geliştirme		Yeni	31	41
Çevresel ve Sosyal Sorumluluk*			4	20
İş Sağlığı ve Güvenliği		Yeni	4	9
Bütünlük		Yeni		11
Profesyonellik		Yeni		9
Tam Zamanında Üretim		Yeni		11
Taahhüt*				20
Ekonominin durumu *				2
Uzun vadeli bir ilişki		Yeni		9
Siyasi durum *				4
Risk			4	

* Thiruchelvam ve Tookey (2011) literatüre ekledikleri yeni kriterlerdir.

Aksiyomatik Tasarım ve Prensipleri

Aksiyomatik Tasarım; Suh tarafından geliştirilen ve ürünler, sistemler ve süreçler için tasarım alanını bilimsel hale getiren bir tasarım yöntemidir (Suh, 1990). Suh, tasarımı tanımlarken iki sorunun etkileşiminden faydalanır: "neyi gerçekleştirmek istiyoruz" ve "nasıl gerçekleştirebiliriz" (Suh, 2001).

Tasarımlar için bilimsel bir temel oluşturmak ve tasarımcıyı mantıklı düşünce süreçleri ve araçları ile destekleyerek tasarım faaliyetlerini geliştirmek aksiyomlarla tasarım yönteminin temel amacıdır. Tasarım aksiyomlarının varlığı aksiyomlarla tasarım içindeki en önemli kavramdır. Ürün tasarımlarının oluşturulmasında ve kurulan çözüm alternatiflerinin en iyisinin seçiminde oransal bir temel sağlayan iki tasarım aksiyomu bulunmaktadır (Suh, 2001) . Bu aksiyomlar aşağıdaki gibidir:

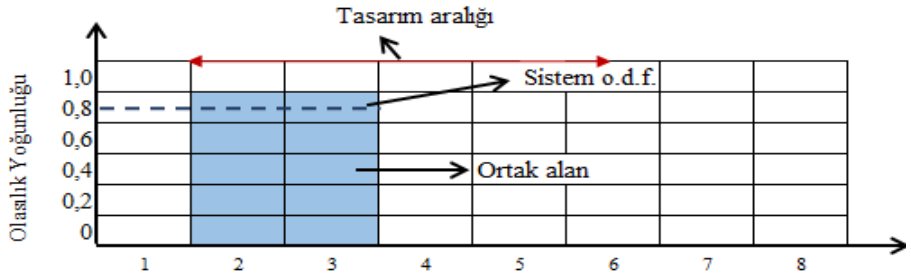
Aksiyom 1 (Bağımsızlık Aksiyomu): Fonksiyonel ihtiyaçların bağımsızlığını devam ettirmek. Fonksiyonel gereksinimler ile tasarım parametreleri arasındaki bağımsızlık ilişkisini tanımlamaktadır. Kabul edilebilir bir tasarımda, bir tasarım parametresi (DP) diğer fonksiyonel ihtiyaçları (*Fİ*) etkilemeden ilgili fonksiyonel ihtiyacı sağlamak için düzenlenebilir.

Aksiyom 2 (Bilgi Aksiyomu): Bilgi içeriğinin minimize edilmesi. Alternatif tasarımlardan Bağımsızlık Aksiyomunu sağlayan en iyi tasarım minimum bilgi içeriğine sahiptir. Bilgi aksiyomu, karar verme sürecinde birden çok seçeneğin bulunduğu durumlarda kullanılmaktadır (Suh, 2001).

Bilgi içeriği I, verilen bir fonksiyonel ihtiyaç (*Fİ*)'yi sağlama olasılığı ile tanımlanır. Eğer verilen bir *Fİ*' yi sağlama başarısının olasılığı *p* ise, olasılıkla ilgili bilgi içeriği *I,* Eş.1 ile ifade edilir:

$$I_i = \log_2\left(\frac{1}{p_i}\right) \qquad (1)$$

Şekil 1'de bir *Fİ*'nin sistem olasılık dağılım fonksiyonu uniform olduğunda, tasarımcının belirlediği "tasarım aralığı" ve sistemin gerçekleştirdiği "sistem aralığı"nın kesiştiği bölgenin kabul edilebilir çözümün bulunduğu alan olduğu görülmektedir.



Şekil 1. Tasarım aralığı, sistem aralığı, ortak aralık ve Fİ'nin sistem olasılık dağılım fonksiyonu

Sistem olasılık dağılım fonksiyonu uniform olduğu durumda *Fİ*'nin gerçekleşme olasılığı Eş.2 ile hesaplanır (Kulak & Kahraman, 2005):

$$p_i = \frac{ortakaralık}{sistemaralığı} \qquad (2)$$

Eş.2'den hareketle bilgi içeriği şu şekilde hesaplanır:

$$I_i = \log_2\left(\frac{sistemaralığı}{ortakaralık}\right) \qquad (3)$$

Bulanık Aksiyomatik Tasarım (AT) ile Tedarikçi Seçimi

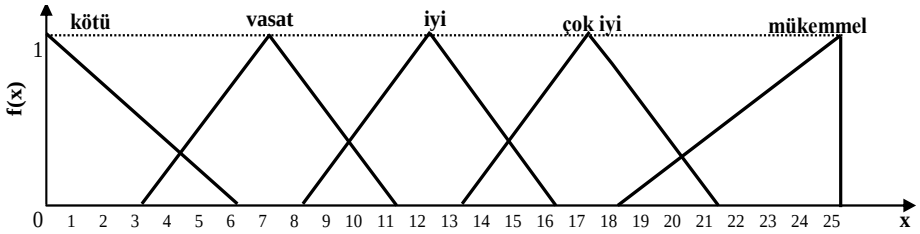
Aksiyomatik Tasarım uygulamasında Bilgi Aksiyomu kullanılmadan önce Bağımsızlık Aksiyomunun sağlandığının teyit edilmesi gerekir. Bu çalışmada alternatifler için sağlanması gerekli olan fonksiyonel ihtiyaçlar, yani belirlenen ve kullanılan kriterler birbirinden bağımsızdır. Her bir alternatifin sahip olduğu bilgi içeriğinin hesaplanabilmesi için fonksiyonel ihtiyaçların (Fİ) tasarım aralıklarının belirlenmesi gerekir. Bu amaçla firmadaki ilgili kişilerle birlikte yapılan çalışma sonucunda fonksiyonel ihtiyaçlar için belirlenen tasarım aralıkları (kısıtlar) ve tedarikçi firmaların gerçekleştirdikleri sistem aralıkları aşağıda Tablo 2'de verilmiştir:

Tablo 2. Firmanın belirlediği tasarım aralığı ve tedarikçilerin sistem aralık verisi

No	Kriterler (Fİ)	Birim	Firma İsteği	AN	JO	AS	TE
	Maliyet		Tasarım Aralığı	Sistem Aralığı			
1	1.1.Fiyat	Euro(10^4)	51-60	49-55	57-63	55-62	52-58
	1.2.Bakım Maliyeti	Euro(10^3)	29-41	30-33	40-45	38-41	39-42
	Teknik Yeterlilik						
	2.1.Kalite Standartları	Dilsel	(18,21,24)	Çok İyi	Mükemmel	Çok İyi	Mükemmel
	2.2.Operasyonel Vakum	Torr(10^-	1000-1075	975-1100	1025-1125	975-1125	975-1150
	2.3.Hacim	Dm^3	1 800-2 200	1700-1950	1900-2100	2100-2300	2050-2200
2	2.4.Elektrik Tüketimi	Kwh	55-72	52-58	65-72	58-64	70-78
	2.5.Teknoloji Seviyesi	Dilsel	(16,19,24)	Çok İyi	Mükemmel	Çok İyi	Çok İyi
	2.6.Sistem Esnekliği	Dilsel	(14,19,24)	Mükemmel	Çok İyi	Çok İyi	İyi
	2.7.Sistem Güvenilirliği	Dilsel	(15,19,23)	Çok İyi	Mükemmel	İyi	İyi
	2.8.Cryo Pompaların kalitesi	Dilsel	(17,20,25)	Mükemmel	Çok İyi	Mükemmel	Çok İyi
	Bakım Onarım						
3	3.1.Garanti Süresi	Ay	24-30	20-28	24-30	24-36	18-26
	3.2.Onarım Servisleri	Dilsel	(14,18,22)	Çok İyi	Mükemmel	Mükemmel	İyi
	3.3.Coğrafi Konum	Km	1800-3000	1900-2100	2900-3200	2600-2800	2800-3100
	Teslimat						
4	4.1.Zamanında Teslimat	Dilsel	(10,12,17)	Vasat	Çok İyi	İyi	Çok İyi
	4.2.Teslimat Süresi	Hafta	26-36	28-32	34-38	25-29	29-33
	İş İlişkileri						
	5.1.Uzun Vadeli Bir İlişki	Dilsel	(15,19,22)	Mükemmel	Çok İyi	Çok İyi	Çok İyi
5	5.2.Sözleşme Şartlarının	Dilsel	(11,15,19)	İyi	Çok İyi	Çok İyi	Çok İyi
	5.3.İş Yapma İsteği	Dilsel	(10,15,20)	Mükemmel	Mükemmel	Vasat	Çok İyi
	5.4.Piyasa İtibarı	Dilsel	(11,20,25)	İyi	Mükemmel	İyi	Mükemmel

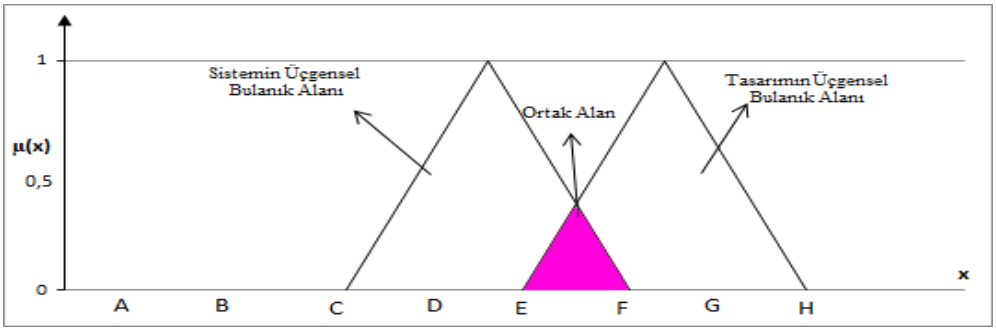
Tablo 2'de de görüldüğü gibi, bazı kriterler sayısal olarak ifade edilemediği için dilsel değişkenler kullanılmıştır. Bu kriterlerin sayısal verilere dönüştürülmesi için Şekil 4.2'de verilen dilsel değişkenlerin üyelik fonksiyonları kullanılmıştır. Buna göre; bir firma "kötü" ile ifade diliyorsa (0,0,6) değerini, "vasat" ile ifade ediliyorsa (3,7,11)

değerini, "iyi" ile ifade ediliyorsa (8,12,16) değerini, "çok iyi" ile ifade ediliyorsa (13,17,21) değerini, mükemmel ile ifade ediliyorsa (18,25,25) değerini alacaktır (Özel, 2008).



Şekil.2. Sayısal olmayan kriterler için üçgensel bulanık sayılar

Bulanık Aksiyomatik Tasarımda aralık değerleri dilsel olarak verildiğinde olasılık yoğunluk fonksiyonunun belirli olduğu durumda üçgensel ya da yamuksal bulanık üyelik fonksiyonları kullanılır. Dolayısıyla ortak alan, üçgensel ya da yamuksal bulanık sayıların kesiştiği bölgedir. Şekil 2'de görüldüğü gibi, ortak alan sistem aralığının bulanık üçgensel alanı ile tasarım aralığının bulanık üçgensel alanın arasındaki kesişim bölgesidir (Kulak & Kahraman, 2005).



Şekil 2. Sistem ve tasarım aralıklarının ortak alanı

Buradan hareketle bilgi içeriği Eş.4 ile hesaplanır (Suh, 2001):

$$I = \log_2\left(\frac{\text{Sistem tasarımının üçgensel bulanık alanı}}{\text{Ortak alan}}\right) \qquad (4)$$

Önceki bölümde bilgi içerikleri hesaplanırken her kriterin ağırlığı eşit olarak kabul edilmiştir. Ancak her bir kriter farklı bir ağırlık değerine (w_j) sahip olduğunda bilgi içeriklerini hesaplamak için mevcut formülasyonlara ek olarak Eş.5'de verilen ifade kullanılır ve bu yapı "Ağırlıklı Bulanık Aksiyomatik Tasarım" yaklaşımı olarak adlandırılır (Kulak & Kahraman, 2005).

$$I_{ij} = \begin{cases} \left[\log_2\left(\frac{1}{p_{ij}}\right)\right]^{1/wj}, & 0 \le I_{ij} < 1 \\ \left[\log_2\left(\frac{1}{p_{ij}}\right)\right]^{wj}, & I_{ij} > 1 \\ w_j, & I_{ij} = 1 \end{cases} \qquad (5)$$

Tedarikçi Firmanın Seçimi

Bulanık Aksiyomatik Tasarım yöntemi kullanılarak maliyet, teknik yeterlilik, bakım onarım, teslimat ve iş ilişkileri ana kriterleri ve bunların alt kriterleri göz önüne alınarak her dört firma için yapılan değerlendirmeler sonucu Tablo 3' de verilmiştir.

Tablo 3. Toplam bilgi içeriğine göre sıralama

	AN	JO	AS	TE
Toplam Bilgi İçeriği	26,658	23,941	26,300	29,098
Sıralama	3	1	2	4

Tablo 3 ile verilen sonuçlar incelendiğinde minimum toplam bilgi içeriği değerinin 23,941 olduğu ve bu değeri JO firmasının sağladığı görülür ve minimum bilgi içeriğine göre JO firması seçilir.

Ağırlıklı Bulanık Aksiyomatik Tasarım ile Tedarikçi Seçimi

Karar verme aşamasında kullanılan kriterler her zaman eşit dereceye ve öneme sahip olamayabilir. Önem derecelerinin birbirinden farklı olduğu durumlarda Ağırlıklı Bulanık Aksiyomatik Tasarım yaklaşımından faydalanılabilir. Bu yaklaşımda kriterlerin ağırlık değerlerinin belirlenmesi yapılması gereken ilk iştir. Kriterlerin ağırlık değerleri işin uzmanlarından görüş alınarak Tablo 4'deki gibi belirlenmiştir:

Tablo 4. Fonksiyonel ihtiyaçlar için ağırlık değerleri

FONKSİYONEL İHTİYAÇLAR	AĞIRLIK F_i	FONKSİYONEL İHTİYAÇLAR	AĞIRLIK F_{ij}
1 Maliyet	0,32	1.1.Fiyat	0,70
		1.2 Bakım Maliyeti	0,30
2 Teknik Yeterlilik	0,26	2.1 Kalite Standartları	0,05
		2.2 Operasyonel Vakum Seviyesi	0,16
		2.3 Hacim	0,10
		2.4 Elektrik Tüketimi	0,05
		2.5 Teknoloji Seviyesi	0,10
		2.6 Sistem Esnekliği	0,15
		2.7 Sistem Güvenilirliği	0,14
		2.8 Cryo Pompaların Kalitesi	0,25
3 Bakım Onarım	0,12	3.1 Garanti Süresi	0,30
		3.2 Onarım Servisleri	0,45
		3.3 Coğrafi Konum	0,25
4 Teslimat	0,18	4.1 Zamanında Teslimat	0,45
		4.2 Teslimat Süresi	0,55
5 İş İlişkileri	0,12	5.1 Uzun Vadeli Bir İlişki	0,15
		5.2 Sözleşme Şartlarının Kabulü	0,47
		5.3 İş Yapma İsteği	0,18
		5.4 Piyasa İtibarı	0,20

Tablo 5. Ağırlıklı bilgi içeriğine göre sıralama

	AN	JO	AS	TE
Toplam Ağırlıklı Bilgi İçeriği	8,48	8,71	6,42	9,42
Sıralama	2	3	1	4

Tablo 5 ile verilen sonuçlar incelendiğinde toplam ağırlıklı minimum bilgi içeriği değerinin 6,42 ile AS firması tarafından sağlandığı görülür ve minimum ağırlıklı bilgi içeriğine göre AS firması seçilir.

Duyarlılık Analizi

Seçilen dilsel değişken değerlerinin değişiminin ulaşılan sonuç üzerinde etkili olup olmadığının kontrol edilmesi amacıyla çalışmaya esas olarak literatürden alınan bulanık dilsel değişken değerleri değiştirilmiştir. Merkez değer sabit tutularak alt sınır değer 2 birim azaltılarak ve üst sınır değeri 2 birim artırılarak "Çok İyi" için (13,17,21) değerleri (11,17,23) değerlerine ve "Mükemmel" için (18,25,25) değerleri (16,27,27) değerlerine dönüştürülmüştür ve bu dilsel değerler için yeniden hesaplamalar yapılmış, bu hesaplamaların sonucu Tablo 6 ile aşağıda verilmiştir.

Tablo 6. Duyarlılık analizi sonrası firmalara göre toplam bilgi içeriği

	AN	JO	AS	TE
Toplam Bilgi İçeriği	26,118	24,306	26,335	30,275
Sıralama	2	1	3	4

Tablo 6 ile verilen duyarlılık analizi sonucuna göre yapılan hesaplamalar sonucu elde edilen toplam bilgi içerikleri incelendiğinde en düşük bilgi içeriğine sahip firma 24,306 değeri ile JO firmasıdır ve ilk sıradaki yerini korumuştur.

Tablo 7. Duyarlılık analizi sonrası ağırlıklı toplam bilgi içerikleri

	AN	JO	AS	TE
Ağırlıklı Toplam Bilgi İçeriği	9,51	11,23	7,93	11,94
Sıralama	2	3	1	4

Tablo 7 ile verilen duyarlılık analizi sonucuna göre yapılan hesaplamalar sonucu elde edilen toplam bilgi içerikleri incelendiğinde en düşük bilgi içeriğine sahip firma 7,93 değeri ile AS firmasıdır ve ilk sıradaki yerini korumuştur.

Sonuç

Bu çalışmada bulanık dilsel değişken aralıklarının değişiminin ulaşılan sonuç üzerinde bir etkisinin olup olmadığı Çok İyi ve Mükemmel dilsel değişkenlerinin alt ve üst sınır değerleri ± 2 birim değiştirilerek kontrol edilmiş, yapılan hesaplamalar sonucunda bu değişimin çözüm üzerinde anlamlı bir etkisinin olmadığı görülmüştür. Firmaların önceliği büyük olan fonksiyonel ihtiyaçlar (kriter) için bilgi içeriği değerleri ne kadar küçük ise, kriterlerin önceliklendirildiği durumda hesaplanan bilgi içeriği değerlerinin de o kadar küçüldüğü görülmektedir. Bu sonuçtan yola çıkıldığında, kriter ağırlıkları sonuç üzerinde önemli bir etkiye sahiptir.

Öneriler

Geliştirilen hiyerarşik tedarikçi seçim yönteminin, nicel ve nitel kriterlerin bir arada değerlendirilebilmesini ve tasarımcının kısıtlarını dikkate almasını sağlayan Bulanık Bilgi Aksiyomu yönteminin daha büyük boyutlu ve karmaşık yapıda olan seçim problemlerine uygulanması mümkündür. Manüel hesap yapılmasının çözüm zamanı açısından bir dezavantaj olduğu düşünülmektedir. Sistematik bir şekilde sonuç üreten bilgisayar yazılımı geliştirilmesi önerilmektedir. Bu sayede daha hassas, daha doğru, kesin ve daha kısa sürede sonuçlar alınabilecek, işletmeler için her türlü seçim probleminde başvurulabilecek, duyarlılık analizi de yapılabilecek bir araç olacaktır. Sonraki çalışmalar için Ekonominin Durumu, Siyasi Durum ve Risk gibi sosyo-ekonomik ve politik kriterlerin toplu durum dalgalanmalarında tedarikçi seçimi yapılabilmesi için başvurulması gereken kriterler olduğu da görülmektedir.

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A MATHEMATICAL MODEL - INTEGRATED WITH AHP FOR SHELF SYSTEMS SELECTION AND SETTLEMENT

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Abstract: Increasing competition has driven businesses to work efficiently. Reduction of total production times for products, minimization of costs, and delivery of products to customers faster and more securely must also address the objectives. In this study, a study has been carried out in order to store materials for the raw material warehouse which is one of the most important part of an operation in Ankara in a more accurate and secure manner, to carry out material handling activities more efficiently and to shorten the delivery times. Prior to the study, the products were classified and alternative shelf systems for outstanding products were examined. The Analytical Hierarchy Process is used to decide the appropriate shelf type. A mathematical model has been developed for placing the shelf type products considering the space requirements. The model is solved with the GAMS package program. The results are evaluated.

Keywords: Shelf systems selection , AHP, shelf settlement

RAF SİSTEMLERİNİN SEÇİMİ VE YERLEŞİMİ İÇİN AHP İLE ENTEGRE EDİLMİŞ MATEMATİKSEL BİR MODEL

Özet: Günümüzde rekabetin artması işletmeleri verimli çalışmaya itmiştir. Ürünler için toplam üretim zamanlarının azaltılması, maliyetlerin minimizasyonu ürünlerin müşterilere daha hızlı ve güvenli bir şekilde ulaştırılması gibi amaçları da ele almak zorundalar. Bu çalışmada Ankara da faaliyetlerine devam eden bir işletmenin en önemli bölümlerinden olan hammadde depo için malzemelerin daha doğru ve güvenli bir şekilde depolanması, malzeme elleçleme faaliyetlerinin daha etkin bir şekilde gerçekleştirilmesi ve sevkiyat sürelerinin kısaltılması amacıyla bir çalışma yapılmıştır. Çalışmada önce ürünler sınıflandırılmış ve öne çıkan ürünler için alternatif raf sistemleri incelenmiştir. Uygun raf tipine karar verebilmek için Analitik Hiyerarşi Prosesin den yararlanılmıştır.Seçilen raf tipine ürünlerin, yer ihtiyaçları dikkate alınarak yerleştirilebilmesi için Bir matematiksel model geliştirilmiştir. Model GAMS paket programı ile çözülmüştür. Ulaşılan sonuçlar değerlendirilmiştir.

Anahtar Kelimeler: Shelf systems selection , AHP, shelf settlement

Giriş

Günümüz de işletmeler iyi bir müşteri hizmet seviyesini yakalayabilmek için bir çok yönteme başvurmaktadır. Depolama da müşteriye istediği ürününü zamanında teslim etmek için başvurulan yöntemlerden birisidir. Depolama ile mallar güvenli bir şekilde saklanabilir ve ihtiyaç olduğunda kısa sürede teslim edilebilir. Her hangi bir ürünün 'kalite ve fiyat' dışında önem taşıyan iki özelliği daha vardır. Bu özellikler 'fayda ve bulunabilme' dir. Depolama ve dağıtım sistemlerinin uygulanmasının ve işletilmesinin bir çok açıdan fayda sağlar bunler;

1. Lojistik performansı en uygun hale getirilmesi
2. Üretkenliğin artırılması
3. Taşıma maliyetlerinin azaltması
4. Gereken ve teslim edilen miktarların dengelemesi
5. Pazardaki konumu iyi hale getirilmesi
6. Depolamayı etkin gerçekleştirmek
7. Malzeme akışının en etkin şekilde yönetimi

Depolamada farklı Depo Operasyonları sözkonusudur. Bunlar Çapraz sevkiyat (Cross docking), Doğrudan akış (Flowthru), Depo sahasında istifleme (Put away)dir.

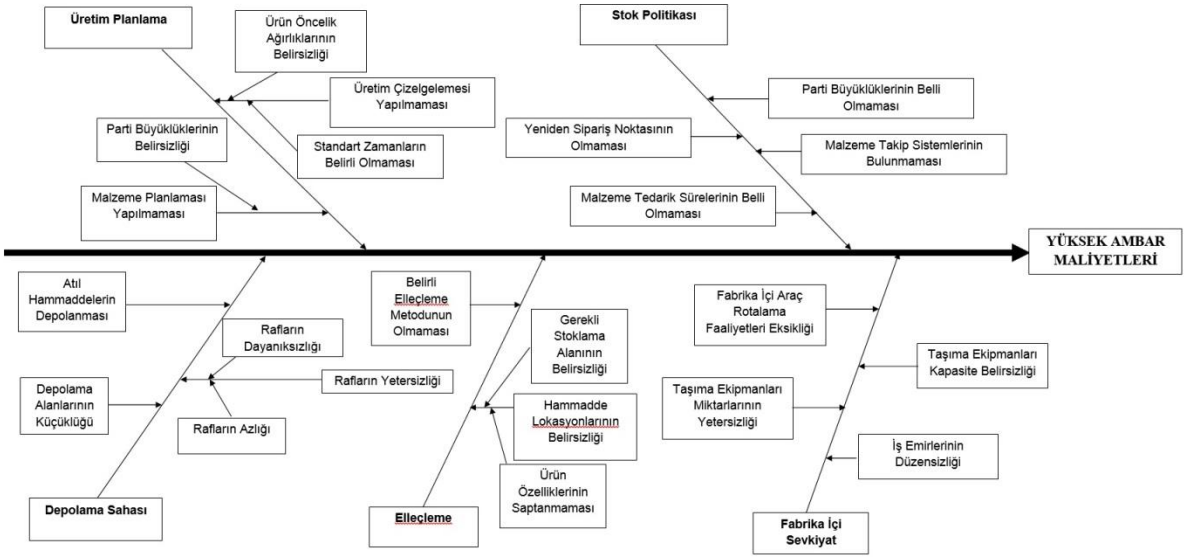
Ürünler depo sahasına ulaştıktan sonra başlayan operasyon süreçler Ürün giriş süreçleri dir. Bunlar mal kabul süreçleri ve yerleştirme süreçleri olmak üzere iki alt süreçtenmeydana gelmektedir. Bu süreç içerisinde; sayım, kontrol, yeniden etiketleme,paketleme ve paletleme gibi işlemler yürütülmektedir.

Ürün yerleştirme süreçleri için birden fazla güzergâh optimizasyon yöntemi mevcuttur. Bunlardan en çok kullanılan yöntem, stok devir hızlarının ve istifleme aracının belirlenen ürünün bulunduğu rafa birim zamanda uğrama sıklığının belirlenmesi ile uygulanır. Bu yöntem için kullanılan en yaygın metodoloji ABC analizidir. A grubu ürünler çıkış noktalarına en yakın, B grubu ürünler daha uzak, C grubu ürünler ise en uzak bölgedeki raflarda depolanmalıdır (Görçün, 2013: 201).

Bu çalışma kapsamında hammadde depo için malzemelerin daha doğru ve güvenli bir şekilde depolanması, malzeme elleçleme faaliyetlerinin daha etkin bir şekilde gerçekleştirilmesi ve sevkiyat sürelerinin kısaltılması amacıyla etkileşimli bir çalışama yapılmıştır.

Yöntem

Öncelikle Hammadde depodaki problemin tanımlanabilmesi için ana problem yüksekambar maliyeti olarak ele alınmış ve balık kılçığı diyagramı çizilerek analiz yapılmıştır. Çizilen balık kılçığı diyagramına bakıldığında problemin beş ana başlıktan oluştuğu görülmektedir. Bunlar üretim planlamanın olmaması, stok politikalarının belirsizliği, depo sahalarının yetersizliği, malzeme elleçleme süreçlerinin ve fabrika içi sevkiyat faaliyetlerinin uzun ve verimsiz olmasıdır. Fabrikada etkili bir üretim çizelgeleme ve malzeme planlama faaliyeti yürütülmemektedir. İşletmede parti büyüklüklerinin, standart zamanların, ürün önceliklerinin belirsiz olması, çizelgeleme ve planlama faaliyetleri nin yapılmasını imkansız kılmaktadır. Firmada parti büyüklüklerinin, yeniden sipariş noktasının ve malzemelerin tedarik süreleri belirsizdir. Ayrıca malzeme takip sistemi yetersizdir. Bu sebeplerden dolayı stok kontrolü etkin bir şekilde yürütülememektedir. Bunların dışındaki depolama sahalarının yetersizliği, malzeme elleçleme süreçlerinin ve fabrika içi sevkiyat süreçlerinin verimsizdir.



Şekil.1. Balık kılçığı diyagramı

Depo raflarının etkin kullanılıp kullanılmadığını gözlemlemek amacıyla hammadde depodaki hacimsel kullanım oranı hesaplanmıştır. Ürünlerin hacimleri en, boy ve yükseklikleri kullanılarak hesaplanmış ve miktarlarıyla çarpılarak kapladıkları hacimler elde edilmiştir. Rafların kullanılmaya müsait hacimleri de ölçülerek hacimsel kullanım oranı hesaplamıştır.

Tablo 1. Hacimsel kullanımlar

Toplam Raf Hacmi (cm^3)	**350414269,5**
Toplam Ürün Hacmi (cm^3)	503044050,2
Hacimsel Kullanım Oranı	%143.557

Bu değerlendirme sonucunda

- ✓ Hacimsel kullanım oranı %100 ü aşmaktadır.
- ✓ Depolama için mevcut olan raf hacminden fazlasına ihtiyaç duyulduğu görülmüştür..

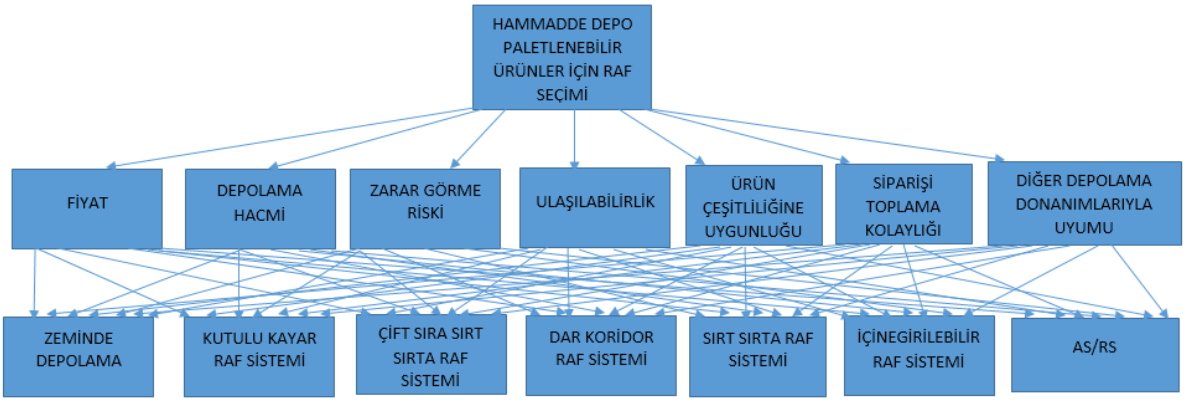
Hammadde depoda tutulan ürünlerin firmanın yıllık stok harcamaları üzerinde nasıl bir etkiye sahip olduğunu tespit edebilmek için bir stok yönetim tekniği olan ABC analizi kullanılmıştır. ABC analizi her parça için yıllık toplam harcamalarını baz alarak pareto prensibi ile sınıflandırma yapan bir tekniktir. A sınıfında yer alan parçalar miktar olarak küçük olmasına rağmen yıllık toplam maliyet üzerindeki etkisi büyüktür.

Fabrikadan alıaylık stok miktarları ve ürünlerin birim maliyetleri çarpılarak ay bazında toplam stok maliyetleri bulunmuş ve daha sonra bunlar yıllık maliyetlere çevrilmiştir. tablo 2. de sunulmuştur.

Tablo2. ABC analizi

ÜRÜN ADI	MALİYET	KÜMÜLATİF MALİYET	KÜMÜLATİF % MALİYET	MİKTAR	KÜMÜLATİF MİKTAR	KÜMÜLATİF % MİKTAR
Döner Tablalı Baba Koltuğu Mekanizması	685580,62	685580,6214	6,774459128	15078	15078	0,0268689
Hettich Kısmı Açılımlı Pimli Frenli Ray (400 mm 25 HD Quadro 9105628 Sağ)	261702,84	947283,4566	9,360435315	50460	65538	0,116788297
Hettich Kısmı Açılımlı Pimli Frenli Ray (400 mm 25 HD Quadro 9105627 Sol)	261323,03	1208606,487	11,94265852	50386	115924	0,206575827
Titus Rafix (Nikelajlı) (06457)	256251,77	1464858,257	14,47477085	425890	541814	0,965509084
Döşemelik Kumaş Lizbon Deri Kırmızı	238752,18	1703610,439	16,8339637	19109,5	560923,5	0,999562091
Döşemelik Kumaş Lizbon Deri Gri	171603,72	1875214,156	18,52963934	13735	574658,5	1,024037773
Hettich Set Silent System Flexibel (Sürme Kapak Stop Mekanizması) Kod: 9082552	169010,83	2044224,983	20,19969375	4193	578851,5	1,031509672
Döşemelik Kumaş Lizbon Deri Kahverengi	168253,96	2212478,944	21,86226931	13478	592329,5	1,055527382
Minifix Çelik Çektirme 18 mm	167149,15	2379628,096	23,51392786	3846688	4439017,5	7,910300803
Hettich Silent System Flexible Aparatsız Yavaşlatıcı Kod:9140968	166341,86	2545969,952	25,15760925	4165	4443182,5	7,917722807
Yandan Açılımlı Masa Rayı	158939,19	2704909,137	26,72814229	4215	4447397,5	7,92523391
40 cm'lik Kısmı Açılımlı Frenli Ray (SmartSlide) Dübelli	151191,99	2856101,127	28,22212261	16335	4463732,5	7,954342775
Compact Düşer Kapak Pistonu L: 244+Braket (HD-15)	132293,74	2988394,864	29,52936275	4136	4467868,5	7,961713101
Düz Menteşe (Hettich 9071205)	131326,63	3119721,489	30,82704653	41218	4509086,5	8,035163313
Siro Dark Brown Plaka (2600x1000x1mm Arkası Bandlı)	127800,62	3247522,112	32,08988867	539	4509625,5	8,036123808
Minifix Vida 18 mm	121632,72	3369154,83	33,29178361	3335028	7844653,5	13,97912238
Döşemelik Kumaş Gazelle Dino 423 (Flokser)	118513,64	3487668,474	34,4628579	5184,8	7849838,3	13,98836166
Ayarlı Baza Elemanı Galvanizli Metal (Mepa)	112115,16	3599783,639	35,5707066	42582	7892420,3	14,06424251
Array 35 cm Teleskopik Ray En:35 mm	101650,55	3701434,192	36,57515085	20657	7913077,3	14,10105316
Hettich Kısmı Açılımlı Pimli Frenli Ray (450 mm 25 HD Quadro 9105630 Sağ)	100468,76	3801902,949	37,56791737	18624	7931701,3	14,134241
Hettich Kısmı Açılımlı Pimli Frenli Ray (450 mm 25 HD Quadro 9105629 Sol)	100220,91	3902123,856	38,5582348	18573	7950274,3	14,16733797
Fauna Masa Köşe Bağlantı Sacı (90x90)	97092,532	3999216,387	39,51763967	24007	7974281,3	14,21011829
Masaj Kiti	92655,71	4091872,097	40,43320277	4525	7978806,3	14,21818181
Döşemelik Kumaş Visage Deri Krem	87610,962	4179483,059	41,29891697	8278,58	7987084,88	14,23293419
Hettich Bilyeli Ray KA 270/400 Kod:1005969	87105,895	4266588,955	42,15964044	21253	8008337,88	14,2708069

Bu analiz sonucunda paletlenebilir ve uzun ürünler için raf seçimi çalışması yürütülmüştür. Paletlenebilir ve uzun ürünler için raf seçimi çalışması yürütülürken kriterler ve alternatiflerin ikili karşılaştırılmasına dayanan Analitik Hiyerarşi Prosesi (AHP) kullanılmıştır.



Şekil 2. İlişkiler matrisi

Ahp sonucunda yapılan değerlendirmede
farklı ürün grupları için farklı raf sistemi kullanılması gerektiğine karar verilmişitr.Ulaşılan sonuçlar. aşağıdaki tabloda verilmiştir.

Tablo3. Raf sistemleri seçimi

	RAF SİSTEMLERİ
Paletlenebilir Ürünler için	KUTULU KAYAR RAF SİSTEMİ
Uzun Ürünler için	KONSOL KOLLU RAF SİSTEMİ
Hırdavat Grubu için	MEVCUT RAF SİSTEMİ

Hammadde depo için raf sistemi ihtiyacının belirlenebilmesi amacıyla öncelikle her üründen ne kadar stoklanacağı adanmış stok politikasıyla belirlenmiştir.Bunun için her ürünün bir önceki yıla ait 11 aylık stok miktarları toplanmış ve her ürünün stok miktarı en yüksek aya göre belirlenmiştir. Her ürün için gerekli lokasyon sayısı maksimum stok miktarları bir lokasyona yerleştirilecek ürün sayısına bölünerek bulunmuştur

Rafların Depoya Yerleştirilmesi ve Ürünlerin raflara atanması için matematiksel bir model kurulmuş ve çözümü GAMS'te kodlanarak yapılmıştır. Depoda var olan tüm ürünler ve lokasyonlar için değil 48 örnek lokasyon ve 10 örnek ürün alınarak yapılmıştır. Alınan örnek ürünler daha önce yapılmış olan ABC analizinin A ve B grubunda bulunan ürünlerdir.

Tablo 4. Ürünlerin raflara atanması / model çözümü

146	147	148	149	150	296	297	298	299	300
141	142	143	144	145	291	292	293	294	295
136	137	138	139	140	286	287	288	289	290
131	132	133	134	135	281	282	283	284	285
126	127	128	129	130	276	277	278	279	280
121	122	123	124	125	271	272	273	274	275
116	117	118	119	120	266	267	268	269	270
111	112	113	114	115	261	262	263	264	265
106	107	108	109	110	256	257	258	259	260
101	102	103	104	105	251	252	253	254	255
96	97	98	99	100	246	247	248	249	250
91	92	93	94	95	241	242	243	244	245
86	87	88	89	90	236	237	238	239	240
81	82	83	84	85	231	232	233	234	235
76	77	78	79	80	226	227	228	229	230
71	72	73	74	75	221	222	223	224	225
66	67	68	69	70	216	217	218	219	220
61	62	63	64	65	211	212	213	214	215
56	57	58	59	60	206	207	208	209	210
51	52	53	54	55	201	202	203	204	205
46	47	48	49	50	196	197	198	199	200
41	42	43	44	45	191	192	193	194	195
36	37	38	39	40	186	187	188	189	190
31	32	33	34	35	181	182	183	184	185
26	27	28	29	30	176	177	178	179	180
21	22	23	24	25	171	172	173	174	175
16	17	18	19	20	166	167	168	169	170
11	12	13	14	15	161	162	163	164	165
6	7	8	9	10	156	157	158	159	160
1	2	3	4	5	151	152	153	154	155

ÜRÜNLER
1
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Sonuç

Bu çalışmada malzeme elleçleme sürelerinin azaltılması, depo alan kullanımının arttırılması, ürünlerin raflara daha etkin bir şekilde depolanması, depolama maliyetlerinin azaltılması, malzemelerin daha güvenli şartlarda depolanması amaçlanmıştır ve yapılmış olan raf seçimi, rafların depoya yerleştirilmesi ve ürünlerin raflara atanması çalışmalarıyla bu amaçlara ulaşılmaya çalışılmıştır.

Öneriler

Geliştirilen Matematiksel model işletme genelini kapsayacak şekilde ele alınıp, modelin çözümünde sezgisel yaklaşımlardan yararlanılabilir.

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THE PERFORMANCE OF 3 DIFFERENT CLASSIFIER ON CLASSIFICATION OF WEBKB DATASET

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Abstract: In this study, an application related to text classification which is from the subordinate branches of pattern definition. The pattern recognition, text classification and operations performed from the components of the work are explained in detail.There are 2 data sets named webkb_train and webkb_test for the application.Of these data sets, webkb_train consists of 2803 lines and webkb_test 1396 lines. These documents have been tested with Naïve Bayes, Bayes and J48 classifiers.

Keywords: Text classification, webkb dataset, classification

WEBKB VERISETININ SINIFLANDIRILMASINDA 3 FARKLI SINIFLANDIRICININ PERFORMANSI

Özet: Bu çalışmada örüntü tanımanın alt çalışma kollarından olan metin sınıflandırma ile ilgili yapılan bir uygulamadır. Çalışmanın bileşenlerinden olan örüntü tanıma, metin sınıflandırma ve yapılan işlemler ayrıntılı olarak açıklanmıştır. Uygulama için webkb_train ve webkb_test adında 2 tane veri seti bulunmaktadır. Bu veri setlerinden webkb_train 2803 satırdan, webkb_test 1396 satırdan oluşmaktadır. Bu dokümanlar Naïve Bayes, Bayes ve J48 sınıflandırıcıları ile test edilmiştir.

Anahtar Kelimeler: Örüntü, metin sınıflandırma, sınıflandırma

Giriş

Örüntü (pattern): ölçülebilen, gözlenebilen, tekrar edebilen ortak düzenli yapı veya benzerlikleri olan bir örnekler kümesidir. Örüntü olarak isimlendirilen olay nesne veya süreçler gürültü veya bozulmalar içerebilir.

Örüntü teriminin bir başka tanımı ise olay veya nesnelerin düzenli bir biçimde birbirini takip ederek gelişmesidir. Gerçek dünyadaki bu örüntüler, genellikle ilgilenilen verilerin nicel tanımlama şekilleridir.

Örüntü tanıma, aralarında ortak özellik bulunan ve aralarında bir ilişki kurulabilen karmaşık işaret örneklerini veya nesneleri bazı tespit edilmiş özellikler veya karakterler vasıtası ile tanımlama veya sınıflandırmadır. Bu bağlamda, örüntü tanımanın en önemli amaçları; bilinmeyen örüntü sınıflarına belirli bir şekil vermek ve bilinen bir sınıfa ait olan örüntüyü teşhis etmektir.
Örüntü tanıma çeşitli kaynaklarda şu şekilde tanımlanmaktadır: Fiziksel objelerin veya olayların önceden belirlenmiş bir veya daha fazla kategoriye ayrılmasıdır (Duda and Hart). Çok boyutlu uzayda yoğunluk fonksiyonunun tahmini veya bu uzayı kategori veya sınıflara ayırma problemidir (Fukunaga). Ölçülen verilerin tanımlanması veya sınıflandırılması(tanıma) ile uğraşan bilim (Schalkoff).
Örüntü tanıma teknikleri birçok mühendislik, tıp ve askeri alanda kullanılmaktadır.

Örüntü Tanıma Uygulamaları

Savunma sanayinde,
Tıp biliminde,
Trafikte,
Konuşma tanıma teknolojilerinde
Metalürjide sert metallerin otomatik derecelendirilmesinde,
Jeolojide sismik hareketlerin incelenmesinde ve deprem tahmininde,

El yazısı, parmak izi, yüz tanıma uygulamalarında,
Uydu resimlerinin yorumlanmasında,
Ses tanıma
EEG sınıflama
DTMF haberleşme işaretlerini tanıma ve radar hedef sınıflama,
Biyomedikal kontrol
Veri madenciliği

Örüntü tanıma olarak bilinen bu uygulamalar, makine öğrenmesi, örüntü sınıflandırma, ayrım analizi ve nitelik tahmini gibi isimlerle de anılmaktadır. Örüntü tanıma temel olarak üç aşamadan oluşmaktadır.

1. Algılayıcılar ve Ön İşlemler: Algılayıcılar, herhangi bir anda mümkün olan birçok doğal durumlardan biri olabilen bazı fiziksel işlemleri ölçerler. Örüntünün (nesne, olay, süreç, İşaret veya görüntü) algılandığı, İşaret veya görüntünün filtre edildiği, çeşitli dönüşüm ve gösterim teknikleri ile işlendiği, bileşenlerine ayrıldığı veya modellendiği kısımdır.

2. Özellik Çıkarma: İşaret ve görüntünün veri boyutunun indirgendiği ve tanımlayıcı anahtar özelliklerinin tespit edildiği ve aynı zamanda normalizasyona tabi tutulduğu aşamadır. Sistemin başarımında en etkili rolü oynar.

3. Sınıflandırma: Çıkarılan özellik kümesinin indirgendiği ve formüle edildiği tanımlayıcı karar aşamasıdır. Sınıflandırıcının rolü örüntüyü özelliklerine göre kategorize ederek uygun sınıflara kaydetmektir.

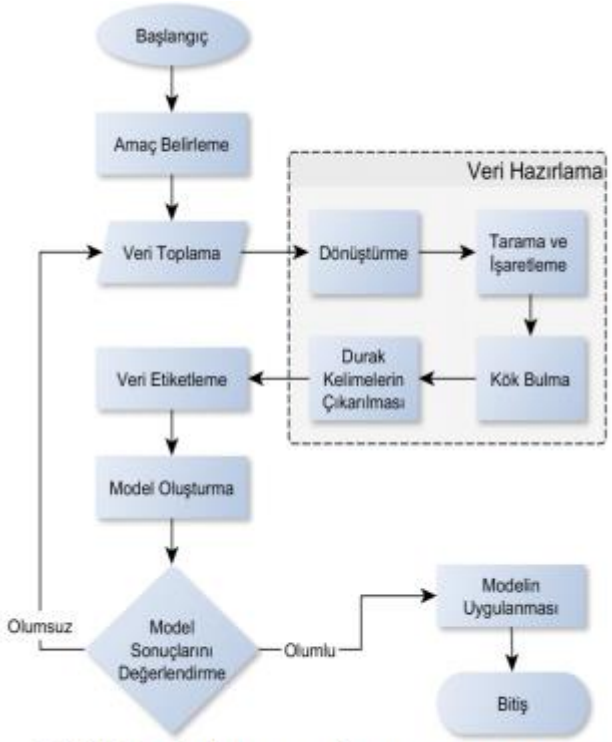
Metin Siniflandirma

Sınıflandırmanın amacı yeni bir nesnenin özelliklerini açıklamak ve bu yeni nesnenin daha önceden tanımlanmış sınıf setlerinden birine atamasını yapmaktır. Günümüzde metin sınıflandırma çok çeşitli alanlarda uygulanmaktadır. Bunlardan bazıları şunlardır: Metin bulup getirme ve kütüphane organizasyonu gibi alanlarda destek sağlayan "dokümanlara sınıf ataması yapmak", sınıfları insanların atadığı uygulamalarda "sınıf atamasında yardımcı rol oynamak", mesajları, haberleri ve diğer metin dizisi halindeki bilgileri alıcılara ulaştırmak", doğal dil işleme sistemlerinin bir parçası olarak; "ilgisiz metinleri ve metin parçalarını filtrelemek", "metinleri, sınıf bazlı işleme mekanizmalarına yönlendirmek" veya "sınırlı şekillerde bilgi edinimini sağlamak", "sözcük analizi işlerinde yardımcı olmak (sözcük belirsizliğini giderme gibi)" vb.

Günümüze kadar metin sınıflandırmada birçok yöntem kullanılmıştır. Bu yöntemlerden bazıları şunlardır: K-EnYakın-Komşu sınıflandırması (k-NN), Naïve Bayes olasılıklı sınıflandırma, Karar Ağaçları, Yapay Sinir Ağları, Destek Vektörleri. Bunların yanında birden fazla yöntemin bir arada kullanılıp sonuçlarının karşılaştırmasının yapıldığı çalışmalar da olmuştur.

Bu çalışmada iyi sonuçlar verdiği gözlemlenen denetimli öğrenme algoritmalarından J48, Bayes ve Naïve Bayes sınıflandırma yöntemleri kullanılmıştır. Denetimli öğrenmede sonuçlar eldeki bir kısım verinin eğitilmesiyle elde edilir.

Metin sınıflandırma süreci iki aşamadan oluşur:
1. Eğitim süreci (öğrenme kümesi – training)
2. Sınıflandırma süreci (deneme kümesi – test)
Eğitim sürecinde hangi sınıfa ait olduğu bilinen ve veri tabanından rastgele seçilen bir kısım veri (öğrenme kümesi - training set) eğitilerek bir model oluşturulur. Sınıflandırma sürecindeyse yine veri tabanından seçilen ve öğrenme kümesinde yer almayan (deneme kümesi- test set) veriler ile uygulanır. Metin sınıflandırma süreci Şekil1'de gösterilmiştir.



Şekil 1. Sınıflandırma aşamaları (Classification phases)

Metin Gösterimi

Dokümanları sınıflandırmaya başlamadan önce, metin formatının düzgün ve kullanılmaya hazır olduğundan emin olmak için dokümanların bazı işlemlerden geçmesi gerekmektedir. Bu işlemler sırasıyla açıklanmıştır.

Veri Ön İşleme (Data Preprocessing)

Veri ön işlemede başlangıç dokümanının eğitim ve sınıflandırma süreçlerine hazırlanması sağlanır. Veri ön işleme veri üzerinde bulunabilen problemleri çözmek, verinin doğal yapısını öğrenerek daha anlamlı ve kaliteli analiz yapabilmek ve veriden daha anlamlı bilgi üretebilmek gibi amaçlar için yapılır. Veri ön işleme adımlarından sonra metin bir diziye aktarılır. Veri ön işleme adımları sırasıyla açıklanmıştır.
1) Dönüştürme: İnternette dokümanlar genellikle HTML, XML gibi çeşitli tiplerde tutulduğundan bunları düz metin haline dönüştürmek gerekmektedir. Bu aşamada metinler HTML ve XML etiketlerden temizlenir.
2) Tarama ve İşaretleme: Bu adım, metin içindeki terimleri ayıklamak için yapılır. Metin simgeler ya da noktalama işaretleri ile kelime ya da ifadelere ayrılır ardından küçük harfe çevrilir.
3) Durak Kelimelerin Çıkarılması: Metin içerisinde çok sık geçen fakat sınıflandırmada bir anlam ifade etmeyen edat, bağlaç ve zamir gibi kelimeler metinden çıkartılır.
4) Kök Bulma: Aynı kökten gelen farklı ek almış kelimelerin doküman içerisindeki kelime sıklıklarına bakılırken aynı kelime olarak algılanması için köklerinin bulunması gerekmektedir.

Anahtar Kelimelerin Oluşturulması (Forming the Keywords)

Dokümanlar arasında kıyaslama yapabilmek için anahtar kelimelerden oluşan bir sözlüğe ihtiyaç duyulmaktadır. Anahtar kelime sözlüğü iki şekilde oluşturulur:
i. Belirli kelimelerin seçilmesi. Burada dikkat edilmesi gereken, anahtar kelimelerin sınıflara özel olarak, kendisini diğer sınıflardan ayıracak şekilde seçilmeye çalışılmasıdır. Anahtar kelimeler o konunun uzmanları ile görüşülerek belirlenirse nispeten daha sağlıklı sonuçlar elde edilebilir.
ii. Metinde geçen tüm kelimelerin seçilmesi. Bu iki yöntemde de kelimeler statik olarak seçilmiş olmaktadır. Bu çalışmada kelimeleri dinamik olarak seçmek, kullanıcının yanlış / eksik kelime seçmesini engellemek ve tüm kelimeleri alarak çok boyutlu bir uzayda çalışmayı engellemek amacıyla farklı bir yöntem ile oluşturuldu. Bu yöntem uygulama bölümünde anlatılacaktır.

Vektör Uzay Modeli (Vector Space Model)

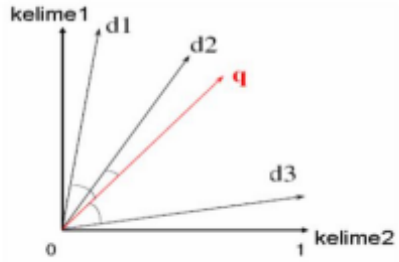
Vektör uzay modeli bilgi çıkarımı, bilgi filtreleme, indeksleme gibi alanlarda kullanılan matematiksel bir modeldir ve doğal dil belgelerinin çok boyutlu uzayda özel bir anlamını simgelemektedir. Metinleri vektörlerle olarak ifade edebilmek için öncelikle uzay eksenlerinin belirlenmesi gerekir. Uzay eksenleri o sınıfın belirleyici kelimelerinden oluşur.

Vektör uzay modelinde kelimeler ve dokümanlar i - j boyutlu bir uzayda gösterilir. Her bir boyut bir kelimeye karşılık gelmektedir. Bu şekilde her doküman bir vektör olarak gösterilebilir. Örnek bir Doküman-Kelime Tablosi Tablo 1'de gösterilmiştir. i incelenen kelime sayısıdır. j ise incelenen doküman sayısıdır (Tablo 1).

Tablo 1. Örnek doküman-kelime Tablosi
(Example document – word table)

	Kelime 1	**...**	**Kelime i**
Doküman 1	Kelime Sıklığı	…	Kelime Sıklığı
Doküman 2	Kelime Sıklığı	…	Kelime Sıklığı
...	Kelime Sıklığı	…	Kelime Sıklığı
Doküman j	Kelime Sıklığı	…	Kelime Sıklığı

Vektör uzay modelinde dokümanların nasıl göründüğü gösterilmiştir (Şekil 3).



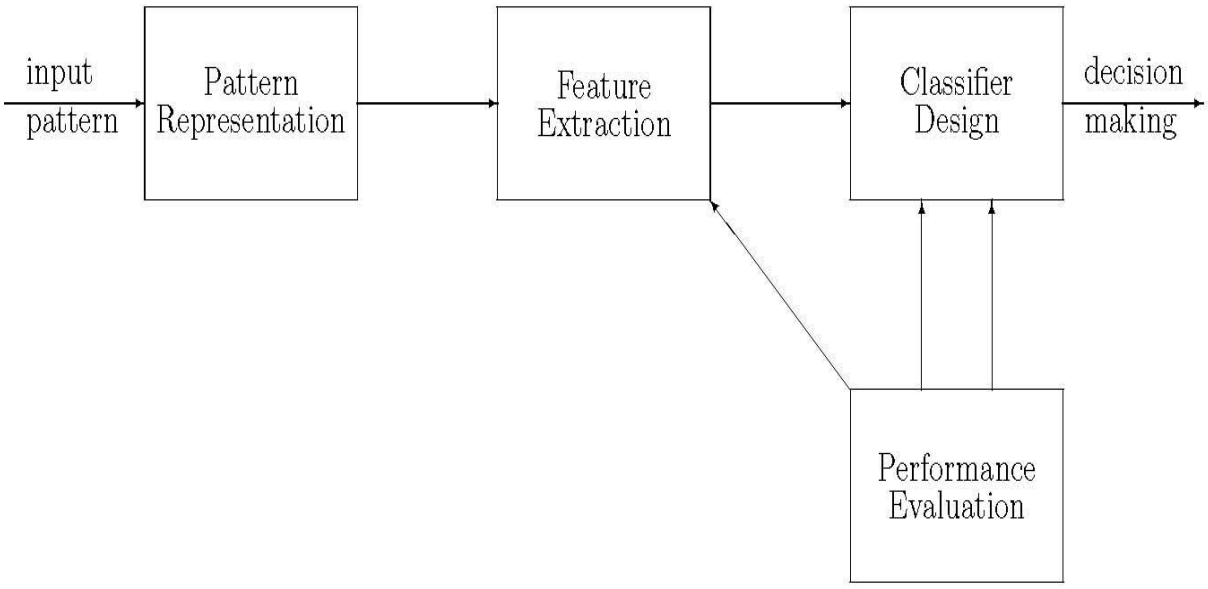
Şekil 3. Vektör uzay modelinde dokümanlar

Uygulama (Implementation)

Uygulama için webkb_train ve webkb_test adında 2 tane veri seti bulunmaktadır. Bu veri setlerinden webkb_train 2803 satırdan, webkb_test 1396 satırdan oluşmaktadır. Bu veri setlerindeki her satır aslında bir text dökümanıdır.

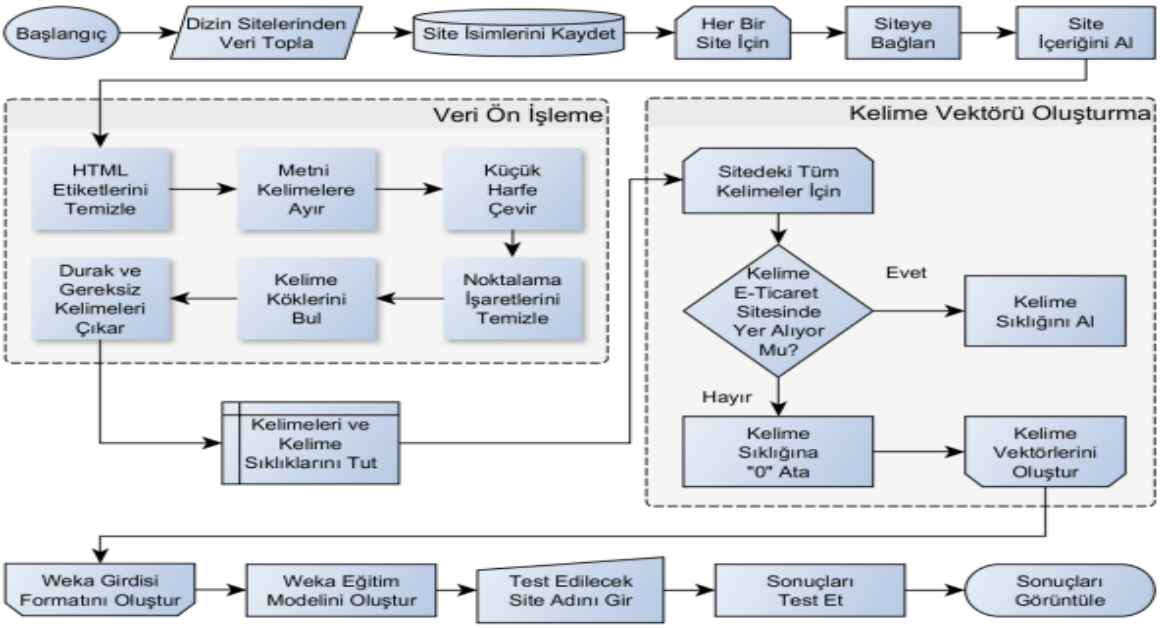
Her veriseti için bütün kelimeleri barındıran ve her dökümandaki frekansını gösteren bir vektör oluşturuldu(Java Programlama ile). Dökümanda bulunan her kelime bir feature olmuştur. Train seti için toplam 7200 civarında unique terimler oluşmuştur. Test seti için ise 4700 civarında unique terimler oluşmuştur.

Bütün oluşturulan bu unique terimler text dosyasının en üstüne olacak şekilde yazdırıldı. En sonunda ise class_id yazıldı. Her satırın hangi class a ait olduğunu belirtmek için. Daha sonra her satır için bütün terimlerin kontrolü yapılıp kaç defa geçtiyse frekanslarını aynı hizaya gelecek şekilde yazıldı. Ve bütün satırlar için frekans matris vektörü oluşturuldu.



Bu oluşturulan vektör .txt uzantılı dosyadan .csv uzantılı dosya haline çevrildi. Bunun sebebi ise sınıflandırma işlemini yapacağımız WEKA programının bu formatta çalışmasından dolayıdır.

Verisetlerini WEKA programına import ettikten sonra NaiveBayes, Bayes ve J48 sınıflandırıcıları ile sınıflandırma işlemlerini gerçekleştirdik.



Şekil 4. Uygulama iş akışı (Implementation workflow)

Tablo1. Eğitim seti için naivebayes sınıflandırıcı

```
=== Stratified cross-validation ===
=== Summary ===

Correctly Classified Instances        1794               64.4165 %
Incorrectly Classified Instances       991               35.5835 %
Kappa statistic                          0.4972
Mean absolute error                      0.1782
Root mean squared error                  0.4213
Relative absolute error                 50.0183 %
Root relative squared error             99.8232 %
Total Number of Instances             2785

=== Detailed Accuracy By Class ===

               TP Rate   FP Rate   Precision   Recall  F-Measure   ROC Area  Class
                 0.723     0.248      0.65      0.723     0.684      0.788    student
                 0.502     0.146      0.557     0.502     0.528      0.775    faculty
                 0.525     0.078      0.481     0.525     0.502      0.84     course
                 0.742     0.038      0.849     0.742     0.792      0.943    project
Weighted Avg.    0.644     0.153      0.649     0.644     0.645      0.825

=== Confusion Matrix ===

   a   b   c   d   <-- classified as
 784 183  78  40 |   a = student
 248 374  96  27 |   b = faculty
  63  81 176  15 |   c = course
 111  33  16 460 |   d = project
```

Tablo2. Test seti için naivebayes sınıflandırıcı

```
=== Evaluation on test split ===
=== Summary ===

Correctly Classified Instances         345               83.1325 %
Incorrectly Classified Instances        70               16.8675 %
Kappa statistic                          0.7583
Mean absolute error                      0.0862
Root mean squared error                  0.2675
Relative absolute error                 24.2458 %
Root relative squared error             63.6437 %
Total Number of Instances              415

=== Detailed Accuracy By Class ===

               TP Rate   FP Rate   Precision   Recall  F-Measure   ROC Area  Class
                 0.861     0.161      0.793     0.861     0.825      0.929    student
                 0.872     0          1         0.872     0.932      0.995    faculty
                 0.724     0.071      0.776     0.724     0.749      0.941    course
                 0.882     0.025      0.833     0.882     0.857      0.989    project
Weighted Avg.    0.831     0.088      0.836     0.831     0.832      0.953

=== Confusion Matrix ===

   a   b   c   d   <-- classified as
 149   0  20   4 |   a = student
   9  75   0   2 |   b = faculty
  26   0  76   3 |   c = course
   4   0   2  45 |   d = project
```

Tablo2. Test seti için J48 sınıflandırıcı

```
=== Evaluation on test split ===
=== Summary ===

Correctly Classified Instances         312               75.1807 %
Incorrectly Classified Instances       103               24.8193 %
Kappa statistic                          0.649
Mean absolute error                      0.1373
Root mean squared error                  0.3375
Relative absolute error                 38.6292 %
Root relative squared error             80.3128 %
Total Number of Instances              415

=== Detailed Accuracy By Class ===

               TP Rate   FP Rate   Precision   Recall  F-Measure   ROC Area  Class
                 0.798    0.136      0.807     0.798     0.802      0.85     student
                 0.791    0.052      0.8       0.791     0.795      0.881    faculty
                 0.724    0.081      0.752     0.724     0.738      0.824    course
                 0.588    0.077      0.517     0.588     0.55       0.803    project
Weighted Avg.    0.752    0.097      0.756     0.752     0.754      0.844

=== Confusion Matrix ===

   a   b   c   d   <-- classified as
 138   8   8  19 |   a = student
   4  68   9   5 |   b = faculty
  18   7  76   4 |   c = course
  11   2   8  30 |   d = project
```

Sonuçlar

Aynı veriseti üzerinde birden fazla sınıflandırıcının performansı test edilmiştir. Naïve Bayes sınıflandırıcının test seti üzerindeki başarımı diğer sınıflandırıcılardan daha yüksektir. Bir sonraki çalışmamızda farklı terim ağırlıklandırma şemalarını kullanarak bu metotların performansları test edilecektir.

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FORECASTING TURKEY'S ENERGY DEMAND USING CUCKOO SEARCH ALGORITHM

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Abstract: Energy demand forecasting is a major problem that has been resolved by policy makers to make important decisions influencing the economy of the country. Cuckoo Search Algorithm (CSA) is an optimization technique based on swarm intelligence which is used to solve numerical optimization problems developed recently. In this study, CSA is used in the estimation of long term energy demand in Turkey. Considering the relation between the increase of some economic indicators, and the increase in energy consumption in Turkey, two different equations are used for energy demand estimation, named as linear form and quadratic form. Long-term energy demand of Turkey from 2012 to 2025, GDP is estimated using Gross Domestic Product (GDP), imports, exports and population indicators. In order to demonstrate the success of the CSA for the energy demand problem, CSA is compared with other methods in the literature. Experimental results indicate that the proposed method is more successful than the other methods.

Keywords: Cuckoo search algorithm, optimization, energy demand, forecasting, Turkey

GUGUKKUŞU ARAMA ALGORİTMASINI KULLANARAK TÜRKİYE'NİN ENERJİ TALEP TAHMİNİ

Özet: Enerji talebi tahminleri, politika yapıcıları tarafından ülkenin ekonomisini etkileyen önemli kararları vermek üzere çözülen önemli bir problemdir. Gugukkuşu arama Algoritması (CSA) son zamanlarda geliştirilmiş sayısal optimizasyon problemlerinin çözümünde kullanılan sürü zekâsına dayalı bir optimizasyon tekniğidir. Bu çalışmada, Türkiye'de uzun vadeli enerji talebinin tahmininde CSA kullanılmıştır. Türkiye'de bazı ekonomik göstergelerin artışı ile enerji tüketimindeki artış arasındaki ilişki göz önüne alınarak, enerji talep tahmini için doğrusal form ve ikinci dereceden form olmak üzere iki farklı denklem kullanılmıştır. Türkiye'nin uzun vadeli enerji talebi 2012'den 2025 yılına kadar, CSA yöntemi sayesinde Gayri Safi Yurtiçi Hasıla (GSYH), ithalat, ihracat ve nüfus göstergeleri kullanılarak tahmin edilmiştir. CSA yönteminin enerji talebi sorununa yönelik başarısını göstermek için CSA yöntemi literatürde bulunan diğer yöntemlerle karşılaştırılmıştır. Sonuçlar önerilen CSA yönteminin diğer yöntemlerden daha başarılı olduğunu göstermiştir.

Anahtar Sözcükler: Gugukkuşu arama algoritması, optimizasyon, enerji talebi, tahmin, Türkiye

Giriş

Enerji, bir ülkenin ekonomik ve sosyal gelişiminde kritik bir rol oynamaktadır. Bu nedenle, enerji konularının tanımlanması ve analizi ve enerji politikası seçeneklerinin geliştirilmesi birinci derecede önemlidir (Dincer & Dost, 1996; Utlu & Hepbasli, 2006a). Enerji talebi tahmini, gelişmekte olan bir ülke için karar vericiler tarafından kullanılan en önemli politika araçlarından biridir. Güneybatı Asya'daki Anadolu yarımadasından Güneydoğu Avrupa'nın Balkan bölgesine uzanan bir Avrasya ülkesi olan Türkiye, gelişmekte olan bir ülkedir (Toksarı, 2007). İnsan yaşam kalitesini artırmak için herhangi bir stratejideki önemli bir bileşen olmanın yanısıra ekonomik büyümedeki önemli bir strateji olarak enerjinin önemi sürekli olarak artmaktadır. Enerji politikası gündemi 1973 ve 1979 petrol krizlerinden bugüne kadar belirgin bir şekilde değişmiştir (Utlu & Hepbasli, 2006b). Son on yılda Türkiye'nin yıllık ortalama gayri safi yurtiçi hâsıla (GSYH) 4.02 olduğunda, nüfusu son yirmi yılda yaklaşık %50 oranında artmıştır. Son yıllarda ihracata dayalı ithalatın oranı %62.3 düzeyindedir. Uzun vadede, bazı dönemlerde kararsız büyüme ve kalıcı enflasyona rağmen istikrarlı bir şekilde artan enerji arzıyla desteklenmesi gerekecek olan Türkiye ekonomisi güçlü bir şekilde planlanmaktadır (Haldenbilen & Ceylan, 2005).

Enerji tahmini, enerji üretimi ve tüketimi ile ilgilenen akademisyenler ve uygulayıcılar arasında dikkat çeken önemli konulardan birisidir (Sözen, Arcaklioğlu, & Özkaymak, 2005). Türkiye'de enerji talebi tahminine ilişkin

ilk uygulamalar Devlet Planlama Teşkilatı (DPT) tarafından basit regresyon teknikleri kullanılarak uygulanmıştır (Ünler, 2008). İlk olarak 1984 yılında Türkiye'nin gelecekteki enerji taleplerinin enerji planlaması ve tahmini için modern ekonometrik teknikler uygulanmıştır. Türkiye enerji talebi tahminlerini genel olarak değerlendirirken, bu çalışmalar her zaman enerji talebinin gerçekte olduğundan daha büyük olduğunu öngörmüştür (Kıran, Özceylan, Gündüz, & Paksoy, 2012). Bu politikalar, Türkiye'nin ithalata bağımlı olmasına ve dış etkilere karşı daha savunmasız olmasına sebep olurken ayrıca enerji pazarlarının serbestleşmesine de engel olmaktadır (Dilaver & Hunt, 2011). Dolayısıyla, enerji tüketimi ve gelir arasındaki ilişkiyi bulmak için doğrudan veya dolaylı olarak enerji geliştirme modelleriyle ilişkili matematik formülleri içeren çeşitli formları kullanarak birçok araştırmadan birçok model geliştirilmiştir (Cheng & Lai, 1997; Eden & Hwang, 1984; Gilland, 1988).

Günümüzde, mühendislik uygulamaları ile ilgili birçok problem, sezgisel yöntemler kullanılarak yeterli şekilde ele alınmıştır. Özellikle populasyon temelli sezgisel algoritmalar, çok noktalı prosedürler sayesinde oldukça hızlı sonuçlar üretebilir. Bu çalışmada, gerekli temel enerji arz talep miktarını doğru bir şekilde tahmin etmek için sürü zekâsına dayanan Guguk Kuşu Arama Algoritması (CSA) önerilmiştir. Bu çalışmada, hem doğrusal hem de kuadratik enerji tahmin modelleri için kullanılan CSA yönteminde, enerji talebi tahmini için giriş parametreleri olarak GSYH, nüfus ve ithalat ve ihracat verileri kullanılmıştır. Önerilen yöntemin tahmin başarısı ile literatürdeki diğer çalışmaların başarısı karşılaştırıldığında, CSA yönteminin en başarılı tahminlerden birini sağladığı görülmüştür. Türkiye'nin enerji arzının birincil tutarı tahmini, önerilen senaryodan elde edilen değerler kullanarak gerçekleştirildi.

Guguk Kuşu Arama Algoritmasi

CSA, guguk kuşlarının doğal davranışlarından, özellikle de bazı guguk türlerinin zorunlu yavru parazitlik özelliklerinden olan yumurtalarını diğer kuşların yuvalarına yerleştirmeleri özelliğinden esinlenerek geliştirilen bir sürü zekâsı tabanlı bir algoritmadır (Yang & Deb, 2009) (Inderscience, 2010). Guguk kuşlarınının davranışını idealleştiren üç kural belirleyerek CSA yöntemi tanımlanmıştır.

1. Her bir guguk kuşu tarafından bir seferde bir yumurta verilir ve bu yumurta rastgele seçilen bir yuvaya bırakılır.
2. Yumurta kalitesi en iyi olan yuva sonraki iterasyona aktarılır.
3. Mevcut ev sahibi yuva sayısı sabittir ve bir kuş tarafından bırakılan yumurta p_a ihtimaline göre ev sahibi kuş tarafından bulunur.

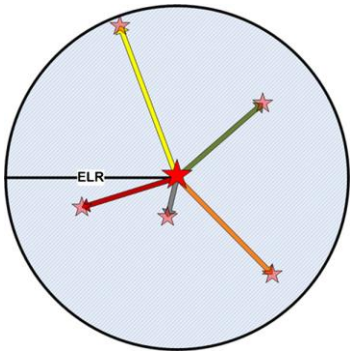
Bahsedilen kurallara ilişkin olarak, CSA aşağıdaki şekilde uygulanmıştır. Yuvadaki her yumurta bir aday çözümü ifade etmektedir. Her bir guguk kuşu, yalnızca bir yumurtayı orijinal haliyle bir yuvaya yerleştirebilir, ancak her yuvada genel olarak bir dizi çözümü temsil eden birden fazla yumurta bulunabilir. CSA'nın görevi, mevcut yuva populasyonundaki daha kötü çözümlerin yerini alacak yeni ve potansiyel olarak daha iyi çözümler üretmektir. Çözümlerin kalitesi, çözülmesi gereken problemin amaç fonksiyonu ile değerlendirilir.

Başlangıç Popülasyonun Oluşum Evresi

Herhangi bir optimizasyon problemini çözmek için, problem değişkenlerinin değerleri bir dizi olarak oluşturulması gerekir. CSA'da bu diziler habitat olarak isimlendirilir. N boyuta sahip bir optimizasyon probleminde, bir habitat, guguk kuşlarının şu anki mevcut pozisyonunu temsil eden $1xN_{var}$ isimli bir dizisi ile ifade edilmektedir.

Guguk Kuşunun Yumurtlama Evresi

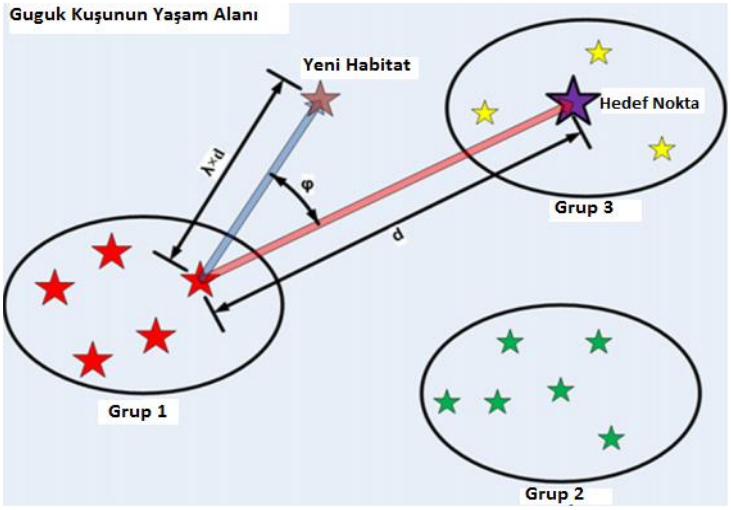
Yumurtalama işlemi, her bir guguk kuşu kendi yumurta bırakma yarıçapı (YBY) içerisine diğer bir kaç ev sahibi kuşun yuvalarında bulunan yumurtalarını rastgele bırakarak başlar. YBY içerisine bırakılan rastgele yumurta yuvaları Şekil 1'de gösterilmiştir.



Şekil 1. YBY içerisine bırakılan rastgele yumurta yuvaları (Rajabioun, 2011)

Guguk Kuşlarının Göç Etme Evresi

Genç guguk kuşları büyüyüp olgunlaştığı zaman, kendi habitatlarında ve toplumlarında ileri süreçte yaşarlar. Yumurta bırakma işlemi olacağında guguk kuşları ev sahibi kuşların yumurtalarına daha benzer yumurtalara sahip olan ve yeni genç kuşlar için daha fazla yemeğin olduğu daha iyi habitatlara göç ederler. Guguk kuşu grupları farklı alanlarda oluşturulduktan sonra, en iyi kazanç değerine (fitness) sahip toplum (grup) diğer guguk kuşlarının göç etmesi için hedef nokta olarak belirlenir. Yetişkin guguk kuşları her yerde yaşadıkları için hangi guguk kuşunun hangi gruba ait olduğunu tespit etmek zordur. Bu problemi çözmek için guguk kuşlarının gruplama işlemi *k-means* kümeleme yöntemi kullanılarak yapılır. Guguk kuşları grubu oluşturulduktan sonra ortalama kazanç değeri hesaplanır. Bu aşamadan sonra ortalama kazançların maksimum değeri hedef grup olarak belirlenir ve sonuç olarak grubun en iyi habitatı göç eden guguk kuşları için yeni hedef habitat olarak tespit edilir. Hedef noktaya doğru göç eden bir guguk kuşu örneği Şekil 2'de verilmiştir.



Şekil 2. Hedef noktaya doğru göç eden bir guguk kuşu örneği

En Kötü Habitattaki Guguk Kuşlarını Yok Etme Evresi

Guguk kuşü popülasyonunda sürekli bir denge olduğu gerçeğinden dolayı *Nmax* ifadesi çevredeki canlı guguk kuşlarının maksimum sayısını kontrol eder ve sınırlandırır. Bu denge yemek sınırlandırmasından kaynaklanmaktadır. Aynı zamanda yumurtalar için hazır yuvayı bulmada yaşanan yetersizlikten kaynaklanmaktadır. Bu yüzden sadece daha iyi kazanç değerine sahip *Nmax* sayıdaki guguk kuşu hayatta kalır ve diğer guguk kuşları habitattan çıkartılır.

Enerji Talep Tahmini Problemine Önerilen Yöntemin Uygulanmasi

Enerji talebi modelleri, literatürde belirtilen dört ekonomik kriter kullanılarak geliştirildi: GSYH, Nüfus, İthalat ve İhracat. Bu faktörlerin bir ülkenin enerji ihtiyacını belirleme üzerindeki en büyük etkisinin olduğuna inanılmakla birlikte, bu kriterlere ilişkin veriler CSA ile enerji talebi modelleri geliştirmek için kullanılmıştır. Tablo 1, 1979 ile 2011 yılları arasındaki Türkiye'nin GSYH, nüfus, ithalat ve ihracat verilerini ve enerji talep

değerini göstermektedir. Bu veriler Türkiye İstatistik Kurumu, Enerji ve Tabii Kaynaklar Bakanlığı (ETKB), Enerji Raporları ve daha önceki çalışmalardan elde edilmiştir (Eden & Hwang, 1984).

Tablo 1. 1979-2011 Yılları arasında türkiye'nin elektrik enerjisi tüketimi, GSYH, nüfus, ithalat ve ihracatı

Yıl	Elektrik Enerjisi Tüketimi (TWh)	GSYH ($ 10^9)	Nüfus (10^6)	İthalat ($ 10^9)	İhracat ($ 10^9)
1979	30.71	82	45.53	5.07	2.26
1980	31.97	68	44.44	7.91	2.91
1981	32.05	72	45.54	8.93	4.7
1982	34.39	64	46.69	8.84	5.75
1983	35.7	60	47.86	9.24	5.73
1984	37.43	59	49.07	10.76	7.13
1985	39.4	67	50.31	11.34	7.95
1986	42.47	75	51.43	11.1	7.46
1987	46.88	86	52.56	14.16	10.19
1988	47.91	90	53.72	14.34	11.66
1989	50.71	108	54.89	15.79	11.62
1990	52.98	151	56.1	22.3	12.96
1991	54.27	150	57.19	21.05	13.59
1992	56.68	158	58.25	22.87	14.72
1993	60.26	179	59.32	29.43	15.35
1994	59.12	132	60.42	23.27	18.11
1995	63.68	170	61.53	35.71	21.64
1996	69.86	184	62.67	43.63	23.22
1997	73.78	192	63.82	48.56	26.26
1998	74.71	207	65	45.92	26.97
1999	76.77	187	66.43	40.67	26.59
2000	80.5	200	67.42	54.5	27.78
2001	75.4	146	68.37	41.4	31.33
2002	78.33	181	69.3	51.55	36.06
2003	83.84	239	70.23	69.34	47.25
2004	87.82	299	71.15	97.54	63.17
2005	91.58	361	72.97	116.77	73.48
2006	99.59	483	72.97	139.58	85.54
2007	107.63	531	70.59	170.06	107.27
2008	106.27	648	71.13	201.96	132.03
2009	106.14	730	73.23	140.93	102.14
2010	109.27	615	74.47	185.54	113.88
2011	114.48	731	74.72	240.84	134.91

Tablo 1, Türkiye'nin sürekli gelişme sürecinde olduğunu ve ekonomik değerlerinin yıllar içinde arttığını göstermektedir. Dahası, tablodan ekonomik değerlerdeki artış ile enerji tüketimindeki artış arasında bir korelasyon olduğu sonucuna varılabilir. Bu korelasyon varsayılırsa, enerji talebi tahminleri doğrusal ve kuadratik olmak üzere iki farklı yoldan modellenmiştir. Bu formlar denklem 1 ve 2'de sırasıyla verilmiştir:

Dört değişkene ait doğrusal formu düzenleyen denklem şu şekilde yazılabilir:

$$Elinear = w1 + w2X1 + w3X2 + w4X3 + w5X4 \quad (1)$$

Dört değişkene ait quadratik form denklemi şu şekilde yazılabilir:

$$Equadratic = w1 + w2X1 + w3X2 + w4X3 + w5X4 + w6X1X2 + w7X1X3 + w8X1X4 + w9X2X3 + w10X2X4 + w11X3X4 + w12X1X1 + w13X2X2 + w14X3X3 + w15X4X4 \quad (2)$$

Enerji talebi tahmininin temel amacı, veriler için en uygun değerleri bulmaktır. (1) ve (2) denklemlerinde $X1$, $X2$, $X3$ ve $X4$ değerleri gerçek GSYH, nüfus, ithalat ve ihracat değerlerini göstermektedir. Verilen yıllarda en uygun enerji talebi tahminini yapabilecek ağırlık değerleri (w_i), sözü edilen bu değerlere göre hesaplanır. Kullanılan amaç fonksiyonu denklem 3'te gösterilmiştir.

$$\min f(v) = \sum_{i=1}^{r} (E_i^{observed} - E_i^{predicted})^2 \quad (3)$$

Burada $E_i^{observed}$ ve $E_i^{predicted}$ değerleri sırasıyla gerçek ve tahmini değerleri, r ise gözlem sayısını belirtir.

CSA Yönteminin Literatürdeki Diğer Modellerle Karşılaştırılması

CSA yönteminin enerji talebi sorununun çözümünde başarılı olup olmadığının gözlenmesi için, literatürde kullanılan diğer modellerle karşılaştırılmıştır. Önceki araştırmalarda, Toksari (Toksarı, 2007) tarafından ACO, Uguz (Uguz, 2015) tarafından ABCVSS, Unler (Ünler, 2008) tarafından PSO ve Kiran (Kıran et al., 2012) tarafından HAPE dahil olmak üzere farklı sezgisel algoritmalar, enerji talebi tahmin problemine uygulanmıştır. Önerilen modeli literatürdeki algoritmalara göre değerlendirmek ve karşılaştırmak için CSA'da diğer algoritmalardaki gibi 1979-2005 verileri Tablo 1'de verilmiştir. CSA algoritması için p_a değeri 0.2 olarak belirlenmiştir; popülasyon büyüklüğü 100, maksimum iterasyon sayısı 5000 olarak deneysel çalışmalar gerçekleştirilmiştir. Bu nedenle, maksimum fonksiyon değerlendirme sayısı (MaxFES) $5x10^5$ olarak belirlendi.

CSA, iki model için de 10 kez bağımsız şekilde çalıştırıldı. Elde edilen en iyi sonuçlar dikkate alındı. Doğrusal ve kuadratik formlar için ABCVSS, HAPE, ACO ve PSO algoritmalarının katsayıları ve hata değerleri Tablo 2 ve 3'te verilmiştir. Tablo 2, CSA yönteminin *w1* katsayısı dışında doğrusal formundaki katsayıların ABCVSS ve HAPE'ye çok benzer olduğunu fakat bağıl hata açısından CSA'nın en iyi sonuç elde ettiğini göstermektedir. Tablo 3, CSA yönteminin en düşük sapma değerlerine sahip olmasından dolayı, kuadratik formda CSA'nın ciddi ölçüde başarı elde ettiği görülmektedir.

Tablo 2. Lineer formda katsayıların ve bağıl hataların karşılaştırılması

Katsayılar	**CSA**	**ABCVSS**	**HAPE**	**ACO**	**PSO**
w1	-59.2238	-55.8991	-55.9091	-51.3046	-55.9022
w2	-0.0060	0.0038	0.0038	0.0124	0.0021
w3	1.9858	1.9123	1.9126	1.8102	1.9126
w4	0.4021	0.3735	0.3734	0.3524	0.3431
w5	-0.5120	-0.4835	-0.4833	-0.4439	-0.4240
Hata	**36.0720**	41.7120	41.7029	45.7239	42.6139

Tablo 3. Kuadratik formda katsayıların ve bağıl hataların karşılaştırılması

Katsayılar	**CSA**	**ABCVSS**	**HAPE**	**ACO**	**PSO**
w1	-52.7120	-97.1458	-43.3096	-96.4418	-96.4408
w2	-0.5850	-0.4834	0.1039	-0.4820	-0.4820
w3	2.7532	4.7674	1.8110	4.7370	4.7370
w4	1.9011	1.0991	-1.4778	1.0937	1.0937
w5	-1.4775	-2.9212	1.1174	-2.8935	-2.9350
w6	0.0178	0.0188	0.0025	0.0188	0.0188
w7	0.0153	0.0231	0.0112	0.0230	0.0230
w8	-0.0159	-0.0256	-0.0074	-0.0255	-0.0255
w9	-0.0587	-0.0627	0.0121	-0.0625	-0.0625
w10	0.0540	0.1020	-0.0030	0.1014	0.1014

w11	0.0268	0.0923	0.0158	0.0915	0.0915
w12	-0.0021	-0.0027	-0.0014	-0.0027	-0.0027
w13	-0.0228	-0.0469	-0.0070	-0.0466	-0.0466
w14	-0.0156	-0.0390	-0.0170	-0.0389	-0.0387
w15	-0.0121	-0.0658	-0.0104	-0.0651	-0.0651
Hata	**19.411**	19.537	20.539	27.947	27.664

Tablo 4, doğrusal ve kuadratik formlar için 1996 ile 2005 yılları arasında CSA yöntemi kullanılarak tahmin edilen enerji talebi değerlerini ve enerji talebini göstermektedir. Tablo 4 ayrıca, tahmini ve gözlemlenen değerler arasındaki sapma değeri ve bağıl hatayı göstermektedir. En yüksek sapma değeri doğrusal form için % -3.20 ve kuadratik form için % -1.73 olmasına rağmen, bu sapma oranları oldukça kabul edilebilir olarak düşünülmektedir.

Tablo 4. Önerilen modellerin 1996 ve 2005 yılları arasındaki enerji talebi tahminleri

Yıl	**Gözlenen Enerji Talebi**	**Tahmin Edilen Enerji Talebi**		**Hata**		**Bağıl Hata (%)**	
		Lineer CSAL	Kuadratik CSAQ	Lineer CSAL	Kuadratik CSAQ	Lineer CSAL	Kuadratik CSAQ
1996	69.86	69.78	70.18	-0.08	0.32	-0.12	0.45
1997	73.78	72.44	73.03	-1.34	-0.75	-1.82	-1.01
1998	74.71	73.27	74.46	-1.44	-0.25	-1.93	-0.34
1999	76.77	74.31	75.44	-2.46	-1.33	-3.20	-1.73
2000	80.5	81.15	80.60	0.65	0.10	0.81	0.13
2001	75.4	76.28	74.71	0.88	-0.69	1.16	-0.91
2002	78.33	79.57	79.46	1.24	1.13	1.59	1.44
2003	83.84	82.49	83.61	-1.35	-0.23	-1.60	-0.27
2004	87.82	87.15	87.57	-0.67	-0.25	-0.76	-0.28
2005	91.58	92.85	91.76	1.27	0.18	1.38	0.19

CSA Yöntemi Aracılığıyla 2012'den 2025 Yılına Kadar Enerji Talebinin Gelecekteki Projeksiyonları

Önerilen yöntemin başarısını literatürdeki diğer araştırmalara kıyasla kanıtladıktan sonra, Türkiye'nin enerji talebine ilişkin 2012 ve 2025 yılları arasındaki tahminler, 1979 ile 2011 yılları arasında güncellenmiş verileri kullanarak doğrusal ve kuadratik formlar için yeni katsayıları belirleyerek yapılmıştır. Bir önceki bölümde belirtildiği gibi parametre değerleri olduğu gibi alınmıştır, ancak tek fark veri aralığının 1979 ile 2011 yılları arasında güncellenmiş olması ve böylece daha yüksek miktarda verilerin kullanılması ile daha iyi tahminlerin yapılmasını sağlamak amaçlanmıştır.

CSA yöntemi, 1979 ile 2011 yılları arasındaki verileri kullanarak doğrusal ve kuadratik formlar için 10 kez gerçekleştirildi. Bulunan en iyi çözümlerin ağırlık değerleri ve hata oranları, denklem 4 ve 5'te sırasıyla verilmiştir.

E_{lineer}= -50.1348 + 0.0239X1 + 1.7576X2 + 0.1000X3 -0.0364X4
(4)
$f(v)_{linear}$ = 152.64113

Önerilen modelin kuadratik biçimi için katsayılar denklem 5'teki gibidir:

$E_{kuadratik}$=-40.3894 + 0.2724X1 + 0.9307X2 +2.6684X3
-3.0019X4 -0.0052X1X2 - 0.0045X1X3 +0.0128X1X4
(5)
- 0.0310X2X3 +0.0386X2X4 + 0.0835X3X4
-0.0004X1X1 + 0.0114X2X2 -0.0186X3X3 -0.1032X4X4

$f(v)_{\text{kuadratik}}$= 52.62081

2012-2025 yılları arasında Türkiye'nin enerji talebini tahmin etmek için güncellenmiş verilere göre bir senaryo hazırlanmıştır.

Bu senaryo; 2012-2025 yılları arasındaki dönemde GSYH'nin ortalama büyüme hızının % 4, nüfus artış hızı % 0.5, ithalat artış hızı % 2.5 ve ihracatın büyüme hızının % 3 olduğu varsayılmaktadır. Elde edilen sonuçlar ABCVSS yöntemiyle karşılaştırılmış ve Tablo 5'te verilmiştir.

Tablo 5. Önerilen yöntemin gelecek yıllardaki enerji talep tahmininin ABCVSS yöntemiyle karşılaştırılması

		CSA		**ABCVSS**	
Yıl	Gözlemlenen Enerji Talebi	Lineer	Kuadratik	Lineer	Kuadratik
2012	120.09	119.65	116.02	112.67	158.99
2013	120.29	121.50	117.47	114.26	164.80
2014	123.94	123.39	119.08	115.92	170.87
2015	N/A	125.34	120.88	117.65	177.19
2016	N/A	127.32	122.87	119.46	183.77
2017	N/A	129.36	125.10	121.34	190.63
2018	N/A	131.44	127.58	123.32	197.76
2019	N/A	133.57	130.33	125.38	205.18
2020	N/A	135.76	133.40	127.53	212.90
2021	N/A	138.00	136.80	129.78	220.91
2022	N/A	140.30	140.58	132.13	229.22
2023	N/A	142.65	144.78	134.59	237.84
2024	N/A	145.07	149.44	137.16	246.78
2025	N/A	147.55	154.59	139.85	256.02

Tablo 5'teki sonuçlar analiz edildiğinde, doğrusal formda CSA ve ABCVSS yöntemlerinin tahmin sonuçlarının birbirlerine yakın gibi gözükse de CSA yönteminin tahmin sonuçları 2012, 2013 ve 2014 yılları gözlenen enerji talebine değerine daha yakın ve gerçekçi bir değer olduğu görülmektedir. Kuadratik form için ise ABCVSS yöntemi tahmin başarısı CSA yöntemine göre daha çok yüksek çıkmıştır. Dolayısıyla, yıllara göre tahmin sonuçlarında belli oranda farklar gözlemlenmektedir. Veriler dikkatlice incelendiğinde, her yıl bir önceki yıla göre CSA ve ABCVSS yöntemleri arasındaki tahmin değerlerinin farkının daha da büyüdüğü görülecektir.

Sonuç

Bu çalışmada, Türkiye'nin uzun vadeli birincil enerji talebi CSA metodu kullanılarak tahmin edilmeye çalışılmıştır. 2012 ile 2025 yılları arasındaki enerji talebi, 1979 ile 2011 arasında alınan GSYH, nüfus, ithalat, ihracat değerlerini içeren 33 yıllık verileri kullanarak tahmin edilmiştir. Bu yöntem için doğrusal ve kuadratik formların katsayıları kullanılmış ve CSA yöntemi aracılığıyla tahminlemeyi en optimize edecek olan bu katsayıların (ağırlık) en uygun değerleri bulunmaya çalışılmıştır. Bu modelin geçerliliğini test etmek için 2012, 2013 ve 2014 yılları arasındaki enerji talebi değerleri kullanılmıştır. Ayrıca, tüm sonuçlar daha önceden belirlenen senaryo kullanılarak ETKB değerleri ile karşılaştırılmıştır. Önerilen yöntem literatürdeki diğer yöntemlerle de karşılaştırılmış ve CSA yönteminin hem doğrusal hem de kuadratik formda oldukça başarılı olduğu görülmüştür.

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ON MULTIPLE INTELLIGENCE APPLICATIONS IN TURKEY EVALUATION OF TECHNOLOGY USAGE

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Abstract: We can say that, in institutions where formal and informal education is provided in Turkey for multiple intelligence applications, the learning environments and activities aimed at the development of more than one intelligence dimension of the student at the same time are being tried to be increased by the related institutions especially within the framework of constructivist learning theory. The increase in these practices has brought some reforms in terms of teacher competence, learning environment and material in educational institutions. We can say that these regulations are mostly technology-centered regulations. We can say that the ability of the teachers to use the technology, the technological tools in the learning environments or the hardware and the materials used in the lessons meet the daily needs of the technologically influential students on the development process of multiple intelligence dimensions. In this study, it was aimed to evaluate the use of technology in education on multiple intelligence applications in the context of the views of secondary school teachers working in public schools in different regions in Turkey. The study was based on qualitative methodology and NVivo 11 program was used for analysis of data and creation of models.

Keywords: Multiple intelligence, middle school, teacher, technology

TÜRKİYE'DE ÇOKLU ZEKÂ UYGULAMALARI ÜZERİNDE TEKNOLOJİ KULLANIMININ DEĞERLENDİRİLMESİ

Özet: Çoklu zeka uygulamalarına yönelik olarak Türkiye'de, formal ve informal eğitimin verildiği kurumlarda, öğrencinin aynı anda birden çok zeka boyutunu geliştirmeye yönelik, öğrenme ortamları ve etkinliklerinin özellikle yapılandırmacı öğrenme kuramı çerçevesinde ilgili kurumlar tarafından arttırılmaya çalışıldığını söyleyebiliriz. Bu uygulamaların artması eğitim kurumlarında öğretmen yeterliliği, öğrenme ortamı ve materyal açısından bir takım yenilikler ya da düzenlemeler getirmiştir. Yapılan bu düzenlemeler daha çok teknoloji merkezli düzenlemeler olduğunu söyleyebiliriz. Öğretmenlerin teknolojiyi kullanma yeterliliği, öğrenme ortamlarında yer alan teknolojik araçlar ya da donanım ve derslerde kullanılan materyallerin teknolojik açıdan günün ihtiyaçlarını karşılama düzeyi öğrencilerin çoklu zekâ boyutlarını geliştirme süreci üzerinde etkili olduğunu söyleyebiliriz. Yapılan bu çalışmada Türkiye'de farklı bölgelerde devlet okullarında görev yapan ortaokul öğretmenlerinin görüşleri çerçevesinde çoklu zekâ uygulamaları üzerinde eğitimde teknoloji kullanımının değerlendirilmesi amaçlanmıştır. Çalışma nitel yönteme dayalı bir çalışma olup verilerin analizinde ve modellerin oluşturulmasında NVivo 11 programından yararlanılmıştır.

Anahtar Kelimeler: Çoklu zekâ ortaokul, öğretmen, teknoloji

Giriş

İnsanlığın ihtiyaçlarına cevap verebilmek amacıyla sürekli olarak değişen dünyamızda, bu ihtiyaçların karşılanması için birbirinden farklı fikirlere dayalı olarak projeler üretilmektedir. Üretilen bu projelerin her biri tasarlama sürecinde birbirinden farklı zekâ türlerinin katkılarını barındırmakla birlikte, bilgi, teknoloji ve uygulamayla birlikte geliştirilebilir. İhtiyaçlara bağlı olarak dünya değiştikçe zekâ kavramı da değişmektedir. Çalışmanın ana değişkenlerinden birini oluşturan çoklu zekâ kuramı da bu değişimin bir ürünüdür.

Çoklu zekâ kuramının temsilcisi olan Gardner (1993) zekayı; "problem çözme kapasitesi ya da bir veya daha fazla kültürel bağlamda değer atfedilen ürünler ortaya koyabilme yetisi" olarak tanımlamıştır. Gardner zekânın tek bir faktörle açıklanamayacak kadar çok sayıda yetenekten ileri geldiğini; çoklu öğrenme ortamlarında bireylerin problem çözme becerisi ve üretkenliğinin daha fazla olabileceğini belirtmiştir (Demirel, 2000; Öngören ve Şahin, 2008). Yeni anlayışa göre zeka; genetik olduğu kadar çevresel etmenlere de bağlı, geliştirilebilir, çoğul, sayısal olarak hesaplanamayan ancak gerçek yaşam koşullarında gözlenen, ve bireylerin

başarılı olabilecekleri farklı yolları anlamak için başvurulan bir kavram olarak algılanır (Saban, 2002; Selçuk vd., 2004; Öngören ve Şahin, 2008). Görüldüğü üzere yeni anlayış bireyi etiketlemek ve sınıflandırmak yerine, onu anlama ve ona fırsatlar sunma gayretine ağırlık vermektedir. Gardner'e (1985, 1993) göre zekâ alanları çoğuldur ve yaşam boyunca yapılan hiçbir etkinlik tek bir zekâ alanını içermez. Dolayısıyla insanlardaki farklı zekâ alanları birbirleriyle etkileşerek uyum içinde çalışırlar. Herkes çeşitli düzeylerde zekâ alanlarına sahip olarak doğarlar, ancak bu zeka alanları insanın yaşamı boyunca edinilen olumlu deneyim ve beslenme gibi faktörlerle geliştirilebilir. O zaman, bu yaklaşımda "kaderci" anlayışa da yer yoktur. Gardner'in önerdiği sekiz farklı zekâ alanı (1) Sözel-Dilsel Zekâ, (2) Mantıksal- Matematiksel Zekâ (3) Görsel-Uzamsal Zekâ, (4) Müziksel-Ritmik Zekâ, (5) Bedensel-Kinestetik Zekâ (6) Sosyal-Kişiler Arası Zekâ (7) İçsel-Özedönük Zekâ ve (8) Doğacı Zekâ olarak ifade edilmiştir. Gardner'a (1993) göre her insanın bir ya da bir kaç zekâ alanı, diğerlerinden daha gelişmiş olabilir(Öngören ve Şahin, 2008). Eğer kişilere zekâ alanlarını geliştirme şansı verilirse, zayıf olan zekâ alanı baskın zekâ alanı haline gelebilir. Bu nedenle, Gardner'in ileri sürdü ğü anlayışta öğrencileri " düşük zekâlılar" veya "üstün zekâlılar" olarak tanımlamak yanlış ve sakıncalıdır. 1739 sayılı Milli Eğitim Temel Kanunu'nda da bireylerin ilgi, istidat ve kabiliyetleri doğrultusunda eğitilmesi gerektiği vurgulanmıştır. O zaman öğrencilerin yetersizliklerine değil, onların güçlü oldukları zekâ alanlarına ve hangi yollarla en iyi öğrendiklerine vurgu yapılmalı; onlara bu alanlarda başarılı olmaları için fırsatlar sunmalıdır (Saban, 2002; Öngören ve Şahin, 2008).

Teknoloji insanlık tarihiyle başlamış ve bilgi akışının hızlı olduğu bu çağda da her alanda olduğu gibi eğitim alanında da kullanılması vazgeçilmezdir (Altıntaş, Kahraman ve Altıntaş, 2013). Ülkemizde de eğitim için vazgeçilmez olan teknolojinin yaygın bir şekilde kullanılmaya başladığı yıllar cumhuriyetin ilanına kadar dayandırabiliriz (Aydın ve Aydın, 2010). Teknolojik gelişmeler eğitim ortamlarını etkilemekte ve eğitim programlarını, öğretmenleri, öğrencilerin eğitim ortamlarının bir parçası olmuştur. Özellikle bilgisayarın eğitim ortamına girmesiyle teori ve uygulamada değişmeler meydana getirmiştir. Alkan (1997)'e göre eğitim teknolojisi; öğrenme-öğretme süreçlerinin tasarımlanması, uygulanması ve geliştirilmesi sürecidir. Eğitim teknolojisi öğretim, öğrenim, gelişimve yönetim teknolojilerini kapsadığından, öğretim teknolojisi, eğitim teknolojisinin bir alt kümesi olarak tanımlanır (Karademirci, 2010; Altıntaş, Kahraman ve Altıntaş, 2013). Araç gereç kullanımı çoklu öğrenme ortamı sağladığı gibi, öğrencilerin bireysel ihtiyaçlarının karşılanmasına yardımcı olur, dikkat çeker, hatırlamayı kolaylaştırır; soyut karmaşık kavramları, anlaması güç olgu ve olayları basitleştirir (Akçay, Feyzioğlu, Tüysüz, 2003; Altıntaş, Kahraman ve Altıntaş, 2013). Çoklu zekâ kuramı içerisinde yer alan hangi zekâ türü olursa olsun neredeyse bütün zekâ türlerinin ürünleri somutlaştırma ihtiyacı öğrenme sürecinde hissetmektedir. Bundan dolayı bu kurama dayalı bütün aktarımlarda teknolojik temelli araç ve gereçlerin kullanılması önemlidir.

Araştırmanın Amacı

"Nitel araştırma yöntemlerinin kullanılarak yapılan bu çalışmada, Türkiye'de devlet okullarında görev yapan ortaokul öğretmenlerinin görüşleri çerçevesinde çoklu zekâ uygulamaları üzerinde eğitimde teknoloji kullanımının değerlendirilmesi amaçlanmıştır. Bu genel amaç çerçevesinde çalışma grubu üyelerine şu sorular yöneltilmiştir:

- ✓ Somutlaştırma kavramı deyince ne anlıyorsunuz?
- ✓ Zekâ ile somutlaştırma arasında bir etkileşim olduğunu düşünüyor musunuz, niçin?
- ✓ Çoklu Zekâ kuramına dayalı hazırlanıp kullanılan etkinliklerde teknoloji destekli materyaller kullanıyor musunuz, niçin?
- ✓ Soyut olan konuların aktarımında materyal kullanıyorsanız, bu materyallerde aradığınız en önemli özellik nedir?

Yöntem

Araştırmanın Modeli

"Türkiye'de devlet okullarında görev yapan ortaokul öğretmenlerinin görüşleri çerçevesinde çoklu zekâ uygulamaları üzerinde eğitimde teknoloji kullanımının değerlendirilmesi" temelli bu araştırma, nitel bir çalışma olup, yarı yapılandırılmış görüşme yöntemiyle gerçekleştirilmiştir. Creswell (1998) nitel araştırmayı, sosyal yaşamı ve insanla ilgili problemleri kendine özgü metodlarla sorgulayarak, anlamlandırma süreci olarak ifade etmektedir. Nitel araştırma sürecinde araştırmacı bütüncül bir araştırma tablosu ortaya koyarak; kelime analizleri, detaylı katılımcı görüşme raporları kullanır ve araştırmayı doğal ortamda düzenler. Nitel araştırmada genel olarak takip edilen araştırma süreci parçadan bütünedir [tüme-varım]. Genel itibariyle nitel araştırmacı gözlem, görüşme ve dokümanlardan yola çıkarak kav ramları, anlamları ve ilişkileri açıklayarak süreci sürdürür

(Merriam, 1998; Yıldırım ve Şimşek, 2008).Yarı yapılandırılmış görüşmelerde ise, görüşme soruları önceden belirlenmiş görüşme durumlarını kapsamaktadır (Balcı, 2004). Bu araştırma da durum çalışması modeli kullanılmıştır. Durum çalışması modeli "güncel bir olgunun gerçek yaşam bağlamında, özellikle bağlam ve olguların sınırlarının kesin olarak belli olmadığı durumlarda görgül olarak araştırılması" şeklinde ifade etmektedir (Yin, 1994, s.13; Merriam, 1998, s. 27).

Çalışma Grubu

Araştırmada çalışma grubunu, Konya, Malatya ve Gaziantep de Milli eğitim bakanlığına bağlı çeşitli okullarda görev yapan 60 sosyal bilgiler öğretmeni oluşturmaktadır. Araştırmanın bu illerde yapılması araştırmacının uygulama sürecinde araştırmanın güvenirliği açısından yaşadığı kolaylıktan dolayı çalışma grubu üyeleri bu illerden seçilmiştir.

Veri Toplama Aracı

Araştırmanın kuramsal boyutu oluşturulduktan sonra "Türkiye'de devlet okullarında görev yapan ortaokul öğretmenlerinin görüşleri çerçevesinde çoklu zekâ uygulamaları üzerinde eğitimde teknoloji kullanımının değerlendirilmesi" için yarı yapılandırılmış görüşme formu hazırlanmıştır. Görüşme formu hazırlanırken öncelikle sorulacak sorular belirlenmiştir. Sorular oluşturulurken kolay anlaşılabilecek sorular yazma, açık uçlu sorular sorma, odaklı sorular hazırlama, yönlendirmekten kaçınma, çok boyutlu sorular sormaktan kaçınma ve soruları mantıklı bir biçimde düzenleme gibi ilkelere (Yıldırım ve Şimşek, 2008) dikkat edilmiştir. Araştırmada kullanılacak olan görüşme formu, İnönü Üniversitesi Eğitim Fakültesinde görev yapan alan uzmanlarına, içerik geçerliliğini sağlamak amacıyla görüşlerine sunulmuştur. Alan uzmanlarından gelen görüş ve öneriler doğrultusunda görüşme formuna son şekli verilmiştir. Görüşme formunda 4 soru yer almaktadır.

Verilerin Analizi

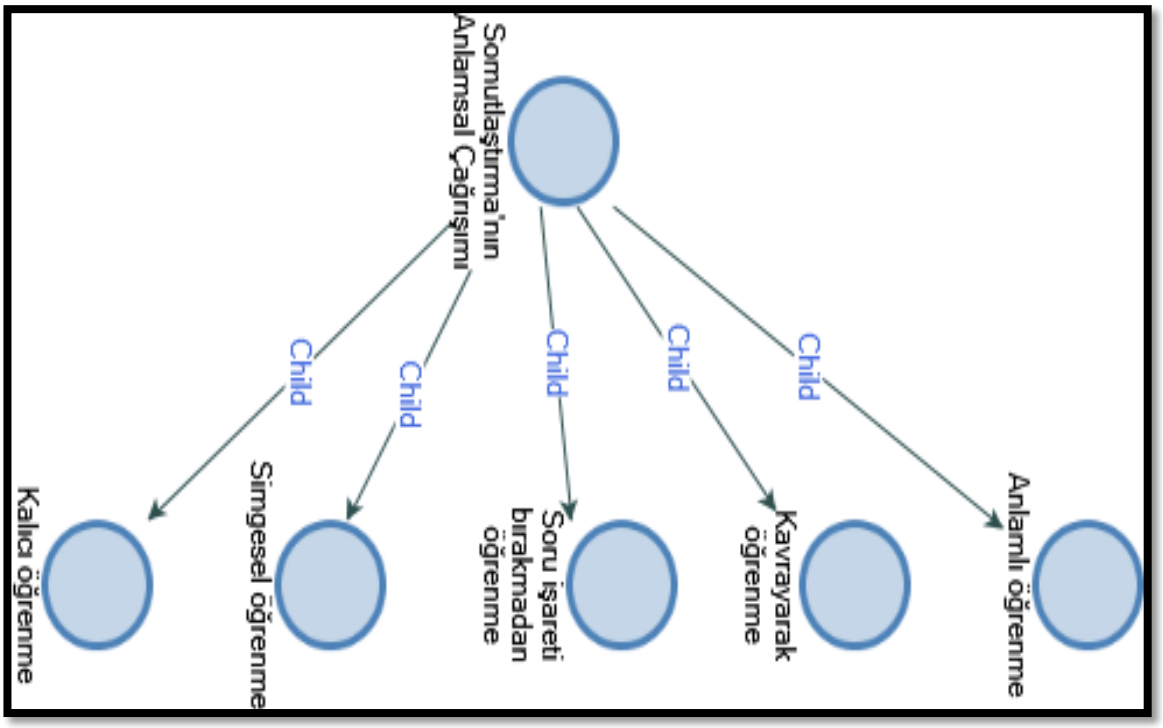
Araştırmada yarı yapılandırılmış görüşme formu ile ilgili çözümlemeler, nitel boyutta gerçekleştirilmiştir. Bilgisayar destekli nitel veri analizi yapılmıştır. Verilerin analizinde ve modellerin oluşturulmasında NVivo 11 programından yararlanılmıştır. Kodlamalar araştırmacıların ortak görüşleri doğrultusunda oluşturulmuştur. Bu çerçevede, "Türkiye'de devlet okullarında görev yapan ortaokul öğretmenlerinin görüşleri çerçevesinde çoklu zekâ uygulamaları üzerinde eğitimde teknoloji kullanımının değerlendirilmesine" yönelik görüşleri betimsel ve içerik analizi teknikleriyle belli temalar altında bu görüşler gruplanarak çözümlenmeye çalışılmıştır. Araştırmanın güvenirliğini sağlamak için, araştırmada ulaşılan uzman görüşüne başvurulmuştur. Araştırmacılar ve uzmanlar tarafından öncelikle ana temalar ardından bunlara bağlı alt temalar oluşturulmuştur. Çözümlemeler sonucunda ortaya çıkan temalar aralarındaki bağları gösterir şekilde modellenmiş ve görselleştirilmiştir. Modelde yer alan ilişkileri gösteren temayı söyleyen kişi sayısı (frekansını) belirlenmiştir. Araştırmacıların ve uzmanın, temalarda yer alması gereken görüşlere ilişkin değerlendirmeleri karşılaştırılarak "görüş birliği" ve "görüş ayrılığı" sayıları tespit edilmiştir. Araştırmacı dışında iki uzmanla birlikte analizler yapılıp, Miles ve Huberman'ın (1994) formülüne göre araştırmacılar arasındaki uyum hesaplanmıştır. Bu hesaplama sonucunda, P =(83/83+1) x 100 = %92 olarak hesaplanmıştır.

Bulgular

"Türkiye'de devlet okullarında görev yapan ortaokul öğretmenlerinin görüşleri çerçevesinde çoklu zekâ uygulamaları üzerinde eğitimde teknoloji kullanımının değerlendirilmesi" temelli bu çalışmada yarı yapılandırılmış görüşme formu aracılığıyla sosyal bilgiler öğretmenlerinden alınan görüşler analiz edilerek aşağıda verilen bulgular elde edilmiştir.

Somutlaştırma Kavramının Çalışma Grubunda Oluşturduğu Çağrışımlar Durumu

Yarı yapılandırılmış görüşme formunda yer alan *"Somutlaştırma kavramı deyince ne anlıyorsunuz?"* şeklindeki soruya çalışma grubunu oluşturan sosyal bilgiler öğretmenlerinin birbirinden farklı yanıtlar vererek çeşitli temalar oluşturdukları şekil 1 de gözlemlenmektedir.



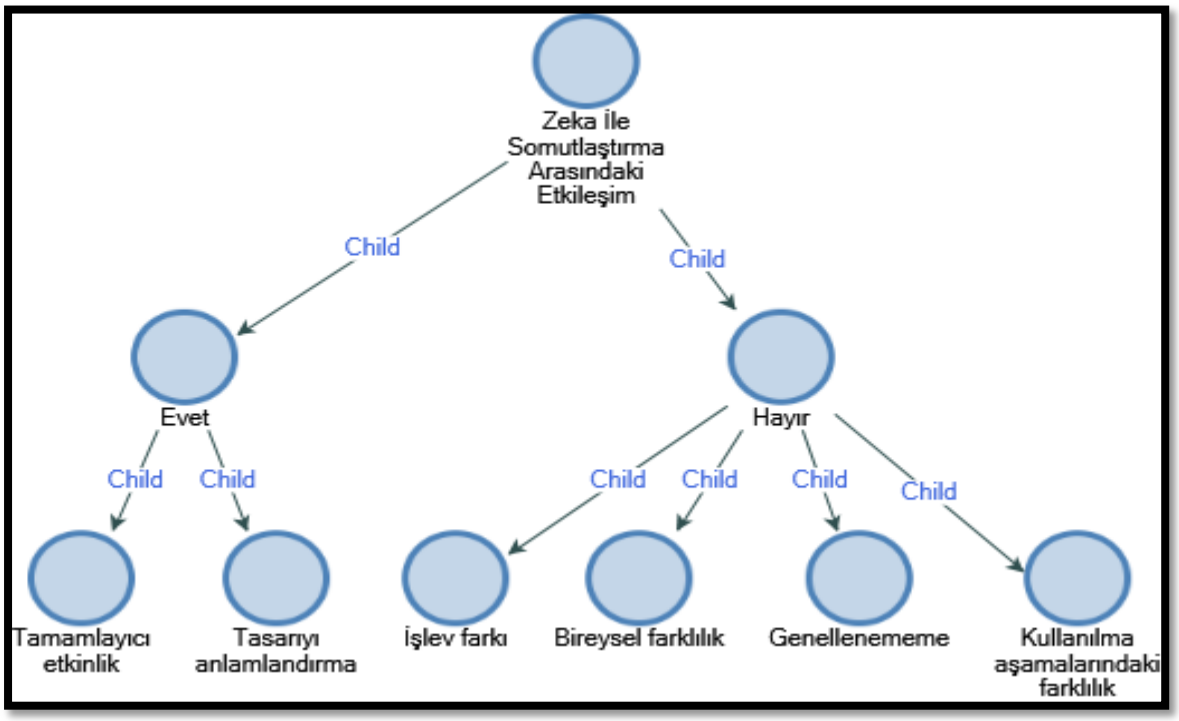
Şekil 1: *Çalışma grubu üyelerinin somutlaştırma kavramına ilişkin algıları*

Yarı yapılandırılmış görüşme formunda yer alan "*Somutlaştırma kavramı deyince ne anlıyorsunuz?*" şeklindeki soruya çalışma grubu üyesi olan sosyal bilgiler öğretmenlerinin 5 farklı tema altında farklılaştıkları şekil 1'de gözlemlenmektedir. Sosyal bilgiler öğretmenleri bu soruya, kalıcı öğrenme (f-9), simgesel öğrenme (f-8), soru işareti bırakmadan öğrenme (f-13), kavrayarak öğrenme (f-18) ve anlamlı öğrenme (f-12) şeklinde temalar altında grupsal bir dağılım göstermektedirler (Şekil 1).

Çalışma grubunu oluşturan sosyal bilgiler öğretmenlerinin somutlaştırma kavramına yönelik sorulan bu soruya vermiş oldukları cevaplar şu şekilde örneklendirilebilir:
"Sosyal bilgiler dersine yaklaşık 8 yıldır giren bir branş öğretmeni olarak somutlaştırma kavramının bende oluşturduğu izlenim öğrencilerin ders işleme sürecinde dersi dinlerken, bir daha dinledikleri konuyu çalışacak zamanları olmayacakmış gibi kalıcı öğrenmelerini sağlayan bütün her şeydir." ***(Sosyal Bilgiler Öğretmeni, 7)***
"Somutlaştırma kavramı her ne kadar Piaget'e göre belli bir yaş aralığında (7-11) kritik bir öneme sahip olsa da ben insanın hayatı boyunca bu kavramın kritik özelliğini devam ettirdiğini düşünenlerdenim. Çünkü birey bu kavram sayesinde soyut olan zihinsel algılamalarını bazı nesne, eşya ya da simgelerle anlamlandırmaktadır." ***(Sosyal Bilgiler Öğretmeni, 41)***

Zekâ İle Somutlaştırma Arasında Bir Etkileşim Olduğunu Düşünme Durumu

Çalışma grubunu oluşturan sosyal bilgiler öğretmenlerine yöneltilen *"Zekâ ile somutlaştırma arasında bir etkileşim olduğunu düşünüyor musunuz, niçin?"* şeklindeki soruya çalışma grubu üyelerinin 2 farklı ana tema ve bunlara bağlı alt temalarla farklılaştıklarını şekil 2 de görülmektedir. Sosyal bilgiler öğretmenleri bu soruya, ana tema olarak "EVET" (f-15) ve "HAYIR" (f-35) şeklinde farklılaştıklarını söyleyebiliriz. Evet diyen çalışma grubu üyeleri, tamamlayıcı etkinlik (f-10) ve tasarıyı anlamlandırma (f-5) temalarını ortaya çıkarırken; Hayır diyen öğretmenler ise, işlev farkı (f-23), bireysel farklılık (f-12), genellememe (f-5) ve kullanılma aşamalarındaki farklılık (f-5) temalarını oluşturmuşlardır (Şekil 2).



Şekil 2: *Çalışma grubu üyelerinin zekâ ile somutlaştırma arasındaki etkileşime ilişkin algıları*

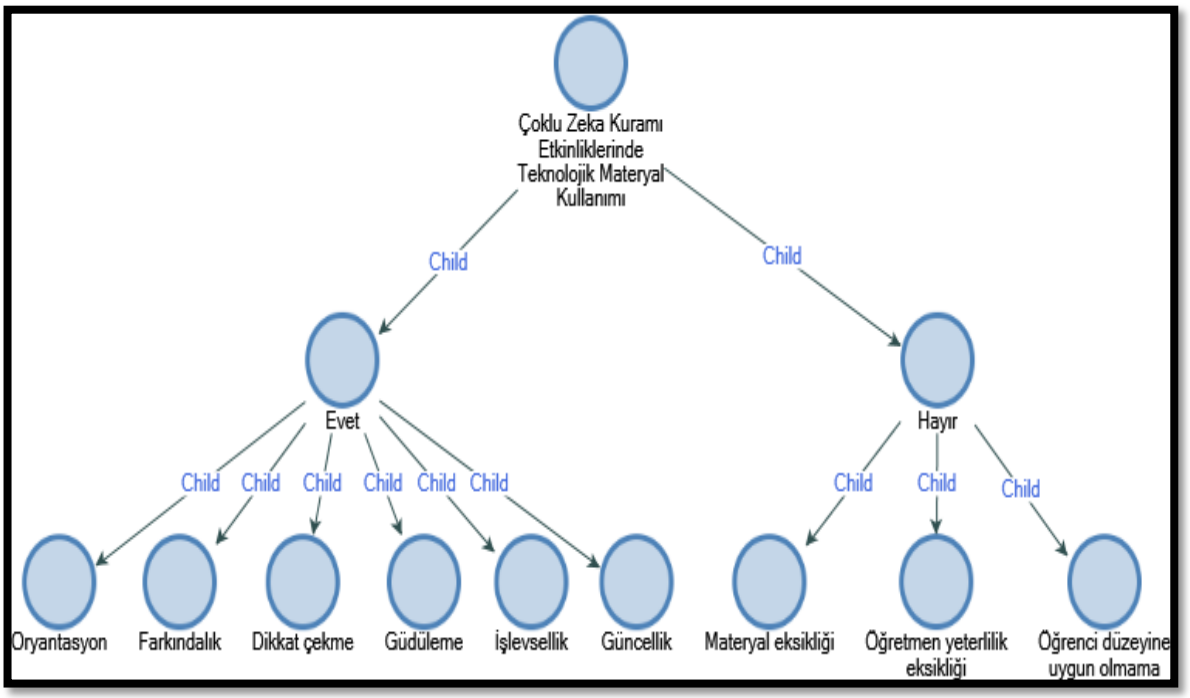
"Zekâ ile somutlaştırma arasında bir etkileşim olduğunu düşünüyor musunuz, niçin?" şeklindeki soruya çalışma grubu üyelerinin verdiği yanıtlar aşağıda örneklendirilmiştir.

"Zekâ ile somutlaştırma arasında bir etkileşimin olması bana göre söz konusu bile değildir. Çünkü zekâ her insanda var olan doğal bir yetenektir. Ancak somutlaştırma, bireyin zihinsel aktivitesi sonucu uzun süreli belleğe alınan ayırt edici uyarıcının kalıcı hale gelmesi için kullanılan her şey olabilir. ***(Sosyal Bilgiler Öğretmeni, 53)***

"Somutlaştırma ile bireyin algılama kapasitesini ifade eden zekâ arasında bir etkileşim kesinlikle bulunmaktadır. Çünkü bireyin öğrenme süreci içerisinde nesne, simge veya herhangi bir araç gereç aracılığıyla öğrendiği durumu kavrama hızı yüksek iken; unutkanlık düzeyi ise düşüktür." ***(Sosyal Bilgiler Öğretmeni, 16)***

Çoklu Zekâ Kuramına Dayalı Hazırlanıp Kullanılan Etkinliklerde Teknoloji Destekli Materyallerin Kullanılma Durumu

Çalışma grubunu oluşturan sosyal bilgiler öğretmenlerine yarı yapılandırılmış görüşme formu aracılığıyla yöneltilen *"Çoklu Zekâ kuramına dayalı hazırlanıp kullanılan etkinliklerde teknoloji destekli materyaller kullanıyor musunuz, niçin?"* şeklindeki soruya, çalışma grubunu oluşturan öğretmenlerin birbirinden farklı yanıtlar verdiği şekil 3 de görülmektedir. Sosyal bilgiler öğretmenleri 2 ana tema ve bunlara bağlı alt temalarla birbirinden farklı düşündükleri ortaya çıkmıştır.



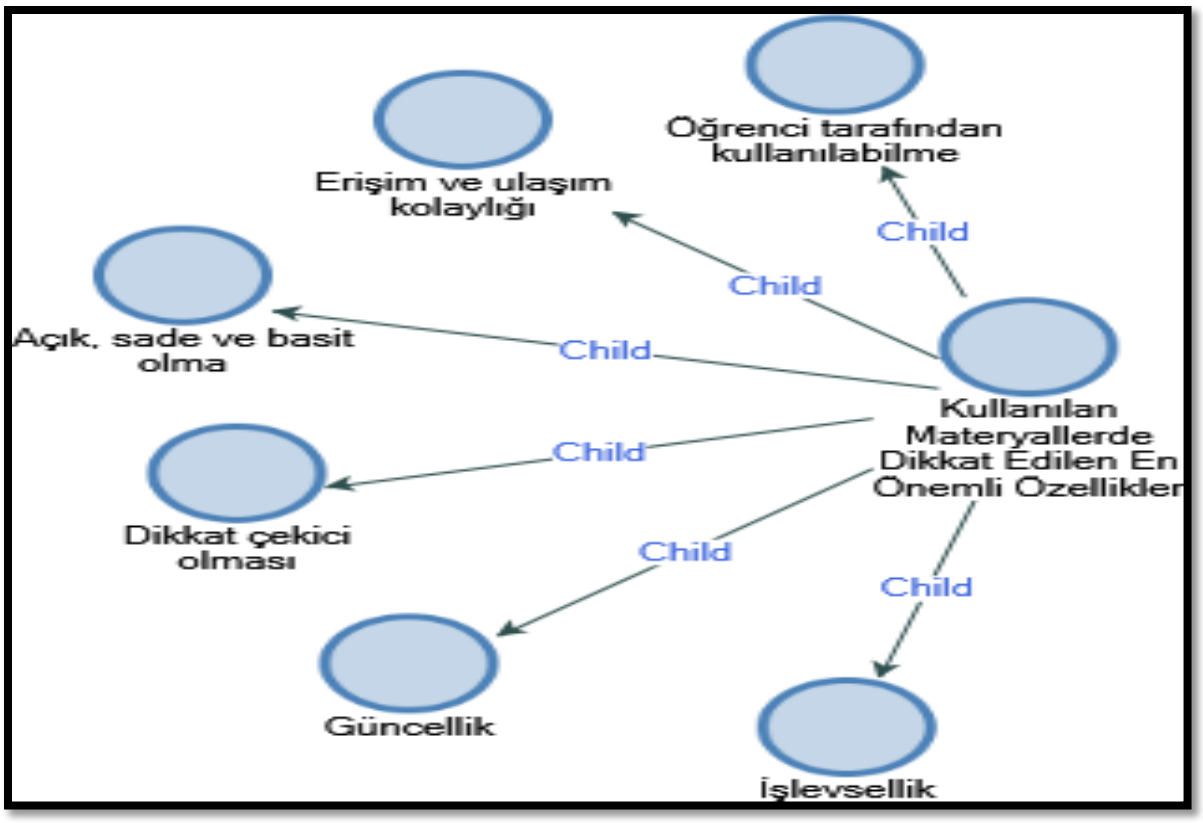
Şekil 3: *Çalışma grubu üyelerinin çoklu zekâ kuramı etkinliklerinde materyal kullanımına ilişkin algıları*

Yarı yapılandırılmış görüşme formunda yer alan *"Çoklu Zekâ kuramına dayalı hazırlanıp kullanılan etkinliklerde teknoloji destekli materyaller kullanıyor musunuz, niçin?"* şeklindeki soruya çalışma grubu üyesi olan sosyal bilgiler öğretmenlerinin 2 ana tema altında farklılaştıkları şekil 3'de gözlemlenmektedir Sosyal bilgiler öğretmenleri bu soruya, ana tema olarak "EVET" (f-45) ve "HAYIR" (f-15) şeklinde farklılaştıklarını söyleyebiliriz. Evet diyen çalışma grubu üyeleri, oryantasyon (f-10), farkındalık (f-5), dikkat çekme(f-10), güdülenme (f-7), işlevsellik (f-5) ve güncellik (f-8) temalarını ortaya çıkarırken; Hayır diyen öğretmenler ise, materyal eksikliği (f-6), öğretmen yeterlilik eksikliği (f-10) ve öğrenci düzeyine uygun olmama (f-4) temalarını oluşturmuşlardır (Şekil 3). Yukarıda 2 ana tema altında bir araya gelen ve farklılaşan sosyal bilgiler öğretmenlerinin görüşleri aşağıda örneklendirilmiştir.

> *"Çoklu zekâ kuramının temelinde birey yaratılış gereği birçok zekâ türüne sahip olarak dünyaya gelip yaşadığı çevre ve geçirmiş olduğu yaşantı sayesinde bunları geliştirdiği ilkesinden dolayı, bu kurama yönelik etkinliklerin hazırlanıp sunulmasında teknoloji destekli materyal kullanıyorum. Ayrıca kullandığım bu materyaller sayesinde öğrencinin derse olan istek düzeyi de artmış oluyor"* ***(Sosyal Bilgiler Öğretmeni, 60)***
>
> *"Bu kuram kesinlikle bireyde var olan yetenekleri ortaya en ideal şekilde ortaya çıkaran kuram olduğunu düşünüyorum. Dolayısıyla bu kurama dayalı aktarımlarda materyal kullanımının genele hitap etmeyeceği kanısındayım. Her bireyin zekâ düzeyi farklı olduğu için kendi seviyesine uygun materyal de farklı olacaktır."* ***(Sosyal Bilgiler Öğretmeni, 27)***

Soyut Olan Konuların Aktarımında Materyal Kullanma ve Bu Materyallerde Aranan En Dikkat Çekici Özellik Durumu

Yarı yapılandırılmış görüşme formunda yer alan *"Soyut olan konuların aktarımında materyal kullanıyorsanız, bu materyallerde aradığınız en önemli özellik nedir?"* şeklinde ki soruya, çalışma grubunu oluşturan sosyal bilgiler öğretmenlerinin 6 farklı tema altında bir araya geldiğini ve farklı düşündüklerini tablo 4 de gözlemlemekteyiz. Yarı yapılandırılmış görüşme formunda yer alan "Soyut olan konuların aktarımında materyal kullanıyorsanız, bu materyallerde aradığınız en önemli özellik nedir?" şeklindeki soruya çalışma grubu üyesi olan sosyal bilgiler öğretmenlerinin 6 farklı tema altında farklılaştıkları şekil 4'de gözlemlenmektedir. Sosyal bilgiler öğretmenleri bu soruya, öğrenci tarafından kullanılabilme (f-13), erişim ve ulaşım kolaylığı (f-8), açık, sade ve basit olma (f-9), dikkat çekici olma (f-15), güncellik (f-10) ve işlevsellik (f-5) şeklinde temalar altında grupsal bir dağılım göstermektedirler (Şekil 4).



Şekil 4: *Çalışma grubu üyelerinin soyut olan konuların aktarımında kullanılan materyallerde aranan özelliklere ilişkin algıları*

"Soyut olan konuların aktarımında materyal kullanıyorsanız, bu materyallerde aradığınız en önemli özellik nedir?" şeklindeki soruya çalışma grubu üyelerinin verdiği yanıtlar aşağıda örneklendirilmiştir.

"Soyut konuların aktarımında sürekli olarak materyal kullanan biri olarak şu cevabı vermek bana göre en doğru özellik olacaktır. Kullandığım bir materyalde aradığım birçok özellik olmakla birlikte dikkat ettiğim en önemli kısmı, materyalin açık, sade ve anlaşılır olmasıdır." ***(Sosyal Bilgiler Öğretmeni, 3)***

"Öğrenme öğretme sürecinde öğrencinin derse katılım düzeyinin artmasında en önemli adımın materyal kullanmak olduğuna inanan biri olarak, işlediğim derslerde soyut olan konuların öğrenciler tarafından daha iyi anlaşılması için sürekli olarak materyal kullanmaktayım. Bu materyalin en önemli özelliği bence dinleyiciler açısından dikkat çekici olması gerekir." ***(Sosyal Bilgiler Öğretmeni, 22)***

Sonuç ve Öneriler

"Türkiye'de devlet okullarında görev yapan ortaokul öğretmenlerinin görüşleri çerçevesinde çoklu zekâ uygulamaları üzerinde eğitimde teknoloji kullanımının değerlendirilmesi" temelli bu çalışmada yarı yapılandırılmış görüşme formu aracılığıyla sosyal bilgiler öğretmenlerinden alınan görüşler analiz edilerek elde edilen bulgular ışığından birbirinden farklı, dikkat çekici sonuçlar elde edilmiştir. Çalışma grubunu oluşturan sosyal bilgilerinin çoklu zekâ kuramına yaklaşımına dayalı derslerde kullanılan etkinliklere materyal ölçütü açısından yaklaşımlarının farklı olması, çalışmanın en önemli sonuçlarından birini oluşturmaktadır. Sosyal bilgiler öğretmenlerinden bir kısmının zekâ kavramını sadece doğal yetenek olarak ifade etmeleri ve materyal kullanımının bireyin zekâ gelişimine ve algılama düzeyine katkı sağlamayacağı şeklinde elde edilen sonuç, çalışmanın dikkat çekici diğer bir yönünü göstermektedir. Çalışma grubunu oluşturan sosyal bilgiler öğretmenlerinin, soyut konuların aktarımında materyal kullanımı konusunda hem fikir olmaları, derslerde kullandıkları materyallerde birbirinden farklı altı özelliği ön plana çıkarmaları, bireyin zekâ gelişimi ile somutlaştırma düzeyi arasında ilişkin çoğu üye için olmaması bu çalışmanın sonuçlarını önemli kılan diğer bir kısımdır. Çalışmada elde edilen bu sonuçlardan hareketle;

- ✓ İlkokul ve ortaokul düzeyinde derslere giren öğretmenler materyal kullanımına daha çok dikkat etmeleri,
- ✓ Soyut konuların aktarımında konuya uygun materyaller kullanmaları,
- ✓ Zekâ ile bireyin kalıcı ve somut algılama kapasitesi arasındaki etkileşim uzmanlar tarafından öğretmenlere anlatılmalı,
- ✓ Çoklu zekâ kuramına yönelik etkinliklere derslerinde yer veren öğretmenlerin bu etkinlikleri

materyallerle desteklemeleri,

- ✓ Öğrencilerin anlama kapasitelerini arttırmayı temele alan zekâ kavramına yönelik derslerde kullanılan teknoloji destekli materyallerin kullanılmasında, bu materyallerin öğrenciler tarafından rahatlıkla kullanılacak şekilde tasarlanmaları gerekir, şeklinde önerilerde bulunulabilir.

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THE PERCEPTIONS OF TURKEY'S TEACHING STAFF RELATED TO EUROPEAN UNION PROCESS

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Abstract: The European Union accession process is a process that begins with an application for official candidacy of an applicant country and is open to all European countries that wish to become an EU member, according to article 49 of the European Union Treaty, which is the legal basis for the accession period. The summit held in Helsinki on 10-11 December 1999 was declared a candidate country on equal terms with the other candidate countries. After this summit was declared, there is a lot of controversy about the process of progress in Turkey - EU relations. The dimensions of these controversies are different in terms of those who are engaged in the debate. In this study, it is aimed to reveal different aspects of the process in Turkey in terms of the EU process in terms of the views of the teaching staff working at different universities in Turkey. The study was based on qualitative methodology and NVivo 11 program was used for analysis of data and creation of models.

Keywords: European Union process, teaching staff, perception, perspective

TÜRKİYE'NİN AVRUPA BİRLİĞİ SÜRECİNE İLİŞKİN ÖĞRETİM ELEMANLARININ ALGILARI

Özet: Avrupa birliği katılım süreci, üye olmak isteyen ülkenin resmi adaylık başvurusuyla başlayan bir süreç olup katılım sürecinin yasal temelini oluşturan Avrupa Birliği Antlaşmasının 49. maddesine göre, AB üye olmak isteyen tüm Avrupa ülkelerine açık bir kurumdur. Türkiye' 10-11 Aralık 1999 tarihlerinde Helsinki'de yapılan zirvede diğer aday ülkelerle eşit şartlarda aday ülke ilan edildi. Bu zirvede ilan edilmesinde sonra Türkiye - AB ilişkilerinde ilerleme süreci ile ilgili günümüze kadar bir çok tartışma yaşanmaktadır. Yaşanan bu tartışmaların boyutları tartışmayı yürütenler açısından farklılıklar göstermektedir. Bu çalışmada da Türkiye'nin AB sürecine ilişkin Türkiye'de farklı üniversitelerde görev yapan öğretim elemanlarının görüşleri doğrultusunda çıkarımlarda bulunarak sürece ilişkin farklı bakış açılarını ortaya çıkarmaktır. Çalışma nitel yönteme dayalı bir çalışma olup verilerin analizinde ve modellerin oluşturulmasında NVivo 11 programından yararlanılmıştır.

Anahtar Kelimeler: Avrupa birliği süreci, öğretim elemanı, algı, bakış açısı

Giriş

Müzakere, çatışma ve ortak çıkarların kesiştiği bir alan olarak tanımlanabilir. Bu alan, 1960'lardan sonra, iki kutuplu uluslararası siyasal sistemin esnekleşmesiyle genişlemeye başladı (Mumcu, 2005). Türkiye kalkınma sürecinin hızlanacağı düşüncesiyle 31 Temmuz 1959'da AET'ye ortaklık başvurusunda bulunmuştur. Bununla birlikte 15 Temmuz 1959'da Yunanistan'ın Topluluğa yaptığı başvuru, olası bir üyeliğin bu ülkeye sağlayacağı avantajlardan yoksun kalma kaygısını da Türkiye'nin başvurusunda önemli bir etken olarak ortaya çıkarmaktadır (Çayhan ve Ateşoğlu Güney, 1996:96; Uysal, 2001). Gereken incelemeleri yaptıktan sonra Topluluk Konseyi başvuruyla ilgili olarak, 11 Eylül 1959'da Komisyon'a Türkiye ile görüşmeleri yürütmesi için yetki verilmesini kararlaştırmıştır. Bunun üzerine başlayan görüşmelerin Ankara Anlaşması'nın imzası ile sonuçlanması tam 4 yıl sürmüştür. (Ceyhan, 1991:23; Uysal, 2001) Bu dönemde gerçekleşen 27 Mayıs 1960 askeri müdahalesi bir süre için ilişkileri olumsuz etkilemiştir. Daha sonra koalisyon hükümetleri döneminde devam eden görüşmeler sırasında Topluluk tarafından önerilen tercihli ticaret anlaşması seçeneğini ise Türkiye reddetmiştir. Çayhan ve Ateşoğlu Güney (1996:97; Uysal, 2001)'e göre yapılan bu ticaret anlaşması önerisinin ardında ekonomik nedenler kadar Topluluğun askeri müdahale sonrasında Türkiye'deki siyasal gelişmelerden duyduğu endişeler nedeniyle ilişkileri sıkılaştırmaktan kaçınma isteği de yatmaktadır. İşte bu yüzden Türk tarafınca kabul edilmeyen ticaret anlaşmasının yerini, yapılan toplam 10 müzakere sonunda 25 Haziran 1963'te Komisyon'un ve Türk hükümetinin temsilcileri tarafından Brüksel'de parafe edilen Ortaklık Anlaşması almıştır. Anlaşma 12 Eylül 1963'te İnönü Hükümeti ve Topluluk yetkilileri arasında Ankara'da imzalanıp 1 Aralık 1964'te yürürlüğe girmiştir (Ceyhan,1991:23; Uysal, 2001; Aydın ve Aydın, 2010). Batı yönlü dış politika tercihini İkinci Dünya Savaşı sonrasında da sürdüren Türkiye, nitekim Soğuk Savaş döneminde Batı ile yakın ittifak ilişki- leri kuran Türkiye, Birleşmiş Milletler'in kurucu üyesi olmuş, NATO, Avrupa Konseyi ve OECD'ye üye olarak da Batı

Avrupa Birliği ile ortaklık ilişkisi kurmuştur. Batı dünyasının bir parçası olarak özgürlük, demokrasi ve insan haklarını savunan Türkiye'nin dış politikasının ana unsurları Avrupalı or- taklarıyla örtüşmektedir (Kürkçüoğlu, 1978: 213-247; Bozkurt, Özcan ve Köktas, 2004:344) Türkiye Cumhuriyeti, kuruluşundan itibaren çağdaş uygarlık yolunda ekonomik kalkınmaya büyük önem vermiştir. Türkiye'nin ekonomik alanda Avrupa ile yakın bir işbirliğine girmesi, Batı Avrupa ile siyasi alandaki işbirliğinin de doğal bir uzantısıdır. Ekonomik kalkınma sürecinin hızlanacağı düşüncesinin yanında 15 Temmuz 1959'da Topluluğa üyelik başvurusunda bulunan Yunanistan'dan geri kalmama kaygısı da Türkiye'nin 31 Temmuz 1959'da AET'ye ortaklık başvurusunda bulunmasına etki yapmıştır(Uysal, 2001:140-153). Topluluk Konseyi başvuruyla ilgili olarak gerekli incelemeleri yaptıktan sonra, 11 Eylül 1959'da Komisyon'a Türkiye ile görüşmelerin yürütülmesi konusunda yetki verilmesi kararını almıştır. Görüşmeler sonunda 25 Haziran 1963'te Komisyon ve Türkiye Hükümeti temsilcileri tarafından Brüksel'de parafe edilen Ortaklık Anlaşması, 12 Eylül 1963'te İnönü Hükümeti ve Topluluk yetkilileri arasında Ankara'da imzalanarak 1 Aralık 1964'te yürürlüğe girmiştir (Karluk, 1996:392; Bozkurt, Özcan ve Köktas, 2004:344; Uysal, 2001:140-153; Aydın, Aydın ve Aydın, 2010). Nihai amacı Türkiye'nin Topluluğa tam üyeliği olan An- kara Anlaşması'nda "hazırlık dönemi", "geçiş dönemi" ve "son dönem" ol- mak üzere üç dönem öngörülmüştür. Geçiş döneminin sonunda ise Gümrük Birliği'nin tamamlanması planlanmıştır (Bozkurt, Özcan, Köktas, 2004:348- 351; Uysal, 2001:140-153; Aktekin, Harnett, Öztürk ve Smart, 2009):

- ✓ **Hazırlık Dönemi:** Ankara Anlaşması'nda 5 yıl olarak öngörülen fakat görüşmelerin uzaması dolayısıyla 8 yıl süren bu dönem 1 Aralık 1964-31 Ara- lık 1972 tarihleri arasını kapsamaktadır. Hazırlık döneminde, Topluluk üstle- neceği tek taraflı yükümlülüklerle Türk ekonomisni güçlendirmeyi ve Güm- rük Birliği'ne geçişe hazır duruma getirmeyi taahhüt etmiştir. Geçici Protokol ile belirlenmiş bazı tarım ürünlerine, Topluluğun ithal kolaylıkları tanıması ve I. Mali Protokol sonucu, AET'nin Türkiye'nin dış ticaretindeki payı 1964- 72 döneminde artmıştır.

- ✓ **Geçiş Dönemi:** Bu dönem 1 Ocak 1973'te Katma Protokol'ün yürürlüğe girmesiyle baslamış ve taraflar karşılıklı ve dengeli yükümlülükler temelin- de, sanayi ürünleri ticaretinde Gümrük Birliği'nin kurulmasını hedef olarak belirlemişlerdir. AET, bazı tarım ürünlerinde ithal kolaylıkları sağlarken pamuk ipliği, pamuklu dokuma ve rafine petrol ürünleri hariç Türk sanayi ürünlerine gümrük vergilerini ve kısıtlamaları derhal kaldırmıştır. Buna kar- şılık Türkiye ise Topluluk menşeli sanayi ürünlerine uyguladığı gümrükleri kademeli şekilde 12 yılda kaldırmayı öngörmüş, korunması gereken hassas sanayi ürünleri için bu süre 22 yıl olarak öngörülmüştür.

- ✓ **Son Dönem:** Ankara Anlaşması'nın 5. maddesinde, Türkiye ve Toplu- luk arasındaki ortaklık ilişkisinde son dönemin gümrük birliğine dayandığı ve âkit tarafların ekonomi politikaları arasındaki eşgüdümün güçlendirilmesi gerektiği vurgulanır (Aktekin, Harnett, Öztürk ve Smart, 2009).

1983 yılında Türkiye'de sivil idarenin yeniden kurulması ve 1984 yılından itibaren Türkiye'nin ithal ikameci politi- kaları hızla terk etmesi ile beraber, Türkiye'nin dışa açılma süreci başlamıştır. Böylece 12 Eylül 1980 tarihinden itibaren dondurulmuş bulunan Türkiye-AET ilişkilerinin canlandırılması süreci başlamıştır. Türkiye,14Nisan 1987 tarihinde, Ankara Anlaşması'nda öngörülen dönemlerin tamamlanmasını beklemeden, üyelik başvurusunda bulunmuştur. Komisyon, bu başvuru ile ilgili görüşünü 18 Aralık 1989'da açıklamış ve kendi iç bütünleşmesini tamamlamadan Topluluğun yeni bir üyeyi kabul edemeyeceğini belirtmiştir. Ayrıca, Türkiye'nin, Topluluğa katılmaya ehil olmakla birlikte, ekonomik, sosyal ve siyasal alanda gelişmesi gerektiğini ifade etmiştir. Bu nedenle, üyelik müzakerelerinin açılması için bir tarih belirlenmemesi ve Ortaklık Anlaşması çerçevesinde ilişkilerin geliştirilmesi önerilmiştir. Türkiye-AB ilişkilerinin dönüm noktası, 10-11 Aralık 1999 tarihlerinde Helsinki'de yapılan AB Devlet ve Hükümet Başkanları Zirvesi'dir. Helsinki Zirvesi'nde Türkiye'nin adaylığı resmen onaylanmış ve diğer aday ülkelerle eşit konumda olacağı açık ve kesin bir dille ifade edilmiştir. Helsinki Zirvesi'nde, diğer aday ülkeler için olduğu gibi Türkiye için de Katılım Ortaklığı Belgesi hazırlanmasına karar verilmiştir. Türkiye için hazırlanan ilk Katılım Ortaklığı Belgesi 8 Mart 2001 tarihinde AB Konseyi tarafından onaylanmıştır. 3 Ekim 2005 tarihinde Lüksemburg'da yapılan Hükümetlerarası Konferans ile Türkiye resmen AB'ye katılım müzakerelerine başlamıştır. Yine aynı gün bir basın toplantısı düzenlenerek Türkiye için Müzakere Çerçeve Belgesi yayımlanmıştır. Böylece, Türkiye ile AB arasındaki inişli çıkışlı ilişki, çok önemli bir dönüm noktasını aşarak yepyeni bir sürece girmiştir (Avrupa Birliği Bakanlığı Tanıtım Kitapçığı, 2014).

Günümüze kadar devam eden süreç içerisinde bir çok fasıl açılmış olup Türkiye bu fasılların gereğini yerine getirmiştir. Ancak son yıllarda Avrupa Birliği üzerine düşeni yerine getirmemiş olup, Türkiye ile güven kaybı problemi yaşamaktadır. Şöyle ki, geri kabul anlaşmasının gereği olarak vize serbestisi sözü vermesine rağmen AB'nin bu sözünü yerine getirmemiş olması Türkiye'nin birliğe olan bakış açısını olumsuz etkilemiştir.

Araştırmanın Amacı

Türkiye'nin Avrupa Birliği Sürecine İlişkin Öğretim Elemanlarının Algılarını belirlemeyi temele alan bu araştırmada, çalışma grubu üyeleri olan öğretim elemanlarının görüşlerinin içerik analizine dayalı olarak değerlendirilmesi amaçlanmaktadır. Bu genel amaç çerçevesinde çalışma grubu üyelerine şu sorular yöneltilmiştir:

- ✓ Türkiye'nin AB gibi uluslararası topluluklara katılımını onaylıyor musunuz, neden?
- ✓ Günümüzde Avrupa Birliği'nin kuruluş amacına hizmet ettiğini düşünüyor musunuz, niçin?
- ✓ Türkiye'nin Avrupa birliği sürecinde, AB ülkelerinin Türkiye'ye karşı tutumlarını samimi buluyor musunuz, niçin?
- ✓ Türkiye'nin AB'ye tam üye olarak kabul edileceğini düşünüyor musunuz, neden?

Yöntem

Araştırmanın Modeli

Türkiye'nin Avrupa Birliği Sürecine İlişkin Öğretim Elemanlarının Algılarını belirlemeye yönelik bu araştırma, nitel araştırma yaklaşımına dayalı yarı yapılandırılmış görüşme yöntemiyle gerçekleştirilmiştir.Creswell (1998) nitel araştırmayı, sosyal yaşamı ve insanla ilgili problemleri kendine özgü metodlarla sorgulayarak, anlamlandırma süreci olarak ifade etmektedir. Nitel araştırma sürecinde araştırmacı bütüncül bir araştırma tablosu ortaya koyarak; kelime analizleri, detaylı katılımcı görüşme raporları kullanır ve araştırmayı doğal ortamda düzenler. Nitel araştırmada genel olarak takip edilen araştırma süreci parçadan bütünedir [tüme-varım]. Genel itibariyle nitel araştırmacı gözlem, görüşme ve dokümanlardan yola çıkarak kav ramları, anlamları ve ilişkileri açıklayarak süreci sürdürür (Merriam, 1998; Yıldırım ve Şimşek, 2008).Yarı yapılandırılmış görüşmelerde ise, görüşme soruları önceden belirlenmiş görüşme durumlarını kapsamaktadır (Balcı, 2004). Bu araştırma da durum çalışması modeli kullanılmıştır. Durum çalışması modeli "güncel bir olgunun gerçek yaşam bağlamında, özellikle bağlam ve olguların sınırlarının kesin olarak belli olmadığı durumlarda görgül olarak araştırılması" şeklinde ifade etmektedir (Yin, 1994, s.13; Merriam, 1998, s. 27).

Çalışma Grubu

Araştırmada çalışma grubunu, Malatya İnönü ve Elazığ Fırat Üniversitelerine bağlı Fen Edebiyat ve Eğitim Fakültesinde görev yapmakta olan 65 öğretim elemanı oluşturmaktadır. Araştırmacının bu illerde yer alan üniversitelerde görev yapan öğretim elemanlarına ulaşma kolaylığı ve araştırmacıya araştırmanın güvenirliği açısından kolaylık sağladığı için çalışma grubu üyeleri bu illerden seçilmiştir.

Veri Toplama Aracı

Araştırmanın kuramsal boyutu oluşturulduktan sonra Türkiye'nin Avrupa Birliği Sürecine İlişkin Öğretim Elemanlarının Algılarını belirlenmesi için yarı yapılandırılmış görüşme formu hazırlanmıştır. Görüşme formu hazırlanırken öncelikle sorulacak sorular belirlenmiştir. Sorular oluşturulurken kolay anlaşılabilecek sorular yazma, açık uçlu sorular sorma, odaklı sorular hazırlama, yönlendirmekten kaçınma, çok boyutlu sorular sormaktan kaçınma ve soruları mantıklı bir biçimde düzenleme gibi ilkelere (Yıldırım ve Şimşek, 2008) dikkat edilmiştir. Görüşme formu hazırlandıktan sonra bir öğretim elemanıyla ön görüşme yapılmış, görüşme tamamlandıktan sonra öğretim elemanın görüşme sorularına verdiği yanıtlar çözümlenerek dökümü yapılmıştır. Anlaşılmayan soru maddeleri değiştirilmiştir. Ön görüşmeye alınan bu öğretim elemanı araştırma kapsamı dışında tutulmuştur. Araştırmada kullanılacak olan görüşme formu, İnönü Üniversitesi, Fırat Üniversitesi ve Yıldız Teknik Üniversitesi Eğitim Fakültelerinde görev yapan alan uzmanlarına, içerik geçerliliğini sağlamak amacıyla görüşlerine sunulmuştur. Alan uzmanlarından gelen görüş ve öneriler doğrultusunda görüşme formuna son şekli verilmiştir. Görüşme formunda 4 soru yer almaktadır.

Verilerin Analizi

Araştırmada yarı yapılandırılmış görüşme formu ile ilgili çözümlemeler, nitel boyutta gerçekleştirilmiştir. Bilgisayar destekli nitel veri analizi yapılmıştır. Verilerin analizinde ve modellerin oluşturulmasında NVivo 11 programından yararlanılmıştır. Kodlamalar araştırmacıların ortak görüşleri doğrultusunda oluşturulmuştur. Bu çerçevede, Türkiye'nin Avrupa Birliği Sürecine İlişkin Öğretim Elemanlarının Algılarına yönelik görüşleri

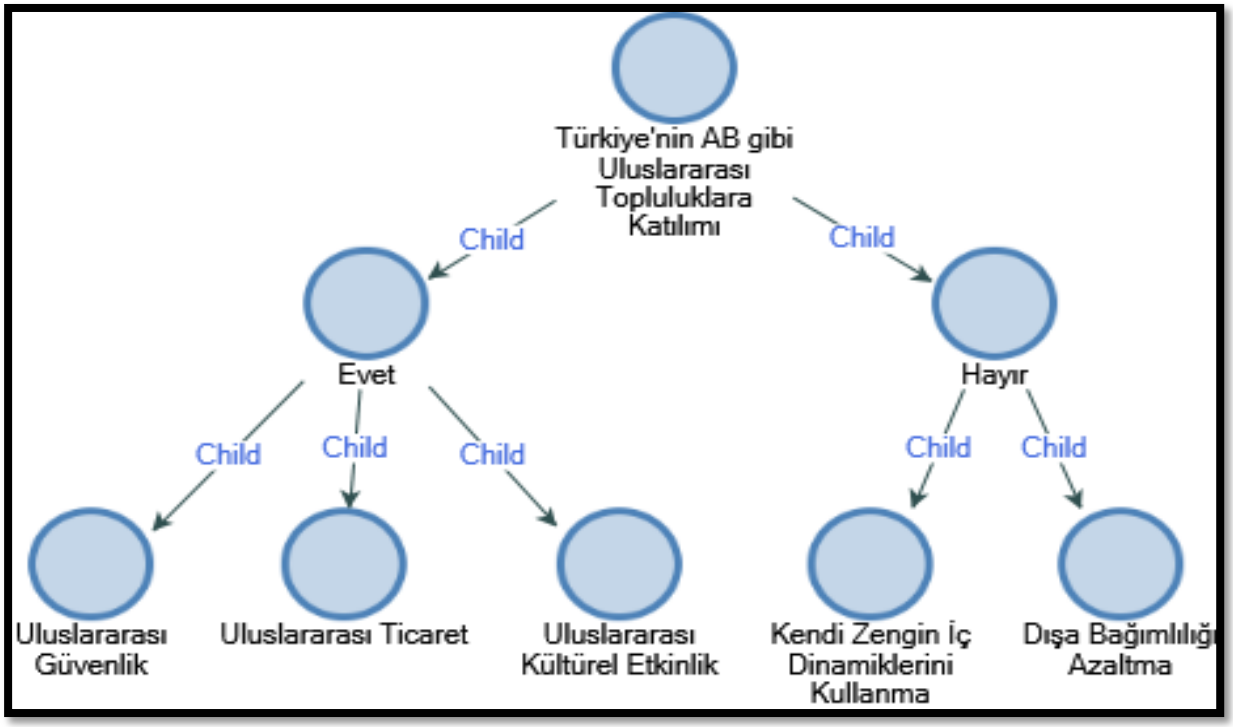
betimsel ve içerik analizi teknikleriyle belli temalar altında bu görüşler gruplanarak çözümlenmeye çalışılmıştır. Araştırmanın güvenirliğini sağlamak için, araştırmada ulaşılan uzman görüşüne başvurulmuştur. Araştırmacılar ve uzmanlar tarafından öncelikle ana temalar ardından bunlara bağlı alt temalar oluşturulmuştur. Çözümlemeler sonucunda ortaya çıkan temalar aralarındaki bağları gösterir şekilde modellenmiş ve görselleştirilmiştir. Modelde yer alan ilişkileri gösteren temayı söyleyen kişi sayısı (frekansını) belirlenmiştir. Araştırmacıların ve uzmanın, temalarda yer alması gereken görüşlere ilişkin değerlendirmeleri karşılaştırılarak "görüş birliği" ve "görüş ayrılığı" sayıları tespit edilmiştir. Araştırmacı dışında iki uzmanla birlikte analizler yapılıp, Miles ve Huberman'ın (1994) formülüne göre araştırmacılar arasındaki uyum hesaplanmıştır. Bu hesaplama sonucunda, P =(83/83+1) x 100 = %92 olarak hesaplanmıştır.

Bulgular

Öğretim elemanlarının görüşleri temelinde, verilerin analizi ile elde edilen bulgular aşağıda yöneltilen sorulara ilişkin oluşan alt başlıklar altında yer almaktadır.

Türkiye'nin AB Gibi Uluslararası Topluluklara Katılımını Onaylama Durumu

Çalışmada araştırma grubunu oluşturan üyelere, yarı yapılandırılmış görüşme formu aracılığıyla yöneltilen *"Türkiye'nin AB gibi uluslararası topluluklara katılımını onaylıyor musunuz, neden?"* şeklinde ki soruya öğretim elemanlarının 2 ana (EVET, f-40; HAYIR, f-25) tema etrafında birleştikleri ya da ayrıştıklarını şekil 1'e bakarak söyleyebiliriz. Evet, ana teması altında bir araya gelen çalışma grubu üyeleri, bu ana temayı, uluslararası güvenlik (f-22), uluslararası ticaret (f-10) ve uluslararası kültürel etkinlik (f-8) temalarıyla gerekçelendirirken; Hayır yanıtını veren üyelerin ise bu ana temayı, kendi zengin iç dinamiklerini kullanma kullanma (f-13) ve dışa bağımlılığı azaltma (f-12) temalarıyla gerekçelendirdiklerini söyleyebiliriz (şekil 1).



Şekil 1: *Çalışma grubu üyelerinin Türkiye'nin AB gibi uluslararası topluluklara katılımını onaylama durumuna ilişkin algıları*

"Türkiye'nin AB gibi uluslararası topluluklara katılımını onaylıyor musunuz, neden?" şeklinde ki soruya birbirinden farklı yanıtlar veren çalışma grubu üyelerinin görüşleri aşağıda örneklendirilmiştir.

> *"En başından itibaren Türkiye'nin AB gibi kuruluşlara karşı çıkıp ilgili kuruluşlara gerekçeli metinlere gönderen bir öğretim üyesi olarak, bizim bu kuruluşlara katılma süreçlerinde sürekli zaman israf edip, her anlamda öz benliğimizden uzaklaştığımızı ifade etmek isterim. Dolayısıyla kesinlikle onaylamıyorum, gerekçe mi biraz daha sınırlandıracak olursam, kendi iç dinamiklerimin farkındalığına ulaşıp, bunların kullanımını şekillendirmek için çaba göstermek olarak açıklamak isterim."* ***(Öğretim elemanı, 3)***

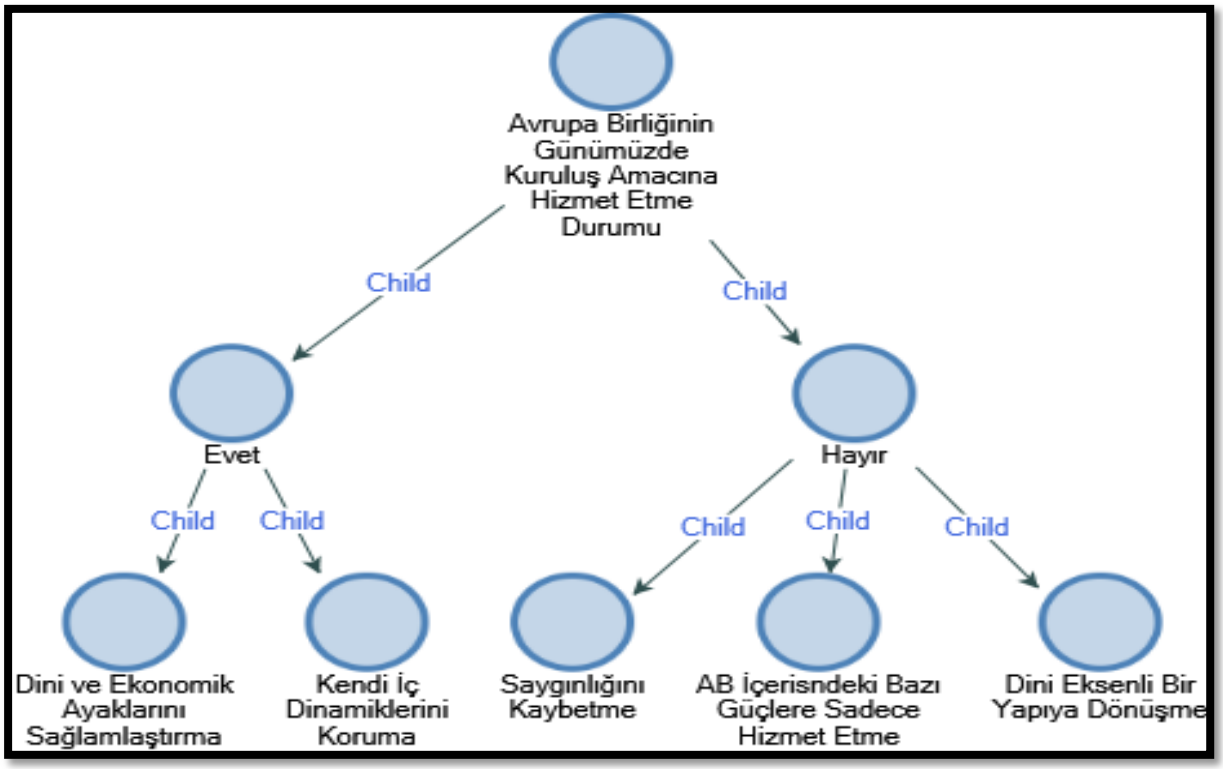
"Türkiye'nin bu gibi kuruluşlara üye olmasını güvenli bir ortamda yaşam ekseninde uluslararası bazda iç ve dış tehditlerden uzak durmak için ve kendini korumak için gerekli olduğunu düşünüyorum." ***(Öğretim elemanı, 44)***

Günümüzde Avrupa Birliği'nin Kuruluş Amacına Hizmet Ettiğini Düşünme Durumu

Çalışma kapsamında hazırlanan yarı yapılandırılmış görüşme formunda yer alan *"Günümüzde Avrupa Birliği'nin kuruluş amacına hizmet ettiğini düşünüyor musunuz, niçin?"* şeklinde ki soruya çalışma grubu üyelerinin iki farklı ana tema altında benzeşip farklılaştıklarını şekil 2 de görmekteyiz. Çalışma grubunu oluşturan öğretim elemanlarının, Evet (f-15) ve Hayır (f-50) ana temalarını farklı alt temalarla gerekçelendirdiklerini (Evet diyenler, dini ve ekonomik ayaklarını sağlamlaştırma /f-10, kendi iç dinamiklerini koruma / f-5; Hayır diyenler, saygınlığını kaybetme /f-15, AB içerisindeki bazı güçlere sadece hizmet etme/f-20,dini eksenli bir yapıya dönüşme/f-30) şekil 2 de görmekteyiz. Aşağıda şekil 2 de çalışma grubu üyeleri olan öğretim elemanlarının görüşlerinin analiz edilmesi sonucu elde edilen bulgulardan hareketle, *"Günümüzde Avrupa Birliği'nin kuruluş amacına hizmet ettiğini düşünüyor musunuz, niçin?"* şeklinde ki sorunun görüş örnekleri aşağıda verilmiştir.

"24 yıldır ülkeme hizmet etmekten her zaman şeref duyan bir dil okutmanı olarak sorunuzu yanıtlarken çalışmanızın sonuçlarını iyi irdeleyip sunulmasını temenni ediyorum. Benim cevabım tabi ki hayır olacaktır. AB kuruluşundan günümüze metin üzerinde ki kuruluş amacına hiçbir zaman hizmet etmediğini söyleyebilirim. Çünkü bu kuruluş, her ne kadar "hızlı bir ekonomik kalkınma ile savaşın yıkıcı etkilerinden kurtulma isteği" olsa da günümüzde, amaçtan tamamen saptığını rahatlıkla söyleyebiliriz. Dini temele alarak, bana dokunmayan yılan bin yaşasın mantığıyla hareket eden bir kuruluş haline gelmiştir." ***(Öğretim elemanı, 9)***

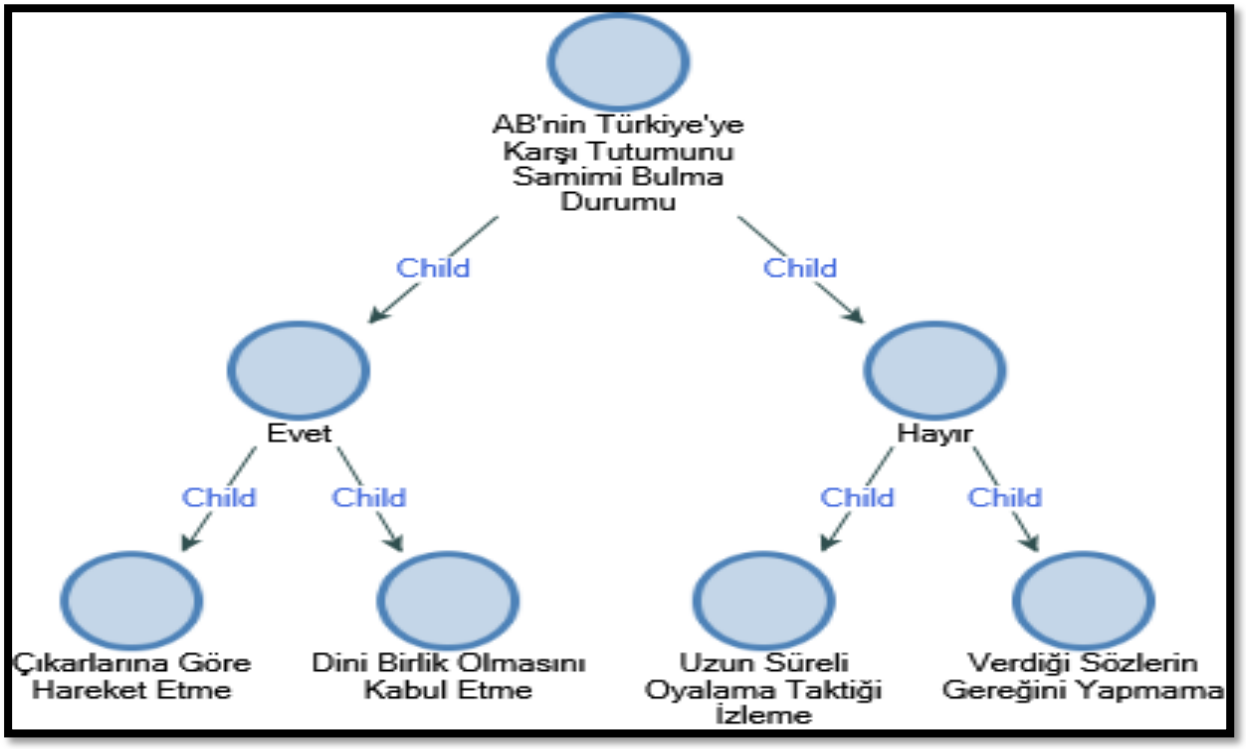
"AB birliğinin amacı dışına çıktığı için bizi almıyorlar ve de almayacaklar şeklinde karamsar yaklaşıma sahip olup eleştirenlere inatla ben bu konuda her zaman ki tezi mi savunmaya devam edeceğim. Benim tezim şu, sizin komşunuza bir katkınız olmazsa bilakis yük oluyorsanız, komşunuz birinci gün kapınızı çalar, ikinci gün çalar ama üçüncü gün sizin sırtını kamburlaştırdığınız gördüğünde sizinle iletişiminizi kesmek zorunda kalır. Dolayısıyla adamlar kendilerine ekonomik anlamda katkı sağlayacak olan ülkelerle yola devam etmek istiyorlar, zorumuza gitmesin ama işin özü bu." ***(Öğretim elemanı, 15)***



Şekil 2: *Çalışma grubu üyelerinin Türkiye'nin AB'nin kuruluş amacına hizmet edip etmeme durumuna ilişkin algıları*

Türkiye'nin Avrupa Birliği Sürecinde, AB Ülkelerinin Türkiye'ye Karşı Tutumlarını Samimi Bulma Durumu

Çalışmada araştırma grubunu oluşturan üyelere, yarı yapılandırılmış görüşme formu aracılığıyla yöneltilen Türkiye'nin Avrupa birliği sürecinde, *"AB ülkelerinin Türkiye'ye karşı tutumlarını samimi buluyor musunuz, niçin?"* şeklinde ki soruya öğretim elemanlarının 2 ana (EVET, f-25; HAYIR, f-40) tema etrafında birleştikleri ya da ayrıştıklarını şekil 1'e bakarak söyleyebiliriz. Evet, ana teması altında bir araya gelen çalışma grubu üyeleri, bu ana temayı, çıkarlarına göre hareket etme (f-22) ve dini birlik olmasını kabul etme temalarıyla gerekçelendirirken; Hayır yanıtını veren üyelerin ise bu ana temayı, uzun süreli oyalama taktiği izleme (f-15) ve verdiği sözlerin gereğini yapmama (f-25) temalarıyla gerekçelendirdiklerini görmekteyiz (şekil 3).



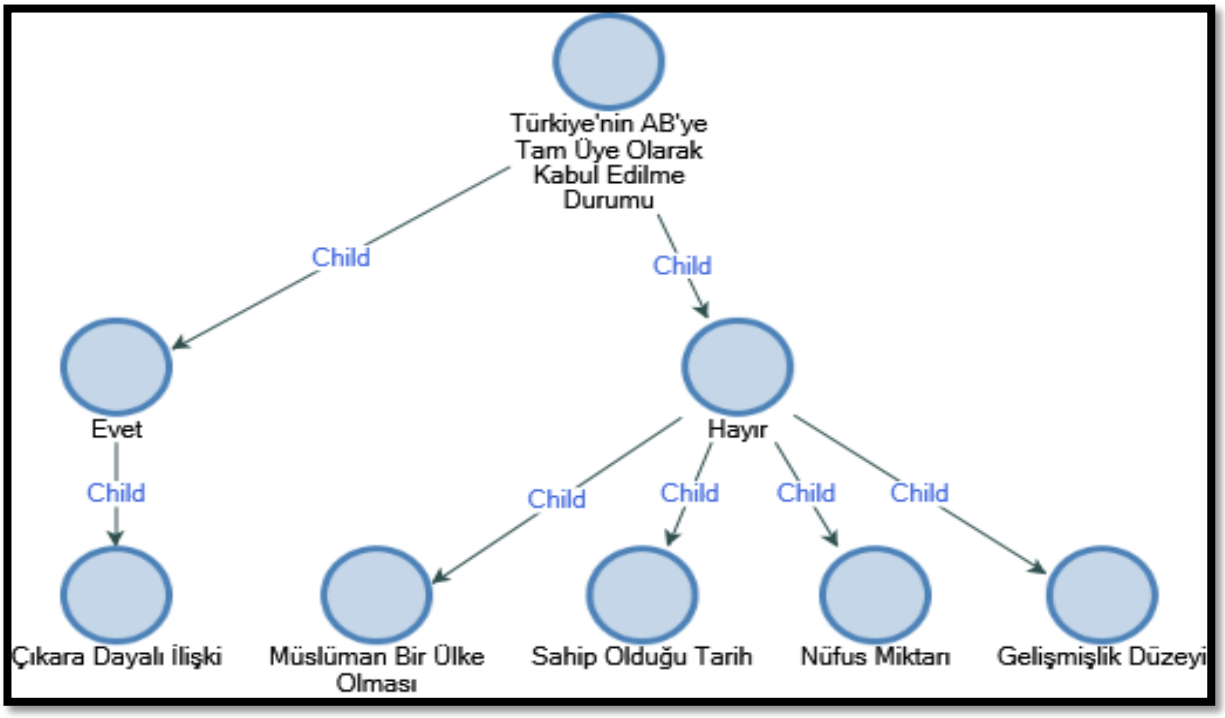
Şekil 3: *Çalışma grubu üyelerinin AB'nin Türkiye'ye karşı tutumunu samimi bulma durumuna ilişkin algıları*

"AB ülkelerinin Türkiye'ye karşı tutumlarını samimi buluyor musunuz, niçin?" şeklinde yarı yapılandırılmış görüşme formunda yer alan soruya çalışma grubu üyelerinin vermiş oldukları örnekler aşağıda örneklendirilmiştir.

> *"AB ülkelerinin ülkemize karşı takınmış oldukları tavrı kesinlikle samimi bulmamakla birlikte onlara hak da vermiyor değilim. Çünkü benim bakış açımdan AB dini temele dayalı bir birlik olduğu için ülkesinin %90'nını Müslüman nüfusun oluşturduğu ülkemize karşı samimi olmalarını da zaten beklemiyorum."* ***(Öğretim elemanı, 2)***
>
> *"AB ülkelerinin ülkemize karşı sergiledikleri tavrın samimiyetle eşleştirilmesi bile kesinlikle büyük bir tartışma konusu olmaktadır. Çünkü bu kuruluş, yıllardır bizi fasıl kavramıyla, uyum süreci kriterleriyle oyalayan bir birliktir. Son dönemde yaptıkları açıklamalara baktığımızda, kendi içlerinde bile ciddi anlamda ciddi sıkıntılar yaşadıkları aşikardır (İngiltere örneği). Geri dönüş anlaşması gereği Türkiye'ye verdiği sözlerin hiç birini yerine getirmeyen bu kuruluş, gerçek yüzünü bir kez daha göstermiştir."* ***(Öğretim elemanı, 39)***

Türkiye'nin AB'ye Tam Üye Olarak Kabul Edileceğini Düşünme Durumu

Çalışma grubu üyelerine yöneltilen *"Türkiye'nin AB'ye tam üye olarak kabul edileceğini düşünüyor musunuz, neden?"* şeklinde ki soruya, öğretim elemanlarının 2 ana (EVET, f-10; HAYIR, f-55) tema etrafında birleştikleri ya da ayrıştıklarını şekil 1'e bakarak söyleyebiliriz. Evet, ana teması altında bir araya gelen çalışma grubu üyeleri, bu ana temayı, çıkara dayalı ilişki (f-10) temasıyla gerekçelendirirken; Hayır yanıtını veren üyelerin ise bu ana temayı, müslüman bir ülke olma (f-20), sahip olunan tarih (f-20), nüfus miktarı (f-5) ve gelişmişlik



düzeyi (f-5)) temalarıyla gerekçelendirdiklerini görmekteyiz (şekil 4).

Şekil 4: *Çalışma grubu üyelerinin Türkiye'nin AB'ye tam üye olarak kabul edilme durumuna ilişkin algıları*

"Türkiye'nin AB'ye tam üye olarak kabul edileceğini düşünüyor musunuz, neden?" şeklinde yarı yapılandırılmış görüşme formunda yer alan soruya çalışma grubu üyelerinin vermiş oldukları örnekler aşağıda örneklendirilmiştir.

> *"46 yaşında olan bir Türkiye Cumhuriyeti vatandaşı olarak, ben bu yaşıma kadar ülkemize karşılıksız hiçbir şeyin verilmediğini gözlemleyen bir akademisyen olarak, Türkiye'nin AB çıkarları çerçevesinde AB'ye yakın gelecekte dahil edileceği kanaatindeyim. Ancak bu sürecin ülkemizde çok şeye mal olacağını da göz önünde bulundurmak gerektiği kanısındayım."* ***(Öğretim elemanı, 18)***
>
> *"Türkiye'nin Müslüman kimliğe sahip bir ülke olması, dünya da ki Müslüman topluluklara yapılan zulmü açıkça dünya kamuoyu önünde, şiddetle eleştirip bu zulmü gerçekleştirenlerle bir takım karşılıklı yaptırımlara gitmesi, bu ve bunun gibi uluslararası dini temelli birlik ya da kuruluşlara alınmayacağı kanısındayım."* ***(Öğretim elemanı, 33)***

Sonuç ve Öneriler

"Türkiye'nin Avrupa Birliği Sürecine İlişkin Öğretim Elemanlarının Algılarını Belirlemeye" yönelik bu araştırmada öğretim elemanlarının algılarından elde edilen sonuçlar, Türkiye'nin AB sürecini yeniden değerlendirme olanağı sağlamıştır. Yarı yapılandırılmış görüşme formu aracılığıyla öğretim elemanlarının görüşleri analiz edilerek elde edilen bulgular ışığından birbirinden farklı, dikkat çekici sonuçlar elde edilmiştir. Öğretim elemanlarının görüşlerinden hareketle çalışmada, Avrupa Birliği'nin kuruluş amacından saptığı, dini eksenli bir yapılanma olduğu, Türkiye'ye karşı samimi tavır takınmadığı, Türkiye'nin Avrupa Birliği'ne tam üye olarak alınmayacağı şeklinde önemli sonuçlar elde edilmiştir. Bu sonuçların yanı sıra, Avrupa Birliği'ne girmemiz gerektiğini ifade eden öğretim elemanlarının olması çalışmanın bir diğer yönünü göstermektedir. Çalışmada elde edilen bu sonuçlar öğretim elemanları tarafından farklı temalarla gerekçelendirilip ifade edilmiştir (Şekil,2,3,4).

Çalışmada elde edilen bu sonuçlardan hareketle;

- ✓ Türkiye'nin AB süreci yeniden ele alınıp çok yönlü bir şekilde değerlendirilmelidir.

- ✓ Türkiye'nin AB sürecine devam edip etmeyeceğine ilişkin gerekirse halkın görüşüne başvurulmalıdır
- ✓ AB- Türkiye ilişkilerinin bu hale gelmesinde etkili olan sebepler irdelenerek değerlendirilmelidir
- ✓ Türkiye'nin kendi iç dinamiklerini harekete geçirip AB gibi uluslararası kuruluşlar karşısında eli güçlendirilmelidir, şeklinde öneriler ileri sürülebilir.

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ANALYSIS OF TURKEY'S REFUGEE POLICY IN THE LIGHT OF SYRIAN REFUGEES' OPINIONS

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Abstract: The first refugee community in Syria entered Turkey on 29 April 2011. Two years after this date, the country has been home to more than 200,000 refugee camps that have reached 21 in number, and a total of 3,000,000 Syrian refugees outside the camp, estimated to be at least 400,000 people. All entries were allowed from the first day when the Syrians started to come to Turkey border in 2011 Spring. As well as those who entered with passports like normal times, those who came without any document were accepted to temporary refugee camps established by Turkey. This policy of Turkey brought both appreciation and criticism both nationally and internationally. In this study, Turkey's refugee policy has been evaluated in the direction of the Syrian refugees in the affected state of this policy. The study was based on qualitative methodology and NVivo 11 program was used for analysis of data and creation of models.

Keywords: Turkey, refugee issue, perception, opinion, policy

TÜRKİYE'NİN MÜLTECİ (SURİYELİ MÜLTECİ) POLİTİKASININ SURİYELİ MÜLTECİLERİN GÖRÜŞLERİ IŞIĞINDA ANALİZİ

Özet: Suriyeli ilk mülteci kafilesi, Türkiye'ye 29 Nisan 2011 tarihinde giriş yaptı. Bu tarihten 2 yıl sonra ülke, sayısı 21'e ulaşan mülteci kamplarında yaşayan 200.000'i aşkın ve kamp dışında kalan ve en az 400.000 kişi oldukları tahmin edilen toplamda 3000.000 Suriyeli mülteciye ev sahipliği yapar hâle geldi. 2011 Baharı'nda Suriyelilerin Türkiye sınırına gelmeye başladığı ilk günden itibaren bütün girişlere izin verildi. Normal zamanlardaki gibi pasaportlarıyla girenlerin yanı sıra, hiçbir belgesi olmadan gelenler de Türkiye tarafından kurulan geçici mülteci kamplarına kabul edildi. Türkiye'nin bu politikası hem ulusal hem de uluslar arası anlamda takdir ve eleştirileri beraberinde getirmiştir. Bu çalışmada da ülkemizde bu politikanın etkilenen konumunda olan Suriyeli mültecilerin görüşleri doğrultusunda Türkiye'nin mülteci politikası ele alınarak değerlendirilmiştir. Çalışma nitel yönteme dayalı bir çalışma olup verilerin analizinde ve modellerin oluşturulmasında NVivo 11 programından yararlanılmıştır.

Anahtar Kelimeler: Türkiye, mülteci sorunu, algı, görüş, politika

Giriş

Türkiye, coğrafi konumu gereği Asya ve Avrupa arasında bir geçiş ülkesi olması hasebiyle münferit göçün yanı sıra kitlesel akınlarla da karşı karşıya kalmıştır. Özellikle 1979 İran Devrimi sonrasında batıya gitmek isteyen İranlılar kitlesel olarak Türkiye'yi transit bir ülke olarak kullanmışlardır (Kaya, 2012). 1989 yılında Bulgaristan'dan gelen Türk soyundan yaklaşık 350 bin civarında göçmenin Türkiye'ye sığınması sonrasındaki kitlesel akın, Irak'tan Türkiye'ye toplu olarak gelen ve sayıları 500 binle ifade edilen Kuzey Iraklının yanı sıra eski Yugoslavya iç savaşı ve Kosova krizi sırasında da devam etmiştir. Ayrıca SSCB'nin dağılması, Doğu Avrupa ülkelerinde yaşanan ekonomik ve politik değişiklikler, Türkiye'yi "düzensiz göçün" (*irregular migration*) veya diğer adıyla "yasa dışı göçün" (*illegal migration*) önemli bir parçası haline getirmiştir. İçinde bulunduğumuz dönemde de Arap Baharı'nın Suriye'deki etkileri ve devam etmekte olan iç savaş nedeniyle sayıları 2 milyona yaklaşan Suriyeli Türkiye'ye akın etmiş ve bu akın halen devam etmektedir. Suriye Arap Cumhuriyeti'nde 2011'in Mart ayında alevlenen olaylar ve iç karışıklıklar sonucu milyonlarca kişi evlerini terk etmek zorunda kalmıştır. Birleşmiş Milletler Mülteciler Yüksek Komiserliği (BMMYK) verilerine göre Suriyelilerin yaklaşık 1,8 milyonu Türkiye'ye göç etmek zorunda kalmıştır (Syria Regional Refugee Response, 2015; SETA Raporu, 2015). Günümüzde bu rakam yaklaşık 4 milyon civarındadır. Türkiye gelen bu yoğun mülteci göçüne rağmen mültecilerin barınma şartlarının iyileştirilmesine yönelik bir takım çalışmalar yapmaya devam etmektedir.

Türkiye Cumhuriyeti Hükümeti, kamp kurmak ve bu kampları yönetmek konusunda başarılı olmuştur. Kamplar, özellikle mültecilere sunulan hizmetler ve konaklama tesislerinin kalitesi bağlamında kayda değer övgüler alıyor. Hepsinde sağlık merkezleri, okullar, sosyal tesisler ve mesleki eğitim kursları gibi donanımlar bulunmaktadır.

Sağlanan hizmetler psikolojik yardımdan televizyon izleme odalarına kadar birçok değişik hizmet kalemi içeriyor ve söz konusu hizmetlerin kalitesi Uluslararası Kriz Grubu *(International Crisis Group, ICG)* tarafından bu kampların "şimdiye kadar görülmüş en iyi mülteci kampları" olarak lanse esilmesini sağladı(McClelland, 2014). *The New York Times* da Şubat ayında "Mükemmel Bir Mülteci Kampı Nasıl İnşa Edilir?" başlıklı bir yazı yayınladı. Ancak bu makale aynı zamanda Suriye'deki çatışma sonu görünmez hâle geldikçe kamp sakinlerinin de nasıl hızla sıkıntılı bir ruh hâline büründüğüne işaret ediyor (International Crisis Group Blurring The Borders, 2013; Kirişçi, 2014). Bu durum, bir kamp sakininin şu sözlerinde tüm çıplaklığıyla ortaya çıkıyor: "Burası 5 yıldızlı bir otel gibi, ama biz burada mutlu değiliz." Gerçekten de kamplar, Suriye'deki rejimin çok uzun ömürlü olmayacağı ve mültecilerin makul bir süre içinde evlerine geri dönebilecekleri beklentisinin hâkim olduğu bir dönemde inşa edilmişti Ancak sürecin günümüze kadar halen çözülememesinin yanısıra Suriye toprakları batılı güçlerin ve terör örgütlerinin güç gösteri sahnesi haline gelmiştir.

Araştırmanın Amacı

"Türkiye'nin Mülteci Politikasının Suriyeli Mültecilerin Görüşleri Işığında Analizini" temele alan bu araştırmada, çalışma grubu üyeleri olan Suriyeli mülteciler görüşlerinin içerik analizine dayalı olarak değerlendirilmesi amaçlanmaktadır. Bu genel amaç çerçevesinde çalışma grubu üyelerine şu sorular yöneltilmiştir:

- ✓ Mülteci metaforik olarak sizce neye benzer, neden?
- ✓ Türkiye'nin mülteci politikasını beğeniyor musunuz, neden?
- ✓ Türkiye'de yaşayan bir mülteci olarak karşılaştığınız problemler nelerdir?
- ✓ Savaş bittikten sonra ülkenize geri dönmeyi düşünüyor musunuz, neden?

Yöntem

Araştırmanın Modeli

"Türkiye'nin Mülteci Politikasının Suriyeli Mültecilerin Görüşleri Işığında Analizini" temele alan bu araştırma, nitel araştırma yaklaşımına dayalı yarı yapılandırılmış görüşme yöntemiyle gerçekleştirilmiştir. Creswell (1998) nitel araştırmayı, sosyal yaşamı ve insanla ilgili problemleri kendine özgü metodlarla sorgulayarak, anlamlandırma süreci olarak ifade etmektedir. Nitel araştırma sürecinde araştırmacı bütüncül bir araştırma tablosu ortaya koyarak; kelime analizleri, detaylı katılımcı görüşme raporları kullanır ve araştırmayı doğal ortamda düzenler. Nitel araştırmada genel olarak takip edilen araştırma süreci parçadan bütünedir [tüme-varım]. Genel itibariyle nitel araştırmacı gözlem, görüşme ve dokümanlardan yola çıkarak kav ramları, anlamları ve ilişkileri açıklayarak süreci sürdürür (Merriam, 1998; Yıldırım ve Şimşek, 2008).Yarı yapılandırılmış görüşmelerde ise, görüşme soruları önceden belirlenmiş görüşme durumlarını kapsamaktadır (Balcı, 2004). Bu araştırma da durum çalışması modeli kullanılmıştır. Durum çalışması modeli "güncel bir olgunun gerçek yaşam bağlamında, özellikle bağlam ve olguların sınırlarının kesin olarak belli olmadığı durumlarda görgül olarak araştırılması" şeklinde ifade etmektedir (Yin, 1994, s.13; Merriam, 1998, s. 27).

Çalışma Grubu

Araştırmada çalışma grubunu, Malatya ve Gaziantep de konteyner kentlerde yaşayan Suriyeli 30 mülteci oluşturmaktadır. Araştırmacının bu illerde yer alan mültecilere ulaşma kolaylığı ve araştırmacıya araştırmanın güvenirliği açısından kolaylık sağladığı için çalışma grubu üyeleri bu illerden seçilmiştir.

Veri Toplama Aracı

Araştırmanın kuramsal boyutu oluşturulduktan sonra "Türkiye'nin Mülteci Politikasının Suriyeli Mültecilerin Görüşleri Işığında Analizi" için yarı yapılandırılmış görüşme formu hazırlanmıştır. Görüşme formu hazırlanırken öncelikle sorulacak sorular belirlenmiştir. Sorular oluşturulurken kolay anlaşılabilecek sorular yazma, açık uçlu sorular sorma, odaklı sorular hazırlama, yönlendirmekten kaçınma, çok boyutlu sorular sormaktan kaçınma ve soruları mantıklı bir biçimde düzenleme gibi ilkelere (Yıldırım ve Şimşek, 2008) dikkat edilmiştir. Araştırmada kullanılacak olan görüşme formu, İnönü Üniversitesi ve Fırat Üniversitesi Eğitim Fakültelerinde görev yapan alan uzmanlarına, içerik geçerliliğini sağlamak amacıyla görüşlerine sunulmuştur. Alan uzmanlarından gelen görüş ve öneriler doğrultusunda görüşme formuna son şekli verilmiştir. Görüşme formunda 4 soru yer almaktadır.

Verilerin Analizi

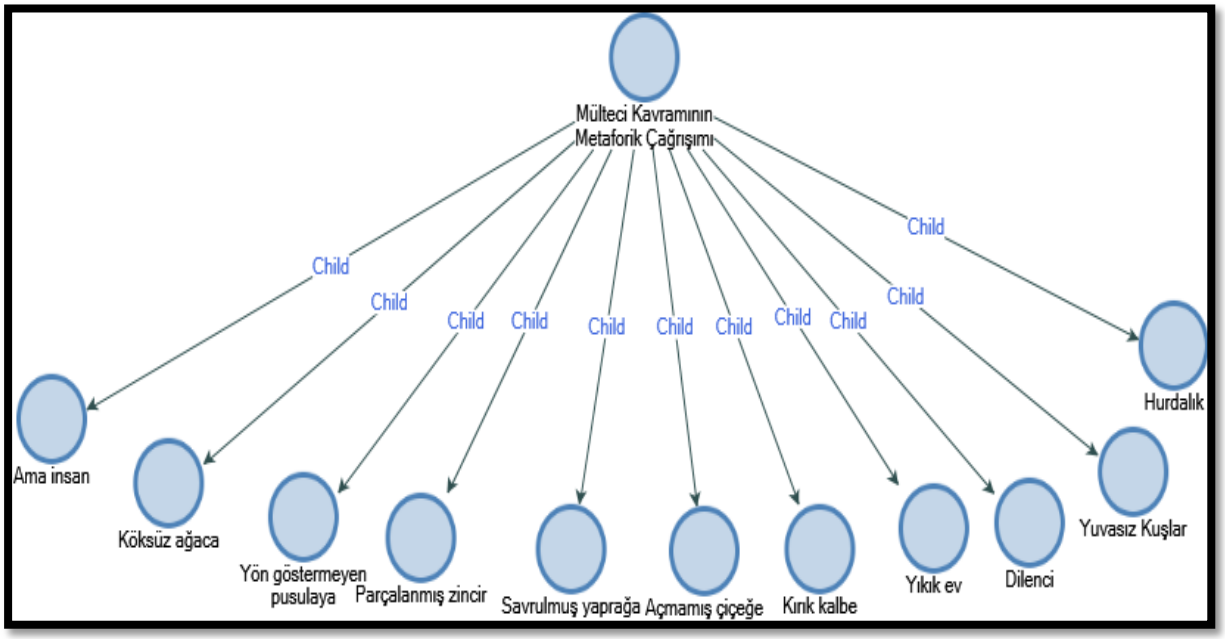
Araştırmada yarı yapılandırılmış görüşme formu ile ilgili çözümlemeler, nitel boyutta gerçekleştirilmiştir. Bilgisayar destekli nitel veri analizi yapılmıştır. Verilerin analizinde ve modellerin oluşturulmasında NVivo 11 programından yararlanılmıştır. Kodlamalar araştırmacıların ortak görüşleri doğrultusunda oluşturulmuştur. Bu çerçevede, "Türkiye'nin Mülteci Politikasının Suriyeli Mültecilerin Görüşleri Işığında Analizine" yönelik görüşleri betimsel ve içerik analizi teknikleriyle belli temalar altında bu görüşler gruplanarak çözümlenmeye çalışılmıştır. Araştırmanın güvenirliğini sağlamak için, araştırmada ulaşılan uzman görüşüne başvurulmuştur. Araştırmacılar ve uzmanlar tarafından öncelikle ana temalar ardından bunlara bağlı alt temalar oluşturulmuştur. Çözümlemeler sonucunda ortaya çıkan temalar aralarındaki bağları gösterir şekilde modellenmiş ve görselleştirilmiştir. Modelde yer alan ilişkileri gösteren temayı söyleyen kişi sayısı (frekansını) belirlenmiştir. Araştırmacıların ve uzmanın, temalarda yer alması gereken görüşlere ilişkin değerlendirmeleri karşılaştırılarak "görüş birliği" ve "görüş ayrılığı" sayıları tespit edilmiştir. Araştırmacı dışında iki uzmanla birlikte analizler yapılıp, Miles ve Huberman'ın (1994) formülüne göre araştırmacılar arasındaki uyum hesaplanmıştır. Bu hesaplama sonucunda, P =(83/83+1) x 100 = %92 olarak hesaplanmıştır.

Bulgular

Suriyeli mültecilerin görüşleri temelinde, verilerin analizi ile elde edilen bulgular aşağıda yöneltilen sorulara ilişkin oluşan alt başlıklar altında yer almaktadır.

Mülteci Metaforik Benzerlik Durumu

Çalışma grubunu oluşturan Suriye uyruklu mültecilere yarı yapılandırılmış görüşme formu aracılığıyla yöneltilen "Mülteci metaforik olarak sizce neye benzer, neden?" şeklindeki soruya birbirinden farklı cevaplar verdikleri şekil 1 de görülmektedir.



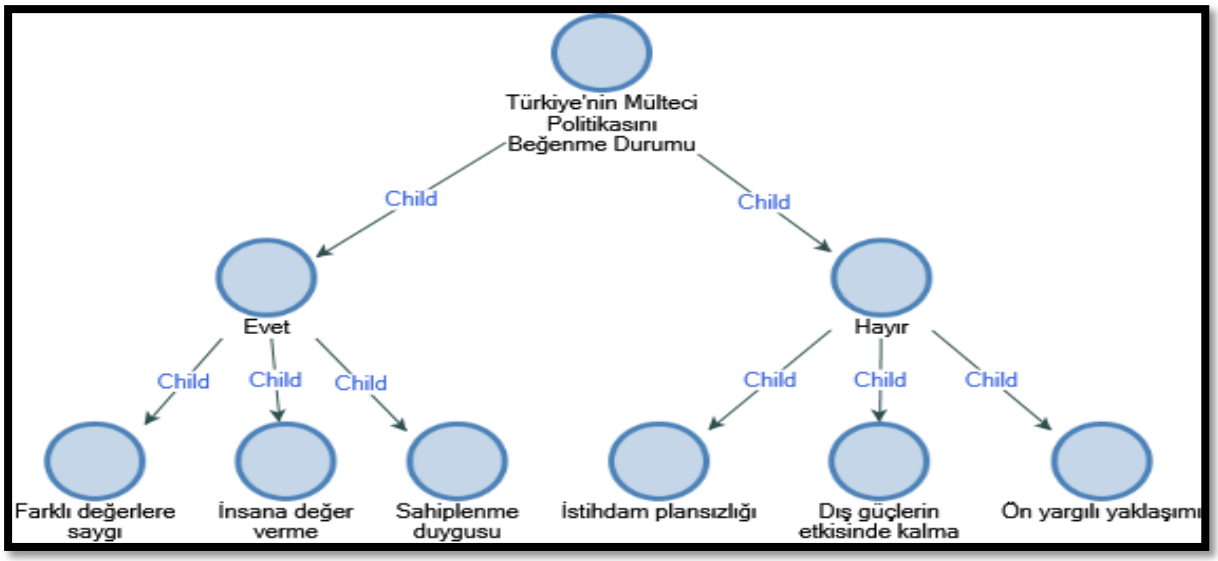
Şekil 1: *Çalışma grubu üyelerinin mülteci kavramına ilişkim metaforik algıları*

Çalışma grubunu oluşturan mülteciler, kendilerine yöneltilen soruya, mülteci kavramını, ama insan (f-8), köksüz ağaç (f-3), yön göstermeyen pusula (f-3), parçalanmış zincir (f-2), savrulmuş yaprak (f-2), açmamış çiçek (f-1), kırık kalp (f-3), yıkık ev (f-1) dilenci (f-2), yuvasız kuşlar (f-2) ve hurdalık (f-3) temalarıyla açıkladıklarını görmekteyiz (Şekil 1).

> *"Mülteci bana göre yuvasız kuşlara benzer. Çünkü, yuvasız kuşların vatanı yoktur. Sürekli havanın durumuna göre değişkenlik gösterir."**(Mülteci, 9)***
> "*Mülteci bana göre, parçalanmış zincire benzer. Çünkü zincirin çarklarından birinin kopması zincir halkası arasında kopukluğa sebep olabilir."* ***(Mülteci, 11)***

Türkiye'nin Mülteci Politikasını Beğenme Durumu

Yarı yapılandırılmış görüşme formunda yer alan *"Türkiye'nin mülteci politikasını beğeniyor musunuz, neden?"* şeklinde ki soruya çalışma grubunu oluşturan Suriyeli mültecilerin iki farklı ana tema ve buna bağlı olarak oluşturdukları alt temalarla farklılaştıkları şekil 2'de görülmektedir.

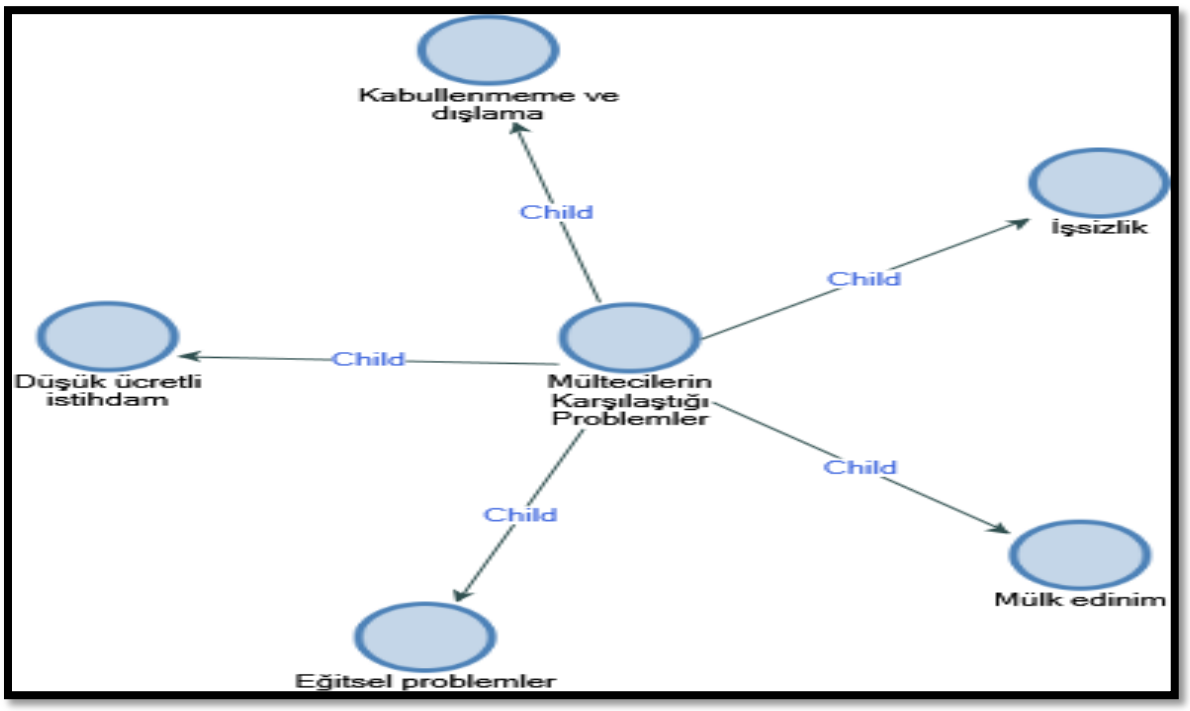


Şekil 2: *Çalışma grubu üyelerinin Türkiye'nin mülteci politikasını beğenme durumuna ilişkin algıları*

Çalışma grubu üyelerinin vermiş oldukları yanıtlar Evet ve Hayır şeklinde (Evet, f-22; Hayır, f-8) şeklinde 2 ana temaya bağlı alt temaların oluşmasını sağlamıştır. Evet diyen çalışma grubu üyeleri bu ana temayı, farklı değerlere saygı (f-5), İnsana değer verme (f-15) ve sahiplenme duygusu (f-2) alt temalarıyla gerekçelendirirken; Hayır yanıtını verenler, istihdam plansızlığı (f-2), dış güçlerin etkisinde kalma (f-1) ve ön yargılı yaklaşım (f-5) alt temalarıyla bu ana temayı gerekçelendirmişlerdir. Şekil 2'de bulguları verilen bu soruya çalışma grubu üyelerinin vermiş oldukları yanıtlar aşağıda örneklendirilmiştir.

> *"Ben işlerimden dolayı daha önceden de çok sık gelip gittiğim için Türkiye'yi zaten çok seviyordum. Onun için hiçbir sıkıntı yaşamadım. Türkiye bizlere çok iyi davranıyor. Hiç kimse savaş ortamında bize yardım eli uzatmadı, bir tek Türkler bize kapıları açtılar. Yani bu politikayı çok beğeniyorum. Çünkü Türkiye gerçek Müslüman bir ülke, gerçek Müslüman insana değer verir. Türklerde bunu yapıyorlar bize karşı."* ***(Mülteci, 17)***
>
> *"Ülkenizin yabancılara karşı davranışlarını beğenmiyorum. Ben buraya geldiğimden beri sürekli sizin halkların söz ve davranışlarıyla dışlanıyorum. İş arıyorum, ama bulamıyorum. Bir lokantada iş buldum. Ancak lokanta da bir bayan bana bakarak bunlara iş vermeyin ki, gidip savaşsınlar deyince ben de dayanamadım kavga ettim ve beni işten attılar. Yani hiç yabancıları sevmiyorsunuz."* ***(Mülteci, 30)***

Türkiye'de Mültecilerin Karşılaştığı Problemler Durumu



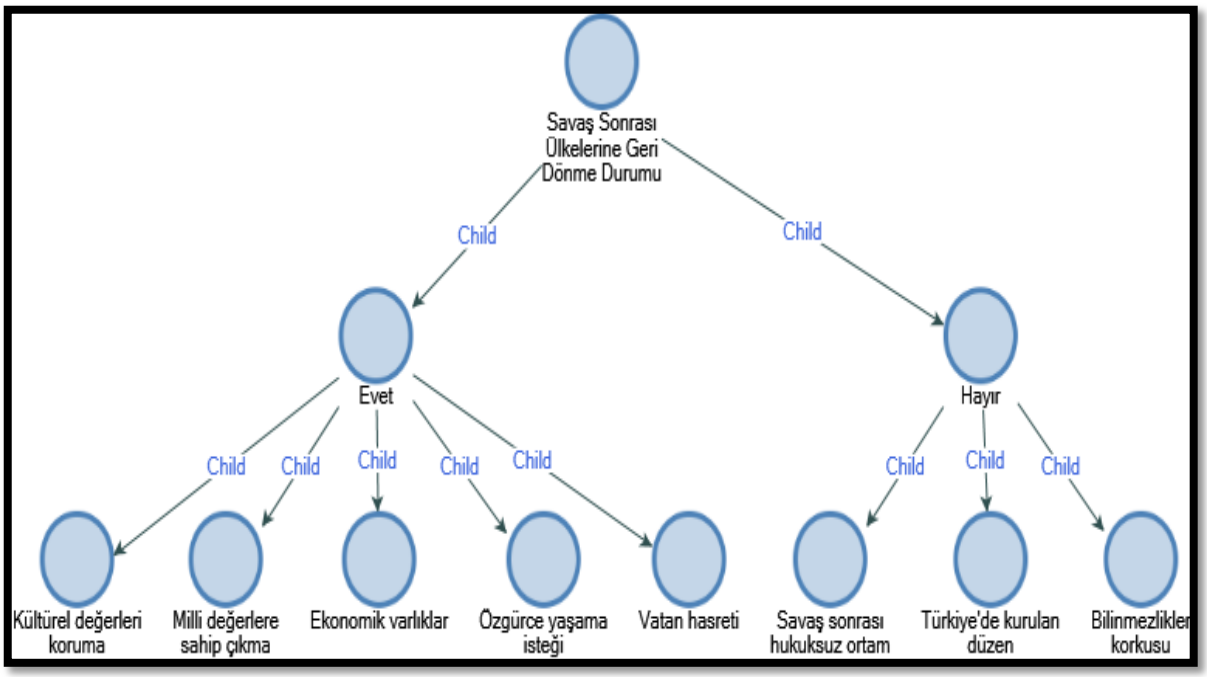
Şekil 3: *Çalışma grubu üyelerinin Türkiye'nin mültecilerin karşılaştığı problemlere ilişkin algıları*

Çalışma grubu üyelerinin çalışma yaprağında yer alan *"Türkiye'de yaşayan bir mülteci olarak karşılaştığınız problemler nelerdir?"* şeklindeki soruya birbirinden farklı yanıtlar vermişlerdir. Bu yanıtlar birbirinden farklı temalar altında toplanmıştır. Mültecilerden oluşan çalışma grubu üyelerinin vermiş oldukları yanıtlardan oluşan temaların dağılımına bakıldığında 5 farklı temanın oluştuğunu şekil 3'de görülmektedir. Bu temalar, eğitsel problemler (f-5), mülk edinim (f-7), işsizlik (f-10), kabullenmeme ve dışlanma (f-3) ve düşük ücretli istihdam (f-5) şeklinde oluştuğunu görmekteyiz. Çalışma grubu üyelerinin vermiş oldukları yanıtlar aşağıda örneklendirilmiştir.

> *"Türkiye'de yaşayan bir yabancı olarak, birçok sorunla boğuşuyoruz. Ancak en önemli problemimiz, düşük ücretli çalışmamızdır. Yaşadığımız yerlerde, bulduğumuz işlerde bizimle aynı işi yapan Türklere verilen ücretle bize verilen arasında çok fark bulunmaktadır. Yani biz çok eziliyoruz. Bu sorunun çözülmesi gerekiyor."* ***(Mülteci,28).***
> *"Türkiye ya da başka bir ülkede savaştan kaçıp gelip yaşamanın tabi ki birçok zorluğu ve sıkıntısı olacaktır. Zaten bunları bile bile evimizi malımızı bırakıp kaçtık buralara geldik. Her sorunun üstesinden gelmeye çalışıyoruz. Ancak Türkler tarafından hor görülme, aşağılanma ve dışlanma ile mücadele edemiyoruz. Çünkü bu yargıları yıkmak bizim elimizde olmayan bir durum."* ***(Mülteci,5)***

Mültecilerin Savaş Bittikten Sonra Ülkelerine Geri Dönme Durumu

Çalışma grubu üyelerinin çalışma yaprağında yer alan *"Savaş bittikten sonra ülkenize geri dönmeyi düşünüyor musunuz, neden?"* Şeklinde ki soruya birbirinden farklı yanıtlar vermişlerdir. Bu yanıtlar birbirinden farklı 2 farklı ana tema altında toplanmıştır. Mültecilerden oluşan çalışma grubu üyelerinin vermiş oldukları yanıtlardan oluşan ana temaların ve bağlı oldukları alt temaların dağılımına bakıldığında şekil 4'de yer alan bir dağılım ortaya çıkmaktadır. Evet diyen (f-17) mülteciler bu ana temayı, kültürel değerleri koruma (f-3), milli değerlere sahip çıkma (f-7), ekonomik varlıklar (f-3), özgürce yaşama isteği (f-4) ve vatan hasreti (f-6) alt temalarıyla gerekçelendirirken; Hayır diyen (f-7) mülteciler bu ana temayı savaş sonrası huzursuz ortam (f-3), Türkiye'de kurulan düzen (f-2) ve bilinmezlikler korkusu (f-2) şeklinde alt temalarla gerekçelendirdiklerini şekil 4'de görmekteyiz.



Şekil 4: *Çalışma grubu üyelerinin savaş sonrası ülkelerine geri dönme durumuna ilişkin algıları*

Çalışma grubu üyelerinin *"Savaş bittikten sonra ülkenize geri dönmeyi düşünüyor musunuz, neden?"* şeklinde ki soruya vermiş oldukları yanıtlar aşağıda örneklendirilmiştir.

> *"Ben bu gidişle Suriye'de savaşın bitebileceğine inanmıyorum. Çünkü dünyanın en güçlü devletleri (Rusya-ABD gibi) bizim ülkemiz üzerinde kurdukları planları yavaş yavaş gerçekleştirmeye başladılar. Ben artık geriye dönmek istemiyorum. Ben Türkiye'yi kendime vatan olarak kabul ediyorum. Çünkü bana sağ olsunlar Türkiye'nin vermiş olduğu imkânlar sayesinde bir düzen kurdum. Bunu yıkmak istemiyorum. Bana diyorlar ki niye gidip savaşmıyorsunuz? Ben kim için kimlerle savaşacağımı bilmiyorum. Suriye'de herkes bir birine sıkıyor."* ***(Mülteci, 18)***
> *"Savaş biter bitmez bir an önce ülkeme dönmek istiyorum. Çünkü beni ben yapan her şeyim o topraklarda kaldı. Ben orada savaş öncesi yaşarken benim bir kimliğim vardı. Şimdi ise hiçbir şeyim yok. O kimliği yeniden elde etmem için ne gerekiyorsa onu yapacağım."* ***(Mülteci, 24)***

Sonuç ve Öneriler

Çalışma grubu üyelerini oluşturan Suriye'li mültecilerin görüşleri perspektifinde Türkiye'nin mülteci politikasının ele alınıp değerlendirildiği bu çalışma, ortaya çıkardığı dikkat çeken önemli sonuçlarıyla mülteci politikasına farklı bakış açısı kazandırması bakımında önem arz etmektedir. Türkiye'de mülteci politikası üzerine yapılan bu çalışmada, elde edilen sonuçlar içerisnde, mültecilerin vatandaşlarımız tarafından hor görülmesi,ya da ön yargılı yaklaşım dikkat çekici sonuçların başında gelmektedir. Suriyeli mültecilerin, savaş sonrası ülkelerine dönme oranında ki düşüş, mülteci kavramına karşı mültecilerin metaforik algılarının farklı olması, mültecilerin Türkiye'nin mülteci politikasını birkaç alt nedenden dolayı beğenmeme çalışmada elde edilen diğer önemli sonuçları oluşturmaktadır. Çalışmada mültecilerin görüşlerinden hareketle elde edilen bu sonuçlar Türkiye'nin mülteci politikasının niteliğini belirlemede etkili olabileceği söylenebilir. Yapılan bu çalışmadan hareketler;

- ✓ Mültecilerin bizim gibi insan olduklarını hiçbir zaman unutmamamız gerektiğini,
- ✓ Mülteciler için oluşturulan konteynır ya da çatır kentlerle vatandaşlarımızın etkileşim düzeyini minimum seviyelere indirmek için ilgililer tarafından tedbir alınması gerektiği,
- ✓ Suriyeli mültecilere ikinci sınıf muameleyi hiçbir koşulda yapmamız gerektiğini,
- ✓ Mültecileri memnun edeceğiz diyerek, kendi vatandaşlarımızn ihitiyaçlarını ikinci plana atmamız gerektiğini,
- ✓ Suriyeli mültecilere Türkiye'nin ve Türk Milletinin yaşam kalitesini aktarmada karşılaşılan sorunlar için oryantasyon eğitimi verilmesi gerektiği, şeklinde öneriler sunulabilir.

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VIEWS OF TEACHERS ON THE LEVEL OF ACHIEVEMENT IN THE SUBJECTOF YESTERDAY, TODAY, TOMORROW IN THE SECOND CLASS IN LIFE SCIENCE COURSE

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Abstract: The aim of this study, based on the views of classroom teachers, is to determine the actualization level of the gains of the theme called "Yesterday, Today, Tomorrow" in the Life Science lesson of the 2nd Grade the participants of this study consist of 100 classroom teachers who work in the towns like Darende, Hekimhan, Kuluncak in 2015-2016 education year. For gathering the data, the teachers guide books for the 2nd grade of life science lesson were used. The obtained data was analized by using SPSS statistical software. The findings were obtained by using t-test and one way analysis of variance "(ANOVA". According to the genders , age, seniority and the districts where they work and those findings were interpreted. LSD test which is technique of post-hoc were used to find the sources of differences when determined any significant difference as a result of ANOVA test. It has seen that the functions in the theme can be gained in good and enough levely, according to the findings. To get better results about the materialization of the functions necessary precautions should be taken.

Keywords: Life-science course, theme, functions, teacher

HAYAT BİLGİSİ 2. SINIF DERSİNDE YER ALAN DÜN, BUGÜN, YARIN TEMASINDA GEÇEN KAZANIMLARIN GERÇEKLEŞME DÜZEYLERİNE İLİŞKİN ÖĞRETMEN GÖRÜŞLERİ

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Özet: Bu araştırmanın amacı; sınıf öğretmenin görüşlerine dayalı olarak Hayat Bilgisi 2.sınıf dersinde yer alan " Dün, Bugün, Yarın" temasında geçen kazanımların gerçekleşme düzeylerini belirlemektir. Araştırmanın çalışma grubunu 2015-2016 eğitim-öğretim yılında ve Darende, Hekimhan, Kuluncak ilçelerinde görev yapmakta olan 100 sınıf öğretmeni oluşturmaktadır. Verilerin toplanmasında, Hayat Bilgisi 2.sınıf öğretmen kılavuzunda bulunan kazanımlardan yararlanılmıştır. Elde edilen veriler SPSS 17 istatistik programı ile analiz edilmiştir. Öğretmenlerin cinsiyetlerine göre ilişkisiz t-testi, öğretmenlerin yaş, kıdem ve görev yaptığı ilçe değişkenlerine göre; tek yönlü varyans analizi "ANOVA" kullanılarak bulgulara ulaşılmış ve bulgular yorumlanmıştır. "ANOVA" testi sonucunda anlamlı farklılaşmanın olduğu durumlarda farklılaşmanın hangi grup ya da gruplardan kaynaklandığını tespit etmek için "post-hoc" tekniklerinden "LSD" uygulanmıştır. Araştırmada elde edilen bulgulara göre; Hayat Bilgisi 2. Sınıf dersinde yer alan "Dün, Bugün, Yarın" temasında geçen kazanımların iyi düzeyde gerçekleştiği görülmüştür. Ayrıca öğretmenlerin cinsiyet, yaş, kıdem ve görev yaptığı ilçe değişkenleri arasında anlamlı bir ilişki bulunmuştur. Kazanımların daha iyi düzeyde gerçekleştirilmesi için gerekli önlemlerin alınması gerektiği sonucuna ulaşılmıştır.

Anahtar Kelimeler: Hayat bilgisi, tema, kazanım, öğretmen

Giriş

Öğrencilerin temel yaşam becerilerine sahip, istenilen davranışları gösteren, sosyal çevresini tanıyan ve içerisinde yaşadığı topluma kolay uyum sağlayan bireyler olarak yetiştirilebilmeleri için, Hayat Bilgisi dersi Türk Eğitim Sistemi içerisindeki bütün programların içerisinde yer almıştır. Hayat Bilgisi dersi temelinde toplu öğretim yaklaşımının olduğu, çocukların hem kendilerini hem de içinde yaşamış oldukları toplum ve dünyayı tanımalarını amaç edinmiş olan; 1924, 1936, 1948, 1968, 1998, 2005, 2009 yılı programlarında aynı isimle yer almış olan bir derstir (MEB,2009;s.5).

Hayat Bilgisi dersinin, ilköğretimin temelini oluşturduğunu söyleyebiliriz. Hayat Bilgisi dersinde çocuklar içinde bulundukları toplumsal ve kültürel çevre hakkında bilgi edinerek; çevresindeki sorunlar hakkında güvenilir ve sağlam bilgiler ışığında çevresine uyum sağlama ve gerekli becerileri kazanmayı öğrenirler. Nitekim Hayat Bilgisi dersinin konuları çocukların yaşamış oldukları çevreden alındığı için ayrı bir değer kazanmaktadır (Binbaşıoğlu,2003;s.36). Bu bağlamda çevrenin çocukların bilgi, beceri ve Hayat Bilgisinin kazanımlarını kazanmasındaki rolü büyüktür. Hayat Bilgisi dersinde araçlar, çocuğun çevresidir. Hayat Bilgisinde çocukların beş duyu organlarıyla algılayabildiği konulara yer verilmesi gerekmektedir (Özdemir,1998;s.1). Buradan yola çıkarak; Hayat Bilgisi dersinin çocukların her türlü gelişimsel durumlarını göz ardı etmemesi ve programdaki konuların ve kazanımların yine çocukların gelişimsel özellikleri dikkate alınarak düzenlenmesi önemli olacaktır.

2009 Hayat Bilgisi Dersi Öğretim Programında birey, toplum, doğa olmak üzere üç temel öğrenme alanı belirlenmiştir. Bu öğrenme alanları ise; insanın, toplumun ve doğanının sürekli değişim içinde olduğu varsayılarak değişim öğesi çerçevesi içinde ele alınmıştır. Öğrenme alanlarını çevreleyecek olan öğe ise temalardır. 2004 Hayat Bilgisi Öğretim Programında okul heyecanım, benim eşsiz yuvam ve dün, bugün, yarın olmak üzere üç temanın Hayat Bilgisi dersini bütünüyle kapsadığı görülmektedir (Çaycı,2012;s.172). Buradan yola çıkılarak, Hayat Bilgisi programının kapsamının belirlenen temalar çerçevesinde olduğu görülmektedir. Hayat bilgisi dersi için özellikle benimsenen toplu öğretim yaklaşımının da bir gereği olarak, bu öğrenme alanlarını aynı anda kuşatabilen üç tema belirlenmiştir. Programda tema adları; "Okul Heyecanım", "Benim Eşsiz Yuvam" ve "Dün Bugün, Yarın" olarak kararlaştırılmıştır.

2009 Hayat Bilgisi Dersi Programının vizyonunda öğrenciler aktif ve öğretmenler ise doğrudan bilgi aktarıcı değil, yol gösterici kişi olarak belirlenmiştir. Öğrencilerin öğrenmekten keyif alan, kendisi ve çevresi ile barışık, milli ve manevi değerlere sahip çıkan, gündelik yaşamda kendisine gereken bilgi ve becerileri kazanmış, değişikliklere açık ve mutlu bireyler olarak yetişmelerin hedeflenmiştir. 2009 Hayat Bilgisi Programının; öğrencilerin etkin olmadığı geleneksel eğitim anlayışının öğrencilerin içlerini bilgiyle dolduracak boş kaplar olarak görmesinin yanlışlığından hareket ederek öğreneni merkeze alan bir kuram olan yapılandırmacı kuramı benimsediği görülmektedir (MEB,2009;s.9).

Öğrencilerin kazanımlara ait bilgilere ulaşmaları için bilgilerin ulaşılabilir bir özellik taşıması gerekmektedir. Bu sayede öğrencilerin bilgilere kendilerinin ulaşmaları sağlanacak ve bilgileri kendilerinin yapılandırmaları sağlanacaktır. Yapılandırmacı yaklaşımın eğitime yansımasının en temel katkılarından biri, öğrencilerin kendi yapılandırdıkları bilgilerin kendi hayatlarında bir karşılığının olduğunu anlamaları olacaktır (Savaş,2007;s.552-553). Öğretmenler tarafından öğrencilere yalnızca bilgi aktarımının doğru olmadığı, öğrencilerin bilgileri kendileri yapılandırması gerekmektedir. Bu yapılandırma sürecinde, öğretmenin rehberlik etme görevini üstlenmesi gerekmektedir. (Demirel,2011;s.154-155).

Yapısalcı öğretmen, öğrenme ortamlarının düzenini sağlarken, disiplin sağlayıcı, bilgi aktaran rolünden çıkarak, rehber, dost, arkadaş düzeyinde bir ilişki kurmalıdır. Öğretmen, konuları öğrencilerin dikkatini çekecek bir konuma getirmeli, öğrencilerle birebir ilişkilerini geliştirerek işbirliği duygularını da geliştirmelidir (Şimşek,2007;s.130). Bununla birlikte, ölçme ve değerlendirme açısından öğretmenler, süreçte yapılan değerlendirmenin yanı sıra, geleneksel ölçme araçlarının kullanılarak öğrenci başarısının değerlendirilmesi gerekliliğinin programda vurgulanmış olması da kazanımların gerçekleşmesi hakkında önemli dönütlerin sağlanmasını da beraberinde getirmektedir. (MEB,2009;S.79-80).

Araştırmanın Amacı

2. sınıf Hayat Bilgisi dersinde yer alan; dün, bugün, yarın temasında geçen kazanımların gerçekleşme düzeylerine ilişkin sınıf öğretmenlerin görüşlerinin neler olduğunun belirlenmesini amaçlayan bu araştırmada aşağıdaki sorulara yanıt aranmıştır:
1. Kazanımlar hakkında sınıf öğretmenlerinin genel görüşleri nelerdir?
2. Öğretmenlerin vermiş oldukları cevaplar cinsiyetlerine göre değişmekte midir?

3.Öğretmenlerin vermiş oldukları cevaplar yaşlarına göre değişmekte midir?
4. Öğretmenlerin görev yaptığı okulun bağlı olduğu ilçe değişkenine göre; kazanımların gerçekleşme düzeyi ile ilgili vermiş oldukları cevaplarda ne gibi farklılıklar vardır?
5. Öğretmenlerin, mesleki kıdemlerine göre vermiş oldukları cevaplar arasında ne gibi farklılık vardır?

Yöntem

Araştırmanın Modeli

İlköğretim 2. Sınıf Hayat Bilgisi dersinde yer alan " Dün, Bugün, Yarın" temasının kazanımlarının gerçekleşme düzeylerine ilişkin öğretmen görüşlerini belirlemeyi amaçlayan bu araştırma betimsel niteliktedir. Araştırmada tarama modeli kullanılmıştır. Tarama modelleri, geçmişte ya da halen var olan bir durumu olduğu şekliyle betimlemeyi amaçlayan araştırma yaklaşımlarıdır. Araştırmaya konu olan olay, birey ya da nesne, kendi koşulları içinde ve olduğu gibi tanımlanmaya çalışılmaktadır. Onları, herhangi bir şekilde değiştirme, etkileme çabası gösterilmemektedir. Bilinmek istenen şey vardır ve olduğu gibi oradadır (Karasar,2009;s.77). Betimsel araştırmalar ise, verilen bir durumu tam olarak tanımlamaktadır. Eğitim alanındaki betimsel çalışmalara; çeşitli öğrenci gruplarının başarılarını belirlemek, öğretmenlerin, yöneticilerin ya da danışmanların davranışlarını tanımlamak, ebeveynlerin tutumlarını ve okulun fiziki şartlarını tanımlamak gibi örnekleri vermemiz doğru olacaktır (Büyüköztürk, Çakmak, Akgün, Karadeniz & Demirel 2013;s.22). Genellikle bir survey (tarama) yöntemi olan betimleme yönteminin grupla ilgili genişlemesine ve çok sayıda denek veya obje üzerinde ve belirli bir zaman dilimi içinde yapıldığı görülmektedir (Kaptan,1993;s59).

Evren ve Örneklem

Bu çalışmanın evrenini, 2015/2016 eğitim-öğretim yılında Malatya iline bağlı Darende, Hekimhan, Kuluncak ilçelerinde bulunmakta olan ilkokullarda görev yapan 175 sınıf öğretmeni oluşturmaktadır. Araştırmanın örneklemini; Malatya iline bağlı Darende, Hekimhan, Kuluncak İlçe Milli Eğitim Müdürlüklerine bağlı ilkokullarda çalışan sınıf öğretmenleri arasından tesadüfi örnekleme yoluyla seçilen 100 sınıf öğretmeni oluşturmaktadır. Örnekleme yöntemi olarak en çok kullanılan yöntem olan random (tesadüfi örnekleme) yöntemi kullanılmıştır.

Veri Toplama Aracı

Araştırmanın verileri, Hayat Bilgisi Programı'nda kazandırılması öngörülen ve Hayat Bilgisi 2.sınıf öğretmen kılavuzunda yer alan kazanımların anket formuna aktarılması ile toplanmıştır. Araştırmanın anketi Hayat Bilgisi dersi 2. sınıf kazanımlarından oluşmakta olup, likert ölçeği temel alınarak hazırlanmıştır. Likert tipi derecelendirme ölçeklerinden, sıklıkla sosyal bilimlerde ve daha çok tutum gibi psikolojik özelliği ölçmede herhangi bir konudaki görüşleri ortaya çıkarmada veya bir davranışa ait gözlenme sıklığını belirmede yararlanılmaktadır (Büyüköztürk, Çakmak, Akgün, Karadeniz & Demirel, 2013;s.129).

Verilerin Analizi

Sınıf öğretmenlerine uygulanmış olan anket yoluyla elde edilmiş olan verilerin, istatistiki anlamda analizinde SPSS 17 (Statistical Package For Social Sciences) paket programından yararlanılmıştır. Verilerin çözümlenmesi işleminde, frekans (N), yüzde (%), aritmetik ortalama ($\overline{X}$) ve standart sapmadan (SS) yararlanılmıştır. Ortalamalar arası farkın anlamlı olup-olmadığını test etmek için ikili gruplarda t-testi, ikiden daha fazla olan gruplarda ise varyans analizi kullanılmıştır. Ortaya çıkmış olan farklılıkların hangi gruplar arasında olduğunu belirlemek maksadıyla da LSD test tekniği kullanılmıştır. Analizler neticesinde ortaya çıkan verilerin kolay yorumlanabilmesi için bulgular bölümünde tablolar oluşturulmuş ve bulgular yorumlanmıştır.

Bulgular

Kazanımların Gerçekleşmesi Hakkında Sınıf Öğretmenlerinin Genel Görüşlerine İlişkin Bulgular

Tablo 1. Kazanımlara ait frekans, yüzde, ortalama ve standart sapmalar

	Tamamen Gerçekleşti		Gerçekleşti		Kısmen Gerçekleşti		Gerçekleşmedi		Hiç Gerçekleşmedi			
Madde	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**$\bar{X}$**	**SS**
2	38	38	48	48	14	16	0	0	0	0	4,24	,683
1	41	41	42	42	16	16	1	1	0	0	4,23	,750
22	42	42	39	39	14	14	5	5	0	0	4,18	,857
20	43	43	33	33	19	19	4	4	1	1	4,13	,928
13	36	36	38	38	21	21	5	5	0	0	4,05	,880
16	27	27	50	50	20	20	3	3	0	0	4,01	,771
12	32	32	41	41	22	22	4	4	1	1	3,99	,893
3	30	30	43	43	23	23	3	3	1	1	3,98	,864
4	16	16	60	60	21	21	3	3	0	0	3,89	,694
21	26	26	43	43	25	25	5	5	1	1	3,88	,890
15	21	21	47	47	28	28	4	4	0	0	3,85	,796
7	20	20	44	44	32	32	3	3	1	1	3,79	,832
23	15	15	54	54	25	25	6	6	0	0	3,78	,773
11	23	23	41	41	26	26	10	10	0	0	3,77	,919
18	23	23	41	41	26	26	9	9	1	1	3,76	,944
14	18	18	45	45	30	30	6	6	1	1	3,73	,862
17	18	18	41	41	36	36	3	3	2	2	3,70	,870
5	17	17	43	43	31	31	7	7	2	2	3,66	,912
10	18	18	36	36	35	35	10	10	1	1	3,60	,932
9	18	18	30	30	41	41	9	9	2	2	3,53	,958
8	8	8	43	43	37	37	9	9	3	3	3,44	,879
19	13	13	31	31	42	42	9	9	5	5	3,38	,992
6	6	6	34	34	37	37	17	17	6	6	3,17	,985
	Genel Ortalama										**3,81**	

Tablo 1'de görüldüğü gibi kazanımlara verilen yanıtlara ilişkin olarak aritmetik ortalaması en büyük olan kazanımdan en küçük olana kazanıma doğru bir sıralama yapılmıştır. Bu bağlamda; kazanımları içeren ankete katılan sınıf öğretmenlerinin bağımlı sorulara verdikleri yanıtlara göre gerçekleştiğine en çok inanılan kazanımlar; "Önceki yıllarda ve şimdi tek başına yapabildiği ve yapamadığı davranışları karşılaştırarak zaman içinde nasıl bir değişim geçirdiğini fark eder." kazanımı, "Kendisinin, arkadaşlarının ve ailesindekilerin fiziksel görünümlerinin zaman içinde nasıl değiştiğini fark eder." kazanımı ile "Yaşadığı çevreyi temiz tutmasının kendisinin ve başkalarının sağlığı ve gelişimiyle ilişkili olduğunu kavrar." kazanımıdır.

Kazanımları içeren ankete katılan sınıf öğretmenlerinin diğer kazanımlara göre daha az gerçekleştiğini düşündükleri kazanımlar, **"**Farklı ülkelerdeki çocukların beslenme, giyinme ve oyun tarzlarındaki değişiklikleri araştırır ve sunar." kazanımı, "Farklı ülkelerde, doğal afetlere karşı alınan önlemlerle ülkemizde alınan önlemleri karşılaştırır." kazanımı ile "Geçmişte kabul gören mesleklerle günümüzde kabul gören meslekler arasındaki farklılıkları karşılaştırır." kazanımıdır.

Araştırmaya katılan sınıf öğretmenleri, Hayat Bilgisi 2. sınıf dersinde yer alan "Dün, Bugün, Yarın" temasında geçen kazanımların gerçekleşme düzeyini değerlendirmelerine yönelik maddelere verdikleri yanıtların aritmetik ortalaması ($\bar{X}$=3,81) olarak bulunmuştur. Bu bağlamda; sınıf öğretmenleri kazanımların gerçekleştirilebilmesini genel olarak "Gerçekleşti" düzeyinde görmüşlerdir.

Sınıf Öğretmenlerinin "Cinsiyet" Değişkenine İlişkin Bulgular

Tablo 2. Sınıf öğretmenlerinin cinsiyet değişkenine göre, "gökyüzünü gözlemler ve gözlemlediği gök cisimlerini listeler" kazanımı için yapılan ilişkisiz grup T testi sonuçları

Cinsiyet	N	$\overline{X}$	S	sd	t	p
Erkek	60	3,55	,852	98	2,14	,034*
Kadın	40	3,92	,858			

*p< 0,05

Tablo 2' de görüldüğü gibi, "Gökyüzünü gözlemler ve gözlediği gök cisimlerini listeler" kazanımının gerçekleşme düzeyi ile sınıf öğretmenlerinin cinsiyet değişkeni arasında (p< 0,05) anlamlı bir farklılaşma görülmektedir. Söz konusu kazanım için erkek sınıf öğretmenlerine ait puanların aritmetik ortalaması ($\overline{X}$)= 3,55, kadın sınıf öğretmenlerine ait puanlarının aritmetik ortalaması, ($\overline{X}$)= 3,92 bulunmuştur. Aritmetik ortalamalar dikkate alındığında farklılaşmanın kadın sınıf öğretmenleri lehine olduğu görülmektedir. Başka bir ifade ile kadın sınıf öğretmenleri, erkek sınıf öğretmenlerine göre ilgili kazanımın daha fazla gerçekleştiğini düşünmektedir. Belet (1999) yapmış olduğu "İlköğretim Kurumlarında Uygulanan Hayat Bilgisi Programının Değerlendirilmesi" başlıklı çalışmasında, kadın öğretmenlerin program ve uygulanışı ile ilgili görüşlerinin genelde erkek öğretmenlere göre daha olumlu olduğunu saptaması araştırmamız ile örtüşmektedir. Araştırmamız ile benzerlik gösteren bu çalışmanın yanı sıra; Alak (2011) 'ın "Hayat Bilgisi Öğretim Programı Öğelerinin Öğretmen Görüşlerine Göre Değerlendirilmesi" başlıklı çalışmasında sınıf öğretmenlerinin cinsiyet değişkeni açısından programın öğelerine yönelik anlamlı bir farklılığın olmadığı saptanmış olup araştırmamız ile örtüşmediği görülmektedir. Öğreten, öğrenme ile ilgili birtakım bilgi ve becerilere sahiptir ve öğrenene bilgiyi öğretme çabası içindedir (Açıkgöz,1998;s.11). Bu bağlamda ve yapılan gözlemler sonucunda; kadın sınıf öğretmenlerinin, erkek sınıf öğretmenlerine göre, kazanımların gerçekleştirilmesi için daha fazla yöntem ve teknik kullandıkları söylenebilir.

Tablo 3. sınıf öğretmenlerinin cinsiyet değişkenine göre, "farklı ülkelerde, doğal afetlere karşı alınan önlemlerle ülkemizde alınan önlemleri karşılaştırır" kazanımı için yapılan ilişkisiz grup T testi sonuçları

Cinsiyet	N	$\overline{X}$	S	sd	t	p
Erkek	60	3,20	,970	98	2,26	,026*
Kadın	40	3,65	,975			

*p< 0,05

Tablo 3'te görüldüğü gibi, "Farklı ülkelerde, doğal afetlere karşı alınan önlemlerle ülkemizde alınan önlemleri karşılaştırır" kazanımının gerçekleşme düzeyi ile sınıf öğretmenlerinin cinsiyet değişkeni arasında (p< 0,05) anlamlı bir farklılaşma görülmektedir. Söz konusu kazanım için erkek sınıf öğretmenlerine ait puanların aritmetik ortalaması, ($\overline{X}$)=3,20, kadın sınıf öğretmenlerine ait puanların aritmetik ortalaması, ($\overline{X}$)= 3,65 bulunmuştur. Aritmetik ortalamalar dikkate alındığında farklılaşmanın kadın sınıf öğretmenleri lehine olduğu görülmektedir. Başka bir ifade ile kadın sınıf öğretmenleri, erkek sınıf öğretmenlerine göre; ilgili kazanımın daha fazla gerçekleştiğini düşünmektedir. Uğur (2006) "2005 İlköğretim 1.,2. ve 3. Sınıflar Hayat Bilgisi Öğretim Programına İlişkin Öğretmen Görüşleri" başlıklı çalışmasında, cinsiyet değişkenine ilişkin olarak; programın durumuna, beceri ve kazanımlarına, ölçme ve değerlendirmesine ilişkin anlamlı bir farkın olmadığı sonucuna ulaşmıştır. Aynı şekilde; Demir (2007)'in yapmış olduğu çalışmada da öğretmenlerin kazanımlar açısından görüşleri, cinsiyet değişkeni açısından anlamlı bir farklılık göstermemektedir. Söz konusu iki çalışma ile çalışmamızın bulgularının örtüşmediği görülmektedir. Okullarımızda, öğretim süreci, ana-babaların tutum ve beklentilerinden, öğretim malzemelerinin kalitesine, öğretmenin beden diline ve soru sorarken ki takındığı tavra kadar birçok etkenin altındadır. Bu açıdan bakıldığında öğretim karmaşık bir etkileşim ağını içermektedir (Açıkgöz, 1998;s.21). Bu bağlamda ve yapılan gözlemler sonucunda; kadın sınıf öğretmenlerinin, erkek sınıf öğretmenlerine göre ilgili kazanımın gerçekleştirilmesinde, karmaşık bir etkileşim ağı olarak nitelendirilen öğretimin uygulanması konusunda daha etik davrandıkları söylenebilir.

Tablo 4. Sınıf öğretmenlerinin cinsiyet değişkenine göre "canlıların hayatta kalabilmeleri için nelere ihtiyaçları olduğunu araştırır" kazanımı için yapılan ilişkisiz grup T testi sonuçları

Cinsiyet	N	$\overline{X}$	S	Sd	t	p
Erkek	60	3,95	,964	98	2,43	**,017***
Kadın	40	4,40	,810			

*p< 0,05

Tablo 4'te görüldüğü gibi, "Canlıların hayatta kalabilmeleri için nelere ihtiyaçları olduğunu araştırır" kazanımının gerçekleşme düzeyi ile sınıf öğretmenlerinin cinsiyet değişkeni arasında (p< 0,05) anlamlı bir

farklılaşma görülmektedir. Söz konusu kazanım için erkek sınıf öğretmenlerine ait puanların aritmetik ortalaması, ($\overline{X}$)=3,95 ve kadın sınıf öğretmenlerine ait puanlarının aritmetik ortalaması, ($\overline{X}$)=4,40 bulunmuştur. Aritmetik ortalamalar dikkate alındığında farklılaşmanın kadın sınıf öğretmenleri lehine olduğu görülmektedir. Başka bir ifade ile kadın sınıf öğretmenleri, erkek sınıf öğretmenlerine göre; ilgili kazanımın daha fazla gerçekleştiğini düşünmektedir. Çakır (2007)'ın yapmış olduğu "Yeni Hayat Bilgisi Programında Yer Alan Kazanımların Önerilen Etkinlikler Çerçevesinde Gerçekleştirilebilme Düzeyinin Belirlenmesi" başlıklı çalışmasında öğretmenlerin Hayat Bilgisi programında yer alan kazanımların önerilen etkinliklerle gerçekleştirilebilme düzeylerine ilişkin görüşlerinde cinsiyete göre anlamlı bir fark bulunmamıştır. Gülener (2010)' in çalışmasında da Hayat Bilgisi öğretim programının beceri ve kazanımlar bakımından öğretmen görüşlerinin cinsiyet değişkeni açısından farklılık olmadığı belirtilmiştir. Söz konusu iki çalışma ile çalışmamızın ilgili kazanımı açısından değerlendirme yaptığımızda örtüşmediği görülmektedir. Eğitimsel amaçlara ulaşılmasında, öğrenci ve öğretmenin karşılıklı saygı ve güvene dayalı kurulan samimi ilişkilerin rolü önemlidir (Açıkgöz,1998;110). Bu bağlamda ve gözlemler sonucunda; kadın sınıf öğretmenlerinin, erkek sınıf öğretmenlere göre ilgili kazanımın gerçekleştirilmesinde, öğrencilerle daha samimi ilişki kurdukları söylenebilir.

Sınıf Öğretmenlerinin "Yaş" Değişkenine İlişkin Bulgular

Araştırmamızdaki ankette yer alan kazanımlar arasından istatistiksel olarak anlamlılık gösteren kazanıma ait maddeler aşağıda tablolar halinde gösterilerek yorumlanmıştır. Başka bir deyişle; diğer maddeler için anlamlı bir farklılaşma olmadığından dolayı sadece anlamlılık gösteren maddeler dikkate alınıp yorumlanmıştır. Daha kolay anlaşılması ve grupların tabloda doğru yorumlanması için gruplara A,B,C,D isimleri verilmiştir. Bu bağlamda; 20-30 yaş grubu=A, 31-40 Yaş grubu=B, 41-50 yaş grubu=C ve 51 ve üstü yaş grubu=D olarak isimlendirilip "ANOVA" sonuçları tablosunda anlamlı fark bölümünde belirtilmiştir.

Tablo 5. Sınıf öğretmenlerinin yaş değişkenine göre "bayram kutlamaları için yaptığı hazırlık çalışmalarını ve bayram sürecindeki duygularını özgün bir şekilde ifade eder" kazanımına ilişkin ANOVA sonuçları

Varyansın Kaynağı	Kareler Toplamı	sd	Kareler Ortalaması	F	p	Anlamlı Fark
Gruplararası	7,801	3	2,600			
Gruplariçi	71,189	96	,742	3,507	**,018**	C-B,D
Toplam	**78,990**	**99**				

*p< 0,05

Tablo 5'te görüldüğü gibi, "Bayram kutlamaları için yaptığı hazırlık çalışmalarını ve bayram sürecindeki duygularını özgün bir şekilde ifade eder" kazanımı için yaş değişkeni gruplarının aritmetik ortalamaları arasındaki fark istatistiksel olarak anlamlı bulunmuştur. [$F_{(3-96)}$ =3,507, p< 0,05]. Başka bir ifade ile sınıf öğretmenlerinin ilgili kazanıma ilişkin belirtmiş oldukları görüşler sınıf öğretmenlerinin yaşlarına bağlı olarak anlamlı bir şekilde değişmektedir. Söz konusu kazanımına yönelik yapılan (Post Hoc Tests LSD)'ye ve aritmetik ortalamalara bakıldığında; D=51 ve üstü yaş grubu, ilgili kazanımın gerçekleşmesi konusunda; C=41-50 yaş grubuna göre ilgili kazanımın daha fazla gerçekleştiğini düşünmektedir. Yine, B=31-40 yaş grubundaki sınıf öğretmenleri, ilgili kazanımın gerçekleşmesi konusunda C=41-50 yaş grubu sınıf öğretmenlerine göre ilgili kazanımın daha fazla gerçekleştiğini düşünmektedir. Öğrenmenin birçok öğretim modeli ve araçların birbirleri ile etkili bir şekilde bütünleştirilmesi ile gelişme sağlanmaktadır (Senemoğlu,2012;s.377). Bu bağlamda ve gözlemlere dayalı olarak; ilgili kazanımın gerçekleştirilmesi için öğretmenler arası yaş değişkenine bağlı olarak, C=41-50 yaş grubu sınıf öğretmenlerinin, çeşitli öğretim modellerini öğretim modeline uygun araçlar ile bütünleştirmedikleri söylenebilir.

Tablo 6. Sınıf öğretmenlerinin yaş değişkenine göre "dünya'nın hem kendi çevresinde hem de güneş'in çevresinde dönmesi sonucunda meydana gelen olguları araştırır; bunlar arasındaki benzerlik ve farklılıkları ayırt eder" kazanımına ilişkin ANOVA sonuçları

Varyansın Kaynağı	Kareler Toplamı	sd	Kareler Ortalaması	F	p	Anlamlı Fark
Gruplararası	7,212	3	2,404			
Gruplariçi	66,498	96	,693	3,471	**,019***	D,A,B,C B-C
Toplam	**73,710**	**99**				

*p< 0,05

Tablo 6'da görüldüğü gibi, "Dünya'nın hem kendi çevresinde hem de Güneş'in çevresinde dönemsi sonucunda meydana gelen olguları araştırır; bunlar arasındaki benzerlik ve farklılıkları ayırt eder" kazanımı için yaş değişkeni gruplarının aritmetik ortalamaları arasındaki fark istatistiksel olarak anlamlı bulunmuştur. [$F_{(3-96)}$

=3,471, p< 0,05]. Başka bir ifade ile sınıf öğretmenlerinin ilgili kazanıma ilişkin belirtmiş oldukları görüşler sınıf öğretmenlerinin yaşlarına bağlı olarak anlamlı bir şekilde değişmektedir. Söz konusu kazanımına yönelik yapılan (Post Hoc Tests,LSD)'ye ve aritmetik ortalamalara bakıldığında; D=51 ve üstü yaş grubu, ilgili kazanımı gerçekleşmesi konusunda; C=41-50, B=31-40 ve A=20-30 yaş grubuna göre ilgili kazanımın daha fazla gerçekleştiğini düşünmektedir. Diğer taraftan, B=31-40 yaş grubundaki sınıf öğretmenleri de C=41-50 yaş grubu sınıf öğretmenlerine göre ilgili kazanımın daha fazla gerçekleştiğini düşünmektedir. Öğrenme açısından yapılandırmacı sınıflar, önceki bilgiler üzerine yeni bilgilerin yapılandırıldığı ve güvenilir tecrübelere dayanılacak ortamların sunulduğu sınıflardır (Özden,2008;68). Bu bağlamda ve gözlemlere dayalı olarak; ilgili kazanımın gerçekleştirilmesi için öğretmenler arası yaş değişkenine bağlı olarak, D=51 ve üstü yaş grubu sınıf öğretmenlerinin daha güvenilir tecrübelere sahip oldukları söylenebilir.

Tablo 7. Sınıf öğretmenlerinin yaş değişkenine göre "yaşadığı çevreyi temiz tutmasının kendisinin ve başkalarının sağlığı ve gelişimiyle ilişkili olduğunu kavrar" kazanımına ilişkin ANOVA sonuçları

Varyansın Kaynağı	Kareler Toplamı	sd	Kareler Ortalaması	F	p	Anlamlı Fark
Gruplararası	6,000	3	2,000			
Gruplariçi	66,760	96	,695	2,876	,040*	C-A,D
Toplam	**72,760**	**99**				

*p< 0,05

Tablo 7'de görüldüğü gibi, "Yaşadığı çevreyi temiz tutmasının kendisinin ve başkalarının sağlığı ve gelişimiyle ilişkili olduğunu kavrar" kazanımı için yaş değişkeni gruplarının aritmetik ortalamaları arasındaki fark istatistiksel olarak anlamlı bulunmuştur. [$F_{(3-96)}$=2,876, p<0,05]. Başka bir ifade ile sınıf öğretmenlerinin ilgili kazanıma ilişkin belirtmiş oldukları görüşler sınıf öğretmenlerinin yaşlarına bağlı olarak anlamlı bir şekilde değişmektedir. Söz konusu kazanımına yönelik yapılan (Post Hoc Tests LSD)'ye ve aritmetik ortalamalara bakıldığında; D=51 ve üstü yaş grubundaki sınıf öğretmenleri ,C=41-50 yaş grubundaki sınıf öğretmenlerine göre; ilgili kazanımın daha fazla gerçekleştiğini düşünmektedir. Diğer taraftan, A=20-30 yaş grubundaki sınıf öğretmenleri de, C=41-50 yaş grubu sınıf öğretmenlerine göre ilgili kazanımın daha fazla gerçekleştiğini düşünmektedir. Öğretmenlerin öğrencilerin sosyal yanlarının gelişimine önem vermeleri gerekmektedir. Bu bağlamda öğrencilerin arkadaşları ve öğretmenleri ile girmiş oldukları etkileşimler çocukları benmerkezcilikten kurtarmaktadır (Senemoğlu,2012;s57). Bu bağlamda ve gözlemlere dayalı olarak; ilgili kazanımın gerçekleştirilmesi için öğretmenler arası yaş değişkenine bağlı olarak, C=41-50 yaş grubu sınıf öğretmenlerinin sosyalleşmeye daha az önem verdikleri söylenebilir.

Sınıf Öğretmenlerinin "Görev Yaptığı Okulun Bağlı Olduğu İlçe" Değişkenine İlişkin Bulgular

Araştırmamızdaki ankette yer alan kazanımlar arasından istatistiksel olarak anlamlılık gösteren kazanıma ait maddeler aşağıda tablolar halinde gösterilerek yorumlanmıştır. Başka bir deyişle; diğer maddeler için anlamlı bir farklılaşma olmadığından dolayı sadece anlamlılık gösteren maddeler dikkate alınıp yorumlanmıştır. Daha kolay anlaşılması ve grupların tabloda doğru yorumlanması için ilçelere A,B,C isimleri verilmiştir. Bu bağlamda; Darende ilçesi=A, Hekimhan ilçesi=B, ve Kuluncak ilçesi=C olarak isimlendirilip "ANOVA" sonuçları tablosunda anlamlı fark bölümünde belirtilmiştir.

Tablo 8. Sınıf öğretmenlerinin görev yaptığı okulun bağlı olduğu ilçe değişkenine göre, "Atatürk'ün önderliğinde ülkemizde gerçekleştirilen köklü değişiklikleri görsel materyaller kullanarak açıklar" kazanımına ilişkin ANOVA sonuçları

Varyansın Kaynağı	Kareler Toplamı	sd	Kareler Ortalaması	F	p	Anlamlı Fark
Gruplararası	6,364	2	3,182	3,876		
Gruplariçi	79,636	97	,821		**,024***	C-A,B
Toplam	**86,000**	**99**				

*p< 0,05

Tablo 8'de görüldüğü gibi, "Atatürk'ün önderliğinde ülkemizde gerçekleştirilen köklü değişiklikleri görsel materyaller kullanarak açıklar" kazanımı için görev yaptığı okulun bağlı olduğu ilçe değişkeni gruplarının aritmetik ortalamaları arasındaki fark istatistiksel olarak anlamlı bulunmuştur. [$F_{(2-97)}$ =3,876, p< 0,05]. Başka bir ifade ile sınıf öğretmenlerinin ilgili kazanıma ilişkin belirtmiş oldukları görüşler sınıf öğretmenlerinin görev yaptığı okulun bağlı olduğu ilçe değişkenine göre anlamlı bir şekilde değişmektedir. Söz konusu kazanımına yönelik yapılan (Post Hoc Tests,LSD)'ye ve aritmetik ortalamalara bakıldığında; A=Darende ilçesinde görev yapmakta olan sınıf öğretmenleri, C=Kuluncak ilçesinde görev yapan sınıf öğretmenlerine göre; ilgili kazanımın daha fazla gerçekleştiğini düşünmektedir. Diğer taraftan B=Hekimhan ilçesinde görev yapmakta olan sınıf

öğretmenleri de, C=Kuluncak ilçesinde görev yapmakta olan sınıf öğretmenlerine göre ilgili kazanımın daha fazla gerçekleştiğini düşünmektedir. Öğretmenlerin konu ile ilgili vermiş oldukları tablo, çizelge ve matrislerin bilgilerin yapılandırılması ve örgütlenmesinde oldukça önemli bir yerinin olduğunu söylemek mümkündür (Senemoğlu,2012;s.300). Bu bağlamda ve gözlemler sonucunda; ilgili kazanımın gerçekleştirilmesi için sınıf öğretmenlerinin görev yaptığı okulun bağlı olduğu ilçe değişkenine bağlı olarak, C= Kuluncak ilçesinde görev yapan sınıf öğretmenlerinin kazanım ile ilgili tablo, çizelge ve matrislerden yeterli derecede yararlanmadıkları söylenebilir.

Tablo 9. Sınıf öğretmenlerinin "görev yaptığı okulun bağlı olduğu ilçe değişkenine göre, "bayram kutlamaları için yaptığı hazırlık çalışmalarını ve bayram sürecindeki duygularını özgün bir şekilde ifade eder" kazanımına ilişkin ANOVA sonuçları

Varyansın Kaynağı	Kareler Toplamı	sd	Kareler Ortalaması	F	p	Anlamlı Fark
Gruplararası	7,120	2	3,560			A-B
Gruplariçi	71,870	97	,741	4,805	**,010***	
Toplam	**78,990**	**99**				

*p< 0,05

Tablo 9'da görüldüğü gibi, "Bayram kutlamaları için yaptığı hazırlık çalışmalarını ve bayram sürecindeki duygularını özgün bir şekilde ifade eder" kazanımı için sınıf öğretmenlerinin görev yaptığı okulun bağlı olduğu ilçe değişkeni gruplarının aritmetik ortalamaları arasındaki fark istatistiksel olarak anlamlı bulunmuştur. [$F_{(2-97)}$ =4,805, p<0,05]. Başka bir ifade ile sınıf öğretmenlerinin ilgili kazanıma ilişkin belirtmiş oldukları görüşler sınıf öğretmenlerinin görev yaptığı okulun bağlı olduğu ilçe değişkenine göre anlamlı bir şekilde değişmektedir. Söz konusu kazanımına yönelik yapılan (Post Hoc Tests,LSD)'ye ve aritmetik ortalamalara bakıldığında; A=Darende ilçesinde görev yapan sınıf öğretmenleri, B=Hekimhan ilçesinde görev yapmakta olan sınıf öğretmenlerine göre; ilgili kazanımın daha fazla gerçekleştiğini düşünmektedir. Yapılandırmacı bir öğretmen, konu ile ilgili görüşlerin öğrenenlerle paylaşılmadan önce öğrenenlerin, öğrenilecek konu hakkındaki bakış açılarının ne olduğunu iyi belirleyebilmelidir (Yapıcı,2014;s.565). Bu bağlamda ve gözlemler sonucunda; ilgili kazanımın gerçekleştirilmesi için sınıf öğretmenlerinin görev yaptığı okulun bağlı olduğu ilçe değişkenine bağlı olarak, A=Darende ilçesinde görev yapan sınıf öğretmenlerinin, öğrencilerin kendilerini ifade etmeleri konusuna ve kazanım ile ilgili bakış açılarına daha fazla önem vermiş oldukları söylenebilir.

Tablo 10. Sınıf öğretmenlerinin "görev yaptığı okulun bağlı olduğu ilçe değişkenine göre, "dün, bugün, yarın temasında geçen kavramları yerinde ve doğru bir biçimde kullanır" kazanımına ilişkin ANOVA sonuçları

Varyansın Kaynağı	Kareler Toplamı	sd	Kareler Ortalaması	F	p	Anlamlı Fark
Gruplararası	3,885	2	1,943			C-A,B
Gruplariçi	55,275	97	,570	3,409	**,037***	
Toplam	**59,160**	**99**				

*p< 0,05

Tablo 10'da görüldüğü gibi, "Dün, Bugün, Yarın temasında geçen kavramları yerinde ve doğru bir biçimde kullanır" kazanımı için görev yaptığı okulun bağlı olduğu ilçe değişkeni gruplarının aritmetik ortalamaları arasındaki fark istatistiksel olarak anlamlı bulunmuştur. [$F_{(2-97)}$ =3,409 , p< 0,05]. Başka bir ifade ile sınıf öğretmenlerinin ilgili kazanıma ilişkin belirtmiş oldukları görüşler sınıf öğretmenlerinin görev yaptığı okulun bağlı olduğu ilçe değişkenine göre anlamlı bir şekilde değişmektedir. Söz konusu kazanımına yönelik yapılan (Post Hoc Tests,LSD)'ye ve aritmetik ortalamalara bakıldığında; A=Darende ilçesinde görev yapan sınıf öğretmenleri, C=Kuluncak ilçesinde görev yapan sınıf öğretmenlerine göre; ilgili kazanımın daha fazla gerçekleştiğini düşünmektedir. Diğer taraftan B=Hekimhan ilçesinde görev yapmakta olan sınıf öğretmenleri de C=Kuluncak ilçesinde görev yapmakta olan sınıf öğretmenlerine göre ilgili kazanımın daha fazla gerçekleştiğini düşünmektedir. Kavram öğretiminde genel olarak tümdengelimsel ve tümevarımsal öğretim yaklaşımlarını bulunduğunu söylemek mümkündür. Öğretmenlerin, bu yaklaşımlardan sadece birisini sürekli kullanmak yerine, gereksinime göre her ikisini de kullanması önemli görülmektedir (Yontar,2015;s.212). Bu bağlamda ve gözlemler sonucunda; ilgili kazanımın gerçekleştirilmesi için sınıf öğretmenlerinin görev yaptığı okulun bağlı olduğu ilçe değişkenine bağlı olarak, C=Kuluncak ilçesinde görev yapan sınıf öğretmenlerinin, kavram öğretme yaklaşımlarının uygulanması ile ilgili bilgilerinin yetersiz olduğu söylenebilir.

Sınıf Öğretmenlerinin " Mesleki kıdem" Değişkenine İlişkin Bulgular

Araştırmamızdaki kazanımlar arasından istatistiksel olarak anlamlılık gösteren kazanıma ait maddeler aşağıda tablolar halinde gösterilerek yorumlanmıştır. Başka bir deyişle; diğer maddeler için anlamlı bir farklılaşma

olmadığından dolayı sadece anlamlılık gösteren maddeler dikkate alınıp yorumlanmıştır. Daha kolay anlaşılması ve grupların tabloda doğru yorumlanması için mesleki kıdem aralıklarına A,B,C ve D isimleri verilmiştir. Bu bağlamda; mesleki kıdemi 1-10 yıl arası olan sınıf öğretmenleri=A, mesleki kıdemi 11-20 yıl arası olan sınıf öğretmenleri=B, mesleki kıdemi 21-30 yıl arası olan sınıf öğretmenleri=C ve mesleki kıdemi 31 ve üstü yıl olan sınıf öğretmenleri=D olarak isimlendirilip, ANOVA sonuçları tablosunda anlamlı fark bölümünde belirtilmiştir. Sınıf öğretmenlerinin, "Mesleki kıdem" değişkenine ilişkin kazanımların gerçekleşmesine yönelik vermiş oldukları görüşlere göre betimsel istatistikleri sırası ile tablolar halinde gösterilmiştir.

Tablo 11. Sınıf öğretmenlerinin mesleki kıdem değişkenine göre, "Atatürk'ün önderliğinde ülkemizde gerçekleştirilen köklü değişiklikleri görsel materyaller kullanarak açıklar" kazanımına ilişkin ANOVA sonuçları

Varyansın Kaynağı	Kareler Toplamı	sd	Kareler Ortalaması	F	p	Anlamlı Fark
Gruplararası	9,212	3	3,071	3,839	**,012***	D-A,B
Gruplariçi	76,788	96	,800			
Toplam	**86,000**	**99**				

*p< 0.05

Tablo 11'de görüldüğü gibi, "Atatürk'ün önderliğinde ülkemizde gerçekleştirilen köklü değişiklikleri görsel materyaller kullanarak açıklar" kazanımı için mesleki kıdem değişkeni gruplarının aritmetik ortalamaları arasındaki fark istatistiksel olarak anlamlı bulunmuştur. [$F_{(3-96)}$ =3,839 , p< 0,05]. Başka bir ifade ile sınıf öğretmenlerinin ilgili kazanıma ilişkin belirtmiş oldukları görüşler sınıf öğretmenlerinin mesleki kıdem değişkenine göre anlamlı bir şekilde değişmektedir. Söz konusu kazanımına yönelik yapılan (Post Hoc Tests,LSD)'ye ve aritmetik ortalamalara bakıldığında; D=31 ve üstü yıl görev yapan sınıf öğretmenleri, B=11-20 yıl ve A=1-10 yıl görev yapan sınıf öğretmenlerine göre; ilgili kazanımın daha fazla gerçekleştiğini düşünmektedir. Gülener (2010) 'un yapmış olduğu çalışmada, Hayat Bilgisi öğretim programının beceri ve kazanımlar bakımından öğretmenlerin hizmet süreleri ile ilgili farklılaşmanın olduğu sonucuna ulaşılmıştır. Bu bakımdan ilgili kazanım doğrultusunda çalışmamızın bulgusu ile Gülener'in çalışmasının sonucu benzerlik göstermektedir. Öğrenmelerin kalıcılığını ve etkililiğinin artırılması bakımından öğretim ortamının ve materyallerin önemli bir yeri vardır. Bilgi sunulurken ne kadar duyu organına hitap edilirse öğrenmenin gerçekleşmesi için harcanacak sürede o derece azalacaktır (Sezer,2005;s.193). Bu bağlamda ve gözlemler sonucunda; ilgili kazanımın gerçekleştirilmesi için, sınıf öğretmenlerinin mesleki kıdem değişkenine bağlı olarak, D=31 ve üstü görev yapan sınıf öğretmenlerinin materyal kullanımına daha fazla önem verdikleri ve kalıcı öğrenme ile ilgili daha fazla bilgi ve tecrübeye sahip oldukları söylenebilir.

Tablo 12. Sınıf öğretmenlerinin mesleki kıdem değişkenine göre, "dünya'nın hem kendi çevresinde hem de güneş'in çevresinde dönmesi sonucunda meydana gelen olguları araştırır; bunlar arasındaki benzerlik ve farklılıkları ayırt eder" kazanımına ilişkin ANOVA sonuçları

Varyansın Kaynağı	Kareler Toplamı	sd	Kareler Ortalaması	F	p	Anlamlı Fark
Gruplararası	6,854	3	2,285	3,281	**,024***	D-A,B
Gruplariçi	66,856	96	,696			
Toplam	**73,710**	**99**				

*p< 0.05

Tablo 12'de görüldüğü üzere, "Dünya'nın hem kendi çevresinde hem de Güneş'in çevresinde dönmesi sonucunda meydana gelen olguları araştırır; bunlar arasındaki benzerlik ve farklılıkları ayırt eder" kazanımı için mesleki kıdem değişkeni gruplarının aritmetik ortalamaları arasındaki fark istatistiksel olarak anlamlı bulunmuştur. [$F_{(3-96)}$ =3,281, p<0,05]. Başka bir ifade ile sınıf öğretmenlerinin ilgili kazanıma ilişkin belirtmiş oldukları görüşler sınıf öğretmenlerinin mesleki kıdem değişkenine göre anlamlı bir şekilde değişmektedir. Söz konusu kazanımına yönelik yapılan (Post Hoc Tests LSD)'ye ve aritmetik ortalamalara bakıldığında; D=31 ve üstü yıl görev yapan sınıf öğretmenleri, B=11-20 yıl ve A=1-10 yıl görev yapan sınıf öğretmenlerine göre; ilgili kazanımın daha fazla gerçekleştiğini düşünmektedir. Çakır (2007)' ın yapmış olduğu çalışmasında öğretmenlerin Hayat Bilgisi programında yer alan kazanımların önerilen etkinliklerle gerçekleştirilebilme düzeylerine ilişkin mesleki kıdemleri açısından fark bulunmamıştır. Bu bakımdan ilgili kazanım doğrultusunda çalışmamızın bulgusu ile Çakır'ın çalışmasının sonucu örtüşmemektedir. Araştırma-İnceleme yolu ile öğretim stratejisinde öğrenciler bilimsel araştırmada izlenen yolları takip ederek konuyu araştırırlar. Bu strateji de öğrenciler öğrendiklerini gelecekteki yaşamlarının bir parçası haline getirdikleri görülmektedir (Cin,2005;s.124). Bu bağlamda ve gözlemler sonucunda; ilgili kazanımın gerçekleştirilmesi için, sınıf öğretmenlerinin mesleki kıdem değişkenine bağlı olarak, D=31 ve üstü görev yapan sınıf öğretmenlerinin öğrencileri daha fazla araştırmaya yönelttikleri söylenebilir.

Tablo 13. Sınıf öğretmenlerinin mesleki kıdem değişkenine göre, "takvimi kullanarak hava durumundaki değişiklikleri günlük ve haftalık olarak gözlemler, gözlem sonuçlarını grafikle gösterir ve yorumlar." kazanımına ilişkin ANOVA sonuçları

Varyansın Kaynağı	Kareler Toplamı	sd	Kareler Ortalaması	F	p	Anlamlı Fark
Gruplararası	7,022	3	2,341	4,032	,010*	B-A,C,D
Gruplariçi	55,728	96	,581			
Toplam	**62,750**	**99**				

*p< 0.05

Tablo 13'te görüldüğü gibi, "Takvimi kullanarak hava durumundaki değişiklikleri günlük ve haftalık olarak gözlemler, gözlem sonuçlarını grafikle gösterir ve yorumlar." kazanımı için mesleki kıdem değişkeni gruplarının aritmetik ortalamaları arasındaki fark istatistiksel olarak anlamlı bulunmuştur. [$F_{(3-96)}$ =4,032, p< 0,05]. Başka bir ifade ile sınıf öğretmenlerinin ilgili kazanıma ilişkin belirtmiş oldukları görüşler sınıf öğretmenlerinin mesleki kıdem değişkenine göre anlamlı bir şekilde değişmektedir. Söz konusu kazanımına yönelik yapılan (Post Hoc Tests,LSD)'ye ve aritmetik ortalamalara bakıldığında; D=31 ve üstü yıl görev yapan sınıf öğretmenleri, B=11-20 yıl görev yapan sınıf öğretmenlerine göre; ilgili kazanımın daha fazla gerçekleştiğini düşünmektedir. C=21-30 yıl görev yapan sınıf öğretmenleri, B=11-20 yıl görev yapan sınıf öğretmenlerine göre; ilgili kazanımın daha fazla gerçekleştiğini, diğer taraftan A=1-10 yıl görev yapan sınıf öğretmenleri de B=11-20 yıl görev yapan sınıf öğretmenlerine göre; ilgili kazanımın daha fazla gerçekleştiğini düşünmektedir. Demir(2007) 'in yapmış olduğu çalışmasında öğretmenlerin kıdem değişkenine göre programın kazanımlar, temalar, öğrenme öğretme süreci ve ölçme değerlendirme sürecine ilişkin görüşleri açısından anlamlı bir fark bulunmamıştır. Bu bakımdan ilgili kazanım doğrultusunda çalışmamızın bulgusu ile Demir'in çalışmasının sonucu benzerlik göstermemektedir. Hayat Bilgisi dersinde gözlem yöntemi en temel yöntem olarak düşünülebilir. Hayat Bilgisi dersinde çocuklara gözlem ile ilgili ödevler vermek bu dersin ve çocukların doğaları ile bütünleşmektedir (Binbaşıoğlu,2003;s.75). Bu bağlamda ve gözlemler sonucunda; ilgili kazanımın gerçekleştirilmesi için, sınıf öğretmenlerinin mesleki kıdem değişkenine bağlı olarak, B=11-20 yıl görev yapan sınıf öğretmenlerinin öğrencilerin olaylar arasında karşılaştırma yapmalarına daha az olanak tanıdıkları söylenebilir.

Tablo 14. Sınıf öğretmenlerinin mesleki kıdem değişkenine göre, "doğal ve yapay çevre arasındaki benzerlik ve farklılıkları ifade eder." kazanımına ilişkin ANOVA sonuçları

Varyansın Kaynağı	Kareler Toplamı	sd	Kareler Ortalaması	F	p	Anlamlı Fark
Gruplararası	6,244	3	2,081			A-B
Gruplariçi	72,316	96	,753	2,763	**,046***	
Toplam	**78,560**	**99**				

*p< 0.05

Tablo 14'te görüldüğü gibi, "Doğal ve yapay çevre arasındaki benzerlik ve farklılıkları ifade eder." kazanımı için mesleki kıdem değişkeni gruplarının aritmetik ortalamaları arasındaki fark istatistiksel olarak anlamlı bulunmuştur. [$F_{(3-96)}$ =2,763, p< 0,05]. Başka bir ifade ile sınıf öğretmenlerinin ilgili kazanıma ilişkin belirtmiş oldukları görüşler sınıf öğretmenlerinin mesleki kıdem değişkenine göre anlamlı bir şekilde değişmektedir. Söz konusu kazanımına yönelik yapılan (Post Hoc Tests,LSD)'ye ve aritmetik ortalamalara bakıldığında; A=1-10 yıl görev yapan sınıf öğretmenleri, B=11-20 yıl görev yapan sınıf öğretmenlerine göre; ilgili kazanımın daha fazla gerçekleştiğini düşünmektedir. Alak(2011) 'in yapmış olduğu çalışmasında öğretmenlerin Hayat Bilgisi öğretim programı öğelerine ilişkin görüşlerinin birbirine yakın olduğu ve istatistiksel anlamda farklılık göstermediği sonucuna ulaşmıştır. Bu bakımdan ilgili kazanım doğrultusunda çalışmamızın bulgusu ile Alak'ın çalışmasının sonucu benzerlik göstermemektedir. Çevrede yaşanan her olay Hayat Bilgisi dersinin inceleme konusu olmaktadır. Bu olaylar doğal olabileceği gibi tarım ve sanayi sorunları da olabilir. Ayrıca; bu olaylar çevreden çevreye farklılık göstermektedir. Hayat Bilgisi dersinde konu aynı olsa bile, uygulanacak yöntemlerin, çevreden çevreye farklılık gösterdiği söylenebilir (Binbaşıoğlu,2003;s.71). Bu bağlamda ve gözlemler sonucunda; ilgili kazanımın gerçekleştirilmesi için, sınıf öğretmenlerinin mesleki kıdem değişkenine bağlı olarak, B=11-20 yıl görev yapan sınıf öğretmenlerinin, olaylara ve kazanımıma yönelik olarak çevreden çevreye farklı yöntem kullanmadıkları söylenebilir.

Tablo 15. Sınıf öğretmenlerinin mesleki kıdem değişkenine göre, "yaşadığı çevreyi temiz tutmasının kendisinin ve başkalarının sağlığı ve gelişimiyle ilişkili olduğunu kavrar." kazanımına ilişkin ANOVA sonuçları

Varyansın Kaynağı	Kareler Toplamı	sd	Kareler Ortalaması	F	p	Anlamlı Fark
Gruplararası	8,805	3	2,935			
Gruplariçi	63,955	96	,666	4,406	**,006***	B-A,C,D
Toplam	**72,760**	**99**				

*p< 0.05

Tablo 15'te görüldüğü gibi, "Yaşadığı çevreyi temiz tutmasının kendisinin ve başkalarının sağlığı ve gelişimiyle ilişkili olduğunu kavrar." kazanımı için mesleki kıdem değişkeni gruplarının aritmetik ortalamaları arasındaki fark istatistiksel olarak anlamlı bulunmuştur. [$F_{(3-96)}$ =4,406, p< 0,05]. Başka bir ifade ile sınıf öğretmenlerinin ilgili kazanıma ilişkin belirtmiş oldukları görüşler sınıf öğretmenlerinin mesleki kıdem değişkenine göre anlamlı bir şekilde değişmektedir. Söz konusu kazanımına yönelik yapılan (Post Hoc Tests,LSD)'ye ve aritmetik ortalamalara bakıldığında; D=31 ve üstü yıl görev yapan sınıf öğretmenleri, B=11-20 yıl görev yapan sınıf öğretmenlerine göre; ilgili kazanımın daha fazla gerçekleştiğini, C=21-30 yıl görev yapan sınıf öğretmenleri, B=11-20 yıl görev yapan sınıf öğretmenlerine göre; ilgili kazanımın daha fazla gerçekleştiğini, diğer taraftan A=1-10 yıl görev yapan sınıf öğretmenleri de B=11-20 yıl görev yapan sınıf öğretmenlerine göre; ilgili kazanımın daha fazla gerçekleştiğini düşünmektedirler. Kılınç (2010)'ın yapmış olduğu çalışmasında; Hayat Bilgisi dersi öğretim programında etik konusuna ilişkin belirlenen kazanım, kişisel nitelikler, değerler ve yaşam becerilerinin etik bilinç kazandırma yeterliliğine ilişkin öğretmenlerin mesleki kıdemleri açısından anlamlı bir farklılık vardır sonucuna ulaşmıştır. Bu bakımdan ilgili kazanım doğrultusunda çalışmamızın bulgusu ile Kılınç'ın çalışmasının sonucu benzerlik göstermektedir. Hayat Bilgisi dersi, çocuğun kendisini, doğal ve toplumsal çevresini tanımasına katkı sunmasının yanı sıra; çocukların değer gelişimini etkileyen oldukça önemli bir derstir. Bu yüzden çocuklara temel bilgi ve becerilerin kazandırılmasının yanında çocukların değer gelişimini desteklemek gerekmektedir. Çocuklar somut işlemler döneminde olduklarından değerleri somutlaştırmak, çeşitli yöntem-teknik ve araç-gereçler kullanmak gerekmektedir (Fidan,2015;s.250). Bu bağlamda ve gözlemler sonucunda; ilgili kazanımın gerçekleştirilmesi için, sınıf öğretmenlerinin mesleki kıdem değişkenine bağlı olarak, B=11-20 yıl görev yapan sınıf öğretmenlerinin, değerler eğitiminin önemi konusunda yeterince bilgi sahibi olmadıkları söylenebilir.

Sonuçlar

Kazanımların Gerçekleşmesi Hakkında Sınıf Öğretmenlerinin Genel Görüşlerine İlişkin Sonuçlar

Diğer kazanımlara göre gerçekleştiği en çok düşünülen kazanımlar;
"Önceki yıllarda ve şimdi tek başına yapabildiği ve yapamadığı davranışları karşılaştırarak zaman içinde nasıl bir değişim geçirdiğini fark eder." kazanımı, "Kendisinin, arkadaşlarının ve ailesindekilerin fiziksel görünümlerinin zaman içinde nasıl değiştiğini fark eder." kazanımı ile, "Yaşadığı çevreyi temiz tutmasının kendisinin ve başkalarının sağlığı ve gelişimiyle ilişkili olduğunu kavrar." kazanımıdır.
Diğer kazanımlara göre gerçekleştiği en az düşünülen kazanımlar;
"Farklı ülkelerdeki çocukların beslenme, giyinme ve oyun tarzlarındaki değişiklikleri araştırır ve sunar." kazanımı, "Farklı ülkelerde, doğal afetlere karşı alınan önlemlerle ülkemizde alınan önlemleri karşılaştırır." kazanımı ile, "Geçmişte kabul gören mesleklerle günümüzde kabul gören meslekler arasındaki farklılıkları karşılaştırır." kazanımıdır.
Araştırmaya katılan sınıf öğretmenleri, Hayat Bilgisi 2. sınıf dersinde yer alan "Dün, Bugün, Yarın" temasında geçen kazanımların gerçekleşmesini genel olarak "Gerçekleşti" düzeyinde görmüşlerdir.

Sınıf Öğretmenlerinin Bağımsız Değişkenlere Göre Vermiş Oldukları Cevaplara İlişkin Sonuçlar
Sınıf Öğretmenlerinde "Cinsiyet" Değişkenine İlişkin Sonuçlar

Bu bölümde sınıf öğretmenlerinin kazanımlar için vermiş oldukları yanıtlara ilişkin sonuçlar "cinsiyet" değişkenini açısından verilmiştir. Cinsiyet değişkenine göre sadece anlamlı farklılaşmanın bulunduğu kazanımlar dikkate alınmış olup aşağıda belirtilmiştir.
"Gökyüzünü gözlemler ve gözlemlediği gök cisimlerini listeler" kazanımını, "Farklı ülkelerde, doğal afetlere karşı alınan önlemlerle ülkemizde alınan önlemleri karşılaştırır" kazanımı ile, "Canlıların hayatta kalabilmeleri için nelere ihtiyaçları olduğunu araştırır" kazanımları açısından ele alındığında; kadın sınıf öğretmenleri, erkek sınıf öğretmenlerine göre ilgili kazanımların daha fazla gerçekleştiğini düşünmektedirler.

"Yaş" Değişkenine İlişkin Sonuçlar

Bu bölümde sınıf öğretmenlerinin kazanımlar için vermiş oldukları yanıtlara ilişkin sonuçlar "Yaş" değişkeni açısından verilmiştir. Yaş değişkenine göre sadece anlamlı farklılaşmanın bulunduğu kazanımlar dikkate alınmış olup aşağıda belirtilmiştir.
"Bayram kutlamaları için yaptığı hazırlık çalışmalarını ve bayram sürecindeki duygularını özgün bir şekilde ifade eder" kazanımının gerçekleşmesi konusunda; 51 ve üstü yaş grubu sınıf öğretmenleri, 41-50 yaş grubu sınıf

öğretmenlerine göre, diğer taraftan 31-40 yaş grubundaki sınıf öğretmenleri ise ilgili kazanımın gerçekleşmesi konusunda; 41-50 yaş grubu sınıf öğretmenlerine göre ilgili kazanımın daha fazla gerçekleştiğini düşünmektedir.
"Dünyanın hem kendi çevresinde hem de Güneş'in çevresinde dönmesi sonucunda meydana gelen olguları araştırır; bunlar arasındaki benzerlik ve farklılıkları ayırt eder" kazanımının gerçekleşmesi konusunda; 51 ve üstü yaş grubundaki sınıf öğretmenleri, 41-50, 31-40 ve 20-30 yaş grubu sınıf öğretmenlerine göre, diğer taraftan 31-40 yaş grubu sınıf öğretmenleri ise, ilgili kazanımın gerçekleşmesi konusunda; 41-50 yaş grubu sınıf öğretmenlerine göre ilgili kazanımın daha fazla gerçekleştiğini düşünmektedir.
"Yaşadığı çevreyi temiz tutmasının kendisinin ve başkalarının sağlığı ve gelişimiyle ilişkili olduğunu kavrar" kazanımının gerçekleşmesi konusunda; 51 ve üstü yaş grubundaki sınıf öğretmenleri, 41-50 yaş grubu sınıf öğretmenlerine göre, diğer taraftan 20-30 yaş grubundaki sınıf öğretmenleri ise ilgili kazanımın gerçekleşmesi konusunda; kendilerini 41-50 yaş grubu sınıf öğretmenlerine göre ilgili kazanımın daha fazla gerçekleştiğini düşünmektedir.

"Görev Yaptığı Okulun Bağlı Olduğu İlçe" Değişkenine İlişkin Sonuçlar

Bu bölümde sınıf öğretmenlerinin kazanımlar için vermiş oldukları yanıtlara ilişkin sonuçlar "Görev Yaptığı Okulun Bağlı Olduğu İlçe" değişkeni açısından verilmiştir. Görev yaptığı okulun bağlı olduğu ilçe değişkenine göre sadece anlamlı farklılaşmanın bulunduğu kazanımlar dikkate alınmış olup aşağıda belirtilmiştir.
"Atatürk' ün önderliğinde ülkemizde gerçekleştirilen köklü değişiklikleri görsel materyaller kullanarak açıklar" kazanımı ve Dün, Bugün, Yarın temasında geçen kavramları yerinde ve doğru bir biçimde kullanır" kazanımlarının gerçekleşmesi konusunda; Darende ilçesinde görev yapan sınıf öğretmenleri, Kuluncak ilçesinde görev yapan sınıf öğretmenlerine göre ilgili kazanımların daha fazla gerçekleştiğini düşünmektedir. Diğer taraftan Hekimhan ilçesinde görev yapan sınıf öğretmenleri de, Kuluncak ilçesinde görev yapan sınıf öğretmenlerine göre ilgili kazanımların daha fazla gerçekleştiğini düşünmektedir.
"Bayram kutlamaları için yaptığı hazırlık çalışmalarını ve bayram sürecindeki duygularını özgün bir şekilde ifade eder" kazanımının gerçekleşmesi konusunda; Darende ilçesinde görev yapan sınıf öğretmenleri, Hekimhan ilçesinde görev yapan sınıf öğretmenlerine göre ilgili kazanımın daha fazla gerçekleştiğini düşünmektedir.

"Mesleki kıdem" Değişkenine İlişkin Sonuçlar

Bu bölümde sınıf öğretmenlerinin kazanımlar için vermiş oldukları yanıtlara ilişkin sonuçlar "Mesleki kıdem" değişkeni açısından verilmiştir. Mesleki kıdem değişkenine göre sadece anlamlı farklılaşmanın bulunduğu kazanımlar dikkate alınmış olup aşağıda belirtilmiştir.

"Atatürk' ün önderliğinde ülkemizde gerçekleştirilen köklü değişiklikleri görsel materyaller kullanarak açıklar" kazanımı ve "Dünyanın hem kendi çevresinde hem de Güneş'in çevresinde dönmesi sonucunda meydana gelen olguları araştırır; bunlar arasındaki benzerlik ve farklılıkları ayırt eder" kazanımlarının gerçekleşmesi konusunda; 31 ve üstü yıl görev yapan sınıf öğretmenleri, 11-20 yıl ve 1-10 yıl görev yapan sınıf öğretmenlerine göre ilgili kazanımların daha fazla gerçekleştiğini düşünmektedir.

"Takvimi kullanarak hava durumundaki değişiklikleri günlük ve haftalık olarak gözlemler, gözlem sonuçlarını grafikle gösterir ve yorumlar" kazanımının gerçekleşmesi konusunda; 31 ve üstü yıl görev yapan sınıf öğretmenleri, 11-20 yıl görev yapan sınıf öğretmenlerine göre ilgili kazanımın daha fazla gerçekleştiğini düşünmektedir. 21-30 yıl görev yapan sınıf öğretmenleri ise ilgili kazanımın gerçekleşmesi konusunda; 11-20 yıl görev yapan sınıf öğretmenlerine göre ilgili kazanımın daha fazla gerçekleştiğini düşünmektedir. Diğer taraftan 1-10 yıl görev yapan sınıf öğretmenleri de 11-20 yıl görev yapan sınıf öğretmenlerine göre ilgili kazanımın daha fazla gerçekleştiğini düşünmektedir.

"Doğal ve yapay çevre arasındaki benzerlik ve farklılıkları ifade eder" kazanımının gerçekleşmesi konusunda; 1-10 yıl görev yapan sınıf öğretmenleri, 11-20 yıl görev yapan sınıf öğretmenlerine göre ilgili kazanımın daha fazla gerçekleştiğini düşünmektedir.

"Yaşadığı çevreyi temiz tutmasının kendisinin ve başkalarının sağlığı ve gelişimiyle ilişkili olduğunu kavrar" kazanımının gerçekleşmesi konusunda; 31 ve üstü yıl görev yapan sınıf öğretmenleri , 11-20 yıl görev yapan sınıf öğretmenlerine göre, yine 21-30 yıl görev yapan sınıf öğretmenleri ise, 11-20 yıl görev yapan sınıf öğretmenlerine göre, diğer taraftan 1-10 yıl görev yapan sınıf öğretmenleri de 11-20 yıl görev yapan sınıf öğretmenlerine göre ilgili kazanımın daha fazla gerçekleştiğini düşünmektedirler.

Öneriler

Yapılan araştırmadan elde edilen bulgulara göre araştırmacı tarafından geliştirilen öneriler şunlardır:
Dün, Bugün, Yarın temasında yer alan kazanımların gerçekleştirilmesi bakımından sınıf öğretmenleri genelde olumlu görüş sergilemişlerdir. Fakat değişen ve gelişen dünyanın koşullarına sürekli ayak uydurulması bakımından kazanımlar sürekli gözden geçirilmelidir.

Kazanımların etkin bir şekilde gerçekleştirilmesini sağlamak amacıyla öğretmenlerin özellikle olaylar ve çevreden çevreye değişmekte olan yöntem ve teknikler konusunda sürekli hizmet içi eğitim almaları sağlanmalıdır.

İkinci sınıf Hayat Bilgisi dersi öğrenci kitaplarındaki etkinlikler, öğretimin verimli bir şekilde uygulanamaması sorununu çözecek, kazanımları etkin bir şekilde gerçekleştirilmesine hizmet edecek biçimde yeniden ele alınıp düzenlenmelidir.

Kazanım sayısı azaltılıp her bir kazanıma ait sürenin artırılarak kazanımlar için daha çok gözlem ,uygulama ve araştırma çalışmaları yapılması başarıyı artırabilir.
Hayat Bilgisi dersi dört duvar arasından kurtarılarak öğrencilerin öğrenme ortamlarının; birebir, yaparak yaşayarak, keşfederek öğrenmeye hizmet etmesi ve bununla ilişkili olarak daha fazla sosyalleşmeleri sağlanmalıdır.

Kalıcı öğrenmenin gerçekleşmesine katkıda bulunacak ve öğretmenlerin materyal kullanma sıklığına hizmet edecek olan materyal geliştirme kurslarının açılması sağlanmalıdır.
Öğretmenlere kavram öğretimi için gerekli stratejiler, öğretim modelleri, yöntem-teknikler konusunda seminer verilmesi sağlanmalıdır.

Öğretmenlerin öğrenciler ile daha samimi ilişkiler kurabilmeleri için çocuk psikolojisi konusunda seminer almaları sağlanmalıdır.

Hayat Bilgisi 2. Sınıf "Dün, Bugün, Yarın" temasında geçen kazanımların gerçekleşme düzeyinin belirlenmesi için öğrenci görüşlerine de başvurularak araştırma yapılabilir. Ayrıca; temalara ait olan kazanımların birbirlerine ön koşul olup-olmaması bakımından incelenmesi yoluna da gidilebilir.

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