Connotation: Educational Mobile Game Application For Turkish

Özlem AKTAŞ[1], Çağdaş Can BİRANT[1], Özgün KOŞANER[2], Atilla SUNCAK[3]

[1]Dokuz Eylül Üniversitesi, Mühendislik Fakültesi, Bilgisayar Mühendisliği Bölümü

[2]Dokuz Eylül Üniversitesi Dilbilim Bölümü

[3][2]Kastamonu Üniversitesi Araç Rafet Vergili MYO Bilgisayar Teknolojileri Bölümü

ABSTRACT

Nowadays, rapidly developing technologies and word games have great effect on students about learning word meanings correctly and abilities to speak properly. In this work, implementation of game software, which can run on mobile devices and in which students may learn meanings of Turkish words with fun, is explained and results are discussed. "Educational computer games" is an important concept in Turkey, and it has not been used in teaching curriculum, yet. In order to resolve this deficiency, a list was formed by keywords, meanings, connotations and images from topics of secondary school curriculum books. Game data is analysed by using statistical methods and reports are generated for parents, teachers and administrators to help watching personal development of students. Moreover, "Turkish Connotation List (Dictionary)", the collection of connotation words, is generated to support developing Turkish Semantic Network, which has very important place in development of Turkish language.

Keywords: Educational game, Infotainment, Edutainment, Mobile game, Game-Based learning.

I. INTRODUCTION

Smart phones and tablet computers are devices that develop rapidly and are easy to use; thus the users of smart phones and tablets are over 1.5 billion today. Among these, Android users are nearly 1 billion, with 708 million Android smart phone users and 216 millions of Android tablet users. In Turkey, the amount of consumers who use mobile internet on their smart phones and tablets has increased to 76% [1]. In addition to all kinds of internet transactions (such as paying bills, shopping, research, etc.) as a wide use, these mobile devices are also used, especially among youngsters for playing online/offline games as leisure time activities and entertainment. Developing technology and some word games which are played via these technologies could affect the way the students' learning of words and their meanings, and their abilities to speak correctly.

It is a fact that some word games such as guessing the antonyms of or guessing the missing letter in a word have been developed so that they could run on the internet but with a limited vocabulary. In the word game developed in this study the Synonym and Near-Synonym Dictionary and the Antonym Dictionary of Turkish Language Association

(TDK) were used; thus the deficiencies of other games in terms of vocabulary were eliminated by using a comprehensive and controlled vocabulary. The game developed in this study aims at the entertainment of the user by playing a game and to learn Turkish words with their synonyms, near-synonyms and antonyms. Also, the game aims at teaching the keywords in the course books in the secondary school curricula (5th, 6th, 7th and 8th grades) and their definitions supported with visual material. The game selects a random word from one of the dictionaries and presents this to the user and the user is expected to enter the first word that comes into mind. The word presented by the system and the word entered by the user are score with regard to the semantic relation (synonymy, near-synonymy and antonymy) between them. In addition, the definition of the presented word, all semantically related words and their definition are listed and an image which visually supports the presented word is shown on the screen. The responses given by the users during the game sessions put another way, the information on what the presented word evoked on the users mind are recorded to be used afterwards. After the transfer of the game data by ending the game session, the inferences made

by a person when a word is heard or seen can be analysed; and via some statistical calculations some reports that would enable the parents and the teachers to gain insight about the students' improvements can be generated and some feedback about the students' psychological statuses can be given. Moreover, a "Turkish Connotation List (Dictionary)" can be created by collecting the words that have connotations by determining whether there is any semantic relation between the presented words and the inferenced words during the game sessions.

In this study, it is expected that users' communication skills and abilities to use Turkish correctly and efficiently would improve. As a result, this project can contribute to the education of an individual who thinks, understands, questions, learns to learn, uses information and solves problems.

II. GAME BASED LEARNING

Game is acknowledged as an activity which exists at every stage of human life; as the most appropriate "language" for knowing the world and expressing love, jealousy, happiness, hostility, inner conflicts, dreams and ideas [2]. While game increases the motivation of the students, it enables them to maintain the self confidence that they could learn; it comforts the students. Therefore, the successes of the students in the courses increase.

Educational games are software that enable the learning of course subjects or improve the students' problem solving abilities using the game format. Educational computer games teach new information or reinforce previous knowledge during the activity while the student is being entertained. It is a well-known fact that the educational computer games are used to attain the course outcomes in the curriculum [3] [4]. These games have become an indispensable method for education around the world. The aims for the development and use of these games are to increase the cognitive activities of the students, to facilitate their learning; and thus making education more efficient. According to a survey conducted by Gee, a member of the National Academy of Education, USA, especially the objectives in strategy games raise interest in the students, force them to endeavour and support their cognitive development [5]. For this reason Gee recommends schools that they adapt some of the strategies used in the games to their education systems in order to better educate the students and to determine their abilities.

Game-based learning environments are problem-based learning environments structured over games that are embedded in some certain problem related scenarios. It is asserted that game-based learning environments are appreciated by the students, reduced their anxieties, facilitated their

individual learning and provided visual support to learning [6]. Via a game, designed by considering the characteristics of the students, both learning is facilitated and the level of recollection increases [7]; therefore, more teachers are opting for game-based learning.

The rapidly developing and spreading technology nowadays and the increased interest in games have caused the software developers to publish some games that could be played on internet sites and mobile devices. These games which we encounter almost everywhere have gained attention and liked by young people, and they have been addiction for them. Today, children spent majority of their time by playing games. In this case, the games should be designed and implemented in a way that they would not spend the time and interest of individuals in vain and would influence their development in a positive way.

Word games are games that facilitate the learning of the words used in the mother language or nay other foreign language and that reinforce memory. There are numerous word games developed for almost every language in the world. In a similar fashion there are games for Turkish, which can be played on the internet and on the mobile devices, such as guessing the word from a given definition and number of letters, arranging the letters of a word, collecting points by arranging random letters into meaningful words, guessing the word which is given as a jigsaw puzzle, anagrams, hangman, word hunt, etc. A great amount of these games are designed with simple interfaces aiming at finding the correct word; however there are some games on websites with advanced graphic animations to enable the entertainment.

III. METHOD FOR CONNOTATION (ÇAĞRIŞIM) GAME

3.1. Statistical Methods

In this project, the words entered into the system by the user were used to determine new semantic relations via the statistical analysis of co-occurrence patterns. Thus, the system is a learning system via the words entered by the user. In addition, as a result of the evaluation of the analyses, at the central system, vocabulary, meaning and connotation maps can be produced in terms of different regions; and the conceptual developments of students can be transformed into reports on the basis of classroom, school, region, and even teacher. The decision times of the students are evaluated using decision cubes, and the concepts that the students have difficulty in responding are determined with regard to classroom, school and region. The spelling errors of the students can also be recorded by the system and each error is evaluated via the edit distance point.

In this project, the response times of the students are evaluated statistically with regard to province, district, school and teacher. These reports include the best response time, the worst response time and the average response time for each student. These reports were obtained using the OLAP (On-Line Analytic Processing) technology [8].

Also the time between the responses by the students are analysed via OLAP cubes, by forming word matrices in terms of student, teacher, school, district and provinces; and lists are produced as to which words are entered in a short response time or in a longer response time.

3.2. Words Used in the Game

In the project, the words to be used in both race-against-time section and educational section were selected from the Turkish Language Association's Synonym and Near-Synonym Dictionary [9] and Antonyms Dictionary [10]. Other words and word definitions are selected from the Turkish Language Association's Contemporary Turkish Dictionary.

In the educational section of the game, the secondary school course books (5th, 6th, 7th and 8th grade) were used to determine the keywords, short definitions and the visual material that would explain the words to be presented to the students. Science, Science and Technology, Mathematics and Social Studies course books used in secondary school curricula were used in this project. Since some schools preferred the books published by the commission of Ministry of National Education (MEB) and other preferred books published by private publishers, the books by both the MEB commission and private publishers were used to collect the keywords to prevent any bias between students of schools which prefer different books. The collection of keywords has been done in two steps: (1) Keywords in the

introduction or summary sections of the units in the course books were collected; (2) The important concepts and name belonging to scientists, historical persons, places and events which were not included in the introduction or summary sections but which were present in the main text sections were collected. Names in foreign languages were added to the keyword list with their original and Turkish forms (e.g. Archimedes and Arşimet). Since the Turkish course books included only reading material, the keywords for this course were collected from the annual plans of 5th, 6th, 7th and 8th grades obtained from Turkish teachers. 2690 keywords collected from all course books and annual plans were examined and identical keywords from different grades and different keywords which refer to the same concept were removed; and at the end 1521 keywords were determined.
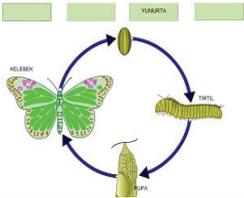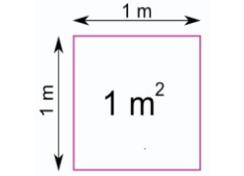
Later, the connotation words that could be in the semantic field of each one of these 1521 keywords were determined. Three connotation words were determined for each keyword (e.g. for the keyword "Joule" the connotation words "unit, energy, and work" were selected). During the collection of the definitions of the keywords, first the definitions in the course books and some glossaries at the end of the course books were used. However, in case any definition could not be found in the course books, Turkish Language Association's Contemporary Turkish Dictionary was used. Since some of the definitions, especially for mathematics and science keywords, from this dictionary, the definitions for these keywords were collected from the internet; and the ones deemed appropriate by teachers and experts were used. In cases where short definitions were not sufficient, explanatory additions were made by the experts. A sample of keywords, connotations words and their definitions are given in the Table 1.

Table 1. Keywords, connotation words and definitions

Number	Unit	Keyword	Connotation Words	Definition
00001	5FEN	allergy	food, itching, pollen	An abnormal reaction of the body to a previously encountered allergen
00002	5FEN	antibiotics	Drug, illness, virus	any of a large group of chemical substances produced by various microorganisms and fungi, having the capacity to inhibit the growth of or to destroy bacteria and other microorganisms
00009	5FEN	evaporation	Boiling, seething, liquid	to convert into a gaseous state or vapor
00314	6FEN5	Erytrocyte	Blood, cell, red	one of the cells of the bloodcontain hemoglobin, and carry oxygen to the cells and tissues and carbon dioxide back to the respiratory organs
00013	5FEN	Natural light sources	Sun, moon, stars	Light sources that emit light naturally on their own
00309	6FEN4	Edison	electricity, light bulb, inventor	The scientist who invented the light bulb
00223	6FEN	plug	Electricity, cable, socket	A device used to transfer electricity from the sockets on the wall
00101	5MAT	Square meter	Field, meter, measure,	a unit of area measurement equal to a square measuring one meter on each side

The samples of keywords and supporting visual material are given in the Table 2.

Table 2. Keywords and connotation words and supporting visual material

Number	Unit	Keyword	Connotation words	Visual material
00002	5FEN	antibiotics	Drug, illness, virus	
00258	6FEN1	Metamorphism	Physics, chemistry, change	
00006	5FEN	Nutrition	Food, beverage, refreshment	
00101	5MAT	Square meter	Field, meter, measure	
00207	6FEN	Science person	Earth, knowledge, human	

3.3 Game Interface

ÇAĞRIŞIM game was designed in two different interfaces as mobile panel and web panel. The mobile interface was implemented as two different modules:

- Entertainment Module: It is a game in which the students could spend their time entertainingly; it enables the students to learn the synonyms, near-synonyms and antonyms of the words in an entertaining manner; and to measure their levels of proficiency.

- Educational Module: It is a game in which the students could learn new information via keywords collected from the course books and their short definitions and supporting visual material; and could determine semantic relation between concepts.

In both modes of game, the definition given in the Turkish Language Association's Contemporary Turkish Dictionary is presented to the user when clicked on the word on the screen. If the response given to the presented word is a synonym or antonym 5 points is given (Figure 1), if it is any other word 1 point is given (Figure 2).
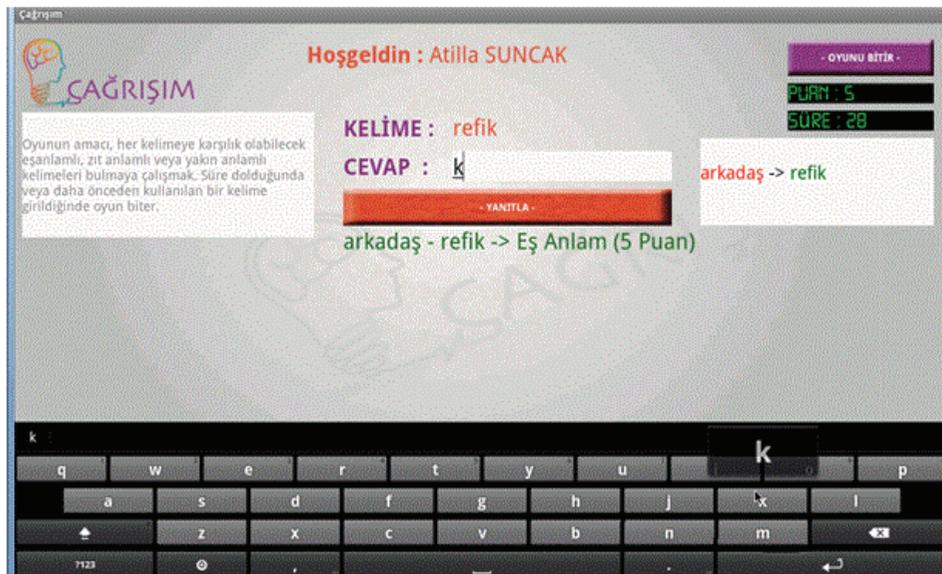
Figure 1. Grading a Synonym word
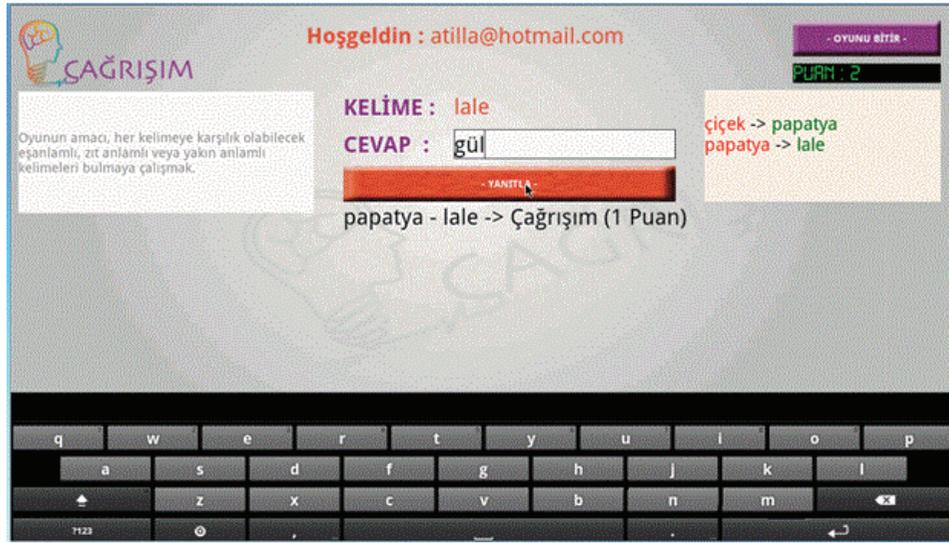
Figure 2. Grading a Connotation word
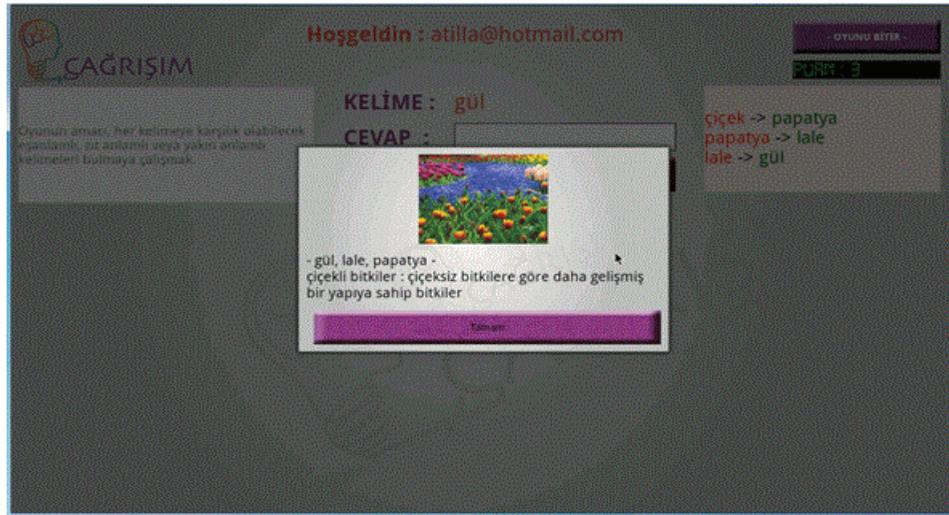
Figure 3. Connotation words, definition and supporting visual material

In the education mode, the words to be presented to the user are selected from among the keywords collected from the coursebooks and the connotation words related to them. If the three consecutive words entered by the user fit in with the connotation map, the keyword of that group, its definition and the supporting visual material are shown to the user (Figure 3).

Three different web panels were implemented for administrators, parents, and teachers:

- Data Entry Panel (Administration Panel): It is an internet based web panel that enables the users with administrator privileges to enter keywords (definition, supporting visual material, synonyms, antonyms, connotations), and information about teachers, students and parents; to assign classrooms and students on teachers and to assign student information on parents; to view all reports with regard to province / district / school / teacher / student.

- Teacher Panel: It is an internet based web panel that enables teachers to list the students in their class or under their supervision, and to query all information about any student, to notice if anything extraordinary is present.

- Parent Panel: It is an internet based web panel that enables parents to monitor the information about the student under their supervision and to notice if anything extraordinary is present.

IV. RESULTS AND DISCUSSION

In order to test the prototype of the implementation of ÇAĞRIŞIM, a test-run was performed with students from two different schools. Permissions were obtained from the parents of 80 students; however 69 students participated in the test-run. The participants were requested to play the ÇAĞRIŞIM game for 5 minutes on an Android tablet and to end the session after five minutes. The participants were also requested to fill the questionnaire form after the game session. Questionnaire for students is given in Table 3.

Table 3. Keywords and connotation words and supporting visual material

Çağrışım Mobile Game Evaluation Questionnaire
We would like to thank you for your participation to the questionnaire that has been prepared in order to evaluate the first sample of CAGRISIM game software which we implemented in our project supported by TUBITAK. In the first part, it is aimed at gaining points by only playing the game. In the second part, it is aimed at finding a "key word" out of three connotation words by playing the game which consists of the words gathered from the content of the curriculum. The details of the game rules are presented in the interface. In this questionnaire, your ideas about the interface and the functionality of the game are desired. Once you started the questionnaire, you can answer any questions and stop answering anytime you want. Thank you for taking this questionnaire.

A- INFORMATION ABOUT THE PARTICIPANT
   1. Age:
   2. Grade:
   3. Sex:

B- EVALUATION
 	
   1. I knew Connotation Game before.
      □ Yes   □ No
 	
   2. I have played this game before.
      □ Yes   □ No
 	
   3. I enjoyed the 'game part'.
      □Absolutely agree   □ Agree   □No idea   □Disagree   □Absolutely disagree
 	
   4. I like the interface of the 'game part'.
      □Absolutely agree   □ Agree   □No idea   □Disagree   □Absolutely disagree
 	
   5. I enjoyed the 'education part'.
      □Absolutely agree   □ Agree   □No idea   □Disagree   □Absolutely disagree
 	
   6. I liked the interface of the 'education part'.
      □Absolutely agree   □ Agree   □No idea   □Disagree   □Absolutely disagree
 	
   7. I would like to play this game again later/recommend this game to my friends.
      □Absolutely agree   □ Agree   □No idea   □Disagree   □Absolutely disagree
 	
   8. I give ……………………….. points out of 10 points for the game.
 	
   9. Suggestions about the game part.
 	
   10. Suggestions about the education part.

According to the comments and grades in the survey filled by the students, it was observed the students had an entertaining time while playing the game and completed the gaming sessions successfully. Samples of the words entered by a student during the test-run are given in Table 3.

Table 3. Words entered by a student in a sample game

Game id	Word 1	Word 2	Result
321	theoretic	Hypothetic	Synonym
321	hypothetic	Logical	Connotation
321	logical	Mental	Synonym
321	mental	Rational	Connotation
321	rational	Intelligent	Synonym
321	intelligent	Clever	Connotation
321	clever	Calm	Connotation
321	calm	Still	Connotation
321	still	River	Connotation
321	river	Stream	Connotation
321	stream	Brook	Connotation
321	brook	Streamlet	Connotation
321	streamlet	Coffee	Connotation
321	coffee	Beverage	Connotation
321	beverage	Glass	Synonym

When the test-run results are evaluated, it is seen that the students rated the game with an average of 8.55 points out of 10. This grade result was calculated by using the reference points given in Table 4.

Table 4. Grading reference for questionnaire.

Evaluation	Point
Absolutely Agree	5
Agree	4
No Idea	3
Disagree	2
Absolutely Disagree	1

It is also seen that 94% of the students stated that they would download the game and recommend the game to others (Table 5). An evaluation comparing the grades of students discloses that while 5th graders rated the game as 9.65/10, 7th graders rated the game as 8.13/10 and 8th

graders 7.86/10. These results may indicate that the game is more interesting for students of younger age.

Table 5. Sample grading the student questionnaires

School Grade	Age	Sex	Q.1	Q.2	Q.3	Q.4	Q.5	Q.6	Q.7	Q.8
5	11	M	No	No	5	4	3	3	5	10
5	12	M	No	No	5	4	3	3	3	8
5	10	M	No	No	5	5	5	5	5	9,5
5	11	F	No	No	5	5	5	5	5	10
5	10	F	No	No	5	4	5	5	5	10
5	11	F	No	No	5	5	5	5	5	10
5	11	M	No	No	5	5	4	5	5	10
7	13	M	No	No	5	4	3	5	4	10
7	13	M	No	No	3	3	2	1	3	6
7	14	F	No	No	3	1	3	1	3	7
7	12	F	No	No	4	4	3	3	5	9
7	13	F	No	No	5	3	3	3	3	8
7	13	F	No	No	4	4	3	3	4	8
7	13	F	No	No	4	3	3	3	5	9
7	13	M	No	No	4	3	4	3	5	8
7	13	M	No	No	4	5	3	4	5	9
8	14	M	No	No	5	5	4	4	5	9
8	14	M	No	No	4	4	3	4	5	9
8	14	F	No	No	4	4	3	3	5	8
8	14	F	No	No	4	4	3	3	4	7
8	14	F	No	No	3	3	3	3	3	7
8	14	F	No	No	3	2	3	3	2	5
8	14	F	No	No	5	4	3	3	5	10

Table 7. The frequency distribution of the students according to their grade

Grade	f	%	Cumulative f	Cumulative %
5th Grade	21	30.43	21	30.43
7th Grade	27	39.13	48	69.57
8th Grade	21	30.43	69	100.00
TOTAL	69	100%		

Table 8. The frequency distribution of the students according to their age

Age	f	%	Cumulative f	Cumulative %
10	6	8.70	6	8.70
11	12	17.39	18	26.09
12	6	8.70	24	34.78
13	21	30.43	45	65.22
14	24	34.78	69	100.00
TOTAL	69	100%		

As Table 8 indicates the great majority of the students who participated in the questionnaire are secondary school students from the 7th and 8th grades. It can be argued that students at these ages are more aware of their educational needs and have a better grasp in evaluating the purpose of the game.

Table 9. The frequency distribution of the students according to their sex

Sex	f	%
MALE	30	43.47
FEMALE	39	56.52
TOTAL	69	100%

Table 10. The frequency distribution of the answers for Question 1 "I knew Connotation Game before."

Sex	F	%
YES	0	0
NO	69	100
TOTAL	69	100%

Table 11. The frequency distribution of the answers for Question 2 "I have played this game before."

Sex	F	%
YES	0	0
NO	69	100
TOTAL	69	100%

As Table 10 and 11 indicates, none of the students have heard about or played the game before.

Table 13. The frequency distribution of the answers for Question 3 "I enjoyed the 'game part'."

Answer	f	%	Cumulative f	Cumulative %
No idea	12	17.39	12	17.93
Agree	24	34.78	36	52.17
Absolutely agree	33	47.82	69	100.00
TOTAL	69	100%		

Table 14. The frequency distribution of the answers for Question 4 "I like the interface of the 'game part'."

Answer	f	%	Cumulative f	Cumulative %
Absolutely disagree	3	4.34	3	4.34
Disagree	3	4.34	6	8.69
No idea	15	21.73	21	30.43
Agree	30	43.47	51	73.91
Absolutely agree	18	26.08	69	100
TOTAL	69	100%		

Table 13 indicates that the great majority of the students like the game. Table 14 indicates that the students liked the interface of the 'play part'. However, 8.69% of the students expressed their dislike and 30.43% had no idea. Although the rest of the students (60.88%) liked the interface, the interface may need some fine tuning, especially for the student with learning difficulties and special needs.

Table 15. The frequency distribution of the answers for Question 5 "I enjoyed the 'education part'."

Answer	F	%	Cumulative f	Cumulative %
Disagree	3	4.35	3	4.35
No idea	45	65.22	48	69.57
Agree	9	13.04	57	82.61
Absolutely agree	12	17.39	69	100.00
TOTAL	69	100%		

Table 15 shows that great majority of the students didn't enjoy the 'education part'. This is an interesting result since the majority of the students enjoyed the 'play part'. This may be due to students' inherent reaction to educational purposes, acknowledging the 'education part' of the game as some curricular task they have to complete in order to become successful. However, other studies should be conducted in order to determine what underlies students' replies.

Table 16. The frequency distribution of the answers for Question 6 "I like the interface of the 'education part'."

Answer	f	%	Cumulative f	Cumulative %
Absolutely Disagree	6	8.70	6	8.70
No idea	36	52.17	42	60.87
Agree	9	13.04	51	73.91
Absolutely agree	18	26.09	69	100.00
TOTAL	69	100%		

Similar to Table 14, the great majority of the students had no idea on the interface of the 'education part'. This may be due to their first encounter with the interface. If they had been given a second or more chances to interact with the interface they would have more certain opinions about the interface.

Table 17. The frequency distribution of the answers for Question 7 "I would like to play this game again later/recommend this game to my friends."

Answer	f	%	Cumulative f	Cumulative %
Disagree	3	4.35	3	4.35
No idea	15	21.74	18	26.09
Agree	9	13.04	27	39.13
Absolutely agree	42	60.87	69	100.00
TOTAL	69	100%		

Table 17 indicates that 73.91% of the students would like to play the game again or they would recommend the came to their friends.

Table 18. The frequency distribution of the answers for Question 7 "I give ……………………….. points out of 10 points for the game."

Points	f	%	Cumulative f	Cumulative %
5	3	4.35	3	4.35
6	3	4.35	6	8.70
7	9	13.04	15	21.74
8	15	21.74	30	43.48
9	18	26.09	48	69.57
10	21	30.43	69	100.00
TOTAL	69	100%		

All of the students score the game with a grade higher than 5 on a scale 1 to 10. One students gave a score of 9.5 but in the study, it is round down to 9. As Table 18 indicates the majority of the students (56.52%) gave highest scores (9 or 10) to the game.

This project aimed at measuring students' levels of understanding of Turkish words by examining the responses given to presented words. For this reason, the pause time between two words, the points they obtained and the frequent errors were summarized via OLAP cubes.

V. CONCLUSION

This study aimed at implementing educational game software that would enable the secondary school students to learn Turkish words with their definitions, synonyms, near-synonyms and antonyms in an entertaining fashion. The purpose in the game is to enter a word evoked after seeing a word in the predetermined time, to collect points in terms of semantic relations between two words (synonymy, near-synonymy, antonymy) and to prevent entering a word that was previously entered. The game software was implemented as online and offline, for running on devices which run Android Mobile Operating System.

The game software implemented in this study aimed at informing the students while entertaining them, and to inform the parents and teacher about the cognitive development of the students. It was observed, during the test-run phase, that the game software achieved these objectives; that the students played the game with enthusiasm, and the teachers found the panels useful and facilitating. When the test-run results are evaluated, it is seen that the students rated the game with an average of 8.55 points out of 10. It is also seen that 94% of the students stated that they would download the game and recommend the game to others. An evaluation comparing the grades of students discloses that while 5th graders rated the game as 9.65/10, 7th graders rated the game as 8.13/10 and 8th graders 7.86/10. These results may indicate that the game is more interesting for students of younger age; and elder students are less interested in the game. Also, when the opinions of the students were examined, it was observed that they had more interest in more animated and interactive games. Therefore, it may be acknowledged as a future study to transform the game software to a structure that can be played in head-to-head mode over the internet, and to enrich the software with animated visual material.

In addition, in the future versions of the game software, the spelling errors will be presented to the students at the end of the game session, and thus the students will be enabled to see their mistakes. The spelling errors which are being sent to the central system after the session are being analysed, and the frequent errors are transferred to the teacher and parent panels. In this manner, parents and teacher are able to evaluate and prevent these errors. In the future versions the points collected may vary with regard to the spelling errors, and in this way the students would be directed to learn the correct spellings of the words. In the project, vocabulary, meaning and connotation maps can be produced in terms of different regions; and the conceptual developments of students can be transformed into reports on the basis of classroom, school, region, and even teacher. In the future versions these reports will be presented in more detail and as graphical illustrations. The decision times of the students are evaluated using decision cubes, and the concepts that the students have difficulty in responding are determined with regard to classroom, school and region. In the future versions, the keywords that the students have difficulty in, and their synonyms and antonyms will be presented to the students more frequently, and thus the students would be enabled to reinforce these concepts.

REFERENCES

[1] BTK Q4 Raporu - Türkiye'de İnternet ve Mobil Pazar İstatistikleri. (2016). Business Intelligence. Retrieved March 31, 2017, from https://www.btk.gov.tr/tr-TR/Sayfalar/Pazar-Verileri.

[2] Yılmaz, T. (2011). Oyunun Eğitimdeki Yeri (Oyun Tabanlı Öğrenme Ortamları). Retrieved December 13, 2014, from http://tubaylmz.wordpress.com/2011/03/03/oyunun-egitimdeki-yerioyun-tabanli-ogrenme-ortamlari/.

[3] Akpınar, Y. (1999). *Bilgisayar Destekli Öğretim ve Uygulamalar*, ANI Yayıncılık, Ankara.

[4] Bottino, R. M., Ferlino, L., Ott, M. & Travella, M. (2007). Developing strategic and reasoning abilities with computer games at primary school level. *Computers & Education*, 49 (4), 1272-1286.

[5] Gee, J., P. & Morgridge, T. (2007). Being a Lion and Being a Soldier - Learning and Games, University of Wisconsin-Madison. Retrieved December 12, 2014, from http://www.jamespaulgee.com/publications.

[6] Yağız, E. (2007). Oyun-tabanlı Öğrenme Ortamlarının İlköğretim Öğrencilerinin Bilgisayar Dersindeki Başarıları ve Öz-yeterlik Algıları Üzerine Etkileri. MSc Thesis, Hacettepe Üniversitesi Fen Bilimleri Enstitüsü Bilgisayar ve Öğretim Teknolojileri Eğitimi Anabilim Dalı.

[7] Facer, K., Joiner, R., Stanton, D., Reid, R., Hull, R. & Kirk, D. (2004) Savannah: Mobile Gaming and Learning. *Journal of Computer Assisted Learning*, 20(6), 399-409.

[8] OLAP Definition. Retrieved March 2017, from http://olap.com/olap-definition/.

[9] Türkçe Eş ve Yakın Anlamlı Kelimeler Sözlüğü (TEYS). (2009). TDK. Retrieved March 5, 2015, from http://tdk.gov.tr/index.php?option=com_esanlamlar&view=esanlamlar.

[10] Türkçe Zıt Anlamlı Kelimeler Sözlüğü (TZS). (2009). TDK. Retrieved March 5, 2015, from http://tdk.gov.tr/index.php?option=com_zitanlamlar&view=zitanlamlar.