

A GAME-BASED APPLICATION ON ENGLISH VOCABULARY
ACQUISITION: A CASE STUDY IN THE EFL CONTEXT

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ABSTRACT

A GAME-BASED APPLICATION ON ENGLISH VOCABULARY ACQUISITION: A CASE STUDY IN THE EFL CONTEXT

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The advances in technologies offer an effective platform for educational activities. For example, games are used in educational contexts as motivating learning tools in many countries. Language learning is one of the educational fields that have been affected by technological improvements. Mobile games can be effective learning tools while learning English as a foreign language.

Within the scope of this pretest/posttest quasi-experimental case study, a game-based application was developed to measure students' vocabulary acquisition in English as a Foreign Language (EFL) context at a Turkish state school in a rural area and evaluated by students and teachers. The study also adopted a mixed method research design with a quantitative and a qualitative aspect. In the design and development of the test part of the game, cross-situational theory was adopted as the theoretical framework. The multiple trial aspect of the theory was emphasized in the game design. The game was developed with Android Development Tools (ADT) and coded using the JAVA programming language. The game-based application was administered to students between second and eight grades (the primary and secondary levels) at a Turkish state school during an English class. Prior to the study, a pre-test was administered to the participants to check whether they know the words to be used in the game. Then the participants played the game on the mobile devices with Android Operating System in different screen sizes in the classroom environment. Following the game-based application, a post-test was administered to the students and they were asked to fill in a survey to evaluate it. Finally, semi-structured interviews were held with the English teachers to gain insights into their opinions of the application.

For the quantitative data analysis in the study, SPSS 22 was used. The paired-sample t- test was used to check whether the pre-test and post-test results were statistically significant or not. One-Way ANOVA method was used to analyze the failed count results. Moreover, Cronbach's alpha was used to check the internal consistency of the student responses to the items on the survey. On the other hand, the content analysis was used in the qualitative data analysis.

At the end of the study, the results showed that Turkish students between second and eight grades at the state school reported having fun and feeling motivated while learning new English vocabulary by means of game based applications. It was also concluded that the multiple trial aspect of cross-situational learning is an effective strategy to learn vocabulary via a game-based mobile application in English as a foreign language in primary (i.e., from Grade 2 to Grade 5) and secondary schools (i.e., from Grade 5 to Grade 8). Moreover, the results of the study indicated that playing the game for learning English vocabulary had a positive impact on students in terms of their interest and motivation. Hence, the findings of the study demonstrated that the game-based application developed in this study was effective in terms of vocabulary acquisition in English and motivating for primary and secondary school students.

Keywords: mobile learning, vocabulary acquisition, cross-situational learning, vocabulary game, game-based learning

ÖZ

İNGİLİZCE KELİME EDİNİMİ ÜZERİNE OYUN TABANLI UYGULAMA: EFL BAĞLAMINDA BİR VAKA ÇALIŞMASI

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Teknoloji gelişmeler eğitsel etkinlikler için etkili bir platform sunmaktadır. Örnek olarak, oyunlar eğitim bağlamında motive edici araçlar olarak bir çok ülkede kullanılmaktadır. Dil öğrenimi teknolojik gelişmelerden etkilenen eğitsel alanlardan bir tanesidir. Yabancı dil olarak İngilizce öğrenenler için mobil oyunlar etkili bir eğitim aracı olabilir.

Bu öntest/sontest yarı deneysel araştırma desenli vaka çalışması kapsamında, kırsal kesimdeki bir Türk devlet okulunda yabancı dil olarak İngilizce öğrenimi bağlamında öğrencilerin kelime edinimini ölçmek için kelime öğreten bir mobil uygulama geliştirilmiş ve öğrenciler ve öğretmenler tarafından değerlendirilmiştir. Çalışma niceł ve nitel yöntemleri n kullanıldığı karma bir desene sahiptir. Oyunun test kısmı tasarlanırken ve geliştirilirken, kuramsal iskelet olarak çapraz-durumsal öğrenme teorisi benimsenmiştir. Oyun tasarımda teorinin çoklu deneme yönü vurgulanmıştır. Oyun Android geliştirme araçları (ADT) ile geliştirilmiş ve JAVA programlama dili ile kodlanmıştır. Oyun tabanlı uygulama Türkiye'deki bir devlet okulunda ilköğretim düzeyinde ikinci sınıfından sekizinci sınıfa kadar öğrenim gören öğrenciler üzerinde İngilizce dersinde uygulanmıştır. Çalışma öncesinde katılımcılara oyunda kullanılacak kelimeleri bilip bilmeyiklerini ölçmek için ön test yapılmıştır. Sonra katılımcılar Android işletim sistemine sahip farklı ekran boyutuna sahip cihazlarla sınıf ortamında oyunu oynamışlardır. Katılımcılar oyun-tabanlı uygulamasını takiben son-test uygulanmış ve oyunu değerlendirmeleri için anket uygulanmıştır. Son olarak, İngilizce öğretmenlerinin uygulama hakkındaki görüşlerini almak için yarı-yapilandırılmış görüşmeler yapılmıştır.

Çalışmadaki niceł verilerin analizinde SPSS 22 kullanılmıştır. Ön-test ve son-test sonuçlarının istatistiksel olarak anlamlı olup olmadığını kontrol etmek için 'Paired-sample t-test' kullanılmıştır. Hatalı sonuç sayılarını analiz etmek için One-Way ANOVA metodu kullanılmıştır. Ayrıca, öğrencilerin anket cevaplarının iç tutarlığını kontrol etmek için Cronbach's alpha metodu kullanılmıştır. Nitel verilerin analizinde ise içerik çözümlemesi yönteminden yararlanılmıştır.

Bu çalışma sonunda edinilen bulgular, ilköğretim okulundaki ikinci sınıfından sekizinci sınıf'a kadarki öğrencilerin oyun tabanlı uygulamalarla İngilizce kelime öğrenirken eğlendiklerini ve motive olduklarını göstermiştir. Ayrıca, ilköğretim okullarında (2'nci sınıfından 8'inci sınıf'a kadar) mobil öğrenme uygulaması aracılığıyla yabancı dil olarak İngilizce kelime öğreniminde çapraz-durumsal öğrenmenin çoklu deneme yönünün oyun tabanlı mobil bir uygulamayla etkili bir yöntem olduğu sonucuna varılmıştır. Buna ek olarak, çalışma sonuçları İngilizce kelime öğrenmek için oyunu oynamanın öğrenciler üzerinde ilgi ve motivasyon açısından pozitif etki yaptığı ortaya konmuştur. Sonuç olarak, çalışmanın bulguları bu çalışmada geliştirilen oyun tabanlı uygulamann ilk ve orta okul öğrencileri için İngilizce kelime ediniminde etkili ve öğrenmeye teşvik edici olduğunu göstermiştir.

Anahtar Kelimeler: mobil öğrenme, kelime edinimi, çapraz-durumsal öğrenme, kelime oyunu, oyun-tabanlı öğrenme

To my family

*My wife, Gülsüm
My daughter, Eda
&
My son, Emre*

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LIST OF ABBREVIATIONS

ADT	Android Development Tools
ANOVA	Analysis of variance
CALL	Computer assisted language learning
CC	Creative Commons
EFL	English as a Foreign Language
ESL	English as a Second Language
ICT	Information and Communication Technologies
MALL	Mobile Assisted Language Learning
RPG	Role playing games

CHAPTER 1

INTRODUCTION

With great improvements in information and communication technologies (ICT), it is inevitable to use ICT applications in our lives. Education is one of the areas influenced by technology. E-learning is the reflection of use of technology in learning activities. E-learning is a broad concept and contains different applications such as online learning management systems, simulations, quizzes, and educational games. Game-based learning applications are tools used in different fields of education to make the learning and teaching process more enjoyable. According to the research studies in education domain, computer games provide an enjoyable and comfortable learning environment for students and improve their problem solving skills (Ebner & Holzinger, 2007). In addition to this, games provide an effective learning environment by enabling students to use their prior knowledge, giving immediate feedback and giving active roles to the students (Oblinger, 2004). Computer games are seen as motivating learning tools by the learners (Kirriemuir & Mcfarlane, 2004). Also, mobile games provide opportunities to engage students in several studies like social studies, science, mathematics and language (Liu, Geurtz, Navarette, Ko, & Lim, 2014).

Language teaching is one of the educational contexts that have been affected by technological improvements (Yaratan & Kural, 2010). Computer-assisted language learning (CALL) is using technology, especially multimedia applications, to support different areas of language learning, such as grammar, writing, and vocabulary acquisition. Computer games are one of the examples of CALL applications in language learning (Levy, 2009). Mobile Assisted Language Learning (MALL) enables students to learn the language anytime and anywhere (Valarmathi, 2011).

Vocabulary acquisition, while learning a foreign language, is seen as a difficult part of learning the language (Meara, 1980). Vocabulary acquisition is important, since without vocabulary, the language cannot be used effectively. In order to use a foreign language, the learner needs to know a large number of words to understand written texts and spoken expressions. This means that learners of a language should extend their vocabulary to communicate meaningfully in that language. To enhance learners' vocabulary acquisition in learning a foreign language, games can be used as effective vocabulary learning tools: games can take the attention of students and motivate them because they like playing games (Yip & Kwan, 2006).

In the scope of this study, a mobile game-based application to be used in teaching English as a foreign language was developed and assessed. The foreign language used in the game was

English because in our country English is one of the compulsory courses in most of the primary, secondary, high schools and universities. Besides, English is one of the mostly used languages through all over the world.

The game was designed and developed for primary and secondary students and testing part was designed and developed by taking cross-situational learning theory as the framework with an emphasis on the multiple exposure aspect. Cross-situational learning is a strategy in which a word and its referent are tracked in multiple trials and the correct mapping is fixed by using the statistical information gathered from these trials (Yu & Smith, 2007). Cross-situational learning is proposed as an effective learning strategy to learn "the meaning of words across multiple exposures despite uncertainty as to the word's true meaning" (Smith & Smith, 2011, p. 408). It is proposed as an effective learning strategy to learn the pairs of words and their referents. The referents may be the meaning of the words or the objects that refer to the word. The claim is that human learners employ cross-situational learning while learning words (Yu & Smith, 2007), even at high levels of referential uncertainty (Smith & Smith, 2011; Pinker, 1989, 1994; Gleitman, 1990). In case of each word exposure, both the linguistic and the non-linguistic context of use provide a set of multiple candidate referents. Although it is not possible to identify the referent of a word on a single exposure, the most appropriate referent might be determined via combining information across multiple exposures (Smith & Smith, 2011).

1.1 Purpose of the Study

In this study a game-based mobile application was developed to be used in teaching English vocabulary as a foreign language by aiming the following:

- to improve students vocabulary acquisition while learning English as a foreign language,
- to contribute to the use of instructional technologies in learning English vocabulary in the EFL context,
- to emphasize the multiple trial aspect of cross-situational learning in a learning game while learning English as a foreign language,
- to contribute to the game-based learning literature.

1.2 Research Questions

The study aims to address the following research questions:

1. What is the impact of using a game-based application on the English vocabulary acquisition of primary and secondary school learners (i.e., those between Grade 2 and Grade 8) in the EFL context?
2. What are the perceptions of students in primary and secondary school (i.e., those between Grade 2 and Grade 8) regarding the effectiveness of the game-based application on their English vocabulary acquisition?

3. What are the perceptions of teachers in primary and secondary schools (i.e., those between Grade 2 and Grade 8) regarding the effectiveness of the game-based application on the English vocabulary acquisition of the EFL learners in their classes?

1.3 Problem Statement

Vocabulary acquisition, while learning English as a foreign language, is seen difficult and boring by EFL learners, especially those in the primary and secondary schools. This difficult part of language learning can be enhanced by integrating technology into the learning process. Particularly, digital games can be helpful to make this boring part of learning more enjoyable since they are seen as motivating learning tools by the students (Yip & Kwan, 2006). Mobile technologies offer a good platform for game applications. In this context, a mobile game-based vocabulary acquisition tool is developed by considering the effectiveness of immediate feedback and providing an interactive learning environment (Ebner & Holzinger, 2007; Oblinger, 2004) and considering the effectiveness of multiple trial aspect of cross-situational learning , which is an effective learning strategy to map the words with their referents (Yu & Smith, 2007).

1.4 Significance of the Study

This study is of significance for students in primary and secondary schools for vocabulary learning purposes. The mobile application suggested in this study is likely to be beneficial in meeting the vocabulary requirement of students in learning English as a foreign language. Moreover, it will be helpful to the instructors to teach vocabulary for the students who learn foreign language in classes or courses via providing online practice opportunities outside class. Furthermore, this study will serve as a future reference for future studies on the development of mobile learning devices at disposal of language learning. More importantly, it will serve as a valuable and motivating learning tool for foreign language learners to improve their vocabulary knowledge. Finally, the current study will shed light on the impact of multiple trials aspect of the cross-situational learning strategy on the vocabulary learning processes of primary and secondary school learners in the English as a Foreign Language (EFL) contexts, which is still a relatively underexplored field of research to date, considering the extensive amount of research conducted in the English as a Second Language (ESL) and EFL tertiary contexts.

1.5 Limitations of the Study

The study has several limitations. The first limitation is concerned with the number of participants. 64 primary and secondary school students in seven different classes from the second to the eight grade at a state school in Turkey participated in the study. The second limitation is related to the data collection procedures. The data was collected cross-sectionally via a game-based application that lasted one day, in seven class hours. The application was limited to maximum 10 students at a time due to the available number of mobile devices. The number of words used in the application was limited. For the study purposes, 28 nouns, 28 verbs and 28 adjectives selected from curriculum's suggested lexis part for seven different student grade levels. The last limitation is concerned with the delayed

post-test. Due to the time constraints in the study, it was not possible to administer a delayed post-test in the study to measure the long-term effects of the game application.

1.6 Term Definitions

Computer aided language learning: CALL is using computer in language learning. Highly developed countries usually use instructional technologies in language learning to provide tools for writing, reading, speaking and listening (Gündüz, 2005).

E-learning: E-learning is using technology in education, often in media (Ruiz, 2006). E-learning contains simulations, quizzes, online learning systems and educational games.

Game: A game is a rule-based formal system with a variable and quantifiable outcome, where different outcomes are assigned different values. The player exerts effort in order to influence the outcome and feels attached to the outcome. The consequences of the activity are optional and negotiable (Juul, 2003).

Mobile learning: With the help of mobile digital devices, learning can be facilitated anytime and anywhere (O'Connell & Smith, 2007).

Mobile Assisted Language Learning: MALL is a subset of CALL and Mobile Learning by which students are able to learn language (Valarmathi, 2011).

Cross-situational learning: Human beings learn word-object mappings with several trials over and over in environments. Cross-situational learning is a strategy in which a word and its referent are tracked in multiple trials and the correct mapping is fixed by using the statistical information gathered from these trials (Yu & Smith, 2007).

CHAPTER 2

RELATED LITERATURE

2.1 Language Learning: Vocabulary Acquisition

In language learning, there are different areas and skills which are grammar, vocabulary, reading, writing, pronunciation, listening, speaking and culture (Levy, 2009). Vocabulary acquisition is seen as the most difficult part of learning a foreign language and students usually think that learning new vocabulary is boring (Lo & Tseng, 2011). Learning vocabulary is seen as an important part of learning a foreign language, because, as reported by Laufer (1997, p.31), learners should know 3000 words to understand written and spoken texts in a language. This implies that the learners of a language should extend their vocabulary. Also, according to McCarthy (1990), even if you know grammar well, you cannot communicate meaningfully in a language without having enough words. Those all show how important it is to expand vocabulary knowledge while learning a foreign language.

2.2 Traditional Vocabulary Learning Through Games

Riedel (2008) emphasized that unconventional teaching strategies are required to be put into practice in the classroom because we are teaching a new generation of students and best strategies to improve learners' achievement in the classroom is using games. Games are thought as useful tools for such understanding in the way of making learning more effective (Sari & Soytas, 2006). Some characteristics of classroom games are as follows (Bradley, 2010): motivating students and creating a competitive learning environment where students can win against one another in the classroom, and providing them the opportunity to be appreciated and recognize the contributions of others when play games in groups or pairs.

Moreover, Wright, Betteridge and Buck (1984) indicated that in the learning process, games engage all students. They also argue that by using games, various contexts can be created for students to express their own opinion, exchange information and use the language to communicate. A relaxed environment like playing games make students interested and involved in class and students manage to learn better (Nguyen & Khuat, 2003). In addition, students will remember the words they learned better because they understand better what they listen to, speak, write and read in the game (Nguyen & Khuat, 2003). McCallum (1980) underlined that one of the highest motivating techniques is a properly introduced game. In circumstances where ordinary approaches do not work well, games may be used as a form of teaching (Nicolson & Williams, 1975). According to Duong (2008), because of the relaxed

atmosphere created by playing games, most of his students told that they could remember new words better and faster. As suggested by Nguyen and Khuat (2003), games make the lessons enjoyable and help students develop and use words in different contexts.

In order to express their feelings and opinions, shy learners always need high entertainment and motivation (Hansen, 1994). Wright, Betteridge and Buck (1984) also pointed out the following benefits of traditional games. First, shy learners will be able to get involved in the class and express their opinions and feelings. Secondly, students are motivated joining in class in order to understand others written text and talking. Thirdly, when games are used in class, their pedagogical value is very important and one must not lose sight of it.

As regards the impact of traditional word games on the student achievement in English vocabulary, Al-Masri and Al-Najar (2014) conducted a quasi-experiment. The experimental group was 81 students (39 males and 42 females) and the control group was 77 students (37 males and 40 females). The experimental group was taught by using word games and the control group was taught by a traditional strategy. The pre-test results showed that males in the control group had a mean of 67.48 while females had a mean of 69.60. The study also displayed that the males in the experimental group had a mean of 68.80 while females had a mean of 69.89. In addition, the post-test results showed that males of control group had a mean of 76.64 while females had a mean of 77.42. The males in the experimental group had a mean of 81.82 while the females had a mean of 82.34. The study indicated that the use of traditional games in the classroom made more favorable impact on the student achievement over traditional learning.

2.3 Digital Games for English Vocabulary Learning

The advances in technology and its integration into the educational context facilitate the use of digital games in language teaching. As it is discussed in the previous chapter, CALL is the use of computers and digital applications, particularly multimedia applications, to support language learning. There are different CALL applications to support different areas in language learning (Levy, 2009). Vocabulary acquisition is one of the foci of CALL applications and there are different CALL applications to support vocabulary acquisition. WordChamp (an online vocabulary building tool) and Lexical Tutor are two such applications (Levy, 2009).

Also, digital games are one of the examples of technological applications in language teaching. In foreign language teaching, games are seen as an effective and motivating tool and take attention of students easily (Gaudart, 1999; Muhamma, 2012). Games can be used both to practice the language (simulation games) and to extend the vocabulary of the students (vocabulary games). Vocabulary games can help to improve vocabulary learning and to gain more vocabularies when compared to face-to-face classes. Both students and teachers regard games as effective vocabulary learning tools, since games can draw the attention of students and motivate them (Yip & Kwan, 2006).

Levy (2009) stated that mobile devices can be used to support vocabulary acquisition since with the advances in technology, they function like computers and they also have features like SMS and internet connection, which can be useful to support vocabulary acquisition. However, their disadvantages, like small screens, should be considered while designing an

application. Games on mobile devices should be considered to take advantages of both the games and mobile devices in language learning.

According to Juul (2003), there are different parameters of a game such as effort, rule, and outcome. However, according to Wittgenstein (1953), all games do not have common properties; they can be in the same semantic category. Also, as suggested by Garris, Ahlers, and Driskell (2002), there are different characteristics of a game defined in the literature, such as interaction, challenge, control, complexity and so on. Moreover, games are categorized according to genre types such as action games, adventure games, fighting games, role-playing games (RPGs), simulations, sport games, strategy games (Gros, 2007). In addition to the entertainment purposes, games have educational values (such games are called learning games). Games are more than entertainment when they are used in the educational context.

Digital game-based learning emerged as technology became the center of our lives and the use of computers in education ceased to motivate students because of the widespread use of computers in our lives (Kiili, 2005). The rationale behind learning games is adding fun to the learning activities and motivating the students. As reported by Klopfer, Osterweil, and Salen (2009), digital learning games are different from games for entertainment in terms of the role they play in the acquisition of knowledge and the promotion of learning in academic context. When games are used in classrooms, they add fun to the learning and students feel more flexible and comfortable (Uzun, 2009). In line with Robertson and Howells (2008), digital games provide a powerful learning environment. Squire (2002) pointed out that games have educational potential from both cognitive and social perspectives. Computer games enable students to repeat their prior knowledge, give immediate feedback and provide an interactive learning environment to them (Ebner & Holzinger, 2007). In line with Kirriemuir and Mcfarlane (2004), there are two key themes for developing digital games for education which are the motivational power of the games for making fun and seeing games as powerful learning tools. Digital games have been regarded as motivational learning tools for education.

With advances in technology, mobile technology has become an effective platform for games. In addition to the PC game applications, mobile gaming also has been accepted as powerful tool to support educational activities such as learning and teaching (Facer & Joiner, 2004). In the study (Thornton & Houser, 2005), which is related to the use of mobile devices in teaching, the results showed that students evaluate the use of mobile devices positively and mobile devices can be powerful tools to support a wide range of teaching activities. Games can be one of the applications running on mobile devices to support educational activities. Schwabe and Göth (2005) conducted a study with a mobile game to support learning. They concluded that the mobile technologies and mobile games may be used to support learning; however, the applications should be designed carefully.

In the literature there are different games designed to support vocabulary acquisition. Hung and Young (2007) classified the English vocabulary games in the literature. The first 6 games were classified by Hung and Young (2007), The WiCFG game, which runs on mobile devices, on the table was their focus and the Bingo Game was the topic of investigation in the study by Lo and Tseng (2011). As seen from Table 1, there are different games in the literature aiming to enhance students' vocabulary acquisition.

Table 1. Some Common Vocabulary Games in the Literature

Game	Description
Cross-word puzzle	Guess the correct word in grids by following the vertical and horizontal hints. Test word ability.
Word Search	Find out the word from a group of English letters.
Quiz	An exam to test the word's meaning by selecting the right answer.
Hangman	Guess the correct letter will appear the right position of the word; otherwise lose a chance to reconstruct the word.
Match game	Find the same pair of cards by turning over two cards once in several cards.
Word Jumble	Put characters in an order into a meaningful word after arranging.
Bingo Game	The game presents randomly vocabularies and the player should select the corresponding word in the other language from the game board. If the user select the correct word than the cell of the word becomes green otherwise grey. To win the game, the player should form a line from green cells.
WiCFG	Students create words from letter and they create word maps, Competition based between groups, there is a teacher side and a student side, teacher monitors them.

Compared with traditional instructional methods, Sitzmann (2011) found educational computer games are better because of interactive simulations, long-term retention, procedural knowledge and declarative knowledge and greater training self-efficacy. In classroom environments, traditional games tend to be used more commonly, as opposed to the digital games.

In fact, computer games have two advantages over traditional ones; first, virtual word that can be created by a computer game, second, students spend less time on problems (Stepien & Gallagher, 1993). In accordance with Stephien and Gallagher (1993), Gee (2007) indicated that games support all five learning capabilities intellectual skills, cognitive strategy, verbal information, attitude and motor skills so inherently employ well-known and relevant educational principles. Players' attention can be preserved for extended period of time by the help of educational games (Becker, 2006). Hansen (1994) claimed that games promote learning and learners' motivation increased with less stressful training and fun. Lepper and Chabay (1985) argued that the integration of games into the learning environments enhance the level of instructional efficiency by raising the level of student involvement in class. Lee (1995) pointed out that with the help of educational games language can be learned enjoying oneself at the same time. Learners' knowledge, behaviors, attitude and skills can be potentially improved with educational games (Papastergiou, 2009). In order to make language acquisition to be effective, games provide encouraging conditions (Wierus, 1994). Moreover, players get immediate feedback about their actions with a good quality game (Gee, 2007). Clayden and Wilson (1988) pointed out that educational games offer self-assessment and interactive feedback.

2.4 Cross-Situational Learning

In real life, there are numerous word-objects mappings in language learning environments and the question is how humans learn the correct referent of a word in such environments. Research studies concentrated on how word learning occurs in a single trial, that's how a word is mapped to the correct referent in a single trial. In line with Trueswell, Medina, Hafri, and Gleitman (2013), the key to all current models of cross-situational word learning is that they emphasize 'the repeated co-occurrences of a word and its referent by formulating an associative learning process that tracks the frequencies of potential referents across all of the contexts in which the word is used' (p.128). According to the literature, attentional (Smith, 2000), linguistic (Gleitman, 1990), social (Baldwin, 1993; Tomasello, 2001) and representational (Markman, 1990) restrictions governed by users enable learners to track fast mapping words to the referents in a single trial (Yu & Smith, 2007). However, in real life situations tracking the fast mapping of words to the correct referents may not occur in a single trial, since there are too many words and too many potential referents and limited cues about the correct mappings. In such cases, learners may not decide on the correct map in a single trial, store mappings from multiple trials and use statistical information from multiple trials to find out the correct word-referent mapping (Yu & Smith, 2007). They indicated the following in this respect:

Even when the referent of a word cannot be unambiguously determined on any single learning trial, across multiple trials involving many different words and many different potential referents, the word will co-occur with its referent more systematically than with any other potential referent (p.418).

Cross-situational learning is proposed as an effective learning strategy for learning pairs of word-referents. In cross-situational learning strategy, a word and its referent are tracked in several trials and the word referent is fixed by using the statistical information gathered from the multiple trials. In fact, it was considered "much more efficient than learning from single, repeated image contexts" (Ludington, 2013, p.554), which might be attributed to a reduction

in terms of the number of unknown referents in each image (Greenfield & Alvarez, 1980), an increase in the ratio of cues to targets (Watkins & Watkins, 1975), and in the number of familiar cues present at retrieval (Estes, 1955). It allows the syntactic pattern of the target language to impact meaning induction Gillette, Gleitman, Gleitman, & Lederer, 1999) or the learner to induct categories from different exemplars. Hence, there is a growing number of studies showing benefits of cross-situational and contextual variation effects on word learning.

Cross-situational learning was studied experimentally both with adults and children (e.g. Smith & Yu, 2008; Smith, Smith, & Blythe, 2011; Vouloumanos & Werker, 2004; Yu & Smith, 2007). Numerous experimental demonstrations pointed out that, even with referentially ambiguous learning instances, toddlers, children and adults are quite good at converging on the intended referent for a word across learning instances (e.g., Gillette et al., 1999; Smith, Smith, & Blythe, 2011; Yu & L. Smith, 2007; Yu & Smith, 2011)

In relation to the impact of the cross-situational learning strategy on early lexical acquisition, Akhtar and Montague (1999) conducted a study that used shapes, textures and colors. The study was made on kids who were 2, 3 and 4 years old. They observed that the older kids who are 4 years old were learning better cross-situationally than youngsters. In addition, Smith and Yu (2008) pointed out that even participants as young as 12 and 14 months were able to solve an ambiguity problem using cross-situational learning statistics.

In relation to the studies with adult learners, the experimental study by Yu and Smith (2007) in the tertiary context indicated that learners exercise cross-situational learning while learning vocabulary. In order to verify this claim they conducted word learning experiments with adult subjects. They investigated whether word-referent mappings can be acquired by the subjects across multiple exposures to multiple ambiguous contexts, where there are multiple objects and words by computing distributional statistics or word and object occurrences. In the study, three experiments were conducted with human participants. At the end of the study, they supported the claim that adult learners employ cross-situational learning during word learning and cross-situational learning is an efficient learning strategy: this result can be used in the further studies. Similarly, Smith, Smith and Blythe (2011) presented experimental evidence demonstrating the effectiveness of learning the meanings of vocabulary across multiple exposures via cross-situational learning among adult learners, even at high levels of uncertainty. Other studies also found high rates of successful cross-situational learning under conditions of referential ambiguity (e.g., Ichinco, Frank, & Saxe, 2009; Kachergis, Yu, & Shiffrin, 2010; Klein & Yu, 2009). Also, Dautriche and Chemla (2014) conducted four cross-sectional experiments with adults. Their findings indicated that learners tend to be engaged in more than the hypotheses they generate about the word meanings, which provide evidence against the recent view of ‘single hypothesis testing’ (p.1). In addition, they revealed that learning occurs faster in learning environments with members from a given group on a consistent basis, disregarding the semantic coherence of the group. Furthermore, their study displayed that the learning situation may be encoded in memory in the course of the learning process. Overall, it put forward that the provision of realistic contexts for the learners are likely to assist them in retrieving and discarding potential referents for a word.

By intersecting the various sets of candidate referents, the most probable referent can be learnt across multiple exposures and combining information (Smith, Smith & Blythe, 2009). The correct mapping is fixed by using the statistical information gathered from multiple trials in which a word and its referent are tracked by cross-situational learning strategy (Yu & Smith, 2007). Moreover, Yu and Smith (2007) indicated that for a correct mapping a single trial may not be enough and multiple exposure may be needed to find out the correct word-referent mapping. Smith and Smith (2011) supported the findings by Smith et al. (2009) in that even though uncertainty as to the word's true meaning, cross-situational learning strategy is proposed as an effective learning strategy to learn across multiple exposures.

There might be situations that cross-situational learning may not be efficient and it should be tested. For instance, Smith et al. (2009) repeated the experiment of Yu and Smith (2007) and concluded that cross-situational learning depends on the presentations of the words and their referents and restricted. The former indicated that in cases where referential uncertainty is low, participants tend to apply a 'rigorous eliminative approach to cross situational learning' (p.1) whereas participants are more inclined to apply 'a frequentist approximation to the eliminative approach' in cases of high referential uncertainty (p. 1)

Taking into consideration the available literature in the field of cross-situational learning in different educational context and the relatively scarce number of studies in the use of this strategy in the context of young learners, this study addresses the impact of a game-based application of cross-situational learning on English vocabulary acquisition in the Turkish context of young learners.

CHAPTER 3

METHODOLOGY

3.1 Research Design

The mixed method design was adopted in the study. The mixed methods research is a methodology for conducting research that involves collecting, analyzing, and integrating (or mixing) quantitative and qualitative approaches (and data) at one or more stages of the research process (Dörnyei, 2007, p.163). The purpose of this form of research is that both qualitative and quantitative research, in combination, achieve a fuller, a more elaborate and comprehensive understanding of a research problem or issue embedded in an educational or social context than either research approach alone, by looking at it from different perspectives (Sandelowski, 2003; Mertens, 2005). The use of mixed methods research also allows triangulation, "the generation of multiple perspectives on a phenomenon by using a variety of data sources, investigators, theories, or research methods with the purpose of corroborating an overall interpretation" (Denzin, as cited in Dörnyei, 2007, p. 165).

In the study in order to investigate the opinions of the students concerning the impact of the game-based application, survey research was employed. It is a "quantitative research method which aims to collect self -report data from individuals and the typical instrument used to serve this end is the written questionnaire" (Dörnyei & Csizer, 2012, p.74). With a view to collect data concerning the classroom teachers' opinions, the semi-structured interviews were used. This type of interview is a mix of the structured interview, a controlled way to obtain information from interviewees, and unstructured interview, which is "similar to a conversation in which the interviewer might ask a single question and then the interviewee has the choice with regard to the extent to which s/he responds" (Bryman, as cited in Alsaawi, 2014, p.149). In the semi-structured interview, the questions are planned in advance, prior to the interview, but the interviewer gives the interviewee an opportunity for the elaboration and exploration of particular issues through the use of open-ended questions (Alsaawi, 2014). This type is appropriate to researchers who have an overview of their topic so that they can ask questions.

The study also adopted a one-group pre-test/post-test quasi-experimental design as 'it is not logically feasible ... to conduct a randomized controlled trial' (Harris, McGregor, Perencevich, Fruno, Zhu, Peterson, & Finkelstein, 2006). The study does not include an experiment and a control group due to the logistic as well as administrative constraints. However, to address the validity and reliability issues in the study, one-way ANOVA and paired sample t-test, and Cronbach's alpha were used.

This study is a case study. Case study is the scrutiny of a “bounded system”, a case or multiple cases (Merriam 1998, p.9) with an in-depth analysis of context through multiple sources of data collection (Duff, 2008). According to Yin (2009), case study is required when a deep understanding of a phenomenon which is mostly surrounded by important contextual conditions is necessary.

Gall, Gall, and Borg (2003) define case study research as “the in-depth study of instances of a phenomenon in its natural context and from the perspective of the participants involved in the phenomenon” (p. 436). The concept of ‘case’ here refers to any individual, group, institution or anything that is bounded in a unique system (Stake, 2005).

The sample of participants in the study was drawn from a case, which is identified as young Turkish EFL learners between Grade 2 and Grade 8 in a rural area in Turkey. It also involved two English teachers, who were teaching these learners at school and, hence, shared certain characteristics and were bounded by certain contextual conditions. The study seeks to uncover the teachers’ and students’ opinions of the impact of the game application on their EFL vocabulary acquisition process. To this end, multiple sources of information were collected through, the open-ended items on the student survey and the semi-structured interviews with the English teachers after the implementation of the game application in class, which is an important characteristic of a case study.

3.2 Participants

The participants of the study were EFL students who were between Grade 2 and Grade 8 at a state school in a rural area in Turkey and two English teachers who were teaching these students. Convenience sampling was employed in the selection of the participants in the study. The student participants were not accustomed to using mobile devices. Their level of proficiency in English ranged between the beginners (Grade 2) and the pre-intermediate (Grade 8). There were 64 students within an age range between 6 and 16, 33 males and 31 females, as listed in *Table 2*.

Table 2. Numbers of Student Participants and Their Grades

Student Grade	Number of Participants	Male Participants	Female Participants
Second Grade	11	5	6
Third Grade	7	3	4
Fourth Grade	9	4	5
Fifth Grade	7	4	3
Sixth Grade	9	6	3
Seventh Grade	11	7	4
Eight Grade	10	4	6
TOTAL	64	33	31

With respect to the teacher participants in the study, they were 30 and 32 years old and had a teaching experience of seven or eight years. They were graduated from the departments of English language teaching in Turkey. One of the teachers was male and the other was female.

3.3 Data Collection

In the study, a game-based application was developed. The development of the game involved several phases. Each phase had different characteristics. In this data collection section the software analysis, the design, the description of the game, and the server side of the game, are discussed. The data collection instruments employed in the study are also mentioned in this section.

3.3.1 Software Analysis

Other vocabulary games were searched on mobile markets, the good and poor sides of them were detected. Vocabulary items were analyzed to be used in the game. Turkish translations of the vocabulary items were decided. For the images to be used in the game the image editor to be used and their sizes were decided. The web-based server was rented to be used during the development of the game and the application phase.

3.3.2 Software Design

At the design phase of the game, English teachers working at primary and secondary schools and the faculty members who are experts on the mobile game-based application were contacted. Before the game-application was administered in the study, it was piloted to a group of state-founded primary and secondary school state school students in the rural area and in the light of the feedback from students, as well as from the experts, the game-application was revised.

Moreover, the digital game design criteria that were developed and applied in some other previous research studies were examined. Furthermore, the design principles in other digital word games were evaluated. Hence, relevant, quantifiable and detailed requirements for the application were determined.

The *Database* was designed using MySQL Workbench 6.2 as shown in Figure 1.

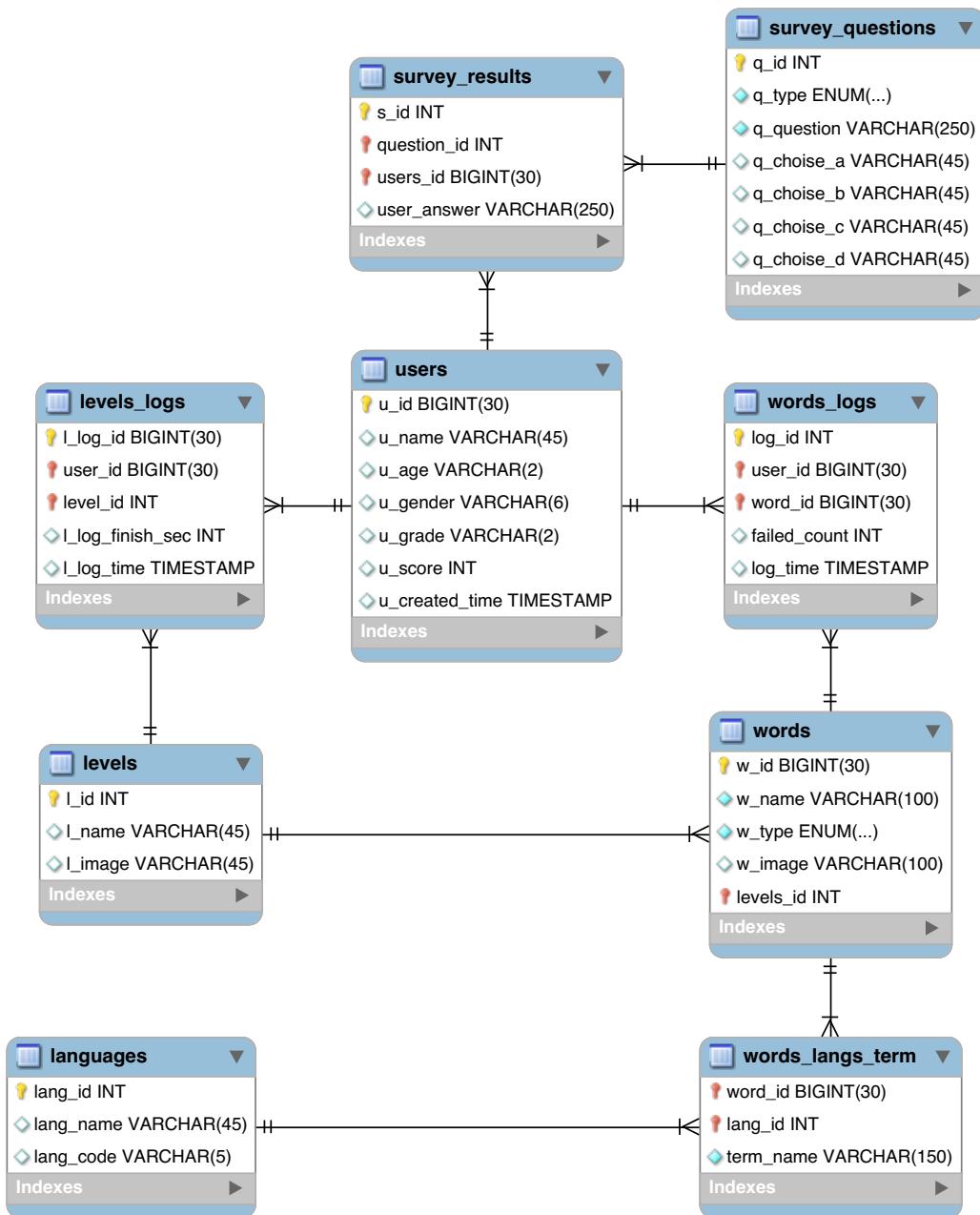


Figure 1. Database ER Diagram

The flowchart for general structure of the game can be seen in *Figure 2*.

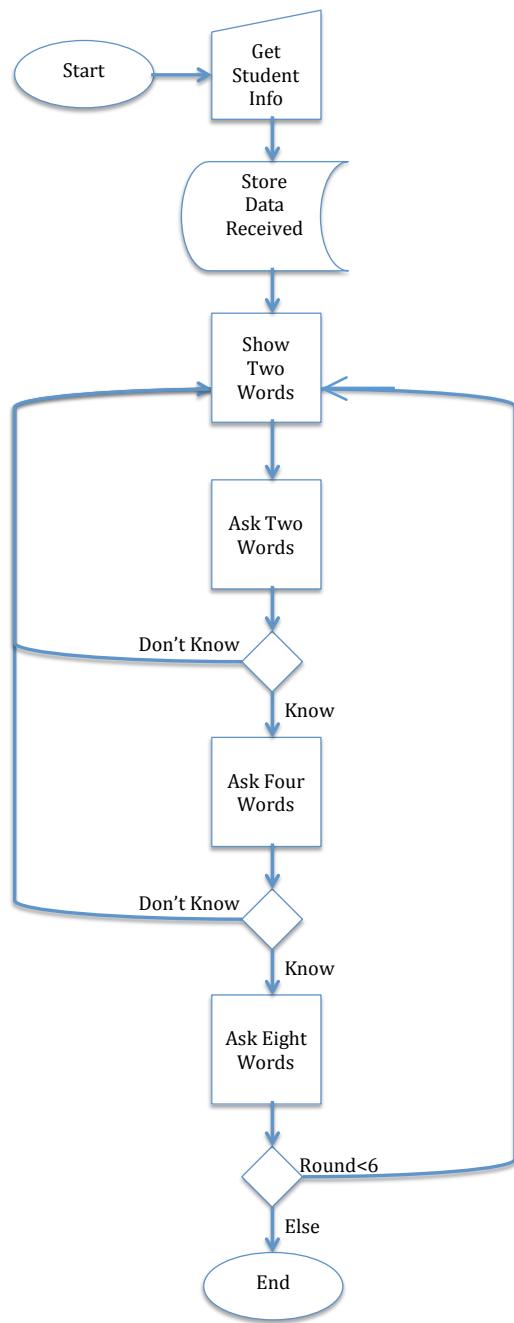


Figure 2. The Flowchart of the Game

The *User Interfaces* were created using Adobe Photoshop CS6 and images were found using Creative Commons (CC) Search.

There is a three-layer structure in the game as shown in *Figure 3*. All the vocabulary data is stored in a database on a server. Client devices request vocabulary data from the web service when the user presses the start button on the game, the web service gathers the data from the database server and sends to the client over the internet.

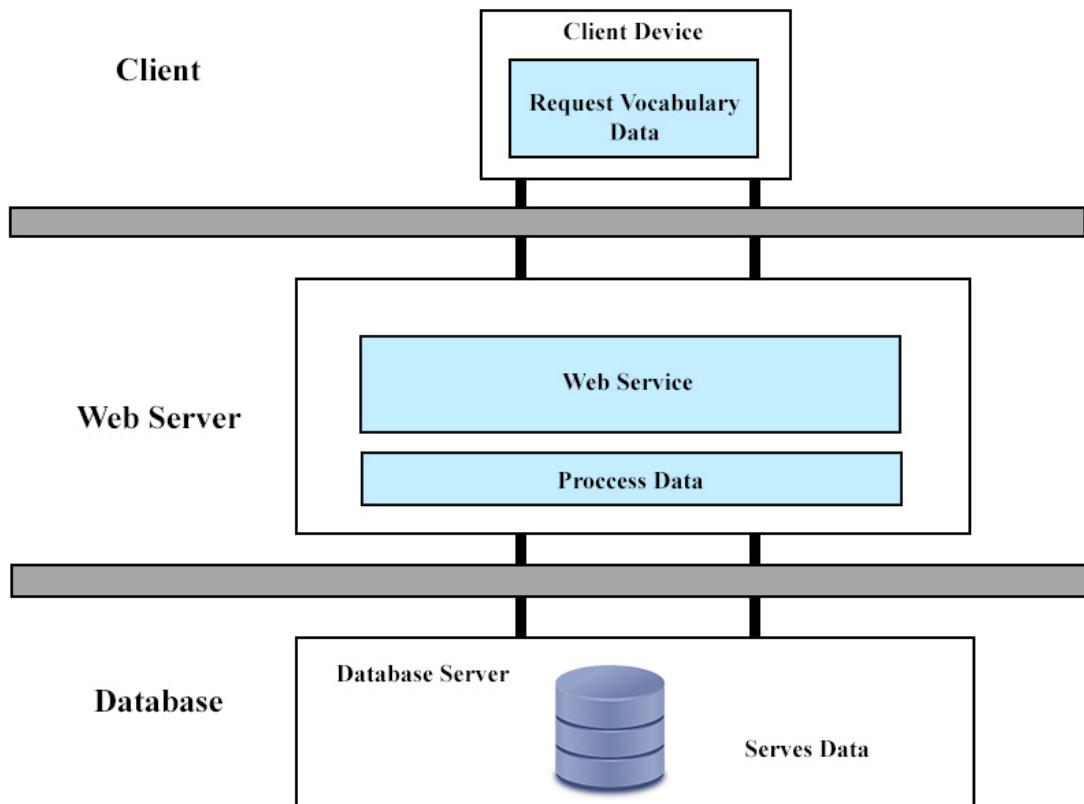


Figure 3. Layer Structure of the Data Process Application

3.3.3 Description of The Game

In this study, a game based application was developed and assessed. The game was a vocabulary game, which aimed to improve students' vocabulary acquisition while they were learning English as a foreign language. The players match an English word with a picture of an object. The game was developed for mobile devices such as tablets in order to benefit from the advantages of mobile technology. The vocabulary learning game was designed and developed by considering the effectiveness of immediate feedback and providing an interactive learning environment (Ebner & Holzinger, 2007; Oblinger, 2004) and considering the effectiveness of the multiple trial aspect of cross-situational learning for correct mapping

to be fixed by using the statistical information gathered from these trials (Yu & Smith, 2007) (mentioned in Section 2.1 and 2.4).

In the design phase of the game, competitiveness was also taken into account, in order to increase the students' achievement (Clifford, 1972) and to make the game more interesting (Ausubel, 1968). Scoring procedures were used to create a competitive environment. Right answers to the questions increased the score whereas wrong answers decreased it. Timing was also a factor affecting the game score to motivate the students.

All the data including words and images were stored on the web server. When the game started, the data was retrieved from the web server.

The general structure of the game-based application is as follows:

- Figure 4 shows starting the game screen. Users are asked names, student grade, age and gender. According to the student grade, the words are retrieved from the web server.



Figure 4. Enterance Screen of the Game

- At the beginning, a pre-test is applied to the student to detect which words he/she knows and doesn't know (Figure 5). There is also a “Bilmiyorum” (I don't know) option in the choices to eliminate the chance of giving a correct answer while not knowing the word.



Figure 5. Pre-test and Post-test Screen of the Game

- The words are shown to the learner two words at a time. When showing the words the students also see images related to the words and also the translation of the words (Figure 6). By pressing the next button, the “two words test” scene appears.



Figure 6. Fist Scene Showing the Words

- On the two words test scene as shown in Figure 7, the player is asked to find the image that is related to the given word which was learned on the previous scene, and, in every question images are randomly placed.

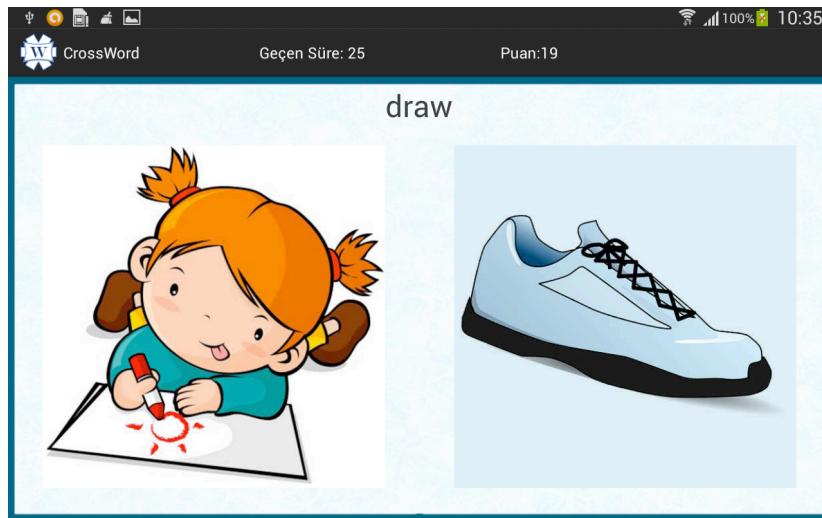


Figure 7. Testing the Words by Two Images

- If the player gives a wrong answer to the question, he/she returns to the first scene that shows the words, related images and Turkish equivalent of the words. Otherwise, the words are asked in two, four and eight image scenes step by step as in Figure 8 and 9.

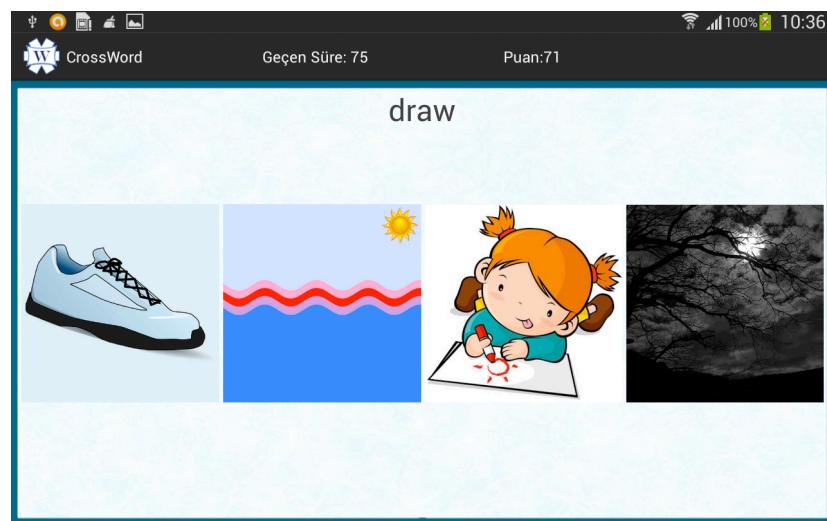


Figure 8. Testing the Words by Four Images

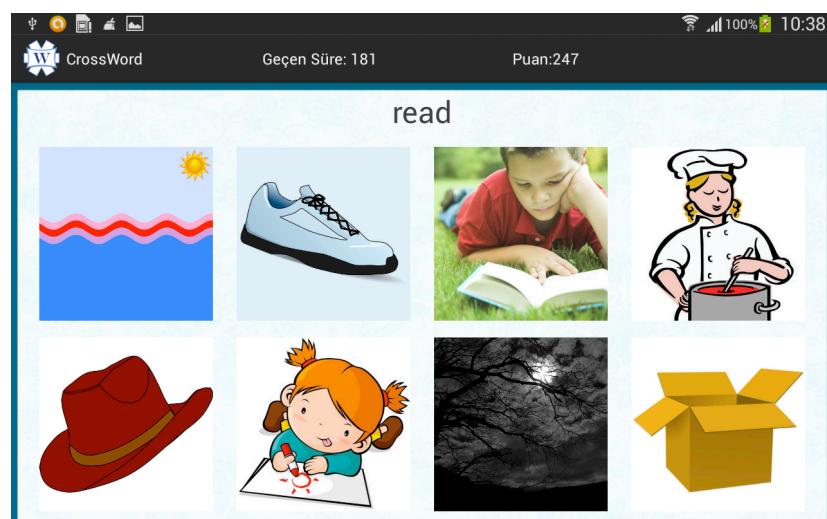


Figure 9. Testing The Words by Eight Images

- The vocabulary items to be learned via the application, which are listed in *Table 2*, were selected from the lexis part suggested in the curriculum in line with the grade levels which is prepared by board of education. Expert opinions were also asked while choosing the words. It is also considered that the words could be supported by an image. When student starts the game, the vocabulary items are selected according to his/her grade retrieved from the web server in order to be taught in the game.

Table 3. The Vocabulary Items Used in The Game

GRADE	NOUN	VERB	ADJECTIVE
2nd Grade	pencil	sing	great
	ear	jump	bad
	book	play	two
	bird	run	green
3rd Grade	house	win	strong
	ball	start	old
	car	ask	cold
	frog	look	angry
4th Grade	box	cook	dark
	hat	draw	wavy
	milk	drive	tall
	shoe	read	shy
5th Grade	toothbrush	sleep	exciting
	birthday	help	delicious
	medicine	save	beautiful
	mosque	travel	blind
6th Grade	prison	rest	cloudy
	crowded	sell	sleepy
	mountain	work	terrifying
	river	unplug	freezing
7th Grade	shower	prepare	large
	moon	watch	alone
	tiger	shop	poisonous
	desert	buy	successful
8th Grade	flood	explode	safe
	dice	listen	square
	fruit juice	pour	ridiculous
	concert	delete	salty

- In the game there is a predefined number of vocabulary items which are four nouns, four verbs and four adjectives for each grade ranging from the 2nd to the 8th grade.
- There are six rounds in the game, and in each round two new words are given to the game player.
- In order to complete the round the student needs to complete two, four and eight images test scenes. If he/she makes a mistake in two and four images test scene, the player returns to the scene where the mistaken vocabulary, related image and translation is shown.

- Each time, the player gives a wrong answer to a question, it is counted with the word id as a failed count.
- Upon completing the game, the student is administered a post-test to detect which words he/she knows and doesn't know. On the post-test phase the same procedures of pre-test are followed.
- At the end of the game, the player sees the vocabulary list in which he/she is able to see all the words in the game, pre-test results, post-test results and the number of mistakes for each word he/she has made (Figure 10).
- Also, the player is able to see the top scores in his/her grade level.

The screenshot shows a mobile application interface titled "CrossWord". At the top, there are icons for signal strength, battery level (98%), and time (10:44). Below the title is a table with 12 rows, each containing a word, its meaning in Turkish, and two test results (Initial Test and Final Test) indicated by red 'X' or green checkmarks. The last column shows the number of errors.

Resim	Kelime	Anlamı	İlk Test	Son Test	Hata Sayısı
	shoe	ayakkabı	X	✓	2
	draw	çizmek	X	✓	2
	wavy	dalgalı	X	✓	4
	dark	karanlık	X	✓	2
	box	kutu	X	✓	2
	read	okumak	X	X	3
	cook	pişirmek	X	✓	4
	hat	şapka	X	X	3
	drive	sürmek	X	✓	2
	milk	süt	X	✓	2
	shy	utangaç	X	X	4
	tall	uzun	X	✓	3

Ankete Geç

Figure 10. Result Screen for Player

3.3.4 The Server Side of the Game

The general structure of the game-based application's web service is as follows:

- In order to login to the system, the master user (teacher) needs to provide a user name and a password (Figure 11).

Login In
Please use your e-mail and password to login.

makkuzu@gmail.com ✓
..... ✓

Login

Makkuzu.com (Crossword Admin Panel) © 2015 Mustafa AKKUZU

Figure 11. Login Screen for Master User

- The teacher can add, edit or delete words from the system.

Words List Add New Word

Word List Form

Image	Word	Term	Type	Level	Language	Actions
	pencil	kurşun kalem	Noun	2. Sınıf	Türkçe	Edit Delete
	ear	kulak	Noun	2. Sınıf	Türkçe	Edit Delete
	bird	kuş	Noun	2. Sınıf	Türkçe	Edit Delete
	sing	şarkı söylemek	Verb	2. Sınıf	Türkçe	Edit Delete
	jump	zıplamak	Verb	2. Sınıf	Türkçe	Edit Delete

Figure 12. Vocabulary Screen for Master User

- The teacher can add, edit or delete levels (student grades) from the system.

Level List Form			
Show 10 entries		Search:	
Name	Image	Actions	
2. Sinif	2.jpg	 Edit	 Delete
3. Sinif	3.jpg	 Edit	 Delete
4. Sinif	4.jpg	 Edit	 Delete
5. Sinif	5.jpg	 Edit	 Delete
6. Sinif	6.jpg	 Edit	 Delete
7. Sinif	7.jpg	 Edit	 Delete
8. Sinif	8.jpg	 Edit	 Delete

Showing 1 to 7 of 7 entries

Previous **1** Next

Figure 13. Levels Screen for Master User

- The teacher can also add, edit or delete survey questions from the system.

Question List Form						
Show <input type="button" value="10"/> entries <input type="text"/> Search: <input type="button" value="Search"/>						
Question	Type	Choice A	Choice B	Choice C	Choice D	Actions
Bence faydalı bir oyun.	multiple	Kesinlikle Katılıyorum	Katılıyorum	Katılmıyorum	Kesinlikle Katılmıyorum	<input type="button" value="Edit"/> <input type="button" value="Delete"/>
Bu oyunun derste de kullanılmasını isterim.	multiple	Kesinlikle Katılıyorum	Katılıyorum	Katılmıyorum	Kesinlikle Katılmıyorum	<input type="button" value="Edit"/> <input type="button" value="Delete"/>
İlginç bir oyundu.	multiple	Kesinlikle Katılıyorum	Katılıyorum	Katılmıyorum	Kesinlikle Katılmıyorum	<input type="button" value="Edit"/> <input type="button" value="Delete"/>
Kelime öğrenmek için bu oyunu kullanmak isterim.	multiple	Kesinlikle Katılıyorum	Katılıyorum	Katılmıyorum	Kesinlikle Katılmıyorum	<input type="button" value="Edit"/> <input type="button" value="Delete"/>
Oynarken hatalarımı hermen görebildim.	multiple	Kesinlikle Katılıyorum	Katılıyorum	Katılmıyorum	Kesinlikle Katılmıyorum	<input type="button" value="Edit"/> <input type="button" value="Delete"/>
Oyun da değişimnesini istediğiniz şeyleri yazınız.	openend					<input type="button" value="Edit"/> <input type="button" value="Delete"/>

Figure 14. Survey Questions Screen for Master User

3.3.5 Data Collection Instruments

The quantitative data in the study was collected via the pre-test, failed counts in the game application, the post-test, and the student survey while the qualitative data was obtained through the semi-structured interviews with the classroom teachers.

3.3.5.1 The Pre-Test

The participants were administered a pre-test to evaluate their prior knowledge about a group of selected words. The words on the pre-test were chosen from different parts of speech: adjectives, nouns and verbs. The test involved four words from three different parts of speech (namely, adjectives, nouns, and) verbs for each grade level (between Grade 2 and Grade 8). The total number of words on the test for each level was 12 and accordingly, the pre-test consisted of 84 words altogether.

3.3.5.2 Failed Counts

In the game phase, the participants used the game to learn the vocabulary items which were selected from the curriculum with the help of an expert. In the game phase, every wrong answer of the student was recorded according to the word id, and wrong answers were logged as failed counts. The students were able to see their failed count scores at the end of the game.

3.3.5.3 The Post-Test

After the game application, a post-test was administered. In the post-test, the same procedures followed in the pre-test were performed. The pre-test that was administered at the beginning of the study was used as the post-test. The latter was administered to the students immediately after the game application. However, some modifications were made in the initial layout of the test to eliminate the familiarity effect on the students before its administration.

3.3.5.4 The Survey

After the treatment, a survey was administered to students in their classrooms. The survey can be seen in Appendix A. It is composed of 14 items. It aims to explore students' views on different aspects of the game application. There are 10 likert-scale items (with four options ranging from 'strongly agree' to 'strongly disagree') which are concerned with the students' views on the usability, feedback, effectiveness and motivation issues related to the game. There are also two open-ended items to gain more in-depth insights into the students' opinions of the game. Before its administration in the classroom, the survey was piloted to a group of students and in line with the feedback from the students, some items were revised and some modifications were made in the layout.

3.3.5.5 The Semi-Structured Interviews with The Teachers

Following the game application, a semi-structured interview was held with the English teachers to be informed of their opinions concerning the impact of the game application on the students' vocabulary acquisition and their level of motivation. The semi-structured interview questions can be seen in Appendix B. It was composed of 10 open-ended questions. The interviews questions were emailed to the teachers.

3.4 Data Analysis

The quantitative data in the study, the survey, was analyzed via SPSS 22. The paired sample t-test was used in order to analyze the statistical significance between the pre-test and post-test results. The failed count averages according to the student grade levels during the game phase were calculated using One-Way ANOVA. The level of significance adopted in the study was $p < .05$. Cronbach's alpha was used to check the internal consistency for the student responses on the survey, in line with Bradley, Waliczek, and Zajicek (1999). On the other hand, the qualitative data, the semi-structured with the classroom teachers, was analyzed via the content analysis (Miles & Huberman, 1984). In line with the analysis, the themes that emerged in the participants' responses to the open-ended items on the survey were first identified. To achieve the inter-relater reliability, an experienced colleague was also involved in the data analysis. Initially, the qualitative data was analyzed for the main categories and sub-categories independently by two parties. Later on, the categories were negotiated and the disagreements over the categories were eliminated. Finally, the categories were refined and finalized. The inter-relater reliability was calculated 85%.

CHAPTER 4

RESULTS

As mentioned in the Chapter 3, the pre-test, the game phase, the post-test and the survey were conducted with participants who were students in primary and secondary state schools in a rural area in a big city in Turkey. In order to get more reliable results, students were observed in the classroom during the experiment. In this chapter, the results of the pre-test, the game phase, the post-test, survey results, and the results of the semi-structured interviews are presented. The students' numbers and grades are shown in *Table 3*.

4.1 Pre-test and Post-test Results

Before and after the game, the pre-test and the post-test were conducted to assess the students' vocabulary knowledge prior to and following their involvement in the game to evaluate its effect on their vocabulary acquisition.

The students' scores increased by 32.33% after playing the game with an increase of 3.88 points in the mean score (*Table 4*). This increase was statistically significant ($p < .000$), as shown in *Table 5*, according to a paired t- test comparison of the pre-test and post-test results. This result indicated that there was a statistically significant improvement in jump distance from 6.50 ± 3.12 to 10.38 ± 2.26 ($p < 0.1$); an improvement of 3.88 ± 1.6 correct answers of 12 words.

Table 4. Paired Sample Statistics Results

	Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Pre Test	6,50	64	3,122
	Post Test	10,38	64	2,264

Table 5. Paired Sample T-test Correlation Results

	N	Correlation	Sig.
Pair 1 Pre Test & Post Test	64	,534	,000

The figure below (Figure 15) shows the average correct answer percentage of the pre-test and post-test scores of students between 2nd grade level and 8th grade level. As shown in the figure, while the pre-test results in some grades showed a relatively low level of success, ranging from 36,36 percent (2nd grade) to 41,67 percent (5th grade), other classes had a relatively high correct answer level such as 78,79 percent (7th grade) on the pre-test. That is probably due to the students' success level. However, while the 2nd grade students achieved a success level of 77, 27 percent on the post-test, the other classes' level of success was between 85 to 90 percent. The post-test results of different grade levels were very close to one another although the pre-test results varied between 36 percent and 78 percent. That might be regarded as an indication of the effect of the game on students' vocabulary acquisition.

The study results pointed out a tendency towards an incremental increase in the post-test scores in line with the increase in the grade level, except for a slight decrease in the grade level 5 and 8, which is consistent with the findings by Akhtar and Montague (1999) and Smith and Yu (2008), indicating an advantage in favour of older learners.

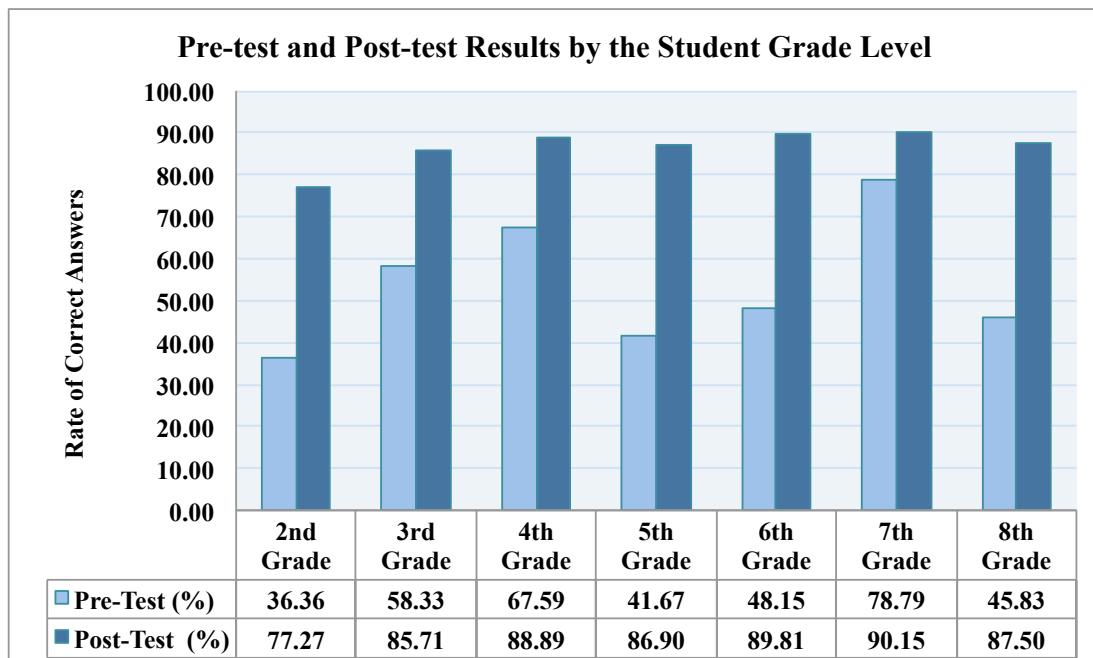


Figure 15. Pre-test and Post-test Results by the Student Grade Level

The correct answer rate of the pre-test and post-test results according to the parts of speech are shown in *Figure 16*. As shown in the figure, while the rate of correct answers of noun and adjective word types on the post-test was about 55 percent, the rate of correct results concerning verbs was 51 percent. However, the rate of correct answers on the post-test regarding adjectives, which was 83 percent, was lower than verbs, which was 87 percent, which is in line with Ludington (2013), indicating that as a word class, young second language learners tend to acquire nouns quicker than verbs. This chart displayed that learning adjectives through the game was somewhat harder than verbs for the participants.

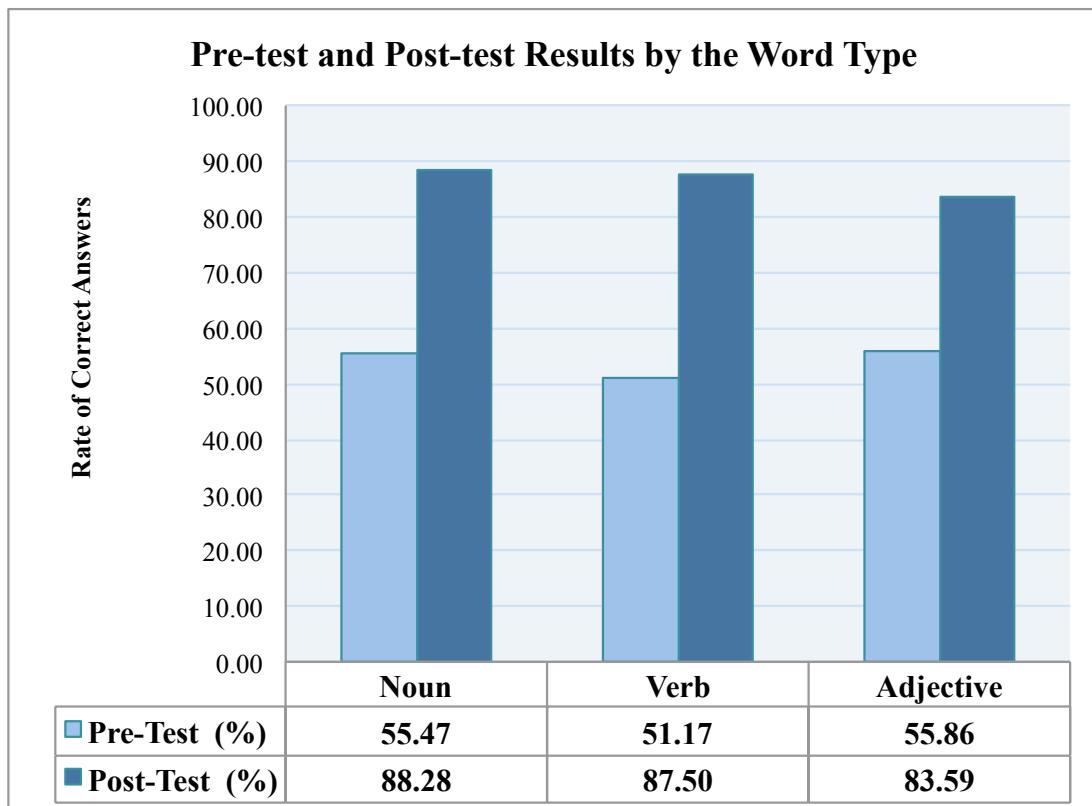


Figure 16. Pre-test and Post-test Results by the Word Type

In Figure 17 below, the pre-test and the post-test results are shown with respect to the students' gender. As shown in the graph, although male and female test results were very close to each other, the rate of correct answers on the pre-test concerning female students were found lower than that concerning male students and the female students were found more successful according to the pre- and the post-test results (Figure 17). This may indicate that that female students had a slightly better performance of memorizing words.

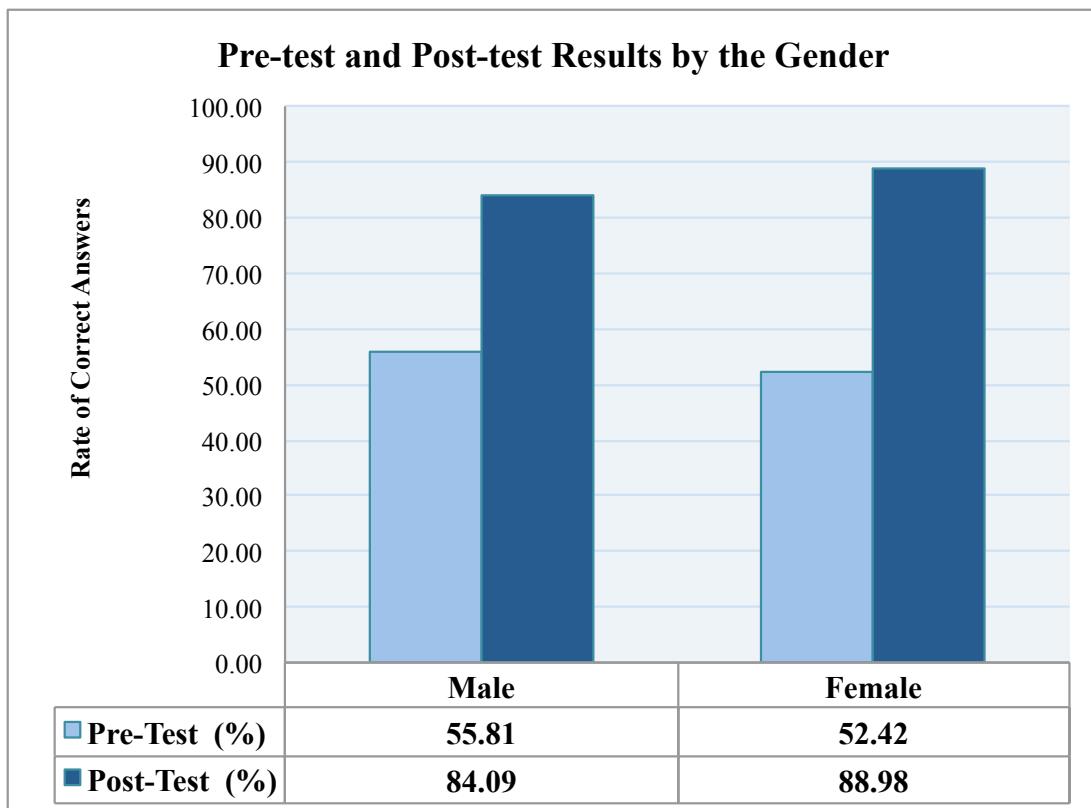


Figure 17. Pre-test and Post-test Results by the Gender

The study of Al-Masri and Al-Najar (2014) on the effect of using traditional word games, examined the performance of students' achievement in English vocabulary. In fact, the pre-test results of the computer game experiment in the current study are quite in line with the study by Al-Masri and Al-Najar (2014) in that the male and female participants had similar mean scores on the test (males' mean score: 55.81 and the females' mean score: 52.42) On the other hand, the results of the post-test administered at the end of the game application indicated a considerable amount of improvement in the participants' performances, unlike the slight progress in the participants' level of achievement in the aforementioned study related to a traditional game. To illustrate, the post-test results of computer game experiment showed that males had 84.09 and females had 88.98 as the average mean score.

Table 6 shows the pre-test, post-test and the differences of pre-test and post-test of the studies according to male and female students. The differences between the post-test and the pre-test of the traditional word games experiment revealed incremental improvement over traditional learning. However, a remarkable difference was observed in terms of the pre- and the post-test results in relation to the current vocabulary learning experiment, as opposed to the results of the traditional word games experiment.

Table 6. A Comparison between the Pre-test and the Post-test Results of the Study by Al-Masri and Al-Najar (2014) and Those of the Current Study

	Study Type	Pre-Test Means		Post-Test Means		Difference of Post-and Pre-Test Means	
		Males	Females	Males	Females	Males	Females
The Study by Al-Masri and Al-Najar (2014)	Traditional Learning (N=77)	67.48	69.60	76.64	77.42	9.16%	7.82%
	Traditional Word Games (N=81)	68.80	69.89	81.82	82.34	13.02%	12.45%
The Current Study (2015)	The Computer Word Game (N=64)	55.81	52.42	84.09	88.98	28.28%	36.56%

4.2 Failed Count Results in Game Phase

Table 7 below demonstrates the One-Way ANOVA results concerning the students' failed counts in the game. This result indicated that the difference between groups was statistically significant ($p=0.001$).

Table 7. Failed Count One-Way ANOVA Results

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	2904,023	6	484,004	4,490	,001
Within Groups	6143,837	57	107,787		
Total	9047,859	63			

Figure 18 below displays the failed count average according to the student grade level. As seen in the figure, the failed count average was higher in the second grade students than the other grades, which are in line with the observations of the classroom teacher, indicating that the majority of the students at this level were not as visual as those in the other grade levels (they were mostly kinesthetic learners).

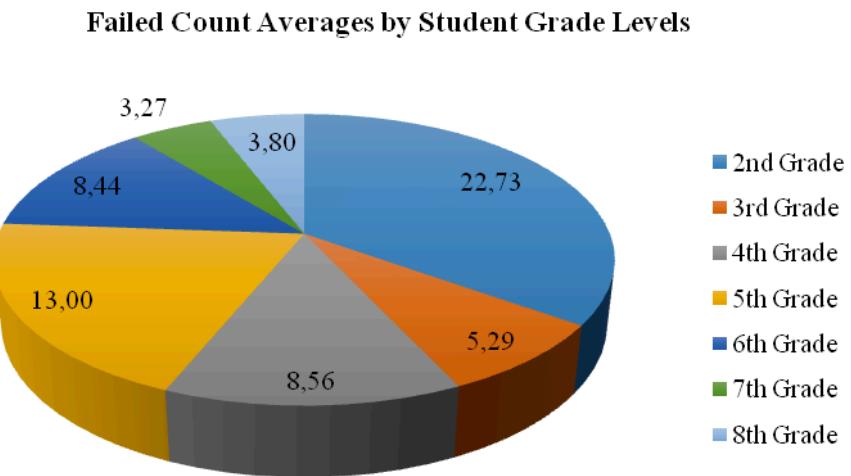


Figure 18. Failed Count Averages by Student Grade Levels

Figure 19 below indicates the average number of mistakes according to different parts of speech (nouns, verbs and adjectives). As shown in the figure, while the participants had the lowest number of mistakes in the verb category, the failed count on the adjective category was indicated higher than both the noun and the verb category. This graph also supports the pre-test and post-test results by the word type in *Figure 16*, which displays that students had difficulty in learning adjectives than verbs and nouns via the game. It can be said that the visualization of nouns and verbs are easier than adjectives.

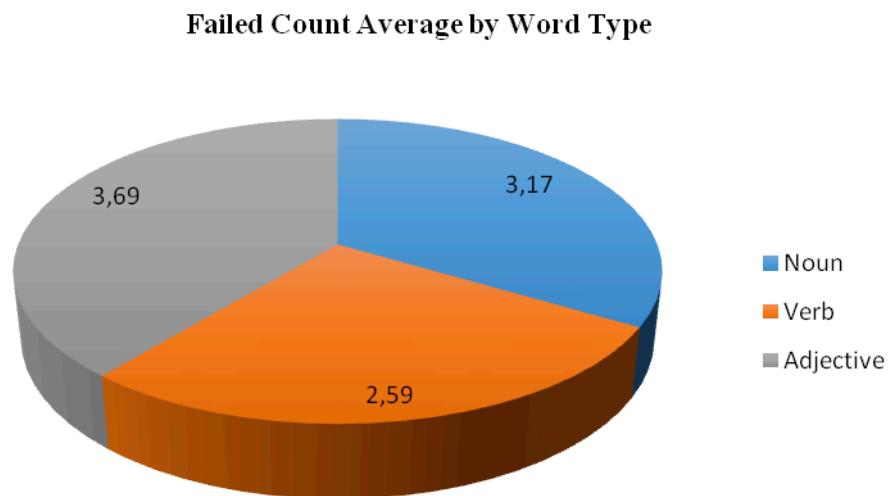


Figure 19. Failed Count Average by the Word Type (revise)

There is a slight difference in the failed count average between male and female students, as shown in *Figure 20*. That also reinforces the pre-test and post-test results according to gender in *Figure 17*. Thus, it can be concluded that the female students in the study had a more developed verbal ability over the male ones.

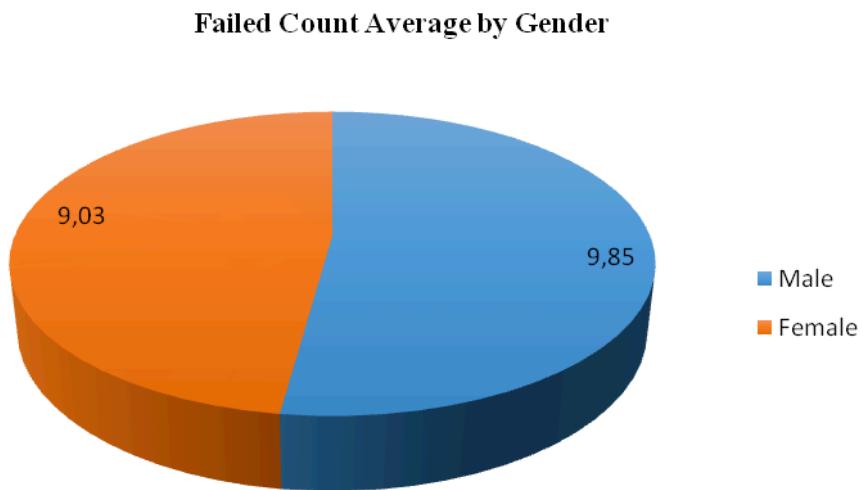


Figure 20. The Failed Count Average according to Gender

4.3 Survey Results

At the end of the game the students filled in a survey (Appendix A), which was mainly designed to measure students' interest in the game, their level of motivation, the user-friendliness of the game, and the extent to which it facilitates student learning.

As *Table 8* shows, Cronbach's alpha reliability co-efficient is 0.800, which indicates a high level of internal consistency for the students' response scale.

Table 8. Reliability Statistic Test Result.

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
,800	,823	12

Figure 21 below demonstrates the students' attitude towards the game. Apparently, most of the students liked the game. The results of the survey showed that most of the students thought the game was useful; they liked to play the game and wanted the game to be used in the classroom. Moreover, the graph displayed that they found the game interesting and

increased their desire to learn vocabulary. Furthermore, they liked the immediate feedback feature of the game.

All the participants involved in the study tended to hold the same point of view about the game as the graphs show according to the students' grade level (Appendix C). Also, the responses to open-ended items pointed out that using images in the game was appealing for most of the students. On the other hand, some students suggested that there should be more vocabulary in the game and that the duration of the game should be extended.

General Survey Results (N=64)

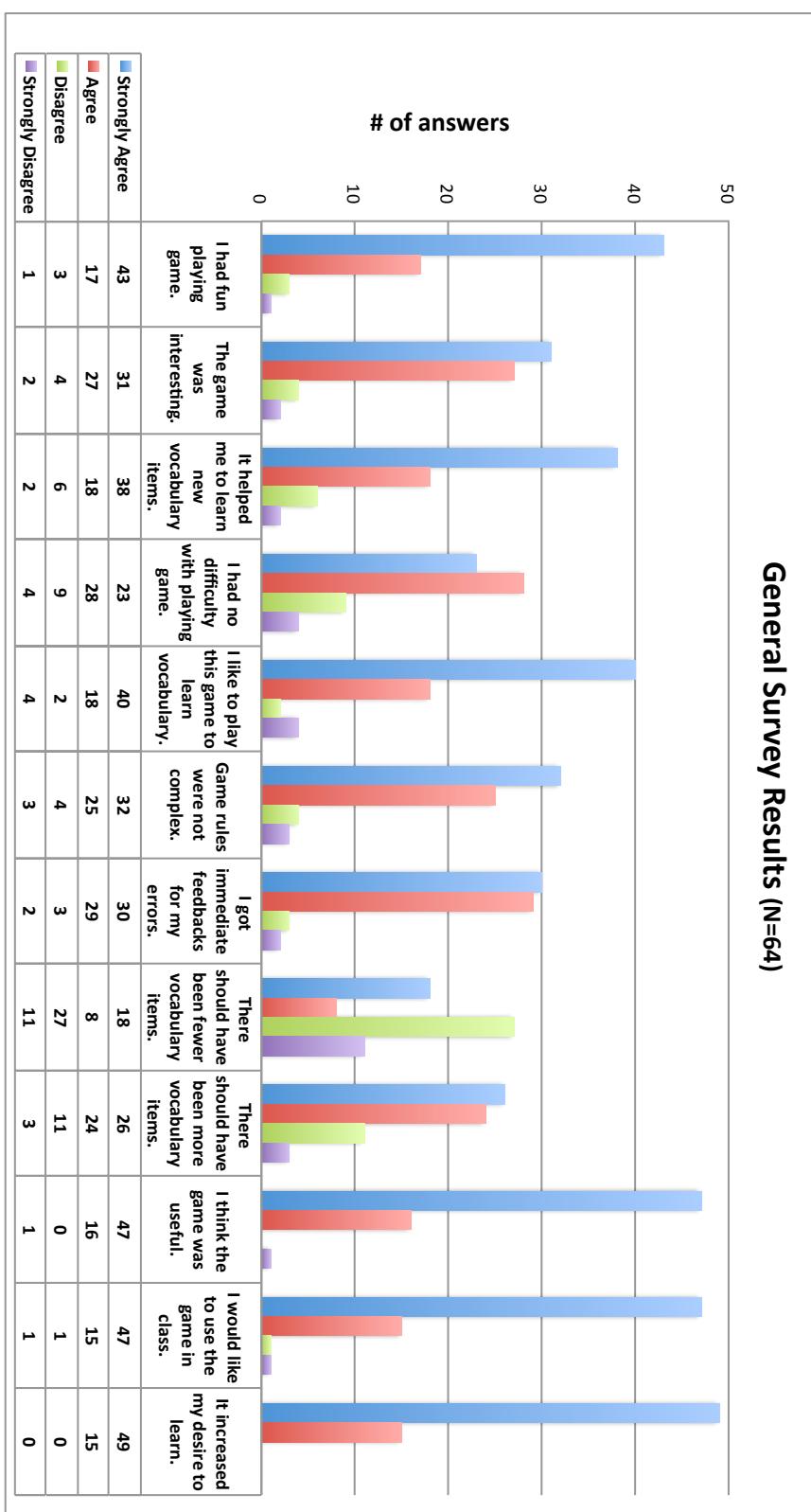


Figure 21. Survey Results

4.4 Results of The Semi-Structured Interviews with The Teachers

Besides the positive attitudes of the students towards the game application, as indicated in the survey results, the English teachers in the study held very positive and favorable views towards using games in their lessons according to the results of the semi- structured interviews.

The teachers of the students indicated that students were highly motivated because they liked playing the game and using a technological device like a tablet pc was impressive, adding that most of the students were using a tablet for the first time. They also indicated that the level of student motivation in class increased with the colorful and enjoyable images which made the vocabulary acquisition easier. This finding is also parallel with the survey result of the students who said they liked the images in the game (as indicated in the Survey Result Section - Section 4.3). Furthermore, they pointed out that some of the students who finished the game earlier than others were asking to play the game again (the game lasted for 10 to 15 minutes according to the player's performance). That also shows how the students liked to use a well-designed game-base application for vocabulary acquisition and how the students' motivation was. The teachers pointed out that the game changed the atmosphere of the classroom from being teacher-based to student-based and the students were actively involved in the learning process and it also increased their self-confidence when they realized they can achieve on their own. Thus, the game was found very helpful in terms of peripheral learning, the strong visual impact it makes and the interactive design feature. In addition, the teachers said that since the scores depend on timing in the game, the students were trying to finish earlier than their peers to get a higher score.

The teachers were of the opinion that using technological devices and also making the students play the game in the classroom made them highly motivated and the most difficult part of learning English as a foreign language (Meara, 1980) became enjoyable with the help of game-based English vocabulary application. Consequently, the students and the teachers were eager to use the game for vocabulary acquisition.

CHAPTER 5

CONCLUSION

With the ICT improvement, it is unavoidable to use ICT applications in our lives and education. E-learning is one of the places that use technology for learning activities. Games are one of the best technological learning tools in education, ensuring motivation, participation and attention. Learning via playing games, students enjoy and also feel comfortable in the classroom while learning the subjects. Games provide participation opportunities for students who have participation problems in the classroom and cannot get feedback due to their lack of participation. Games also provide immediate feedback for the students who are too shy to join classroom activities.

Language teaching is also one of the educational contexts that are affected by technological improvements. Vocabulary acquisition is the difficult part of learning the language for students and it is inevitable to learn vocabulary while learning a foreign language. Also, in order to communicate meaningfully, learners should extend their vocabulary. Games make it easy for learners to acquire vocabulary.

In the scope of this study, a mobile game-based application was developed and assessed for teaching English vocabulary for primary and secondary school students who are learning English as a foreign language. An English vocabulary acquisition game was chosen because in Turkey English is one of the mandatory courses in most of the primary, high schools and in some universities. Moreover, English is one of the mostly used languages through all over the world. Cross-situational learning is recommended as an efficient learning strategy to pairing vocabulary to their referents. Thus, at the development and design phases of the test part of the game, the multiple exposure aspect of cross-situational learning was taken as a theoretical basis.

Laufer (1997) indicated that to understand written and spoken texts in a language, the learner should extend his/her vocabulary knowledge. Furthermore, as Lo and Tseng (2011) remarked, while learning a foreign language, vocabulary acquisition is boring for students. At the end of this study, it was revealed that using games in vocabulary acquisition is very effective while learning English as a foreign language in primary and secondary schools. As Uzun (2009) and Kirriemuir and Mcfarlane (2004) stated, students felt more comfortable and flexible when the game was used in the classroom. All the students in the experiment were motivated and participated in the game. It gave the learners an opportunity to receive immediate feedback and to be involved in an interactive learning environment, as pointed out by Ebner and Holzinger (2007) and Oblinger (2004). The results of the survey indicated

that students were happy to get immediate feedback. As the game drew the attention of the students and motivates them, both students and teachers regarded the games as effective learning tools, which is in line with Yip and Kwan (2006). The findings of this study reinforced those of other studies, indicating that using the vocabulary game was effective, and raised the motivation level of students, making vocabulary learning enjoyable (Kirriemuir & Mcfarlane, 2004), as the survey results show in *Figure 21*.

As the results of this study demonstrated, it can be argued that using mobile games in education is an effective strategy concerning students' motivation (Gaudart, 1999; Muhamma, 2012). Mobile games are very effective to motivate students and it is very important that it gives real time feedback when it is needed. Therefore, more research studies are needed on mobile games in education especially on vocabulary acquisition because students need a high level of motivation when memorizing vocabulary in a foreign language (Lo & Tseng, 2011).

Furthermore, there need to be multiple trials to find out the correct word-referent mapping (Yu & Smith, 2007) and the multiple exposure aspect of cross-situational learning is an efficient learning strategy while learning English vocabulary as a foreign language in primary and secondary schools via mobile learning game, which was indicated in the current study.

The game contributed to the creation of a learner-centered learning environment in class. It encouraged students to be actively involved in the game. The immediate feedback feature of the game helped students to gain their self-confidence in relation to learning new vocabulary in English. With the ongoing feedback they received on their performance, their efficiency of learning new words increased. Accordingly, as their English teachers also pointed out, the game helped students for positive attitudes towards learning English vocabulary.

The result of the study also showed that learning adjectives via a digital game was harder to learn than other vocabulary items (See *Figure 16* and *Figure 19*) and female students demonstrated a slightly better performance than male students (*Figure 17* and *Figure 20*), which is in accordance with the study by Al-Masri and Al-Najar (2014). Students older than second graders also showed a better performance due to their more developed verbal ability, as discussed in the previous chapter and the graphs in *Figure 15* and *Figure 18* showed. This finding is consistent with Yu and Smith (2007) and Smith et al. (2011). Moreover, the survey results are quite revealing in that it displayed the strong preference of primary and secondary school students in Turkey towards playing mobile games to traditional classroom activities in vocabulary acquisition, which is a phenomenon commonly observed in Turkey, as well as all around the world.

The results of the game application in this study can be said to be comparable to those obtained from of Al-Masri and Al-Najar (2014), which was concerned with the impact of traditional word games on students' level of achievement in EFL vocabulary acquisition. Comparing the study of Al-Masri and Al-Najar (2014), using the computer game in this study led students to perform better in terms of learning EFL vocabulary as compared to their performance in a traditional game environment. The results of the game application showed that using computer games for vocabulary acquisition is more efficient than traditional games.

Due to the limited sample size in the study (only 64 students) and the limited number of mobile devices (10 devices) used in the study it is not possible to generalize the results. In addition, due to the technical and logistic constraints imposed on the study, the pronunciation aspect of the mobile game, which constitutes a very significant aspect of learning EFL vocabulary, was not incorporated in the study. Therefore, a pronunciation component could be added to further research studies. Moreover, this study was limited to primary and secondary school EFL students within an age range of 6 to 16, who are from the 2nd to the 8th grades in Turkey. Taking all these factors into consideration, further research should be extended to different age groups, learners from different countries and different ethnic groups.

The favorable views of the classroom teachers in relation to the game-based application in the study indicates that the integration of such applications as the one used in the study into mainstream EFL vocabulary instruction can facilitate the vocabulary learning process of EFL learners by increasing the level of learner motivation in a competitive atmosphere and, hence, is likely to enhance the effectiveness of the quality of vocabulary instruction in the Turkish context. The immediate feedback feature of the game-based application is also likely to promote learner autonomy in learning vocabulary in the EFL settings. The learners might be encouraged to play the game outside class in their own time and record their performances to see their own progress in learning vocabulary.

The semi-structured interviews with the classroom teachers revealed that the technicalities of the game should be reconsidered so that the screen sizes of the mobile devices are adjusted in line with the images used in the game. The interviews also pointed out the need to extend the duration of the game and to increase the number of the vocabulary items from different parts of speech. Although the study findings demonstrated that the competitive aspect of the game was found motivating by the learners, it is important that the classroom teachers do not ignore the collaborative and cooperative aspect of the game. The game could be turned into a collaborative one where the learners compete in groups.

Taking into account that the participants in the study were not familiar with the use of mobile devices prior to their involvement in the study, the future researchers might consider organizing a training program to introduce the game application to the students and provide in-class opportunities for them to do hands-on-practice before launching the study. The integration of such a training program into the study might result in a higher reliability of the results. It might also enhance the potential learning gains on the part of the participants and facilitate the accomplishment of the learning outcomes of the game application. It might even further increase the level of student motivation, particularly the students who were not familiar with mobile technology, leading them to be more enthusiastically involved in learning new vocabulary in English.

Last but not least, a longitudinal study could be conducted to investigate the long-term impact of the game application on the students' progress in learning vocabulary and their vocabulary gains more reliably. As the semi-structured interviews with the teachers pointed out, the cross-sectional design of the study did not allow the measurement of the long-term effects of the application. In addition, further research studies with an experimental design, where both experimental and control groups are involved, could be conducted.

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APPENDICES

APPENDIX A: SURVEY QUESTIONS

The student survey is composed of 14 items. It aims to explore students' views on different aspects of the game application. There are 12 likert-scale items (with four options ranging from 'strongly agree' to 'strongly disagree'), which are concerned with the students' views on the usability, effectiveness and motivation issues related to the game. There are also two open-ended items to gain more in-depth insights into the students' opinions of the game.

	Kesinlikle Katılmıyorum (Strongly Disagree)	Katılmıyorum (Disagree)	Katılıyorum (Agree)	Kesinlikle Katılıyorum (Strongly Agree)
1) Oyunu oynarken eğlendim. (I had fun playing game.)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2) İlginç bir oyndu. (The game was interesting.)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3) Oyun yeni kelimeler öğrenmemeye yardımcı oldu. (It helped me to learn new vocabulary items.)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4) Oyunu oynamakta hiç zorlanmadım. (I had no difficulty with playing game.)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5) Kelime öğrenmek için bu oyunu kullanmak isterim. (I would like to play this game to learn vocabulary.)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6) Oyundaki kurallar karmaşık değildi. (Game rules were not complex.)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7) Oynarken hatalarımı hemen görebildim. (I got immediate feedbacks for my errors.)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

8) Oyundaki kelime sayısı daha az olmaliydi. (There should have been fewer vocabulary items.)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9) Oyundaki kelime sayısı daha fazla olmaliydi. (There should have been more vocabulary items.)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10) Bence faydalı bir oyun. (I think the game was useful.)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11) Bu oyunun derste de kullanılmasını isterim. (I would like to use the game in class.)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12) Öğrenme isteğiimi artırdı. (It increased my wish to learn new words.)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

13) Oyunla ilgili en çok neyi sevdiniz? (What did you like most about the game?)

14) Oyunda değişimini istediğiniz şeyleri yazınız. (Write down that you like to be changed about the game.)

APPENDIX B: INTERVIEW QUESTIONS

The semi-structured interview with the teachers is composed of 10 items. It aims to explore teachers' views on different aspects of the game application. The open-ended items are prepared to get the teachers' opinions about the game.

- 1)** How was the motivation of the students?
- 2)** Was the game appropriate for the student level?
- 3)** How helpful do you think the game was for students' vocabulary acquisition?
- 4)** Would you like to make your students use this application for vocabulary acquisition?
- 5)** Do you think the app made any changes in the class atmosphere?
- 6)** How was the situation with the early and late finishers?
- 7)** How was the students' attitude towards the game?
- 8)** What was the effect of the game on classroom atmosphere?
- 9)** Do you think it has any effect on students' exams results?
- 10)** Do you want to add anything else?

APPENDIX C: SURVEY RESULTS

2nd Graders Survey Results (N=11)

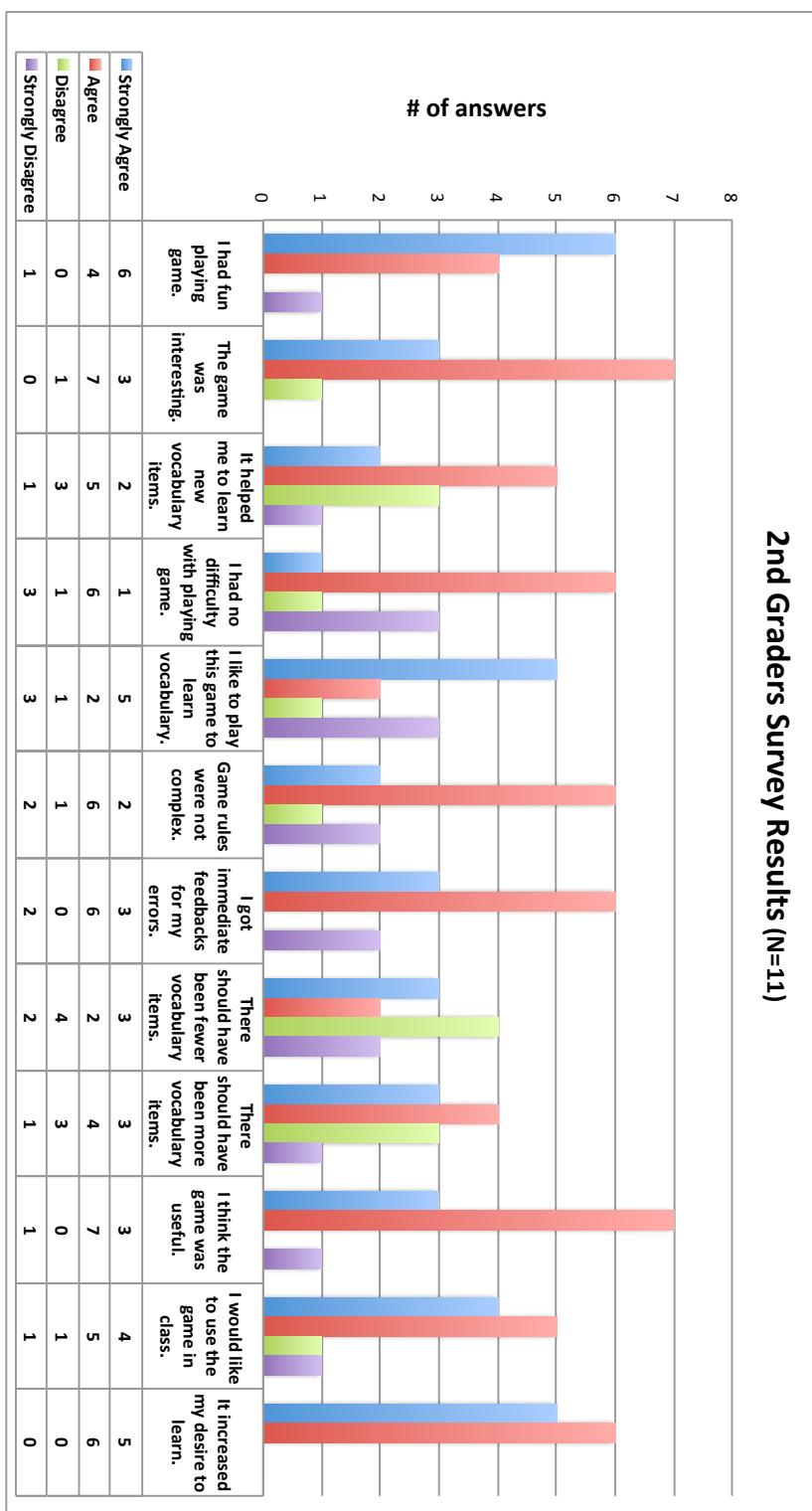


Figure 22. Survey Results of 2nd Graders

3rd Graders Survey Results (N=7)

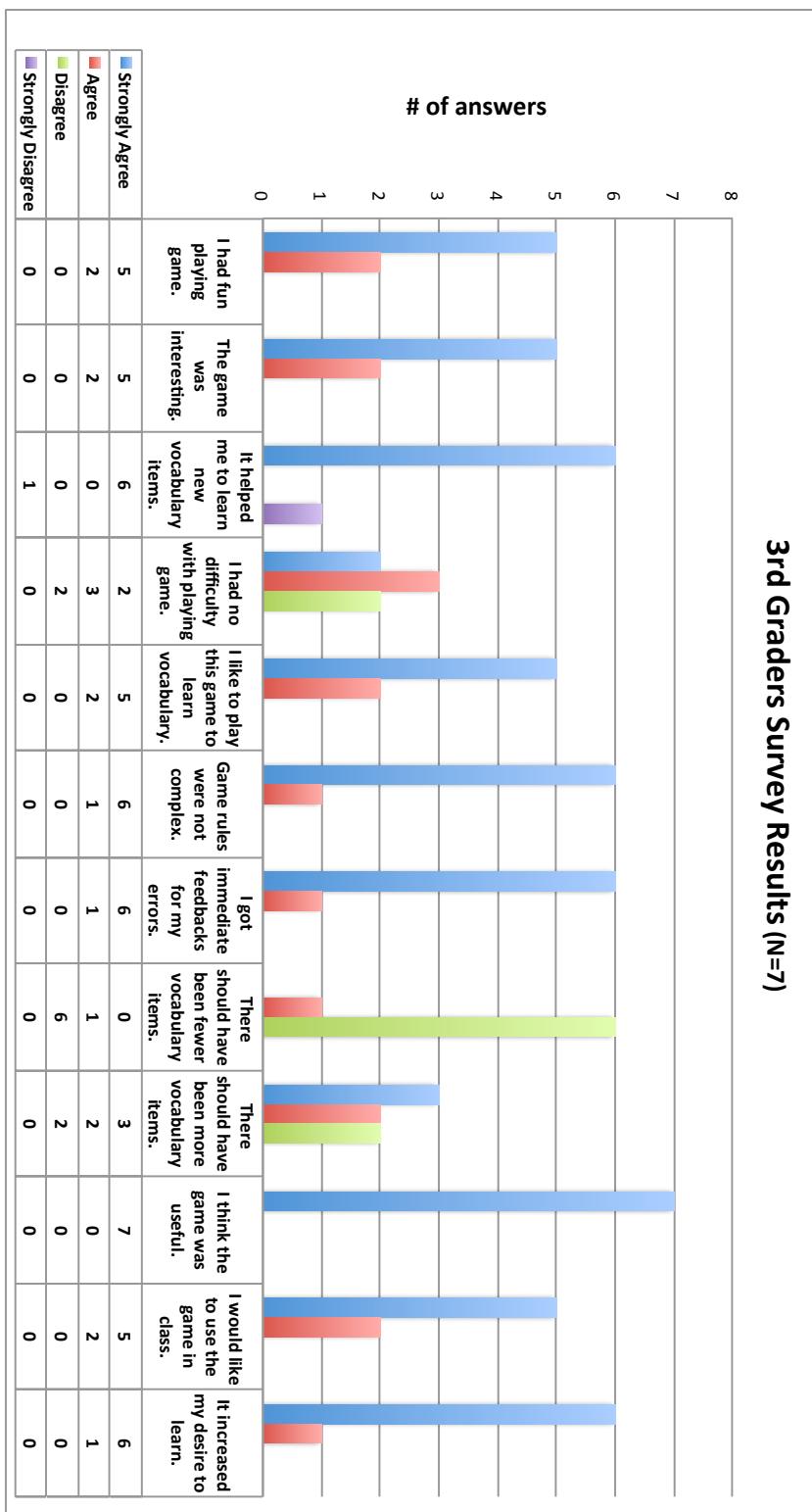


Figure 23. Survey Results of 3rd Graders

4th Graders Survey Results (N=9)

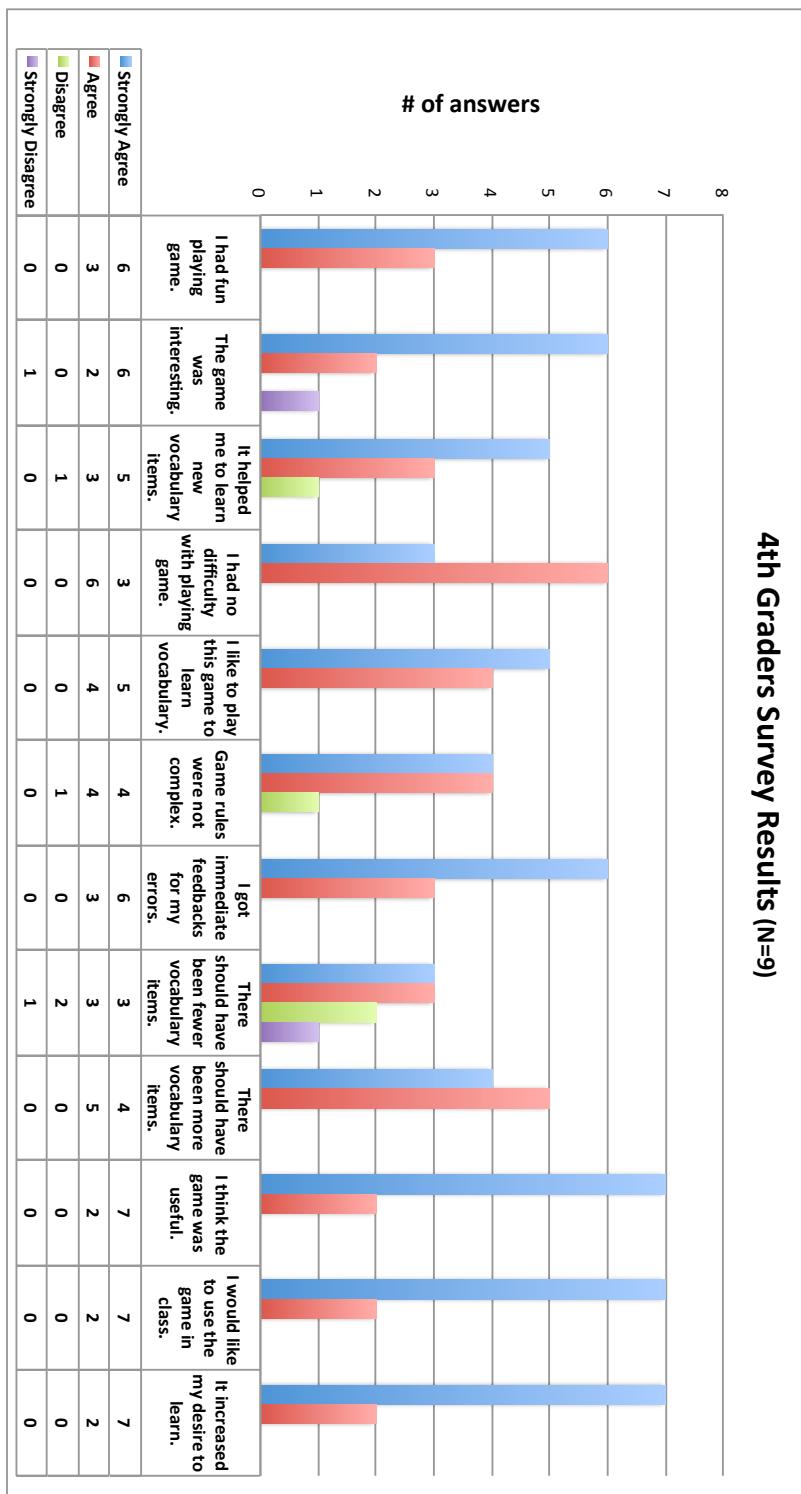


Figure 24. Survey Results of 4th Graders

5th Graders Survey Results (N=7)

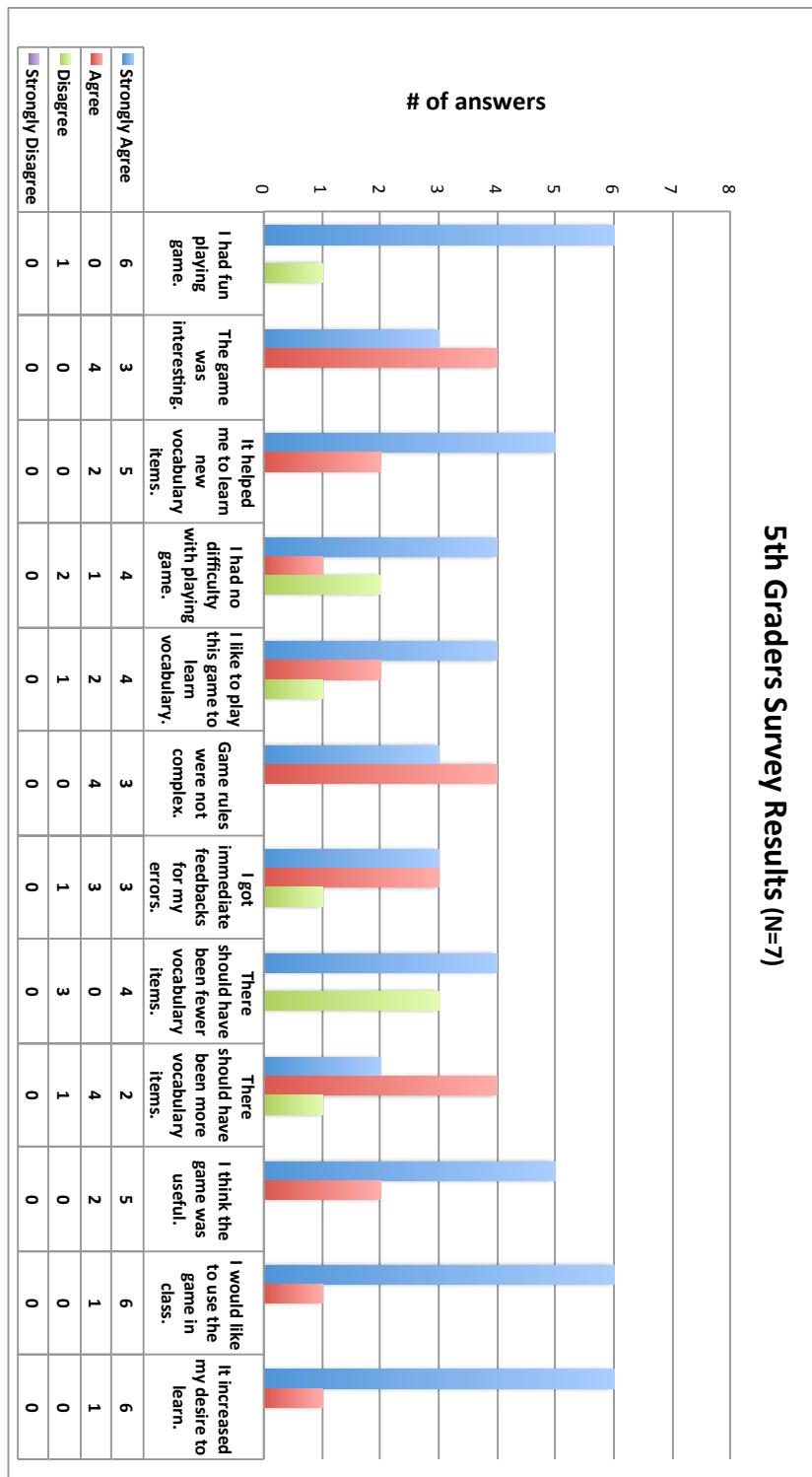


Figure 25. Survey Results of 5th Graders

6th Graders Survey Results (N=9)

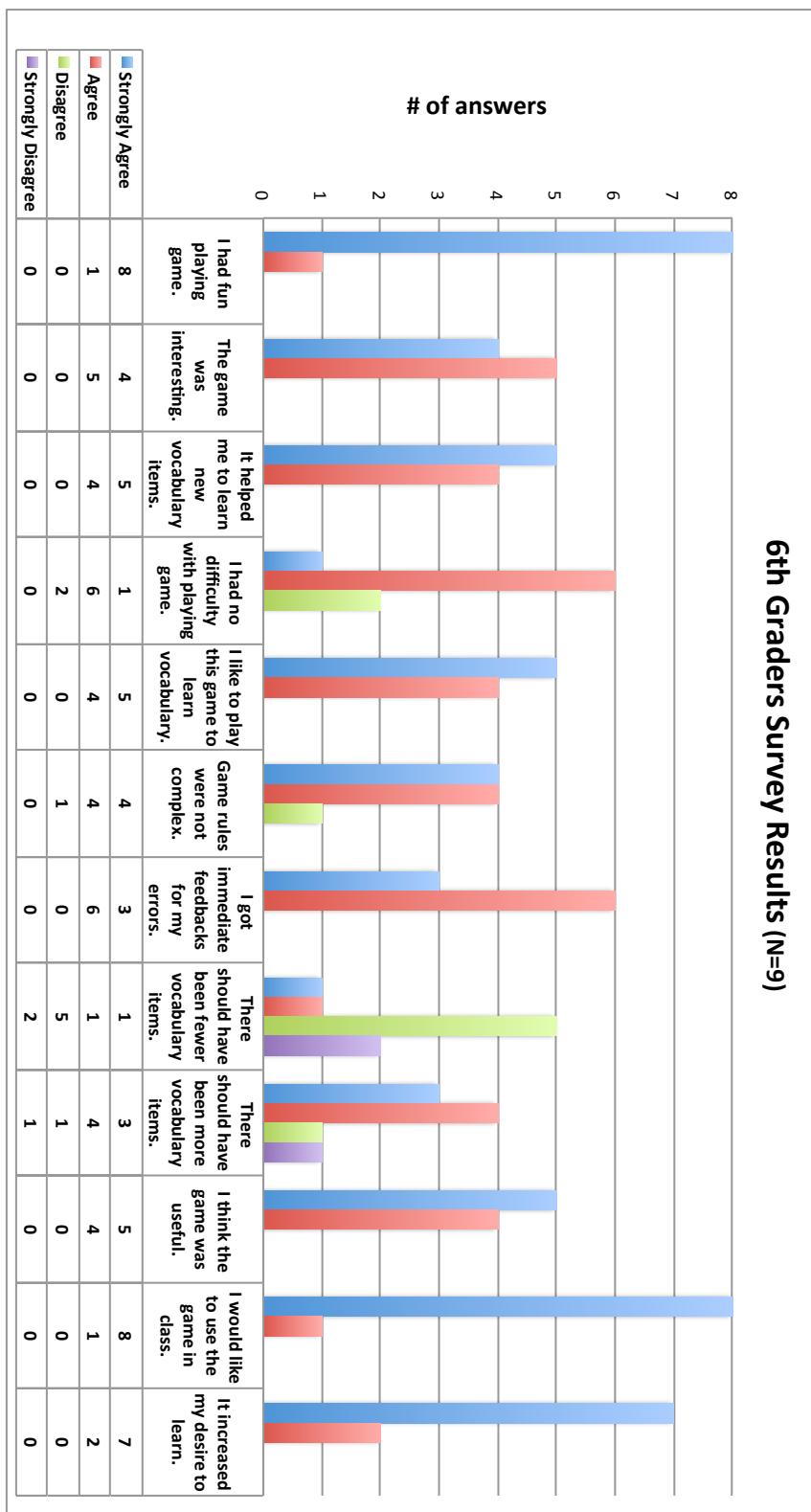


Figure 26. Survey Results of 6th Graders

7th Graders Survey Results (N=11)

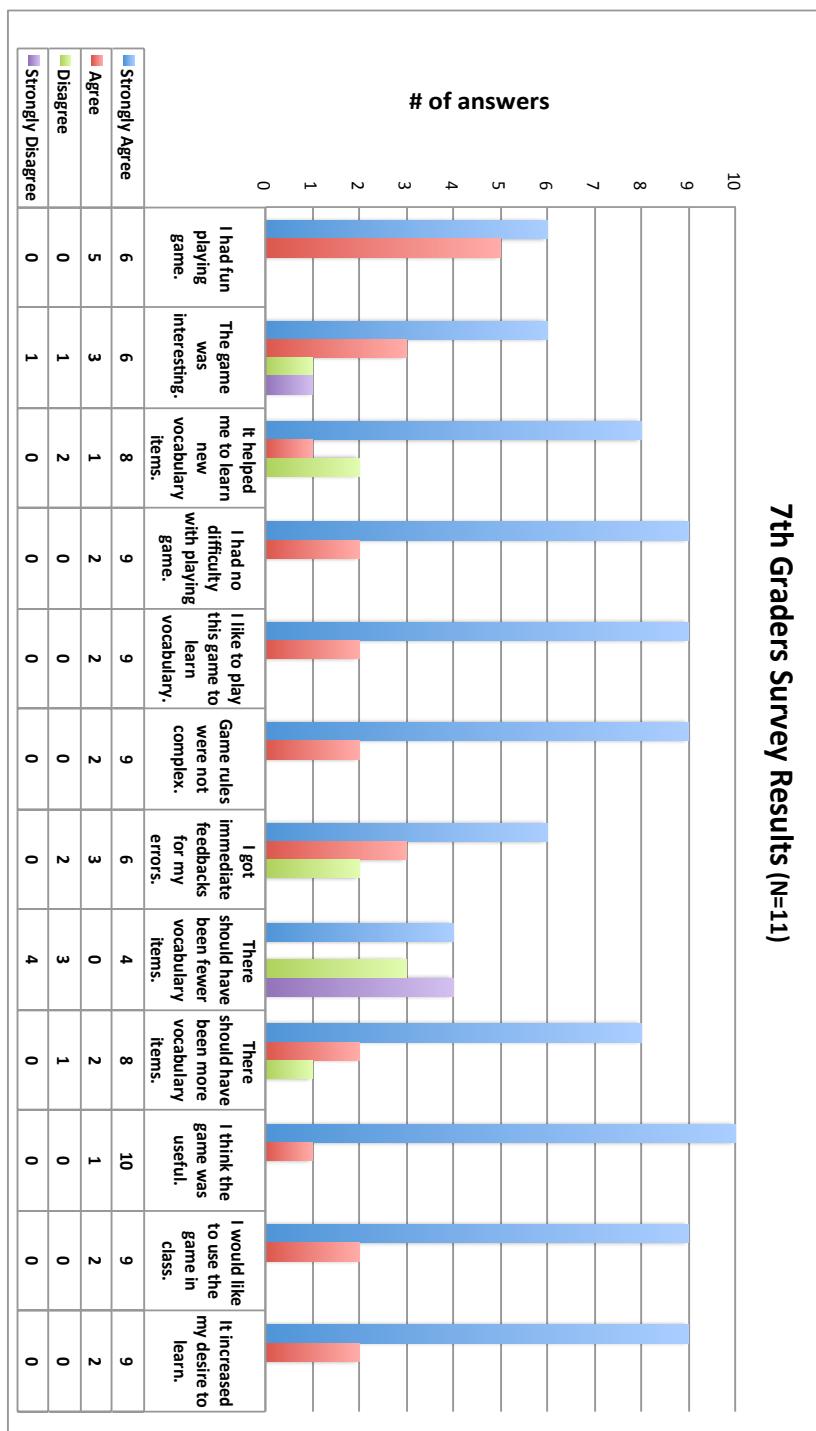


Figure 27. Survey Results of 7th Graders

8th Graders Survey Results (N=10)

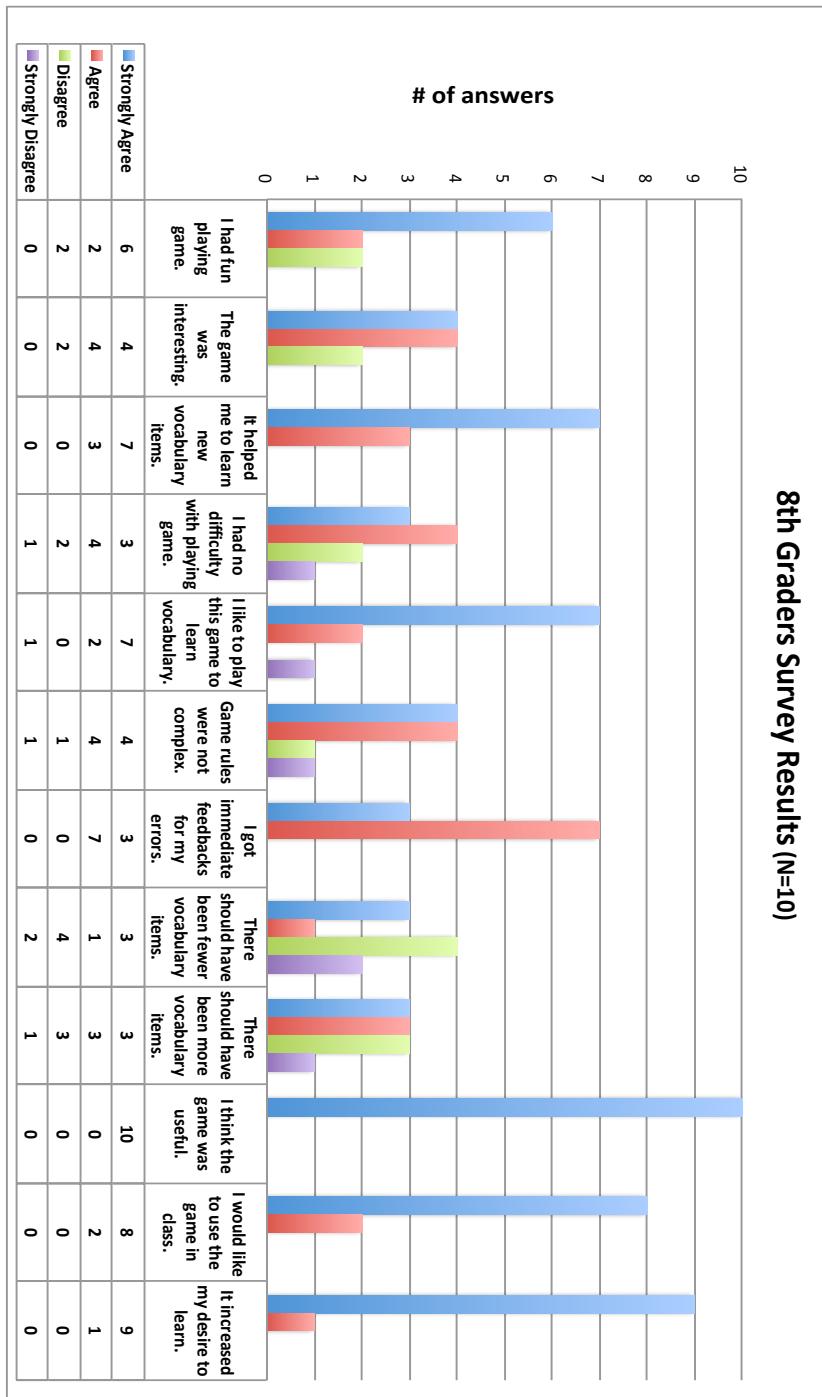


Figure 28. Survey Results of 8th Graders