REPUBLIC OF TURKEY
ABANT IZZET BAYSAL UNIVERSITY
INSTITUTE OF EDUCATION SCIENCES
DEPARTMENT OF ENGLISH LANGUAGE TEACHING
ENGLISH LANGUAGE TEACHING PROGRAM

THE EFFECTIVENESS OF AUGMENTED REALITY SUPPORTED MATERIALS ON VOCABULARY LEARNING AND RETENTION

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M.A. THESIS

By
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Thesis Supervisor
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EĞİTİM BİLİMLERİ ENSTİTÜSÜ MÜDÜRLÜĞÜ'NE,

Özgür DOĞAN'a ait Artırılmış Gerçeklik ile Desteklenmiş Materyallerin Kelime Öğrenimi ve Akılda Kalıcılığı üzerine Etkisi adlı çalışma, jürimiz tarafından Yabancı Diller Anabilim Dalında YÜKSEK LİSANS TEZİ olarak kabul edilmiştir. 15/07/2016

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To my daughters, Eylül and Deniz Arya…

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LIST OF ABBREVIATIONS

AR	: Augmented Reality
CALL	: Mobile Assisted Language Learning
ICT	: Information and Communication Technologies
MALL	: Mobile Assisted Language Learning
MoNE	: Ministry of National Education

ÖZET

ARTIRILMIŞ GERÇEKLİK İLE DESTEKLENMİŞ MATERYALLERİN KELİME ÖĞRENİMİ VE AKILDA KALICILIĞI ÜZERİNE ETKİSİ

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Danışman: Yrd. Doc. Dr. Sedat AKAYOĞLU
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Günümüzde, gittikçe küreselleşen ve her geçen gün mobil teknolojiler tarafından domine edilen bir dünyada yaşamaktayız. Sadece teknoloji mobilleşmekle kalmayıp, aynı zamanda da bu teknolojileri kullanan hayatın her kesiminden insan da mobil hale gelmekte, ve mobil cihazlar modern insanların vazgeçilmez uzuvları haline gelmektedir. Görsel, işitsel, kinetik gibi öğrenme stilleri göz önüne alındığında, eğitim teknolojisi uzmanlarının öğrenciler için öğrenme süreçlerini daha kolaylaştıran ve eğlenceli hale getiren yöntemler geliştirmelidir. Dahası, öğrencilerin boş zamanlarında sınıflarının fiziksel sınırlarının dışında İngilizce çalışmalarını sağlayacak yenilikçi fikirler de geliştirilmelidir. Bu yenilikçi fikirlerden bir tanesi de dil öğrenimi için bir potansiyele sahip olsa da Türk EFL bağlamında kullannılmamış olan Artırılmış Gerçeklik'tir. Bu çalışmanın amacı, Türk EFL öğrencileri bağlamında Artırılmış Gerçeklik ile desteklenmiş materyallerin kelime öğrenimi ve akılda kalıcılığı üzerine etkisinin incelenmesidir.

Artırılmış Gerçeklik ile desteklenmiş materyallerin kelime öğrenimi ve akılda kalıcılığı üzerine etkisi, deney safhası 5 hafta süren karışık yöntem araştırma deseni ile incelenmektedir. Bu çalışma için bir kontrol ve bir de deney grubu oluşturuldu. Denekler, Erzincan Üniversitesinde öğrenim gören başlangıç seviyesi derecesinde İngilizce yeterliliğine sahip 40 hazırlık öğrencisinden oluşmaktadır. Nicel veriler Kelime Bilgisi Testleri ve Nitel Veriler de görüşmeler ve demografik bilgi anketi yoluyla toplanmıştır. Toplanan veriler, IBM SPSS 19 istatistik yazılımı kullanılarak, ANCOVA ve Bağımsız Örneklem t-testleri aracılığıyla analiz edilmiştir.

Hem nicel hem de nitel verilerin analizi, Artırılmış Gerçeklik ile desteklenmiş materyallerin kelime öğrenimi ve akılda kalıcılığı üzerine etkisini kanıtlamıştır. Katılımcılar olumlu tutum geliştirmiş ve Artırılmış Gerçeklik ile desteklenmiş materyallerin, bilinmeyen kelimelerin öğreniminde ve özellikle de bu kelimelerin hatırlanmasında yardımcı olduklarına dair görüş belirtmişlerdir.

Anahtar kelimeler: Artırılmış Gerçeklik, Mobil Öğrenme, Mobil Destekli Dil Öğrenimi, Tutum

ABSTRACT

THE EFFECTIVENESS OF AUGMENTED REALITY SUPPORTED MATERIALS ON VOCABULARY LEARNING AND RETENTION

Doğan, Özgür

M.A. Thesis, Program of English Language Teaching
Supervisor: Assist. Prof. Dr. Sedat AKAYOĞLU
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Today, we live in an increasingly global and connected world dominated by mobile technologies, becoming a mobile-centric world each day. And it is not just technology that is going mobile but also people from all walks of life and the mobile devices have become an indispensable part of modern human beings. When the learning styles of learners such as visual, auditory, and kinesthetic are taken into account, educators and educational technologists, edtechucators in short, should develop more engaging methods for learners to make their learning process much easier and more enjoyable. Moreover, some innovative ideas which could allow learners to study English outside the boundaries of physical classrooms at their leisure time should be devised. One of these innovative ideas is Augmented Reality that has not been utilized much in the Turkish EFL context, though it has much potential for the language learning. The purpose of this research is to investigate the effectiveness of Augmented Reality supported materials on vocabulary learning and retention in the context of Turkish EFL learners. Additionally, it also aims to find out students' opinions towards using Augmented Reality supported materials.

The effectiveness of Augmented Reality supported materials on vocabulary learning and retention is analyzed through a mixed method research design, experimental research phase of which takes five weeks. A control and an experiment group have been employed, both of which include 20 and a total of 40 students who study at Erzincan University and have elementary level English language proficiency. Quantitative data have been gathered through Vocabulary Knowledge Tests and qualitative data have been gathered through semi-structured interviews and demographic information survey. Gathered data have been analyzed trough ANCOVA and Independent Samples t-tests in IBM SPSS 19 statistics software.

Analysis of both quantitative and qualitative data has proved the effectiveness of the Augmented Reality supported materials on vocabulary learning and retention. Participants have expressed positive opinions and reported that Augmented Reality supported materials have been helpful in learning unknown words and particularly in revision of them.

Key words: Augmented Reality, Mobile Learning, Mobile Assisted Language Learning, Attitude

CHAPTER I

INTRODUCTION

1. Introduction

In the first chapter, the background of the study, statement of the purpose, and research questions will be discussed followed by the significance of the research, and brief definitions of the terms used in the research.

1.1. Background of the Study

In the blink of an eye, Information and Communication Technology (ICT) has been shaped as one of the essential building blocks of modern society (UNESCO, 2002). In ever changing world, mobile technologies have an important role in every aspect of people's lives. As soon as they rise from bed, they reach to their smart phones, and try to catch up with the social networks they belong to; either call it Twitter or Facebook. They share their most intimate moments of their lives with their social media friends and get notified about theirs through technology. They turn on the smart TV's connected to internet in their living rooms and either read RSS feeds or check the weather while sipping their morning coffees. They get on their cars and connect their iPhones to cars' audio system via Bluetooth and listen to their favorite tracks while going to work. At lunch break, they first check in Swarm to see who else is having lunch with them in the same restaurant and pay the bill through mobile apps. They do shopping even without leaving the comfort of their homes.

This list may get even longer to emphasize the importance and benefits of technology in daily life. Naismith, Lonsdale, Vavoula, Sharples (2004) report this situation as:

"We take it for granted that we can talk to other people at any time, from wherever we may be; we are beginning to see it as normal that we can access information, take photographs, record our thoughts with one device, and that we can share these with our friends, colleagues or the wider world."

But what about learning and teaching? Johnson, Smith, Willis, Levine, and Haywood (2011) argues that variety of devices and Internet of Things (IoT) make teachers question their roles as educators and urge them to think outside the box to help their students best as ubiquitous devices let learners learn and study on the go. Can educators also take advantage of mobile technologies in their schools, particularly in their language classrooms?

Throughout the last ten or fifteen years, technology, especially in terms of computers, has created a powerful presence in foreign language education (Jones, 2001). Especially, with the introduction of internet, the computers have had an immense impact on language teaching and learning. Many technological advances, such as Web 2.0 applications and Youtube videos, have let students study either on their own or with other learners around the world. ICT has become such an indispensable tool to engage and motivate students that it is now much easier to make interesting and engaging activities by getting away from dull and repetitive exercises. Old school methods are no more appealing to teachers as they have become more aware of the positive results of interactive activities offered by technological developments and there is a trend among language teachers to integrate technological tools into their teaching styles.

An important factor for teachers to integrate technology and its affordances into their classrooms is Generation Z (Internet Generation or Digital Natives) waiting for them in the classrooms. They are born and grow up with technologies that teachers force

themselves to adapt, and this Generation Z has no difficulty in exploiting any type of technological devices with which most teachers struggle to use. Unlike teachers, Generation Z is never intimidated to experiment with those new technological toys as they are almost always “connected” to internet and they just “google” the unknown.

Mobile learning is marketed not only as the mobile technologies involved in the process but also as the mobility of the user and Digital Natives, as Generation Z is also called, are increasingly becoming mobile natives. They never drop their mobile devices and bring their mobile habits into classrooms, meaning that schools and teachers need to keep up with these mobile natives and teach them with what these mobile natives already have in their pockets. The effects of mobile learning are pervasive; mobile learning applications and mobile natives are increasing at an unprecedented rate, thus schools and teachers should provide the education that keeps up with this rate.

Taking advantage of mobile learning in language classrooms paves the way for mobile assisted language learning (MALL). MALL has some unique characteristics that distinguish itself from in a way its predecessor computer assisted language learning (CALL) in its use of technological advancements that are personal, portable, and ubiquitous. MALL has developed as a field of study, which was once thought to be a subfield of mobile learning or CALL partly due to the extensive use of mobile devices such as cellphones, tablets, and MP3 players in language classrooms. These devices provide countless benefits for language learners during their language learning experiences by turning the process into a personalized and informal learning.

1.2. Statement of Purpose

It is a generally accepted view that vocabulary is one of the problematic areas in the EFL and ESL as the number of the words to be mastered may be overwhelming for the learners. Richards (1976) states that though an exact number of words learners need to

master cannot be identified precisely, it is an obvious fact that students that steadily increase their vocabulary generally become good at their language skills. And it is not just the learning that is problematic but also the retention of it. To be an independent and competent language user as reported in Common European Framework of Reference for Languages (Council of Europe, 2001), the learner must have a one vital target: a larger vocabulary, which puts the learner on a path that has been taken by numerous learners but not completed by all. Learners might have an important obstacle here while reaching that target as to which words they should learn first. New learners could easily communicate with the people in the target language provided that they get a hold of the frequent words in the target language, between 1500 or 2000 words. Laufer (1997) argues that learners should master around 3000 high frequency words to comprehend a majority of them in oral and written discourse. Richards (1976) and Nation (2001) provide what students need to know about a word before it should be counted as a learned lexical item, which consists of its meaning, spelling, lexical parts, stress, grammatical class, collocations, register, associations, connotations, and frequency.

Today, we live in an increasingly global and connected world dominated by mobile technologies. And it is becoming a mobile-centric world each day. Let's call it; the mobile phone has become an indispensable part of modern human beings. According to the Pew Research Center, the mobile phone is the most rapidly adopted consumer technology of all time, (Smith, 2010). Moreover, usage of other mobile devices such as iPads, and android tablets is increasing. And it is not just consumers who are going mobile but also employees, students, and government agencies; which means people, from all walks of life, are going mobile.

As in the case of Turkey, however, English is not a second language to be mastered but a foreign language. Thus, this makes the learning process a bit harder for the Turkish EFL learners as they do not have many chances to practice the newly-learned vocabulary, also the language itself, apart from the classroom. Naturally, the natural selection in

language occurs which means less used vocabulary items are destined to be forgotten, as Darwin would have put it if he had been a linguist.

For the last two decades, countries all around the world have been inquiring about the methods and ways to integrate technology into their educational systems. Turkey has taken its part in this endeavor with FATIH project, an abbreviation of Movement of Enhancing Opportunities and Improving Technology. FATIH is an ICT project funded by the Ministry of National Education (MoNE) in Turkey and defines its main objective in its official website as *"to provide ICT equipment to classes in order to achieve the ICT supported teaching until the end of 2013"* (Fatih Projesi, n.d.).

In its website, Fatih Project aims five goals within the scope of MoNE's work space in order to transform Turkish society into an information society as shown below:

- *"Lifelong learning approach, development of the proper structures in which all individuals can improve themselves through e-learning, and development of the e-content.*
- *All students that graduate from secondary education should have the ability to use the basic information and communication technologies.*
- *One of the three individuals in society should benefit from e-education facilities through the effective usage of Internet.*
- *Providing equal opportunities to everybody on learning and usage of the information and communication technologies.*
- *One of the two individuals in society should be Internet user*
- *Internet should be made reliable for society* (Fatih Projesi, n.d.)"

Equipping classrooms with latest technology and students with tablets is a right step towards transforming the society into an information society. However, it should not be forgotten that appropriate materials are needed to use with the cutting-edge technology. When the learning styles of learners such as visual, auditory, and kinesthetic are taken into account, educators and educational technologists or edtechucators in short should develop

more engaging methods for learners to make their learning process much easier and more enjoyable, lowering their affective filters so that they learn much better, which is one of the main foundations of Krashen's Input Theory (Krashen, 1985).

Moreover, some innovative ideas which could allow learners to study English outside the boundaries of physical classrooms at their leisure time should be devised. One of these innovative ideas is Augmented Reality that has not been utilized much in the Turkish EFL context, though it has much potential for the language learning. Many researchers in the field of Augmented Reality have pointed out that Augmented Reality has a great capability to enhance education (Kaufmann & Schmalstieg, 2003; Squire & Jan, 2007; Dunleavy, Dede, & Mitchell, 2009; Billinghurst & Duenser, 2012). Thanks to AR, anywhere could be transformed into a class where learning can occur anytime and students can exploit the benefits provided by AR technologies anytime they want by using their mobile ubiquitous devices. Through the utilization of immersive and collaborative AR applications, students' spatial abilities can be enhanced (Kaufmann & Schmalstieg, 2003; Martin-Gutierrez, Saorin, Contero, Alcaniz, Perez-Lopez, Ortega 2010). AR has a great potential not just for STEM classes but for all the disciplines to integrate learning into the students' everyday experiences and activities. Most teachers of EFL feel intimidated to explore the affordances offered by AR as there seems to be a prejudice that these affordances require upper level technical knowledge to develop for use in their classes.

1.3. Research Questions

To overcome those issues discussed above and to analyze the effectiveness of augmented reality supported materials on vocabulary learning and retention, the research questions below have been posed.

1. What are the effects of Augmented Reality supported materials on tertiary level Turkish EFL learners' vocabulary learning?

   a. Is there a significant difference between control and experiment group in their pre-test scores?
   b. Is there a significant difference between control and experiment group in their post-test scores?

2. What are the effects of Augmented Reality supported materials on tertiary level Turkish EFL learners' vocabulary retention?
   a. Is there a significant difference between control and experiment group in their follow up test scores?

3. What are the opinions of learners towards using Augmented Reality supported learning materials?

1.4. Significance of the Research

For the past decade, mobile phones have been used extensively in language classrooms by both students and teachers and they have been really a helpful tool for language learning. Augmented reality, on the other hand, has not found enough appeal yet in language classrooms. It was once thought to be a part of a science fiction film but that is not the case anymore. It is now much easier to develop and utilize than it was in the past thanks to the advances in AR technology. It has an important potential to enhance the knowledge provided by computers, smartphones, and even the printed book, which is the core objective of this research.

Although there are many studies on using AR in educational settings (Kaufmann & Schmalstieg, 2003; Squire & Jan, 2007; Dunleavy, Dede, & Mitchell, 2009; Billinghurst & Duenser, 2012), the number of studies in the field of language teaching, especially vocabulary, is limited. Furthermore, this study aims to be one (maybe the first) of the building blocks of the research in the Turkish EFL context by investigating the effects of AR on English vocabulary learning.

1.5. Definition of Terms

Augmented Reality: Augmented Reality is the addition or superimposition of a computer-generated digital data over the real world, resulting in a reality which is augmented (Johnson, et al., 2011).

Attitude: Wenden (1998) describes attitude as the learned motivations, valued beliefs, evaluations, what one believes is acceptable, or responses oriented towards approaching or avoiding.

Computer Assisted Language Learning: According to Levy, Computer Assisted Language Learning is the exploration and utilization of applications of the computer in language classrooms (Levy, 1997).

Mobile Learning: M-learning could be described as "learning across multiple contexts, through social and content interactions, using personal electronic devices" (Crompton, 2013).

Mobile Assisted Language Learning: Mobile-assisted language learning (MALL) is the utilization of mobile and ubiquitous technologies in the case of language learning, particularly in conditions in which mobile device portability provides certain benefits (Kukulska-Hulme, 2013).

1.6. Conclusion

In this first chapter of the research, the background of the study, statement of the purpose, and research questions have been presented followed by the significance of the research, and brief definitions of the terms used in the research. Over the last two decades, there have been great advancements in technology that have found its way into language classrooms. MALL and AR promise a positive outcome in learners' mastery of target language vocabulary through their use of real world and digital content combination.

CHAPTER II

LITERATURE REVIEW

2. Introduction

This second chapter offers a general overview of the previous studies and theoretical framework for the research. It starts with constructivism as the theoretical framework of this study followed by a discussion of Computer Assisted Language Learning (hereafter, CALL) and the importance of Mobile Learning in education and its impact on language learning; previous relevant research on Mobile Assisted Language Learning (hereafter, MALL), Augmented Reality and Vocabulary Learning.

2.1. Theoretical Framework

Each educational activity, whether it's technology dependent or not, in any given context ought to be framed based on informed theories about how individuals learn. One can find many educational theories which have developed over the course of time as educationalist theoreticians and researchers attempt to comprehend and explain how individuals learn best and in what sort of context. While there is no one proven best theory, they all inform about the way by which teaching occurs and educational activities are designed.

2.1.1 Constructivism

Constructivism is in line with the history of education and is an extensive term used by many specialists such as educators, psychologists, philosophers; however, it is essentially the idea that knowledge is formed through first hand experiences, which provide context for that knowledge and states that knowledge is purposefully created to adapt oneself to the world around him (Skrinda, 2004). It is not just the transformation of knowledge from one individual to another but literally the construction of new knowledge based on their current and existing knowledge and focuses on reflection and experience (Wertsch, 1997).

Problem solving is at the center of this theory. As individuals try to find solutions to a problem, they reflect on their past and immediate experiences and start to build their own comprehension (Smith, 2001). Methods of instruction in constructivist theory often consist of task-based, experiential, discovery, collaborative, hands-on, and project-based learning. The constructivist approach to learning focuses on experience and reflection on that experience as illustrated below (Figure 2.1):

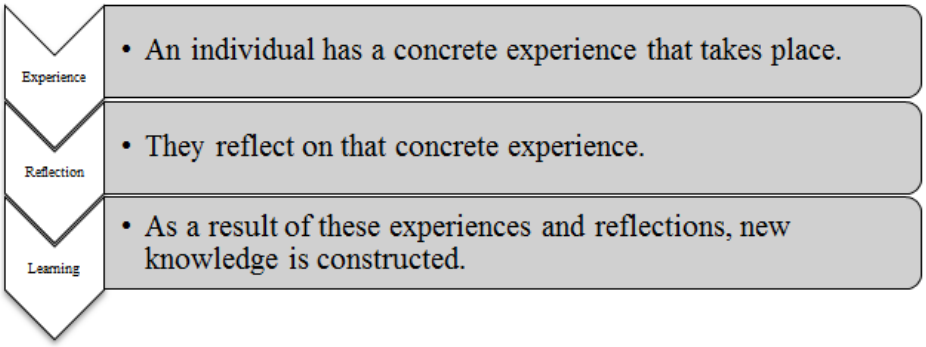

Figure 2.1. Constructivist approach

2.1.2 Learner in constructivism

Learning is an individual and personal experience that involves a progressive adaptation from the individual's cognitive development to the physical environment around them (Huang, 2002). Constructivism explores how a student acquires knowledge and the proponents of constructivism think that students acquire knowledge in an ideal way particularly when actively engaged. The learner is perceived as someone that acts upon her experiences and in the process tries to get hold of an understanding and derive meaning of those experiences. The meaning and relevance are constructed by the individual learner and is dependent on their experiences. The proponents of Constructivism argue that learning is not a passive process but active and the role of the learner is to build new opinions or concepts based on their experiences. They focus on the learner instead of the teacher (Gamoran, Secada, & Marrett, 2000).

Children construct theories or hypotheses of learning by situations of relationship. They perpetually add previously learned knowledge into new knowledge; thus getting aware of their immediate environment and build ideas. The proponents of Constructivism claim that the children do not simply absorb ideas from what teachers say to them but instead they actually invent their own constructs and opinions (Brown, Collins, Duguid 1989; Ackerman 1996). The learning experience that takes place is an internal cognitive activity leading to new knowledge.

2.1.3 Teacher in constructivism

Instruction that centers on the constructivist approach involves providing experiences for the learner. Educators are perceived as facilitators that aid their learners to construct their own knowledge and conceptualizations (Gamoran, Secada, & Marrett, 1998). The crucial role of the educator is to offer an environment where the learners could

experience spontaneous learning. The learners ought to be given space to comprehend and build meaning through personal experiences in their own terms while they go through developmental processes.

Mistakes are common in learning which may often involve cognitive conflict that encourages the learner to develop new knowledge schemes adapted from their experiences.

This teaching style often encourages group discussion to facilitate reflection based upon the activities or experiences that took place during the learning. Characteristics of constructivist type of teaching methods would include that:

- the students are actively engaged,
- the environment is free to express themselves,
- the exercises are interactive and learner centered rather than educator centered and
- the educators aid the learning process by encouraging learners to be responsible and autonomous (Johnson, 2001).

Some notable exercises in a constructivist classroom may consist of:

- Experimentation: Learners one by one do an experiment and then as a class evaluate the outcomes.
- Research projects: Learners investigate the subject and talk about their results in the class.
- Field trips: These activities provide a hands-on experience for some abstract ideas discussed in the class. Class discussions could take place at the end of these activities.
- Films: Films offer visual concepts for the learning experience.
- In-class discussions: In-class discussions is common in all of the methods exercises above and they are one of the most essential parts of constructivist instruction methods due to the reflection that is involved.

Table 2.1 below illustrates the differences between the traditional classroom and the constructivist one (Brooks & Brooks, 1993).

Table 2.1. Differences between the traditional classroom and the constructivist one (Brooks, et al., 1993)

	Traditional Classroom	**Constructivist Classroom**
Curriculum	Curriculum is presented part to whole, with emphasis on basic skills. Strict adherence to fixed curriculum is highly valued.	Curriculum is presented whole to part with emphasis on big concepts. Pursuit of student questions is highly valued.
Curricular Activities	Rely heavily on textbooks and workbooks.	Rely heavily on primary sources of data and manipulative materials.
How Students are Viewed	Students are viewed as blank slates onto which information is etched by the teacher.	Students are viewed as thinkers with emerging theories about the world.
Teacher	Generally behave in a didactic manner, disseminating information to students. Teachers seek the correct answer to validate student learning.	Teachers generally behave in an interactive manner, mediating the environment for students. Teachers seek the students' point of view in order to understand students present conceptions for use in subsequent lessons.
Assessment	Assessment of student learning is viewed as separate from teaching and occurs almost entirely through testing.	Assessment of student learning is interwoven with teaching and occurs through teacher observation of students at work and through student exhibitions and portfolios.
How Students Work		

	Students primarily work alone.	Students primarily work in groups.

Most of the constructivist views are based on the studies of Piaget, Vygotsky, Papert, the Gestalt psychologists, Barlett and Bruner, and also John Dewey, to mention just a few. There is no one constructivist theory of learning, and majority of the proponents of Constructivism have two essential opinions: that students are actively engaged in building their own knowledge and that social interactions have a critical role for knowledge building (Bruning, et al., 2004). This assumption takes constructivism to two main views which are cognitive constructivism and social constructivism.

The first one is based on the research of John Piaget, who was the most famous developmental psychologist talking about learning as an act of construction. He is often attributed as the father of the theory of constructivism. He was influenced by both the Behaviorist and Gestalt theories of learning. He proposed that an individual's internal cognitive structure changes due to:

- One's interaction with the environment,
- One's exposure to a progressive life experiences

Piaget is best known for his ages and stages theory that anticipates what children are and are not able to understand at various ages and developmental sequences for cognitive abilities. He posits that knowledge cannot be transmitted to individuals just like pouring water into an empty glass, instead individuals construct their own knowledge and they do this through experiences which allow them to create schemas.

Social constructivism, on the other hand, is based on the Russian psychologist and philosopher Lev Vygotsky's research. He draws the attention to social and cultural interactions in learning which forge individual development through a discovery model of learning. In broad terms, social contexts of learning are priority and knowledge is constructed mutually together with others. A conceptual shift from individual to social interaction is observed in social constructivism. There are four main principles that could

be extracted from Vygotsky's views: mediated learning, cognitive apprenticeship, proximal development zone, and the social nature of learning.

2.2. Computer Assisted Language Learning (CALL)

Technology, as it has in every part of our lives, has undeniable effects in language learning and teaching, especially with the invention of the computer. One can order food, transfer money, send presents to friends, communicate and even can get a diploma with the help of a computer which is connected to the internet. These are just some of the things anyone can do with the help of the technology. Rost (2002) defines technology as "a way of accomplishing something" and suggests this can mean any of the following four statements in a teaching-learning environment".

- offering learners real learning opportunities, and aiding them to learn effectively;
- making language learning fun;
- aiding learners to be better language learners, or
- making language teaching fun (Rost, 2002).

Computer Assisted Language Learning is often perceived as the utilization of computers as an aid for presenting the language learning material and the focus is often thought to be "teaching" not "learning"; and Kern (2006) suggests three roles for the computers, tutor, tool and medium respectively and adds that it is not computers that helps learning best but effective use of them.

There are many definitions of CALL in English Language Teaching. Computer Assisted Language Learning (CALL) has become the final term consented at the 1983 TESOL convention in a meeting of all interested sides. CALL relates to the field of technology and language teaching and learning though some revisions for the agreed term have been suggested (Chapelle, 2001).

Levy (1997) describes Computer Assisted Language Learning as “the search for and the study of applications of the computer in language teaching and learning.” Levy (1997) lists commonly used acronyms for computers in education in Table 2.2. According to Egbert (2005), Computer Assisted Language Learning is described as any means of language learning thanks to Information Communication Technologies.

Table 2.2. Commonly used acronyms for computers in education (Levy, 1997)

CAI (Computer-Assisted Instruction)	ICAI (Intelligent Computer-Assisted Instruction)
CAL (Computer-Assisted Learning)	ITS (Intelligent Tutoring Systems)
CML (Computer-Managed Learning)	CMC (Computer-mediated Communication)
CMI (Computer-Managed Instruction)	CELL (Computer-Enhanced Language Learning)
CBE (Computer-Based Education)	TELL (Technology-Enhanced Language Learning)
CBI (Computer-Based Instruction)	

2.2.1. History of Computer Assisted Language Learning

The idea of learning and teaching through computers dates back to 1960, to the initiation of CALL (Computer Assisted Language Learning). Levy (1997) claims that it may be said that CALL started with the PLATO Project (Programmed Logic for Automatic Teaching Operations) which was carried out in 1960. PLATO Project stands as the backbone of CALL with what it brought about language learning.

Levy (1997) also adds that PLATO could not cater for every student’s needs particularly in speaking and understanding. According to Hart (1981) PLATO aimed to satisfy the need for vocabulary and grammar exercises based on Grammar Translation

Method, thereby providing more class time for speaking and writing activities. On the other hand, Smith and Sherwood (1976) claim that PLATO was especially developed to offer interactive self-paced teaching for a great number of learners. PLATO was created by a professor of electrical engineering, Don Bitzer. The first version was later modified, which led to the creation of PLATO II, III AND IV.

TICCIT stands for "Time-Shared, Interactive, Computer Controlled Information Television". TICCIT Project was initiated in 1970s. According to Levy (1997) it was a mixture of television technology with computer technology. Levy (1997) asserts that it included its own in-built teaching feature and is still one of the very few computer systems that have been developed only via a certain theory of teaching or learning. This system has the ability to mix texts, audios and videos with each other. Levy (1997) sees TICCIT as the first example of multimedia CAI (Computer Assisted Instruction). TICCIT has an instructional framework called "Component Display Theory" which was developed by Merril (1988). According to Merril (1988), Component Display Theory was composed of three essential parts: "a 2-dimensional performance-content classification system, a taxonomy of presentation forms and a set of prescriptions relating the classification system to the presentation forms."

Storyboard, written by John Higgins, is a computer program which aims to rebuild a text, word by word, utilizing textual tips like title, the introductory material and the textual tips in the passage. Moreover, it gave the chance to write the teachers or the students their own texts. According to Levy (1997) early versions of this program were published by Wida Software, London in 1982. Higgins (1984) defines the storyboard as a program which uses the total deletion principle in which a hangman-like setting is displayed at word level to complete the missing parts of a text with the dashes and punctuations to help the learner guess the words. The storyboard did not contain scoring; it had a help section which provided the right words whenever the learner asked for it. Levy (1997) adds that versions of Storyboard are now available for Windows and Macintosh computers for English,

Spanish, French and German. Warschauer (1996) suggests that we can divide CALL into three parts:

1. Behavioristic CALL
2. Communicative CALL
3. Integrative CALL

Behaviorist CALL was carried out around sixties and seventies which happens to be the time when the Audio-Lingual Method was very popular. According to Warschauer (1996), the computer had a role of a tutor in this model, offering repetitive language drills. This was also the time when the PLATO Project was initiated.

Communicative CALL, as clear by the name, was built on the Communicative Approach, implemented in seventies and eighties as a response to behavioristic approach. Communicative CALL focused on communication and the use of forms not only the grammar knowledge itself. Different from the behavioristic CALL, the communicative CALL programs presents skill based exercises in a non-drill format by using games, reading, text reconstruction and word processors. The communicative CALL still benefits the computer as a tutor, despite the fact that it offers learners choices, control and interaction.

The Integrative CALL which came out in 1990's is basically based on the Internet and multimedia. It focuses on both content and the form and provides learner autonomy. It aims to teach grammar explicitly. It also provides intrinsic motivation. It aims to make students be able to produce original sentences. It uses computer mediated communication through e-mails, chat rooms and video conferencing.

Bax (2003), on the other hand, offered a different examination of history of CALL as opposed to the one given above by Warschauer. Bax thought the history of CALL as:

- Restricted CALL: It has a lot of common characteristics with Warschauer's Behavioristic CALL

- Open CALL: Bax (2003) argues that we were in an Open phase of CALL though some classrooms could also have certain Restricted and even Integrated CALL features.
- Integrated CALL: a form of normalization where the technology seems to be undetectable and totally incorporated into daily life.

However, many of the developments in CALL seem to go hand in hand with the innovations in technology. For example, sales of tablet computers might surpass that of PCs as people increasingly prefer products such as iPads to desktop or laptop computers, which suggests mobile assisted language learning (MALL) might be the main focus of the next decade.

In Turkish context, roots of computers in education date back to 1985, when they were introduced to secondary schools and the first computer labs were kicked off (Akayoglu & Kilickaya, 2008). Since then, many schools have been equipped with computers and computer labs. However, the rate of training professionals for effective use of computers couldn't keep up with the rate of equipping, thus creating a great lack of humanware (Warschauer, 2002).

Equipping the classrooms with latest technology does not necessarily endorse notable improvement in CALL. Hence, pre-service and in-service teachers in Turkey should be provided required CALL training to get best of technology (Akayoglu & Kilickaya, 2008).

2.2.2. Advantages of Computer Assisted Language Learning

A great number of students in developing countries still do not have enough financial means to live in or travel to the country in which the target language is spoken to improve their cultural awareness and fluency in the target language. Nonetheless, due to the

advances in technology, language learners now have the opportunity to access online discourse communities such as forums, and blogs (Kern, 2006). Yanpar and Yildirim (1999) list the advantages of CALL as follows;

- CALL offers students a chance to study at their own pace.
- It leads to active participation.
- It enhances the quality of teaching methods.
- The students have the chance to see their own progress.
- It gives students the chance to repeat and practice after school hours

According to Kung (2002) teachers now have come to accept that taking advantage of computer technology and its embedded language learning programs could provide a chance to develop independent and cooperative learning contexts and offer learners new language experiences. Wang (2008) summarizes the benefits of computers in language learning classrooms as follows;

- CALL programs may offer language students more freedom from physical classrooms
- Language students have the choice to study anytime and anywhere
- CALL software could provide an amazing stimuli for language learning
- Computers could promote learning interaction between learners and teachers
- Computers could assist classroom instruction via a different options

2.2.3. Disadvantages of Computer Assisted Language Learning

Regarding disadvantages, Kenning and Kenning (1984) reported that reading on a flat screen could be more tiring instead of a printed text. Brown (1997) presented the disadvantages of CALL as computer equipment, screen size, students' familiarity and negative opinions towards computers and computer anxiety. Lee (2000) noted that the limitations of Computer Assisted Language Learning could be sorted out as:

- monetary barriers,
- handiness of computer hardware and software,
- technical and theoretical expertise, and
- adoption of the technology.

Wang (2008) argues that the main problem is the financial problems to afford the necessary equipment to implement CALL, adding that continual updates to keep up makes the problem mores serious. Secondly, computers cannot deal with unpredicted cases thanks to technological limitations while the educators can cope with the situation when encountered. Thirdly, Wang (2008) asserts that both educators and learners require training to operate computers in order not to make the teaching and learning process a failure.

Kern (2006) emphasizes that in technology and language learning there are some complex cases forcing educators to analyze effectiveness in terms of what people do with technology, how they do it, and what it means to them. Threatening though it sounds, the overall success of it completely depends on who uses it and how they exploit its advantages.

2.3. Mobile Learning (M-learning)

In terms of mobile technologies, the term “mobile” is usually attributed to any means that are portable and personal. Mobile technologies have become an indispensable part of most people these days, and new developments like wearable devices in the technology makes us wonder what is next at the end of the year, not even next year. And as educators, we must find the ways how we could best take advantage of these developments to help students learn. And these mobile technologies are already common among young people, though they are generally perceived as distractors by teachers and school managers. Nevertheless, Sharples (2003) (as cited in Naismith, et al., 2004) suggests that rather than perceiving mobile devices as disruptive, educators ought to try to utilize the capacity of the

technologies that students always have with them and seek to utilize these technologies in learning practice.

According to the results of the studies carried out in the field of mobile learning, it could be argued that mobile learning has a positive influence on students' motivation and achievement levels. Though a great number of studies in the field are being carried out day by day, there does not seem to be a clear, common, definitive definition of mobile learning agreed by all the researchers and stakeholders, which seems surprising. Parsons (2014) provides a timeline that illustrates some major developments in history of mobile learning in Figure 2.2.

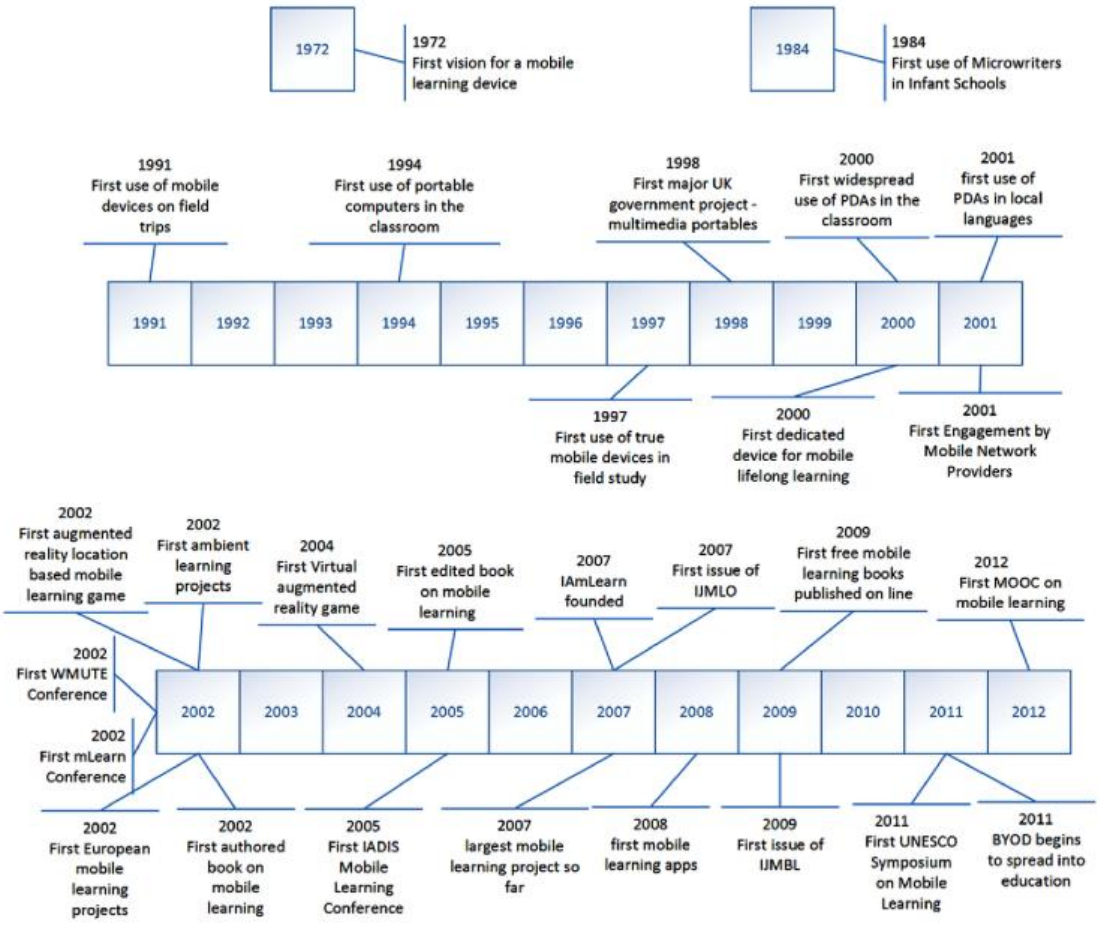

Figure 2.2. Timeline for mobile learning (Parsons, 2014).

2.3.1. Current mobile usage statistics

According to “We Are Social’s new Digital, Social and Mobile in 2015 report”, mobile phones usage leads the digital world more and more, and one thing is certain that ‘ubiquitous connectivity’ will add to this popularity even more pace during 2015 with the increasing number of cheaper handsets and more affordable data connections (Klemp, 2015). As of January 2015, nearly 40% of the world’s population has internet access though they connect to it through various gadgets.

Unique mobile users are over 50% of the world’s population as of September 2014. As it is reported both by GSMA Intelligence and Ericsson, there are more than 7 billion active mobile subscriptions.

A great proportion of mobile use is due to smartphones, and these devices account for 38% of the world’s active connections. Approximately half of global mobile connections can be now qualified as broadband either a 3G connection or better, however mobile data access speed changes greatly from one country to another. Even though average mobile data access speed is slow, it is shown that 900MB of data is used every month in Ericson's latest Mobility Report data (Cerwall, 2015).

Nevertheless, more than 75% of the world’s mobile connections are still pre-paid, and the costs of buying a mobile phone and keeping an active mobile connection make up an important proportion of household expenditure in many developing countries. Moreover, more than half of the world’s mobile connections still originate from basic model phones, which suggests most of the people are unable to access ‘rich’ user experiences such as online video even if they want to.

On the other hand, tablets usage increased gradually in 2014, with 7% of all web pages served in the past month going to those devices. When mobile phones and tablets are combined, they now constitute 38% of all web pages served around the world. Thus,

desktops and notebooks witnessed a 13% decline in share of web traffic when they were compared to the same period of the previous year (Klemp, 2015).

In Turkey, there are almost 37.7 million active internet users out of 76.7 million population with 69.6 million mobile subscriptions. When compared to 2014, there are 5% growth in the number of active internet users and slightly more than 2% growth in the number of mobile subscriptions. Average daily use of the internet via a mobile phone for mobile internet users is 2 hours and 51 minutes, which is a significant figure when even a quarter of it is directed to learning. Total number of active mobile internet users is 31.7 million which 41% of the population of Turkey is (Klemp, 2015).

When compared to 2014, share of web page views by mobile phones in Turkey is 28% which suggests 62% increase and 4% by tablets which suggests 37% increase. Total number of mobile subscriptions in Turkey is 69.6 million, 58% of which is pre-paid mobile connection and 66% of which has broadband connection. Percentages of the population using social media apps, watching videos on mobile, playing games on mobile, using mobile location-based search, and using mobile banking are 24%, 28%, 22%, 22%, and 25% respectively (Klemp, 2015).

2.3.2. Definitions of Mobile Learning

When you search for the term “mobile” in Google, approximately 5.490.000.000 results show up and for the term “mobile learning” almost 254.000.000. But what is mobile? And what is mobile learning?

According to Dictionary.com, the term mobile means “capable of moving or being moved readily” (Mobile, 2015). A great number of developments in technology can be classified as “mobile, since they are portable and moveable. According to Naismith, et al. (2004), mobile technologies might be classified as in the Figure 2.3:

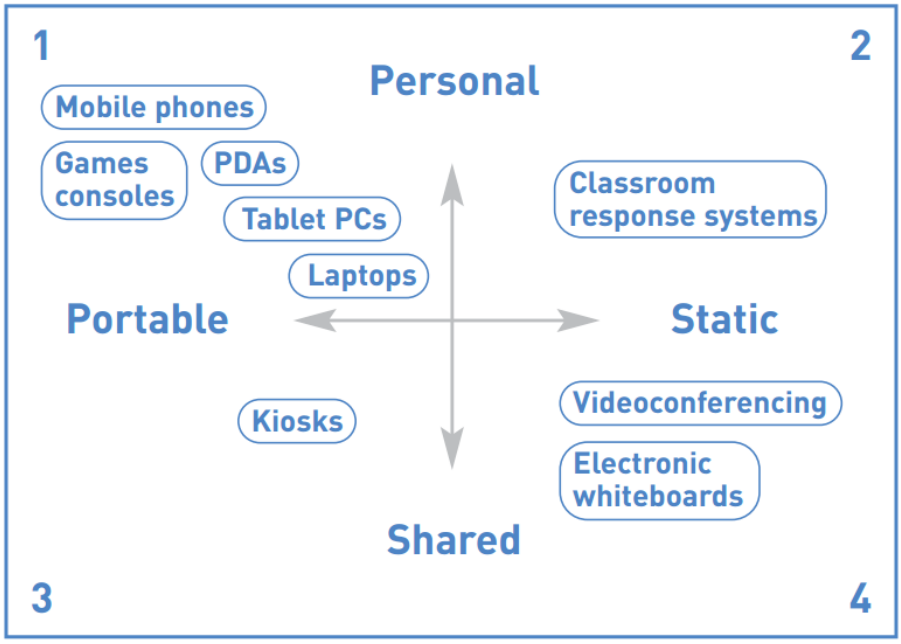

Figure 2.3. Classification of mobile technologies (Naismith, et al., 2004).

As it could be seen from figure 2.3, the most two striking features of mobile technologies are personalization and portability of these devices. With the rise of Internet of Things (IoT) and wearable devices, these two features will be much more important than ever before.

When it comes to the definition of mobile learning, an increasing number of studies in the field have been carried out to this date, however; there does not seem to be a clear, common, definitive definition of mobile learning agreed by all the researchers and stakeholders. It was argued that it was partly owing to the rapid evolution of the field and partly owing to the uncertainty of the term "mobile" in terms of its relation to mobile learning or mobility of the learner (Kukulska-Hulme, 2009). Thus, the term mobile in mobile learning takes us to two important issues:

- Mobility of the learner: Learners can take advantage of any educational activity without the restraint of doing them at a fixed physical place, which implies learning on the go, anytime and anywhere.

- Mobile devices: Small, pocket-sized devices that can be carried around without any difficulty could be used for teaching and learning.

Vavoula and Sharples (2002) states that in order for learning to be seen as mobile it should have three characteristics:

- It should be mobile in terms of physical space,
- It should be mobile between different fields of life
- and it should be mobile in terms of time.

O'Malley, et al. (2003) describe mobile learning as occurring when the students is not at a stable, fixed location, or when the student benefits the learning opportunities provided by mobile technologies. Kukulska-Hulme and Traxler (2007) opened a new window in the problematic area of definition by creating eight categories to offer a different perspective:

- Technology-driven mobile learning
- Miniature but portable e-learning
- Connected classroom learning
- Mobile training and performance support
- Large-scale Implementation
- Inclusion, assistivity, and diversity
- Informal, personalized, situated mobile learning and
- Remote, rural, and development mobile learning.

Traxler (2005) defined it as any educational arrangement in which the only or dominant technologies are PDA's. Winters (2006), moreover, provides another perspective for mobile learning by giving four different categories:

- Technocentric
- Relationship to e-learning
- Augmenting formal education

- and Learner-centered

On the other hand, Naismith, et al. (2004) take an activity-based approach to categorization, which are six broad theory-based types of learning (Figure 2.4):

- Behaviorist: activities based on reinforcement and feedback
- Constructivist: activities that provide experiences for students to build new opinions based on their current and previous experiences
- Situated: activities based on authentic context and culture such as museums
- Collaborative: exercises that encourage learning via interaction with others
- Informal/Lifelong: exercises which promote learning outside the learning environment
- Support/Coordination: activities that help coordination among learners and teachers or other learners

Theme	Key Theorists	Activities
Behaviourist learning	Skinner, Pavlov	• drill and feedback • classroom response systems
Constructivist learning	Piaget, Bruner, Papert	• participatory simulations
Situated learning	Lave, Brown	• problem and case-based learning • context awareness
Collaborative learning	Vygotsky	• mobile computer-supported collaborative learning (MCSCL)
Informal and lifelong learning	Eraut	• supporting intentional and accidental learning episodes
Learning and teaching support	n/a	• personal organisation • support for administrative duties (e.g. attendance)

Figure 2.4. An activity-based categorization of mobile technologies and learning (Naismith, et al., 2004)

According to Sharples, et al. (2007), mobile learning could be defined as the process of realization via dialogues across several contexts among individuals and personal interactive technologies. By enhancing Sharples' definition, Crompton (2013) proposed a

new definition for mobile learning: “learning across multiple contexts, through social and content interactions, using personal electronic devices.”

2.3.3. Benefits and challenges in Mobile Learning

Mobile learning surely is not the solution for all the defects in the education system; it has benefits and challenges that should be tackled. Mobile devices have their potential, but as in the case of computers, careful planning should be carried out in order to best take advantage of them to help students learn. Tablets and mobile phones have the ability to challenge the status quo in the education system, therefore, teachers, instructional designers and app developers should collaborate. Otherwise, equipping the classrooms with smart boards and handing the tablets to students without any careful planning and training will be destined to fail. Moreover, teachers often feel unsafe when they use a new technology as they are not like their 21st century students who are born digital natives. Table 2.3 briefly illustrates the benefits and challenges mobile learning offers.

Table 2.3.The benefits and challenges mobile learning offers

Benefits	**Challenges**
Cheaper than Notebooks and Desktops	Connectivity
Continuous Learning	Battery Life
Location Free	Screen Size
New Opportunities for Remote Areas	File Formats (Various Standards)
Enjoyable Learning Process	Limited Memory, Computing Power
Personalized Learning	Security
Alternative Learning Environment	Cost of Broadband
Reaching Underprivileged Students	Insufficient Instructional Design
Bring Your Own Device (BYOD)	Scale and Sustain

As Yamaguchi (2005) states that thanks to their portability mobile devices are superior to PCs though PCs are way better than mobile devices for easily processing various types of information like images, audios, and texts. Satar and Akcan (2014) argue

that not only the students but also the teachers should become competent in digital literacies, and the teachers should also use new technological affordances and teach in online environments. The last but not the least, modern smartphones are equipped with more than 15 sensors such as tilt, acceleration, air pressure, ambient temperature, humidity, illumination, magnetic field etc. If we can unlock them for learning, one thing is certain that we are to open new windows in education.

2.4. Mobile Assisted Language Learning (MALL)

Mobile language learning is increasingly becoming an integral part of higher education with a wider availability of lightweight handheld devices, which allow ‘anywhere’ and ‘anytime’ learning (Bayyurt, Ercetin, Karatas, 2014). Due to the rapid evolution of mobile devices such as mobile phones and tablets, Mobile Assisted Language Learning (MALL) has developed as a field of study, which was once thought to be a sub-field of mobile learning or computer assisted language learning. As has been stated by Kukulska-Hulme and Shield (2008), MALL makes itself distinct from CALL in terms of usage of personal, portable mobile devices which leads to new types of learning, priming access and interaction among different contexts. Mobile-assisted language learning is the utilization of mobile and ubiquitous devices in the field of languages, particularly in contexts in which portability feature of these devices present certain benefits (Kukulska-Hulme, 2013). Thornton and Houser (2005) note that these devices could actually become efficient tools so that language learning materials could be delivered to the learners even though they have some disadvantages such as screen size and low computing power etc. Today, most of the researchers in the field think it will allow language learning to become more personalized and informal (Chinnery, 2006; Kukulska-Hulme & Shield, 2008).

Colpaert (2004) observed that throughout CALL’s historical perspective, stages of amateur development have preceded stages of professional development, and he wondered whether the mobile hype will make its way into the hands of teachers once easy to use tools become widespread to create needs-specific mobile apps. The hype Colpaert is referring is

MALL and since the last fifteen years a great many articles about MALL has been published. Thus, some researchers have tried to categorize MALL in different ways. In their overview article, Kukulska-Hulme and Shield (2008) argue that most of the MALL related studies published in academic journals tend to be divided between two main approaches:

- Content-related studies, focusing on formal language learning contexts in which there seems to either little or no human interaction
- Design-related studies, emphasizing the informal nature of m-learning in which interaction among learners and teachers or themselves and independent learning are prioritized

Viberg and Grönlund (2012), on the other hand, propose three distinct key categories in their literature review of MALL by providing a systematic analysis of the field between the years 2007 and 2012 in terms of methods, research content, theories, and approaches:

- Technological concepts of learning
- Techno-centered concepts
- Learning environment
    - Theoretical development
    - Practical aspects

Burston (2013, 2014) in his annotated bibliography and literature review of MALL provides a detailed and expansive overview of the field. Duman, Orhon, and Gedik (2015) trace the evolution of the field by analyzing the studies published between the years 2000 and 2012 to learn about the research trends in the field. In their paper, Duman et al (2015) state that vocabulary is the most researched topic in the field followed by the usability, and perception/attitude studies as seen in Figure 2.5. As MALL is still in its infancy period though growing rapidly (Viberg & Grönlund, 2012), there does not appear to be any formal theory of mobile assisted language learning (Kukulska-Hulme & Shield, 2008).

Topic	2004	2005	2006	2007	2008	2009	2010	2011	2012	Total
Vocabulary	2	1	–	2	7	–	8	4	4	28
Grammar	–	–	–	–	1	–	–	–	–	1
Listening	–	–	–	–	2	1	–	3	2	8
Speaking/Pronunciation	–	–	–	–	2	2	1	1	–	6
Reading	1	–	–	1	1	–	1	1	–	5
Writing	–	–	–	–	–	–	–	–	1	1
Integrated skills	–	–	–	–	1	1	1	1	–	4
Dictionary use	–	–	–	1	1	1	–	1	–	4
Assessment-evaluation	–	–	–	–	–	–	–	1	1	2
Multimedia use/Design	–	–	–	–	1	1	2	2	–	6
Instructional design	–	–	–	–	–	–	–	1	1	2
Identity/Sense of community	–	–	–	–	1	1	1	–	–	3
Usability	–	1	–	3	5	1	4	1	1	16
Potential uses/Drawbacks	–	–	1	–	3	1	2	1	1	9
Interaction/Collaboration	1	–	–	–	–	2	1	–	–	4
Perception/Attitude	–	–	–	–	1	1	1	3	5	11
Academic achievement	–	–	–	–	–	1	–	–	1	2
Total	4	2	1	2	26	13	22	20	16	

Figure 2.5 Topic based classification of studies between 2004 - 2012 (Duman, et al., 2015).

In terms of the distribution of devices by research topic (Figure 2.7), Duman et al (2015) provide some interesting findings since mobile phones which were initially devised for oral communication purposes have been heavily used in the vocabulary area. Kukulska-Hulme and Shield (2008) argue that the MALL studies have not been able to take advantage of this initial purpose successfully.

2.4.1. Research on mobile devices in language learning

Especially for the last fifteen years, various studies and research projects have been carried out and thus MALL has found its way into the language classroom through five dominant mobile technologies, namely mobile phones, tablets, e-dictionaries, PDAs, and MP3 players. As in the case of m-learning, the choices over different mobile devices have changed over the time as these devices have got more computing power and storage capacities; and PDAs have almost been completely replaced by mobile phones and this constitutes one of the true examples of evolution in mobile technology. Moreover, Horizon

Report of 2015 envisages that wearable technologies and Internet of Things (IoT) might replace mobile devices.

In a project of mobile phone usage in the context of foreign language teaching in United States, Brown (2001) explores their use and potential in Spanish language learning and indicates that some technical shortcomings have affected the study negatively though students have reacted in a positive manner.

Thornton and Houser (2001) describe the teaching of English vocabulary via SMS in a Japanese University and propose that learning new words via SMS compared to learning via PCs increase the students' vocabulary greatly. Kiernan and Aizawa (2004) try to analyze the effectiveness of mobile devices for vocabulary learning in a classroom setting in Japan, claiming that to acquire a second language the best way is via tasks.

Gilgen (2005) carries out a study that examines the usage of various mobile devices to become alternatives of a traditional computer laboratory. Even though the technological constraints of the time create some issues, all the students in the project have stated satisfaction with in-class activities done via mobile devices.

According to Attewell (2005), a great number of new technologies find their way to the mobile phone market with each passing day and in his paper he investigates the use of mobile phones by learners who are not registered in full time for an Italian course and reports favorable results.

Stockwell (2007) provides an interesting finding in his article which involves 11 students studying English vocabulary for thirteen weeks. In the study, most of the activities have been done on PCs; more than half of the learners have almost never attempted to complete them via their mobile phones and they have got lower grades with their mobile phones than their scores on PCs.

Comas-Quinn, et al. (2009) attempt to use a mobile blog developed to facilitate the language learning process of learners of Spanish and to foster their active participation so that they could share their experiences and reflections. However, student participation was very low.

Palalas (2009) analyzes the experiments carried out through iPod Touch to support the learning outside the classroom for English for Specific Purposes classes. Though students stated that they were highly satisfied while they were utilizing the software, there were minimum levels of interaction; and mobile devices' connectivity capabilities were almost never utilized. Therefore, the learning was restricted to non-reciprocal listening and memorization.

Başoğlu and Akdemir (2010) describe a pilot test which analyzes the effectiveness of a flashcard application developed to facilitate English vocabulary learning of university level students via mobile devices. The flashcard application on mobile devices has been found out to be more effective than paper-based flashcards on students' vocabulary learning.

De Jong, Specht, and Koper (2010) study four information delivery methods and their effects on vocabulary learning. It has been observed that the learners took advantage of location-based support more in the end of the research. Bayyurt and Karatas (2011) point out the importance of needs-analysis while developing mobile language learning modules and platforms.

Chan, et al. (2011) analyze two 10-week long podcast studies in Singapore via questionnaires and interviews to find out students' attitudes towards the podcasts' quality, usefulness, and podcast-based studying. Positive results have been obtained in the attitudes of the students in favor of teacher encouragement, expectations, experience with mobile learning, and motivation.

Saran, Seferoglu, and Cagiltay (2012) compare the effects of English vocabulary learning via mobile phone based multimedia messages (MMS), web pages, and printed form. The findings of the study indicate that learners that have been sent multimedia messages have learnt more words than the ones that have studied through the web and paper-based pages.

Bayyurt, Ercetin, and Karatas (2014) describe the experiences and the results of MLARG (Mobile Learning in At-Risk Group) project, a European Lifelong Learning Project (Leonardo Project) aiming to use mobile technologies to develop study tools and methodology for youngsters studying at tourism vocational high schools (aged 16-17) with limited financial resources and life chances in Weberian perspective, a concept of probability that tries to find out how possible it is, under specific factors, that an individual's life turn out a certain way (Hughes, et al., 2003).

Duman et al (2015) in their recent review note that the most commonly used mobile devices in MALL tend to be mobile phones and PDAs, and the least used devices tend to be electronic pocket dictionaries and e-book readers (Figures 2.5 and 2.6).

Mobile device	2004	2005	2006	2007	2008	2009	2010	2011	2012	Total
Cellular phone	1	1	1	3	8	2	3	6	4	29
Personal Digital Assistant	–	1	1	1	4	1	4	3	2	17
Portable music/video player	–	–	1	–	1	1	4	–	3	10
Smart phone	–	–	–	–	1	1	3	3	1	9
Tablet PC	–	–	–	1	1	–	–	1	–	3
Handheld computer	1	–	–	–	1	–	–	1	–	3
Pocket electronic dictionary	–	–	–	–	–	1	–	1	–	2
Laptop/Notebook	1	–	–	–	–	1	–	–	1	3
E-book reader	–	–	–	–	–	–	1	–	–	1
Other (digital voice recorder, multi-function camcorder, game console)	–	–	–	–	–	1	–	–	1	2

Figure 2.6. The most commonly used mobile devices in MALL

Research topic	Mobile device									
	Mobile phone	Smart phone	MP3/iPod	E-dictionary	Tablet PC	Laptop	Handheld c.	E-book	PDA	Other
Vocabulary	14	6	2	–	–	–	1	1	6	–
Grammar	1	–	–	–	–	–	–	–	–	–
Listening	3	–	2	–	1	–	1	–	4	1
Speaking/Pronunciation	4	–	2	–	1	–	1	–	1	1
Reading	–	–	–	–	1	–	–	–	3	–
Writing	–	–	–	–	–	1	–	–	1	–
Integrated skills	–	2	–	1	–	–	–	–	2	–
Dictionary use	1	–	–	2	–	–	–	–	–	–
Assessment-evaluation	1	–	–	–	–	–	–	–	–	1
Multimedia use/Design	1	3	–	1	–	–	–	–	2	–
Instructional Design	2	–	–	–	–	–	–	–	–	–
Identity/Sense of community	3	–	1	–	–	–	–	–	–	–
Usability	6	1	–	–	–	–	–	–	9	–
Potential uses/Drawbacks	4	1	3	–	2	–	–	–	2	1
Interaction/Collaboration	3	–	1	–	1	–	1	–	–	1
Perception/Attitude	5	3	1	–	–	–	1	–	1	–
Academic achievement	–	–	2	2	–	–	–	–	–	–

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Figure 2.7. The most commonly used mobile devices and related research topics.

2.5. Augmented Reality

Augmented Reality is a catchy word these days, and it was once thought to be a gimmick, but now there is a new player in the scene and businesses like Pepsi, Ikea, and Volkswagen etc. have already got their hands on it to provide their customers new experiences while selling their products through many commercial applications. The variety of mobile devices in everyday life makes it easier for learners as these ubiquitous devices provide ready access to tools to take advantage of learning content by means of mobile AR applications. AR is about to become an everyday term and inseparable part for most people. It is a mixture of the real and digital worlds.

The two concepts, Virtual Reality and Augmented Reality, are usually considered together like two sides of the same coin. Milgram and Kishino (1994) illustrates a clear picture for the umbrella term Mixed Reality in Figure 2.8, Reality-Virtuality Continuum:

Figure 2.8. Reality-Virtuality Continuum (Milgram, et al.'s, 1994)

As could be seen on the left of the continuum, there is real environment which is the physical world people live in. By adding digitalized content onto this physical world, augmented reality occurs. On the far right of the continuum, however, there is virtual environment where there is no physical real object but just digital content, this environment is generally called virtual reality. By adding real, physical objects to this virtual environment, augmented virtuality occurs. Virtual Reality presents people just a digital virtual environment while AR literally augments the real world experience, therefore bridging the gap between the physical world and the digital world in a seamless way (Chang, Morreale, & Medicherla, 2010). Augmented Reality lets the users to engage in real world while visually obtaining extra digitalized visual information.

In the 2011 Horizon Report, Augmented Reality is described as superimposition of a digital contextual layer of data on the physical world, resulting in a reality which is enhanced or augmented (Johnson, et al., 2011). It adds a computer generated - video, graphics, text, sound or GPS data - virtual layer of data upon the physical world and through a mobile phone or a tablet it provides information about the augmented object or environment (Azuma, 1997; Zhou, Duh, & Billinghurst, 2008).

Several researchers (Azuma, 1997; Kaufmann, 2003; Zhou, et al., 2008) have proposed that an AR application needs to have the following three characteristics:

- Combining the physical and digital worlds: Digital objects ought to be combined with the physical objects in the individual's immediate real environment

- Having real time interaction: Objects need to be added and changed in real time
- Being registered in a 3D space: Virtual content needs to be registered in a 3D space

Johnson, Levine, Smith, & Stone (2010) identified two different Augmented Reality implementations, being either marker-based or markerless-based. Marker-based augmented reality systems generally take advantage of a QR code to generate a layer as soon as it is detected by a scanner or as in the case of most mobile devices by a camera.

Markerless-based augmented reality systems, on the other hand, depend on a tracking system involving GPS or the other sensors in a mobile device. While marker-based systems are much easier to develop, markerless-based systems are more common as they can function anywhere without the strain of any specially designed QR codes or reference points.

What both systems have in common, however, is that they need a specific software or browser to get to work. Either markerless-based or marker-based, both systems superimpose text, audio, video, and 3D model on real world as shown in Figure 2.9 (Cheng & Tsai, 2012).

The premium advantage of AR is that it provides a kind of learning that is available at the exact moment of need, which means learners do not need to turn their PCs on, because the digital content is just in front of them through mobile devices when it is needed.

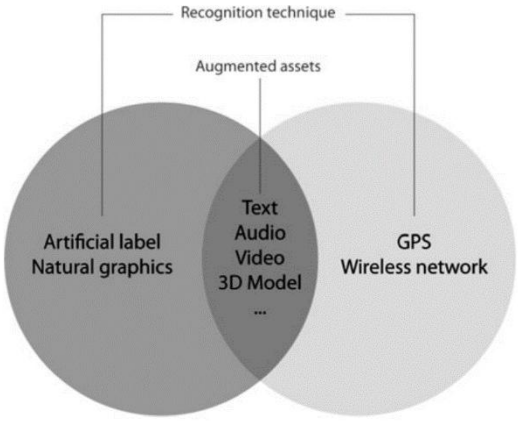


Figure 2.9. A comparison of image-based and location-based AR (Cheng and Tsai, 2012).

2.5.1. Development of Augmented Reality

Thomas Caudell, a Boeing researcher, is attributed the term as he is thought to have coined it in 1990 when he was working on a neural systems project at Boeing. However, the idea of augmented reality dates back to an 18th century American author, L. Frank Baum, who is especially known for the novel *The Wonderful Wizard of Oz.* In his novels, Baum envisaged a lot of technological advancements such as TVs, laptop computers and of course augmented reality. In 1957, Morton Heilig, a cinematographer, created Sensorama that could add real effects to movies. In the 1960s, an electrical engineering professor, Ivan Sutherland was the first by developing the first head-mounted display to develop a system that could be used for Augmented Reality and Virtual Reality (Sutherland, 1968). Myron Krueger created Videoplace for visual object interaction in 1975. In 1992, Louis Rosenberg developed Virtual Fixtures, the first functional AR system. In 1998, AR was introduced into education in the USA by Ramesh Raskar, Welch, Henry Fuchs. In 2000, ARQuake, an outdoor mobile AR game, was showcased in the International Symposium on Wearable Computers by Bruce H. Thomas. Since then, there have been many improvements in the field of augmented reality thanks to the developments in technology in terms of hardware and software. In 2008, Wikitude AR Travel Guide was launched. In 2009, ARToolkit brought augmented reality to the web browser. In 2011, AR apps started to appear for

smartphones. In 2013, Google introduced Google Glass, namely augmented reality glasses. In 2015, Microsoft's premier device, HoloLens, was announced. Figure 2.10 illustrates the historical development of Augmented Reality.

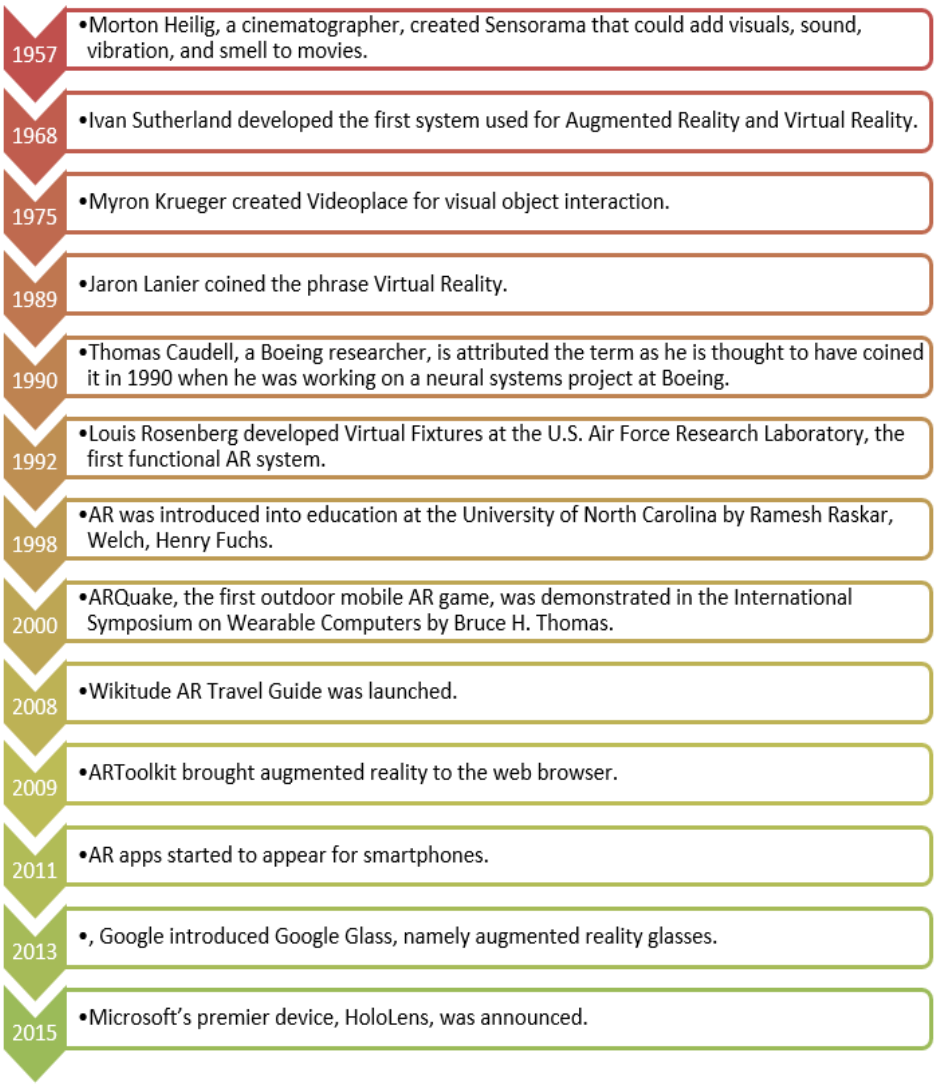


Figure 2.10. Historical development of Augmented Reality.

2.5.2. Augmented Reality Technology

Augmented Reality has some basic hardware necessities to be able to work, which are (Azuma, 1997; Billinghurst, et al., 2001):

- A video camera

- Storage device
- A powerful processor
- A user interface

Moreover, due to the technological developments, Johnson, et al., 2010 add the following to the list to improve the user experience:

- GPS Technology
- Image Recognition Software
- Speakers and Sound Systems
- Internet Access
- Intuitive Interfaces

The digital content in Augmented Reality, however, can be viewed through various methods. Augmented Reality display systems basically use two main display systems as shown in Figures 2.11, 2.12, 2.13 and these are:

- See-through displays (Head Mounted Displays, HMD/HUD)
    - Video-see-through systems
    - Optical see-through systems
- Monitor-based displays

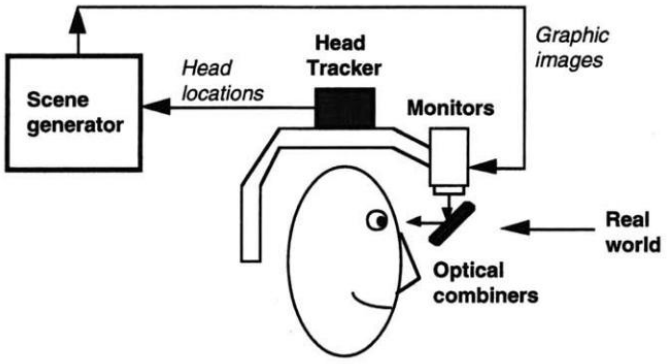


Figure 2.11. Optical see-through display (Azuma, 1997)

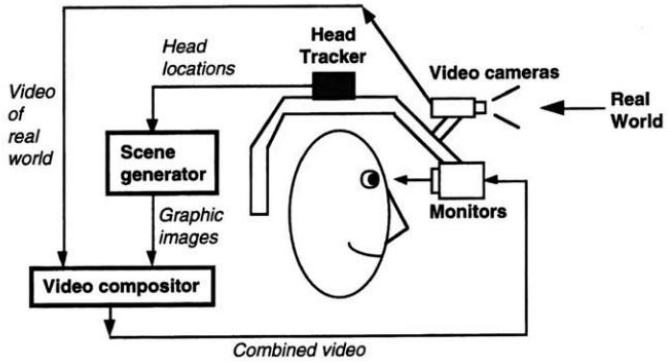


Figure 2.12. Video see-through display (Azuma, 1997).

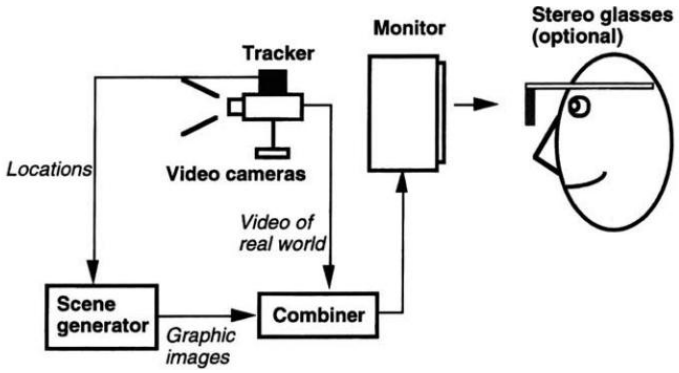


Figure 2.13. Monitor-based displays (Azuma, 1997).

Yuen and Johnson (2011) report that AR applications have gradually turned out to be portable and common for mobile devices over the years. Thanks to the recent developments in technology, smartphones and tablets now can be used as an alternative video-see-through systems and they are called Handheld Displays. As can be inferred from their names, users hold these devices in their hands. These Handheld Displays have both advantages and disadvantages. In terms of their advantages, they are portable and ubiquitous devices, but in terms of disadvantages, users need to hold these devices in front of them constantly, which adversely affects the experience the user is having.

2.5.3. Applications of Augmented Reality

Over the course of time, the way we learn and teach have been revolutionized by constant technological developments. Today, the potential of Augmented Reality for many

fields such as entertainment, marketing, military, medicine, engineering, advertising etc. cannot be denied. In today's world, Augmented Reality development is experiencing a boom, and various young companies are publishing Augmented Reality Web-browsers and a great many AR applications which can superimpose extra information through the mobile phone or tablet's camera all over the world within many fields. Additionally, the gaming industry is after Augmented Reality developers to produce unimagined experiences to their customers. Sony has already released Eye Pet, an augmented pet for its PlayStation platform.

Layar, Wikitude, Blippar, Junaio, Aurasma, Hoppala, Augment, Mixare, Word Lens, Daqri, and Argon are some of the Augmented Reality browsers which enable end users to experience Augmented Reality in an effortless way.

There are many popular and powerful Augmented Reality apps for various operating system platforms. For example, Anatomy 4D (http://daqri.com/project/anatomy-4d/) is a free and cross platform app developed by Daqri that provides the learners an Augmented Reality tour of the human body with the ability to select specific parts of the body such as cardiac, or skeletal system. Field Trip (http://www.fieldtripper.com) is a free and cross platform location aware app developed by Google that serves as a private mobile tour guide. iOnRoad (http://www.ionroad.com) is a paid and cross platform driving app developed by iOnRoad Ltd that provides the driver many alerts on the road such as collision threat, speeding alerts and other data by using the mobile devices' native camera, GPS and sensors. Wikitude (http://wikitude.com) by Wikitude GmbH, a free and cross platform app, allows users to see more than their eyes could provide such as information about sights, restaurants and events since it includes both location-based browsing and image recognition. Theodolite (http://hunter.pairsite.com/theodolite) by HRT, a paid and iOS based app, is a multifunctional app that benefits a map, compass, photo/movie camera, GPS, rangefinder, and two-axis inclinometer. It is particularly helpful for those who are into sightseeing, boating, hiking, hunting, and outdoor sports. If a user ever wonders about a plane flying over his head, then Plane Finder AR (http://pinkfroot.com/plane-finder-ar-

track-live) by Pinkfroot Limited, a paid and iOS based app, is the perfect app for providing information about the planes over the region, with their flight number and distance in real time. Star Walk (http://vitotechnology.com/star-walk.html) by Vito Technology Inc., a paid and cross platform app, is an interactive astronomy guide app that allows the user to investigate more than 200,000 astrological objects with detailed information. Snapshop (http://www.snapshopinc.com) by SnapShop Inc. is another paid iOS based augmented reality app enabling the user to visualize how furniture might appear within their living room.

There are also many Augmented Reality games that show what AR can do potentially for the gaming sector and that it can offer an untraditional way to experience. Some of them are:

- Parallel Kingdom by PerBlue (http://www.parallelkingdom.com)
- Ingress by NianticLabs@Google (https://www.ingress.com)
- Real Strike By Universal Elite Ltd (http://www.yiistudio.info/)
- ARBasketball By Augmented Pixels (http://augmentedpixels.com/)
- Temple Treasure Hunt Game By ThoughtShastra Solutions (http://www.thoughtshastra.com)
- PaintBall By Mambo Studios (http://mambostudios.com/)
- Toyota 86 AR By Fuerte International (http://www.toyota86ar.com/)
- SpecTrek By Games4All (http://www.spectrekking.com/)
- AR Invaders By Quill Pen Studio (http://www.soulbit7.com/)
- Zombies Everywhere! By Useless Creations Pty Ltd. (http://uselessiphonestuff.com/)
- AR.Race 2 By Parrot SA (http://ardrone2.parrot.com/)
- AR Defender 2 By Bulkypix (http://int13.net/)

2.5.4. Augmented Reality Application Development Tools

There are numerous development toolkits and software packages to create Augmented Reality applications, and a summary of them is illustrated in Table 2.4 below:

Table 2.4. Augmented Reality Applications (http://www.augmentedplanet.com/resources/developer-tools/).

Tool Name	Type	Description	Platform
3DAR	Mobile	Location	iOS
andAR	Mobile	Marker	Android
AR Toolkit	Web	Marker	
AR23D	Mobile	Natural Feature Tracking	iOS/Android/BlackBerry /Symbian
ARLab	Mobile	Marker Location Gaming Visual Search	iOS/Android
ARToolkit	Mobile	Marker	iOS
d'Fusion	Mobile	Natural Feature Tracking Face Tracking	iOS
DroidAR	Mobile	Marker Location	Android
junaio	Mobile	Natural Feature Tracking Location	iOS/Android
Layar	Mobile	Natural Feature Tracking Location	iOS/Android
Minerva Project	Web	Marker	FlashOther
Mobile SDK	Mobile	Natural Feature Tracking	iOS/Android
Obvious Engine	Mobile	Natural Feature Tracking	iOS
Qualcomm	Mobile	Natural Feature	iOS/Android

		Tracking	
Seca02	Web	Animation tools	FlashOther
String	Mobile	Natural Feature Tracking	iOS
ViewDLE	Mobile	Face Recognition	iOS
Wikitude	Mobile	Location	iOS/Android/BlackBerry/Symbian

2.5.5. Augmented Reality in educational settings

Constant technological developments in recent years have enabled Augmented Reality to be used in many fields, namely entertainment, marketing, military, medicine, engineering, advertising etc. and it is already being utilized in the commercial markets. Developers have produced many Augmented Reality apps for mobile devices, which leads to a quick evolution in the field. Many researchers in the field of Augmented Reality have pointed out that Augmented Reality has a great capability to enhance education (Kaufmann & Schmalstieg, 2003; Squire & Jan, 2007; Dunleavy, Dede, & Mitchell, 2009; Billinghurst & Duenser, 2012). Thanks to AR, anywhere could be transformed into a class where learning can occur anytime and students can exploit the benefits provided by AR technologies anytime they want by using their mobile ubiquitous devices. Through the utilization of immersive and collaborative AR applications, students' spatial abilities can be enhanced (Kaufmann & Schmalstieg, 2003; Martin-Gutierrez, et al., 2010). AR has a great potential not just for STEM classes but for all the disciplines to integrate learning into the students' everyday experiences and activities. Educational Augmented Reality apps are already helping teachers in the modern classrooms. In addition, the affordances of Augmented Reality in education are endless as it could help explain more abstract ideas in a tangible way by superimposing digitalized objects onto real world. These digitalized objects generally consist of text, image, video, audio, and 3D models. Augmented Reality also serves as a catalyst between the virtual and real world. While overlaying virtual objects onto the learners' immediate environment, Augmented Reality offers learners some

cognitive help during their problem solving process, thus reducing the cognitive load on them in terms Cognitive Load Theory (Sweller, 1988).

The variety of mobile devices that students bring with them into the classrooms implies that students already own the tools that could provide ready access to take advantage of learning content by means of mobile AR applications. Moreover, they get the chance to construct their own ideas about the learning content through their own experiences especially when learning is enhanced by mobile devices and Augmented Reality apps. Thus, they do not become passive learners but active learners who engage themselves actively in the learning process in which they choose what to learn when and where they feel.

Kaufmann and Schmalstieg (2003) used Augmented Reality in math classroom to improve students' understanding of 3D geometry by designing 3D images to experience the visual models from different perspectives. Wagner and Barakonyi (2003) proposed a collaborative Augmented Reality software to teach its users the meaning of kanji symbols via PDAs. Dunleavy, et al. (2009) designed Alien Contact, a project based on Augmented Reality, in order to help the students in middle and high schools in the North America in the areas of math, language classes, and scientific literacy skills. At the end of the research, they reported that the simulation activity improved the collaboration among the students and increased their motivation. Liu (2009) designed a ubiquitous language learning project, the Handheld English Language Learning Organization (HELLO), which integrates a sensor and handheld Augmented Reality-supported game to improve students' English speaking and listening skills. Verma (2011) introduced Mobile Assisted Word-Learning (MAWL) to facilitate vocabulary learning via an Augmented Reality based collaborative interface. The user points his mobile device to a page with text; as soon as camera recognizes any specific word meaning of which the user wants to learn via OCR technology, the related learning materials such as meaning, synonyms, antonyms, pronunciation, images etc. are presented on the interface. Liu and Tsai (2013) developed Augmented Reality based materials to understand if these materials could help students

enhance their writing skills in English composition classes. The findings show that the college students were actively engaged in the tasks and wrote meaningful essays, focusing on the effectiveness of these AR learning materials on language learning. Some other notable examples of Augmented Reality implementations education could be seen in Figure 2.14.

AR Environment	Description
Alien Contact!	Aliens crash land near a school and students are responsible for determining the purpose of the visit.
Dow Day	Students take on the role of a news reporter covering the Dow Chemical protests in Madison, Wisconsin and investigate interests and perspectives of students, police and others.
Environmental Detectives	A toxin is discovered in the local water supply and students must work to identify the cause of the spill, design a remediation plan, and present their solution.
Hip Hop Tycoon	Students act as specialists in business finance, sales, and human resources in an attempt to build and run a successful store.
Mad City Mystery	Students act as doctors, environmental scientists and government officials to investigate the cause of a death at a nearby lake.
Mentria	While using their Spanish speaking skills, learners investigate clues and gather evidence to absolve themselves from a crime.
The Mystery Trip	Over the course of a four day camping trip, students learn how to enjoy the outdoors responsibly.
Mystery at the Museum	Acting as either a biologist, technologist or a detective, students must work together to investigate a theft.
Saving Lake Wingra	Students must learn more about a local lake and prepare a presentation for their city council.
South Shore Beach	Students role-play as water chemists, doctors, or wildlife ecologists who must investigate an illness linked to a local beach.

Figure 2.14. Notable examples (Wasko, 2013).

There are also many Augmented Reality apps especially designed for use both in educational and everyday settings:

- LearnAR (http://learn-ar.net)
- Fetch lunch rush (http://pbskids.org/fetchlunch.html)
- Zooburst (http://zooburst.com)
- Wordlens (http://questvisual.com)
- Voice translator (http://smartlof6.org/smartloft) etc.

The majority of the Augmented Reality systems used in educational settings generally supports various pedagogical approaches such as Constructivist learning, Situated learning, Games-based learning, Enquiry-based learning (Johnson, et al., 2010; Shelton, 2002).

Today, the developments in the Augmented Reality field keeps growing at an incredible rate, changing the way we live, study, work, and travel. But, majority of the specialists in education feel intimidated to explore the affordances offered by AR as there seems to be a prejudice that these affordances require upper level technical knowledge to develop for use in their classes. However, again due to the recent developments in AR technology, these affordances now could be created just using a browser based editor and could be experienced using a mobile browser, which already exists in their students' pockets and bags provided that teachers adopt Bring Your Own Device (BYOD) policy.

2.5.6. The future of Augmented Reality

It could be argued that Augmented Reality is still in its initial stage, but it probably will not take a long time to fully blossom; and provided that Augmented Reality becomes an everyday part of our lives like QR codes we see everywhere, it will create much more affordances not just for education but for all the other fields mentioned.

As illustrated in Table 5, there are numerous developmental toolkits for Augmented Reality, which is both a good thing as many of them cost nothing and offer many unique features; and a bad thing as there is not one common and effortless platform to develop AR applications for the end users.

Despite their costs, the popular wearable devices like Google Glass and HoloLens already offer many practical learning benefits. But as in the case of many technological devices, there will always be a day when cheaper versions or alternatives start to take over the market and make their ways into the hands of common people. And just then, we will witness the true nature of AR. Last but not least, using technology in classroom never guarantees success.

2.6. Vocabulary

To express one's own ideas and communicate his thoughts without any misunderstanding, it is critical to have a large vocabulary. The word vocabulary comes from Medieval Latin vocābulārius which means "concerning words." According to Dictionary.com, vocabulary is defined as a list or collection of the words or phrases of a language, technical field, etc (Vocabulary, 2015).

The vocabulary learning is probably the most significant part of any successful language learning as nothing could be conveyed without vocabulary (Wilkins, 1976; Schmitt, 1997; Stockwell, 2007). McCarthy (1990) argues that "no matter how well one masters grammar, no matter how successfully the sounds of L2 are learned, without vocabulary to express a various meanings, communication in target language just cannot occur in any meaningful way." If not mastered, vocabulary will tend to obstruct communication (Allen, 1983). Therefore, vocabulary has an extremely critical role in language learning.

According to The Global Language Monitor, a company that investigates and tracks trends in language usage especially in media all over the world, the exact number of words in the English is 1,080,646.4 as of May 8, 2015. Giving an exact number for the total number of the words in any language might be controversial as it is still not clear for what exactly it is meant by just one single word. For instance, the word *"do"* has some quite a few fellows in its word family such as *do, does, did, done, doer,* and *doing*. So, is it just one word or more? Whether it is just one word or more, one thing is certain that it always intimidates beginner level students. However, they should not be intimidated as even the native speakers of any given language do not know the every word in their native languages.

Which words the learners should master first? It is generally claimed that beginner learners could easily communicate with the people in the target language if they learn the

most frequent words in that language, which are generally between 1500 or 2000 words. Laufer (1997) argues that learners should master around 3000 high frequency words to comprehend a majority of them in oral and written discourse.

Teachers generally provide the new words either in context or in isolation and then expect from their students to learn and utilize them properly (Akın, Seferoğlu, 2004). Another thing that is certain that majority of words that students need to use or comprehend cannot be covered in class, therefore, it is provide learners the skills they require about how and what to learn outside the classrooms.

The skills or strategies adopted by the students while learning new words are called Vocabulary Learning Strategies and Schmitt (1997) developed a taxonomy of them for foreign languages with two dimensions as shown in Table 2.5.

Table 2.5. A taxonomy of vocabulary learning strategies (Schmitt, 1997)

Discovery Strategies	Determination Strategies
	Social Strategies
Consolidation Strategies	Social Strategies
	Memory Strategies
	Cognitive Strategies
	Metacognitive Strategies

Discovery strategies, the first dimension in which students attempt to find the meaning of a specific word, have two sub-categories as shown in Table 6. In determination strategies sub-category, students attempt to find the meaning of a specific word on their own via either guessing or using bilingual dictionaries. In social strategies sub-category, students ask either to the teacher for translation or their peers in a group work activity.

On the other hand, consolidation strategies, the second dimension in which students consolidate a word as soon as it is learned, have four sub-categories as shown in Table 6. In

social strategies sub-category, students practice the newly learned words through interaction with native speakers. In memory strategies sub-category, students utter the newly words aloud or use pictures. In cognitive strategies sub-category, students practice through written activities, such as word lists. In metacognitive strategies sub-category, students review their learning process through testing (Schmitt, 1997).

Richards (1976) and Nation (2001) provide what students need to know about a word before it should be counted as a learned lexical item, which consists of its meaning, spelling, lexical parts, stress, grammatical class, collocations, register, associations, connotations, and frequency. Knowing what a word means gets tricky from time to time as learners tend to have difficulty in producing some words though they can easily recognize them as soon as they read in a reading passage or hear them in a listening activity. Melka (1997) defines the vocabulary of the learner in that situation as receptive vocabulary, contrasted with productive vocabulary that is the one the learner can utilize in his oral or written discourse anytime he feels like. Productive vocabulary is just the tip of the iceberg, but below it remains the bigger part, receptive vocabulary.

However, a serious problem in vocabulary learning that causes a lot of problems for a learner is forgetting. Forgetting can be defined as the disappearing or inability to retrieve the information that is once stored in short or long term memory. German psychologist Hermann Ebbinghaus (1885) hypothesized that individuals tend to forget a certain percentage of newly learned items exponentially since the time they consume them. He suggested a forgetting curve (Figure 2.15) that illustrates the decline of memory and how information is lost over a period of time provided that the individual does not attempt to retrieve it. The rate at which forgetting of learned items occurs vary in terms of the difficulty of those items and it also differs among individuals due to some external and internal factors such as stress, or anxiety.

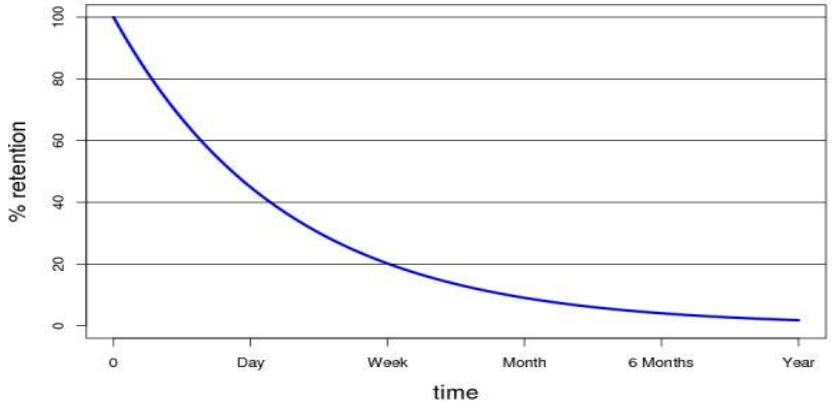


Figure 2.15. Ebbinghaus' Forgetting Curve

To overcome forgetting, individuals could employ memory strategies that can help them store and retrieve the learned items. Oxford (1990) suggests four types of memory strategies to overcome forgetting, which are creating mental linkages; applying images and sounds; reviewing; and, employing actions.

While learning a new vocabulary item, students could take advantage of vocabulary learning techniques in order to master it. Oxford and Crookall (1990) analyzed the majority of the techniques employed by the L2 learners by exploring their theoretical assumptions and applicability for vocabulary learning. The techniques were:

- Word Lists
- Flashcards
- Dictionary Use
- Word Grouping
- Word or concept Association
- Visual Imagery
- Aural Imagery
- Keyword
- Physical Response
- Physical Sensation

- Semantic Mapping
- Reading and Listening Practice
- Speaking and Writing Practice
- Structured Reviewing

In the concluding remarks part of her vocabulary booklet, McCarten (2007) concludes that teachers should aid learners to comprehend that learning is like climbing the stairs that happens step by step over time, and should encourage learners to find out extra information by themselves, personalizing the learning and tailoring it to learners' certain needs.

2.7. Conclusion

In the second chapter, related previous studies and theoretical concepts for this research have been provided. The theoretical framework, constructivism, has focused on the learner and the teacher. CALL history, advantages, disadvantages have been provided through notable studies. The significance of mobile learning in education and its impact on MALL have been discussed. Augmented Reality has been explored through its historical development and applications in many field. Finally, brief review of vocabulary learning has been discussed.

CHAPTER III

METHODOLOGY

3. Introduction

In this third chapter, the methodology which was used in the research will be discussed. Additionally, it will provide some information about the participants in the research, and the instruments that have been utilized, followed by the analysis of data in terms of the research questions.

3.1. Research Design

To understand the effectiveness of Augmented Reality supported materials on vocabulary learning and retention, a mixed methods research design, experimental research phase of which takes five weeks, has been adopted. The idea behind this thinking comes from a need for different perspectives and clearer understanding to compare the qualitative experiences with the quantitative data. The mixed methods research design could be defined as gathering, evaluating and combining both quantitative and qualitative methods in just one study to comprehend the research problem (Creswell, Plano Clark, Gutmann, Hanson, 2003). There are two groups, a control and an experiment group, a total 40 students who have elementary level English language proficiency.

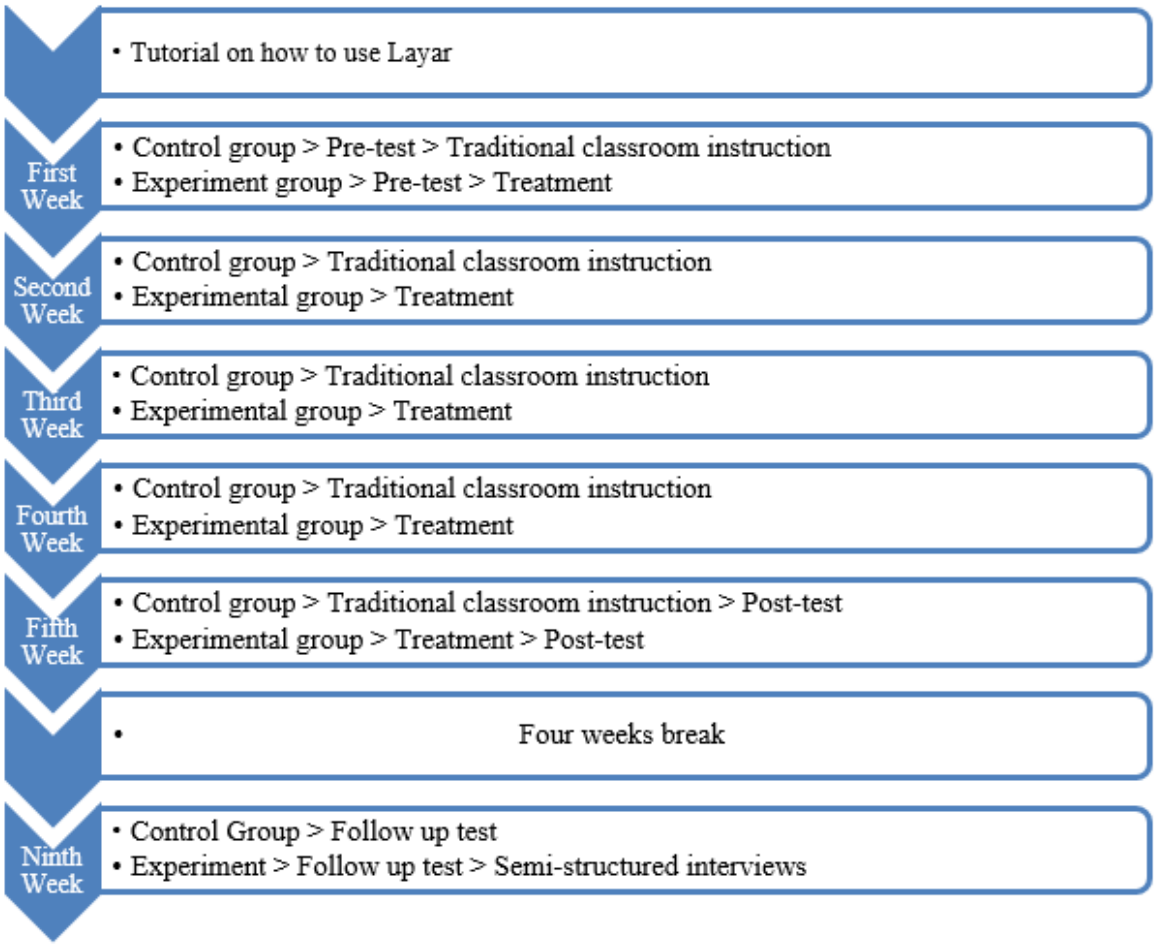


Figure 3.1. Research timeline

3.2. Context

Erzincan University was founded in 2006 and has been growing rapidly with new schools, faculties, and institutes since then. The School of Foreign Languages is responsible for the modern foreign language education for the students and it regulates the foreign language education in preparatory classes and other degree programs at the university. In preparatory classes, 32 hours of English classes are taught a week, which include 12 hours of Main Courses, 6 hours of Grammar Courses, 6 hours of Oral Communication Courses, and 8 hours of Video Courses. The students in preparatory classes are all placed into the

level classes according to their performances at the Erzincan University Proficiency Exam which is taken at the beginning of the fall term of each new academic year.

3.3. Participants

The participants of this research are tertiary level students studying at Erzincan University in 2014-2015 academic year. There are two groups, a control and an experiment group, both of which include 20 students and a total of 40. The students in both groups were assumed to have same language proficiency level as they were all placed in the elementary level classes according to their performances in the Erzincan University Proficiency Exam which was taken at the beginning of the fall term of 2014-2015 academic year. Participation in the research was voluntary but all the students in both groups consented to participate.

Participants were requested to complete a demographic information questionnaire on their mobile devices, which was enquiring about their age, gender, whether they have a mobile phone, data access in their mobile plans, access to internet where they live and at their university, what the operating system of their mobile phone is.

According to the results of the questionnaire, participants' ages range from 17 to 20. The control group consists of fifteen male and five female students. The experiment group consists of seventeen male and three female students. All the students in the experiment group have mobile phones. Except two students, rest of the group has data access in their mobile plans. When they are in the class, those two students access internet through the free Wi-Fi service of Erzincan University. Erzincan University provides free Wi-Fi access to all its students and teaching members in all its buildings in its campus. When they are not at the university campus, students access internet where they live, as all the participants state that they all have internet access where they live.

The students were requested to provide information about the operating system of their mobile phones as they would use an Augmented Reality application specially designed for Android and iOS mobile operating systems. In the experiment group, eighteen students had Android and iOS mobile operating system, and two did not have either Android or iOS mobile operating system. However, those students stated that they had tablets operating on Android. Therefore, all the students had access to the qualified tools to participate in the research.

3.4. Data Collection Procedure

The control group gets traditional style classroom instruction which includes twelve teaching hours a week and utilizes the course book New Headway, Elementary, 4th Edition (L. Soars & J. Soars, 2014). In terms of an English class, traditional style classroom instruction teaches “the course book” instead of “English”, focuses on “what” not “how”, and generally occurs in a physical boundary such as a classroom or school. The experiment group, on the other hand, utilizes the same course book and teaching hours but it is enhanced through an Augmented Reality application called Layar, which provides students an augmented learning experience to learn and practice new vocabulary in and outside the class.

In the first week of the research, Layar was introduced to the experiment group and students were asked to download and install the app from the respective repositories, respectively Google Play Store and Apple App Store. After the installation process which only took a few minutes since the application was not very big in its size, the students attended a tutorial on how to use the application, especially how to scan the course book and engage in the added interactive content.

In the first week, a Vocabulary Knowledge Scale Test (See section 3.4.1.2. for detailed information about VKS) was utilized as a pre-test both for control group and experiment group to evaluate the participants’ entry vocabulary level prior to the augmented reality enhanced mobile vocabulary learning treatment. Participants in the

experiment group used Layar in and outside the classroom for five weeks to learn the new vocabulary in the course book units that would be covered during that school term. The control group got traditional style classroom instruction.

At the end of the fifth week, the treatment was stopped and a post-test in the form of a VKS, including the same 20 target words in the pre-test, was administered to both groups as a post-test to evaluate the participants' gained vocabulary just after the treatment. Pre-test and post-test were developed on the basis of words introduced in the course book.

After the fifth week, the experiment group started to get the same style traditional classroom instruction as in the case of control group for four weeks, at the end of which both groups were administered the same VKS as a follow up test to evaluate the participants' vocabulary retention.

To get more insights about using Augmented Reality supported materials and to enhance the quantitative and qualitative data, students were asked to answer a few questions about their experience in semi-structured interviews at the end of the research.

3.4.1. Instruments used in the research to collect data

To collect quantitative data, a demographic information questionnaire, a pre-test, a post-test, and a follow up test based on Vocabulary Knowledge Scale were utilized; and for the qualitative data of the research, semi-structured interviews were carried out.

3.4.1.1. Demographic Information Questionnaire

The Demographic Information Questionnaire consists of ten questions and enquires about participants' age, gender, whether they have a mobile phone, data access in their

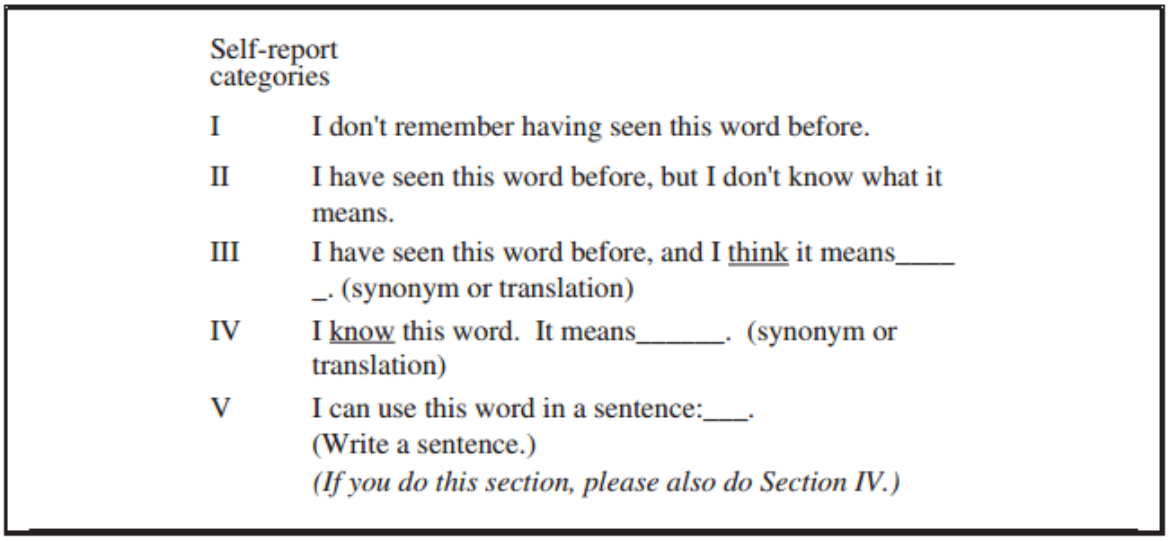
mobile plans, access to internet where they live and at their university, what the operating system of their mobile phone is. It was collected via participants' mobile devices (See Appendix A).

3.4.1.2. Vocabulary Knowledge Scale (VKS)

The Vocabulary Knowledge Scale (VKS) was first developed in 1993 to evaluate the Persian- and French-speaking learners' vocabulary gains at the Second Language Institute of the University of Ottawa, which was later refined and utilized in a few follow-up research (Paribakht & Wesche, 1993, 1996, 1997; Wesche & Paribakht, 1996). Wesche and Paribakht (2009, pp. xiv) elaborate on their goal in developing VKS as:

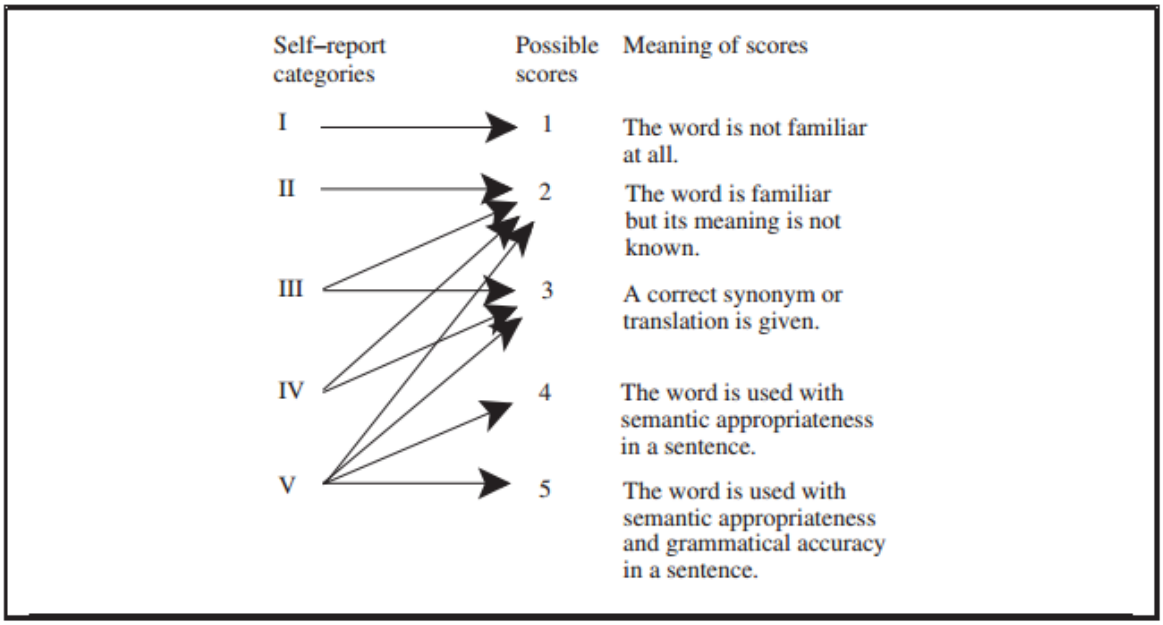
> *"We developed the VKS for the purpose of documenting evidence of learners' knowledge of selected L2 words, to allow tracking and comparison of their knowledge gains in different contexts involving written texts. It uses both a self-report Elicitation Scale and confirmation tasks evaluated on a separate Scoring Scale to identify five kinds of target word knowledge that are widely considered to represent progressive stages in learning a given word. These range from recognition of the word form to the ability to use the word with both semantic and syntactic accuracy in a sentence. VKS scores offer a relatively efficient means of broadly characterizing a reader's knowledge of selected target words at a given point in time; they do not, however, provide detailed information on the process of learning individual words or a particular dimension of that process."*

Vocabulary Knowledge Scale consists of an appropriate elicitation self-report category of five items as shown in Figure 3.2. These five items, then, are scored according to the scale in Figure 3.3. Learners rank each target word from 1 to 5, thus providing a range of knowledge from complete lack of knowledge to the ability to utilize the word with meaningful and correct form in a sentence (Paribakht & Wesche, 1996).



Self-report categories	
I	I don't remember having seen this word before.
II	I have seen this word before, but I don't know what it means.
III	I have seen this word before, and I think it means_____. (synonym or translation)
IV	I know this word. It means_____. (synonym or translation)
V	I can use this word in a sentence:___. (Write a sentence.) *(If you do this section, please also do Section IV.)*

Figure 3.2. VKS elicitation scale: Self-report categories (Paribakht & Wesche, 1996)



Self–report categories	Possible scores	Meaning of scores
I	1	The word is not familiar at all.
II	2	The word is familiar but its meaning is not known.
III	3	A correct synonym or translation is given.
IV	4	The word is used with semantic appropriateness in a sentence.
V	5	The word is used with semantic appropriateness and grammatical accuracy in a sentence.

Figure 3.3. VKS scoring categories: Meaning of scores (Paribakht & Wesche, 1996)

VKS was adopted to prepare the pre-test, post-test, and follow up test (See Appendix B). The tests included the same 20 target words from the course book that would be covered during the language instruction.

3.4.1.3. Semi-structured Interviews

Drever (1995) points out that utilizing semi-structured interviews in based upon a series of open questions provide a very flexible way for researchers by encouraging participants to speak freely. In structured interviews, researchers use questions that are already prepared before the interview takes place. However, in semi-structured interviews, researchers start with a broad, general question, and detailed questions are expected to emerge over the course of the interview through rapport-building, thought-provoking interjections, and critical event analysis. Thus, participants do not feel overwhelmed and the interview takes form of a social chat, in which they speak more freely by giving researchers a chance to easily obtain much more information from themselves.

To create a comfortable and reliable atmosphere, semi-structured interviews conducted with the participants were carried out in Turkish as the use of native language could enable them to express their opinions and experiences more easily and freely, without the barriers of miscommunication.

3.4.1.4. Layar

Thanks to the quick popularity of the Internet and the World Wide Web, the development of augmented reality and interactive print has gained a new dimension. Augmented Reality technology now takes advantage of the benefits of print and combine them with digitalized objects, by which Layar claims itself to be continuing what the internet began: connecting the real and digital worlds.

Layar, though started in 2009, quickly attained international popularity and became one of the first mobile augmented reality browsers in the market (Madden, 2011). Layar defines its mission in its website (https://www.layar.com/about/) as:

"to provide the highest quality tools and services for augmented reality and interactive print. We believe augmented reality has the power to effect change in the way people discover and interact with useful and educational information."

Layar takes advantage of image recognition technology that lets developers or anybody create materials for the digital devices. By using Layar Creator, anybody can upload a printed image to the website, and add on that printed image the digital content that they want others to see. The digital content is added to that printed image via buttons such as audio, video, call, website, social media, email buttons etc. Later, all that is needed to be done is to download the Layar app, scan the page and interact with the digital content. Though it sounds pretty simple, the real flow that happens behind the scene is described as shown in Figures 3.4. and 3.5.:

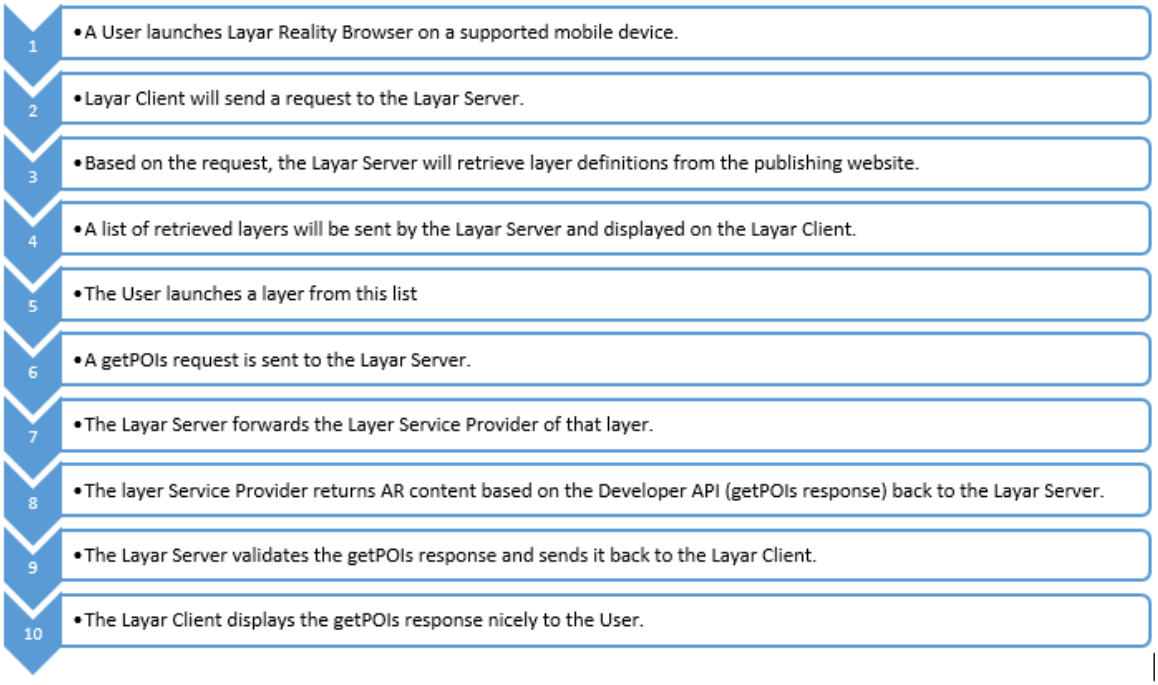


Figure 3.4. The flow of using the Layar platform

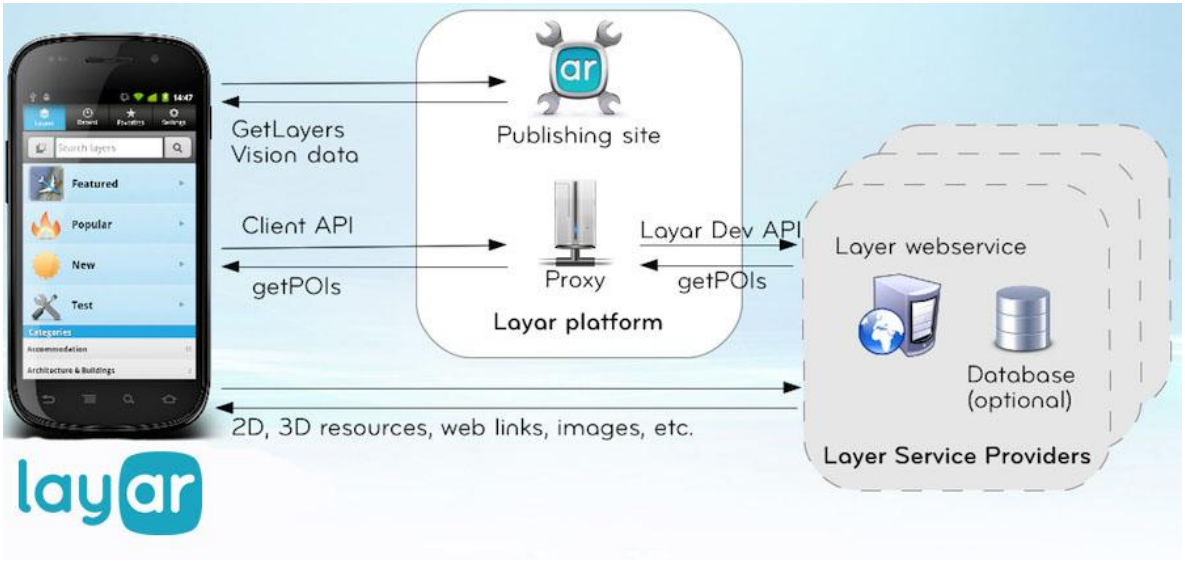


Figure 3.5. The architecture of Layar platform (https://www.layar.com/documentation/browser/layar-platform-overview/)

In the case of current research, the researcher created digital content for the participants using HTML (Hypertext Markup Language) widgets directing them to Quizlet website (See next section for Quizlet) in Layar Creator. For the digital content creation process, the researcher used the following flow: The researcher

1. identified the new words in the units.
2. imported these words into Quizlet website and created online quizzes for the learners.
3. used the embedding codes of the prepared quizzes and created HTML widgets in Layar Creator.
4. published the prepared widgets in Layar Creator after testing them so that they could be available for the Layar app.

During the treatment process of the research, by using Layar app in their mobile devices:

1. The participants scanned the pages of their course books to study the new words and Layar app displayed layers of information or digital content by superimposing on the course book through mobile devices.
2. The participants selected one of the layers and got engaged in the activities such as flashcards, word games etc. created by the researcher.
3. The participants bookmarked the pages they wanted to study again without scanning the course book in their favorites section of the app. Thus, they could continue their learning on the move (See Appendix C for screenshots).

3.4.1.5. Quizlet

Quizlet was started in 2005 by a high school student, Andrew Sutherland, who wanted to facilitate his vocabulary learning process in his French class and shared it with other students (https://quizlet.com/). Since then, it has gradually become one of the world's most used educational tools created by learners for learners. The site defines its mission as:

"Every person on earth deserves access to free, powerful, and inspiring learning tools - and our mission is to build them."

Quizlet's interactive vocabulary learning activities can be easily embedded into other web pages, learning management systems (LMS), or shared on social media networks such as Facebook. Main features of the site are free to use and the site claims they will always be. Quizlet provides custom made interactive vocabulary learning activities in its website (See Appendix C for screenshots). These are:

1. Flashcards Mode: Users study the words and their definitions through traditional Flashcard technique with flip and flow features. Also, users can choose to listen to the word's pronunciation if they want.
2. Learn Mode: Users are tested after they study the cards. This mode tracks which words they know or do not know, and retest on the users' mistakes.
3. Speller Mode: Users type what they hear. During the treatment, the researcher noticed that most of the participants did highly well on this mode due to their mobile devices' predictive keyboards.

4. Test Mode: Users are presented randomly generated test consisting of Written, Matching, Multiple Choice, or True/False question types.
5. Scatter Mode: Users match the words and definitions and compete for the top score in a restricted time.
6. Space Race Mode: Users type the correct term for the definitions as they scroll out of the screen and compete for the top score

In class, participants got engaged in all these six activity types on their mobile devices at the begging of the lesson that day and continued outside anywhere and anytime, making the treatment a real ubiquitous activity.

An interesting insight from the research: the researcher did not have to explain the participants how to use the Quizlet activities as those digital natives intuitively started to do them, which proves the effectiveness of the general user interface of the website.

3.5. Data Analysis

Pre-test and post-test designs are common in educational research designs to explore effects of treatment on participants. These designs are generally analyzed through an ANOVA on gain scores or a repeated measures ANOVA to test the treatment. In the parametric statistic of ANOVA, the aim is to analyze the effect of independent variable uniquely and together with the dependent variable (Creswell, Plano Clark, et al., 2003). However, an Analysis of Covariance (ANCOVA) on post-test scores, with pre-test scores as covariate generally presents a more credible and informative analysis for researchers. Thus, ANCOVA and Independent Samples t-test were utilized to evaluate the effect of the augmented reality enhanced materials on the vocabulary learning and retention in SPSS 19 software.

3.6. Conclusion

This chapter discusses the methodology used in the research. The research design was clearly outlined. A description of participants through demographic information was presented, followed by the instruments used in the research to collect data, which are Vocabulary Knowledge Scale, Demographic Information Questionnaire, Semi-structured interviews, Layar, and Quizlet. Finally, data analysis method was outlined.

CHAPTER IV

RESULTS

4. Introduction

This fourth chapter aims to introduce the results of the data analysis procedures related to each research question. The results obtained from the statistical analysis will be presented via tables and graphs to avoid misunderstanding.

4.1. The Effectiveness of Augmented Reality Supported Materials on Vocabulary Learning

The first research question aims to investigate the effects of Augmented Reality supported materials on tertiary level Turkish EFL learners' vocabulary learning. With this in mind, two sub questions have been identified. The first sub question (a) investigates whether there is a significant difference between control and experiment groups in their pre-test scores. As it has been reported in the first section of Chapter III, the research design includes an experiment group receiving the treatment of Augmented Reality supported materials and a control group receiving no treatment. It is critical to conduct a pre-test to evaluate the both groups' initial vocabulary levels preceding the treatment process as they need to be at the same level.

Thus, to find an answer for the first sub-question (a), a VKS based pre-test was conducted with both groups and the results were analyzed through an Independent Samples T Test. As could be seen from the Table 4.1 and Table 4.2 ($p>0,05$), the results did not indicate a significant difference in the scores between control ($M=44.15$, $SD=8.04$) and experiment ($M=44.6$, $SD=8.04$) groups; $t(38) = -.177$, $p = 0.861$.

Hence, neither the control group nor the experiment group was superior over one another in the target vocabulary and can be treated as equals at the beginning of the research.

Table 4.1. Group Statistics for Pre-Test Scores

	Group	N	Mean	Std. Deviation	Std. Error Mean
Pre Test	Control Group	20	44,15	8,048	1,800
	Experiment Group	20	44,60	8,049	1,800

Table 4.2. Independent Samples Test Results for Pre-Test Scores

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Pre test	Equal variances assumed	,065	,800	-,177	38	,861	-,450	2,545	-5,602	4,702
	Equal variances not assumed			-,177	38,000	,861	-,450	2,545	-5,602	4,702

Since there was not any significant difference in groups' pre-test scores, the treatment phase of the research was started. Treatment was administered to the experiment group for four weeks and the control group received traditional classroom instruction for the same period of time.

The second sub question (b) investigates whether there is a significant difference between control and experiment groups in their post-test scores. Thus, a VKS based post-test was conducted with both control and experiment group to observe any change in

participants' vocabulary learning and the results were analyzed through ANCOVA test using the pre-test as covariate. What ANCOVA does is that it controls for pre-test values and lets the researcher look at the post-test values and see if there is a significant difference between the control group and experiment group. Mean scores and standard deviation of both groups can be seen in Table 4.3 in which the mean score of experiment group exceeded that of control group greatly by almost eighteen points.

Table 4.3. Descriptive Statistics For Post Test Scores

Dependent Variable:Post Test

Group	Mean	Std. Deviation	N
Control Group	58,15	15,675	20
Experiment Group	76,10	9,624	20
Total	67,12	15,730	40

Table 4.4. Levene's Test of Equality of Error Variances[a]

Dependent Variable:Post Test

F	df1	df2	Sig.
10,558	1	38	,002

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

a. Design: Intercept + PreTest + group

Table 4.5. Tests of Between-Subjects Effects

Dependent Variable:Post Test

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	3667,096[a]	2	1833,548	11,338	,000	,380
Intercept	8963,489	1	8963,489	55,429	,000	,600
PreTest	445,071	1	445,071	2,752	,106	,069
Group	3288,382	1	3288,382	20,335	,000	,355
Error	5983,279	37	161,710			
Total	189881,000	40				
Corrected Total	9650,375	39				

a. R Squared = ,380 (Adjusted R Squared = ,346)

As seen in Table 4.5, the ANCOVA result (p=,000) of the post-test analysis indicated a significant difference implying the effectiveness of the treatment of Augmented Reality supported materials on vocabulary learning.

4.2. The Effectiveness of Augmented Reality Supported Materials on Vocabulary Retention

The second research question aims to investigate the effects of Augmented Reality supported materials on tertiary level Turkish EFL learners' vocabulary retention. With this in mind, a sub question has been identified. The sub question investigates whether there is a significant difference between control and experiment groups in their follow up test scores.

After the treatment was completed, both groups received normal classroom instruction for another four weeks and at the end of that four-week-interval a VKS based follow up test was conducted with both control and experiment groups. The results were analyzed through an Independent Samples T Test.

Table 4.6. Descriptive Statistics For Follow up Test Scores

	Group	N	Mean	Std. Deviation	Std. Error Mean
Follow Up Test	Control Group	20	45,25	17,204	3,847
	Experiment Group	20	65,35	9,588	2,144

As could be seen from the Table 4.6 and Table 4.7 (p<0,05), the results of the follow up test scores indicated a significant difference between control (M=45.25, SD=17.204) and experiment (M=65.35, SD=9.588) groups.

Table 4.1, 4.3, and 4.6 show the mean scores of pre-test, post-test, and follow up test respectively for both groups. Control group started with a mean score of 44.15 in pre-test, increased it to 58.15 in post-test in four weeks, suggesting that it got 14 points gain score. However, control group could not retain 14 points in the follow up test and retreated to the mean score of 45.25, suggesting a gain score of 1.10.

Table 4.7. Independent Samples Test Results for Follow up Test Scores

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Follow Up Test	Equal variances assumed	7,793	,008	-4,564	38	,000	-20,100	4,404	-29,016	-11,184
	Equal variances not assumed			-4,564	29,763	,000	-20,100	4,404	-29,097	-11,103

Experiment group, on the other hand, started with a mean score of 44.60 in pre-test, increased it to 76.10 in post-test in four weeks, suggesting that it got 31.50 points gain score. And experiment group got a mean score of 65.35 in the follow up test, suggesting that it retained a gain score of 20.75.

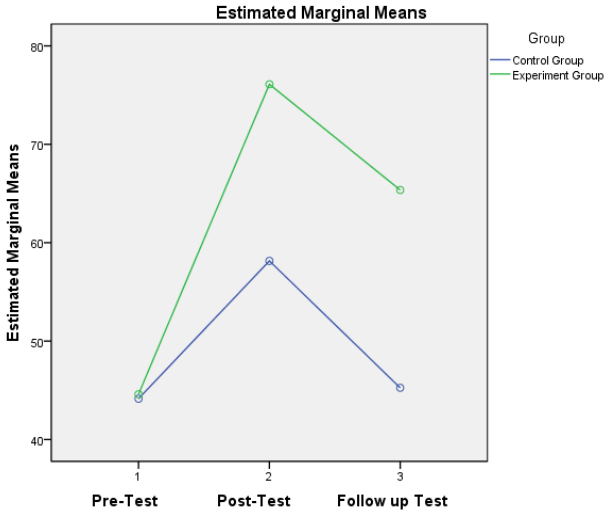


Figure 4.1. Estimated Mean Scores of Pre-Test, Post-Test, an Follow up Tests Results

4.3. The Opinions of Learners towards Using Augmented Reality Supported Learning Materials

The third research question aims to investigate what the opinions of learners towards using Augmented Reality supported learning materials are. Thus, semi-structured interviews were carried out with the participants face-to-face and individually in their native language, Turkish, during the next few weeks following the treatment, and then they were transcribed and translated for data analysis. Students were given codenames to facilitate the reporting. The following questions are the ones that were discussed in the interviews:

1. *Would you like to learn a foreign language via mobile devices?*
2. *What do you think about the application?*
3. *What are the advantages and disadvantages of the application?*

4.3.1 First Interview Question

For the first interview questions, Student 3 reported that:

> "*Using mobile devices, especially smartphones, to learn a foreign language would greatly help me in my language studies as they could provide many affordances such as bilingual dictionaries, translation apps, and opportunity to learn on the go*."

Student 6 stated that:

> "*I think it was very convenient to study the unknown new words through mobile phone instead of my PC*."

Student 8 reported that:

> "*It was very easy to get hold of where I was at the previous class and to do the review on the go and I felt really good myself while studying on my 24/7 companion phone* ."

4.3.2 Second Interview Question

For the second interview question, Student 7 said that:

> *"Layar had an easy user interface to understand and interact, I could still remember the words in the first four units and I could not remember the words in the following units as efficiently as they did in the first four (The treatment process took four weeks and only the first four units of the course book were enhanced through Augmented Reality and the rest of the units in the course book were taught without the support of AR.), that it was an easy and a quick way to learn and study the new vocabulary, and it saved time for me as I did not have to waste time as in the case of a dictionary to find out which definition of a specific word was required when I encountered a word with many definitions, that the system would especially help me in the reading course classes, as well as main course classes, since lots of unknown words are encountered in the reading texts, that availability of the pronunciation feature and the dictation exercise (Speller) helped me improve my spelling and pronunciation a lot."*

Student 1 stated that:

> "*It was uncomfortable at first, but later on I got used to the interface and I believe it could be a useful tool in any class.*"

Interviewees also mentioned the positive effects of using Augmented Reality supported learning materials such as increased attention during the lesson, interest to the course, curiosity for the extra mobile activities, and eagerness and motivation to study on the go.

4.3.3 Third Interview Question

On the advantages and disadvantages of the application, Student 12 stated that:

> *"Immediate grading in test exercises and feedback motivated me, I could do the exercises whenever and wherever I was since I always had my mobile phone with me and this made me forget the concept of pre-class preparation, that it should have continued with the rest of the units in the course book throughout the academic term, that it always provided immediate help and revision opportunity for the new words even when I skipped classes, and lastly that it was fun."*

However, Student 2 reported that:

> *"The scanning the course book pages got problematic for me in the first week of the treatment and made me feel frustrated."*

But later on it was figured out that the problem was because of the network coverage as that student did not have either mobile data or Wi-Fi access to use the app at that time.

The overall impression from the participants was that learning English vocabulary through Augmented Reality supported materials created a relaxing atmosphere to encourage vocabulary study. They expressed that Augmented Reality supported materials were helpful in learning unknown words and in particular, in regular revision of those words.

4.4. Conclusion

This chapter presents the results of the data analysis procedures related to each research question. The results obtained from the statistical analysis have been presented via tables and graphs to avoid misunderstanding.

CHAPTER V

DISCUSSION & CONCLUSION

5. Introduction

In this chapter, discussion of the research results will be presented by comparing the current research with the results of others conducted in the respective fields. The effectiveness of Augmented Reality supported materials on vocabulary learning will be discussed followed by their effects on vocabulary retention. Using the semi-structured interview results data, participants' opinions towards Augmented Reality and Mobile Learning will be evaluated. The conclusions to the research will be presented, followed by the implications and limitations; and will conclude by offering recommendations for further research.

5.1. Discussion

5.1.1. Discussion of the Effectiveness of Augmented Reality Supported Materials on Vocabulary Learning

This current study is one of many studies carried out to find out the effectiveness of technology in language classrooms. Owing to the rapid transformation of mobile devices such as mobile phones and tablets, MALL has developed as a field of study, once thought to be a sub-field of mobile learning or computer assisted language learning. Kukulska-Hulme and Shield (2008) point out that MALL makes itself distinct from CALL in terms of usage of personal, portable mobile devices which lead to new types of learning, priming access and interaction among different contexts. The results of the current research are in

line with Kukulska-Hulme's (2009) proposal that mobile learning technology is a lot more beneficial for doing activities outside of the classroom. Thornton and Houser (2005) note that these devices could actually become efficient tools through which language learning materials could be delivered to the learners. This idea is also in line with the scope of this current study.

Studying vocabulary is not just a crucial part of any language learning but also one of the most problematic areas to master. Learners of a language need to have a large vocabulary to express their ideas and communicate their thoughts without any misunderstanding in a variety of situations. As Nation (2001) claimed, it should be an essential part of every language curriculum in a systematic way rather than an incidental one. Thus this study aimed to incorporate the vocabulary teaching into the very daily lives of the students. If not mastered, vocabulary will tend to obstruct communication (Allen, 1983). McCarten (2007) states that teachers should help their students to figure out that learning is like climbing the stairs that happens step by step over time, and should encourage learners to find out extra information by themselves, personalizing the learning and tailoring it to learners' certain needs. This study has let the students to study the words gradually and build on what they have learned before.

Teachers generally provide the new words either in context or in isolation and then expect from their students to learn and utilize them properly (Akın, Seferoğlu, 2004). Moreover, the majority of words necessary to use or comprehend cannot be easily covered in class, therefore, teachers should provide learners the skills they require about how and what to learn outside the classrooms. The current research aimed to offer a new way of learning vocabulary powered by Augmented Reality and mobile devices. As Specht, et al. (2011) reported, augmented books are just one basic form of combining real-world objects and digital superimposed augmentations. Naismith and Corlett (2006) argue that successful mobile learning should be incorporated with standard classroom learning and with the learning experiences of learners. This study have adopted Augmented Reality as its core technology and incorporated it into the classroom teaching and learning.

In the light of the pre-tests results, there was not any significant difference between the control and experiment group. Main reason of this could be due to the fact that all the participants had all been placed in the elementary level classes according to their performances in the Erzincan University Proficiency Exam which was taken at the beginning of the fall term of 2014-2015 academic year. This could explain why both group had similar scores and almost the same mean score from the pre-test.

Many researchers in the field of Augmented Reality have pointed out that Augmented Reality has a great capability to enhance education (Kaufmann & Schmalstieg, 2003; Squire & Jan, 2007; Dunleavy, Dede, & Mitchell, 2009; Billinghurst & Duenser, 2012). It is clear that the mean scores of the experiment group exceeded that of the control group greatly by almost eighteen points when the mean scores of post test results are taken into account. The experimental group was eighteen points ahead of the control group mainly because the students' motivation and interest were raised by the treatment and they could study the words on the move. As reported by Dunleavy, et al. (2009), AR based exercises help to raise students' understanding and increase their learning motivation because students can easily access the overlaid content from their mobile phones not only just as they are studying but also on the move. Thus, in the study Augmented Reality supported learning materials enabled the participants to gain and construct the content knowledge that they would need during the main course classes. They were able to refer to this content knowledge in their studies and got an active role in their own learning process (Villano, 2008; Jerry & Aaron, 2010).

Augmented Reality supported learning materials can increase the effectiveness of not just language learning but also medicine, advertising, tourism, entertainment, and aviation. It is obvious that Augmented Reality is transforming education profoundly and capable of enhancing learning and teaching (Billighurst, et al., 2012; Dunleavy, et al., 2009; Kaufmann, et al., 2003). Billinghurst, et al. (2001) argue that combining real and virtual world objects provide learners access to rich media content that is relevant and immediate.

As in the case of current research, Augmented Reality has the capability to overlay the digital content as in the form of multimedia and makes this digital content available to the students just at the exact time and place of need. While overlaying virtual objects onto the learners' immediate environment, Augmented Reality offers learners some cognitive help during their problem solving process, thus reducing the cognitive load on them in terms Cognitive Load Theory (Sweller, 1988). It should not be forgotten that using technology in class does not always guarantee success; on the contrary, inefficient and poor utilization of it may lead to inferior learning outcomes.

Augmented reality, on the other hand, has not found enough appeal yet in language classrooms but will certainly do in the immediate future as teachers start to accept that it is no longer a developer's job to create learning materials which are limited in pedagogy and that they can do them themselves for their students' needs thanks to the recent developments in the field that allow them to create those materials just with a few mouse clicks. While creating those materials, they just need to keep in mind what skills they would like to train and then design suitably (Overbay, et al., 2010).

The results of the current study have contributed to the previous claims that students perceived mobile devices easy and useful to use when it came to language learning, and this finding aligns with the previous research in the literature on this aspect in studies by Attewell (2005), Burston (2014), Chinnery (2006).

5.1.2. Discussion of the Effectiveness of Augmented Reality Supported Materials on Retention

Activities based on Augmented Reality supported materials not only enhance vocabulary learning but also lead to higher levels of retention. Xialong (1988) argues that there might be a link between remembering the words and the contexts they were studied.

The research provided a unique way to study the words in the course books, thus a new experience that will not be easily forgotten.

After a four-week-interval, both groups were administered the same VKS as a follow up test to evaluate their vocabulary retention. Control group could only retain a gain score of 1.10 while experiment group retained a gain score of 20.75. Compared to the control group, experiment group achieved a higher level of retention. Hence, it could easily be suggested that vocabulary learning through Augmented Reality supported materials contributed positively to the experiment group participants' vocabulary retention.

Craik and Lockhart (1972) suggest that the memory of a word becomes permanent especially when learners adopt an active mental involvement relating the word to the existing knowledge. The results of this mixed method research confirmed that Augmented Reality supported materials increased retention of the words, that they were more effective than traditional vocabulary teaching, and helped participants retain the words for a longer time, which proved their success and suggests that they are beneficial in vocabulary learning and should be used widely not only in language classrooms but also on the move thanks to portability of mobile devices.

5.1.3. Discussion of the Opinions of Learners towards Using Augmented Reality Supported Learning Materials

Several studies, such as De Jong et al. (2010), Chinnery (2006), Kern (2006), Jerry et al. (2010), Stockwell (2007) investigated and measured the effect of learning through mobile devices on language learning by analyzing the students' learning processes, and opinions towards the mobile devices. Despite some technical shortcomings, Brown (2001) reports that students have reacted in a positive manner in his Spanish language study. Moreover, Gilgen (2005) claims that all the students in the project have stated satisfaction

with in-class activities done via mobile devices even though the technological constraints of the time create some issues.

According to the semi-structured interviews carried out with the participants in the experiment group, majority of the participants reported that learning English vocabulary through Augmented Reality supported materials not only improved their vocabulary but also encouraged them to study anytime anywhere thanks to ubiquitous nature of the materials, which further showed the effectiveness of the treatment of Augmented Reality supported materials in vocabulary learning. The participants in the experiment group have also shown a strong motivation for learning through Augmented Reality and mobile devices.

Participants' responses show that majority of them found Augmented Reality supported materials easy to use and beneficial for their vocabulary learning. Analysis of the results data also show that these materials not only increased their motivation to learn, but also improved their vocabulary learning and retention results. Dias (2009) reports that using augmented books could enhance students' perceptions about the value of the learning material and could provide better understanding of the content.

Most of the participants reported that the availability of the words' pronunciation feature in the exercises had a positive impact on their vocabulary learning as they learned the correct pronunciation of the words as well as their meaning, though correct pronunciation was not measured in the research.

As in several attitude studies, there is generally a positive attitude towards learning through mobile devices, but this should be supported by applications with a powerful instructional design. This current study is in line with the most studies in terms of positive attitude towards learning through mobile devices.

5.2. Overview of the research

The effectiveness of Augmented Reality supported materials on vocabulary learning and retention has been investigated in this study. Related literature on Constructivism, Computer Assisted Language Learning, Mobile Learning, Mobile Assisted Language Learning, Augmented Reality, and Vocabulary has been reviewed. Solutions for the three research questions have been presented. The research questions were:

1. What are the effects of Augmented Reality supported materials on tertiary level Turkish EFL learners' vocabulary learning?
    a. Is there a significant difference between control and experiment group in their pre-test scores?
    b. Is there a significant difference between control and experiment group in their post-test scores?
2. What are the effects of Augmented Reality supported materials on tertiary level Turkish EFL learners' vocabulary retention?
    a. Is there a significant difference between control and experiment group in their follow up test scores?
3. What are the opinions of learners towards using Augmented Reality supported learning materials?

A mixed method research design was adopted in the research, and the participants were divided into two groups, a control and an experiment group, both of which included 20 and a total of 40 tertiary level students, studying at Erzincan University in the fall term of 2014-2015 academic year. Vocabulary Knowledge Scale was adopted to prepare a pre-test to see if there was a significant difference between control and experiment group before the treatment; a post-test to see if there was a significant difference between control and experiment group after the treatment, and a follow up test to see if there was a significant difference between control and experiment group in their vocabulary retention levels. The tests included the same 20 target words from the course book that would be covered during the language instruction. For four weeks, the experiment group received the treatment of

Augmented Reality supported materials through an Augmented Reality app called Layar, which provided students an augmented learning experience to learn and practice new vocabulary even on the go while the control group received traditional classroom instruction. After the treatment, experiment group turned back to traditional instruction as in the case of control group for another four weeks and following this four weeks break both groups were administered a follow up test. Test scores were analyzed via SPSS 19 software and the analysis of the post-test and follow up test results showed a significant difference in favor of the treatment. Semi-structured interviews were carried out to enhance the obtained qualitative data, which also suggested positive opinions towards using mobile and Augmented Reality supported materials.

5.3. Implications and Recommendations of the current research

5.3.1. Implications for Teachers and Teacher Trainers in ELT

Incorporating Augmented Reality and mobile devices into the ELT classrooms might pave the way for extracurricular activities in which other language learning areas and skills could be fostered. Moreover, it might also foster the learning on the go.

In order to express one's own ideas and communicate his thoughts without any misunderstanding, it is critical to have a large vocabulary for any language learner. And technology has helped learners greatly in their difficult task of vocabulary learning through many devices, especially mobile ones as they live in the age of mobile connectivity. Mobile phones have found their ways into language classrooms and they have been a really helpful tool in facilitating language learning, though perceived as distractors by some. Technology is not evil but blessing and using the right device for the right activity is critical.

5.3.2. Implications for further research

Enhanced by mobile connectivity, various sensors, and high level computing power, wearable devices and cutting edge clothes that provide sensory information and feedback are expected to dominate the AR market soon, especially in the fields of education, health and sports. Augmented Reality has been developing at such a rate that related educational research ca not keep the pace. Future research should strive to bridge this gap. There is a famous saying: *"If you do not attempt, you will never know"*, so teachers should come to recognize the fact that AR is the door to new opportunities in education just like in any other field and they should not feel unsafe and intimidated to use it as it is just a few touches and mouse clicks away. Today mobile technologies are required to be incorporated into classroom teaching, but they are just like shoes, it is certain that everyone needs them but what is more important is that they need to find the one that fits.

5.4. Limitations of the current research

As in most studies, the current study has its specific limitations. Admittedly, the current research was carried out in a public university in Turkey within a narrow sample size. A larger sample size would be ideal to generalize the results to a larger population. Thus, the results should only be seen as indicative rather than conclusive. More indicative and conclusive research results might be obtained with larger sample size.

The research was carried out with students at a beginner level, which is also believed to have limited the content to be taught. It is open to discussion whether there will be different results with upper level students.

However, what this current research proved is that utilizing ubiquitous, mobile and Augmented Reality supported materials on a daily basis can positively influence students' vocabulary learning and retention.

5.5. Conclusion

In this chapter, discussion of the research results have been presented by comparing the current research with the results of others conducted in the respective fields. The effectiveness of Augmented Reality supported materials on vocabulary learning have been discussed followed by their effects on vocabulary retention. Participants' opinions towards Augmented Reality and Mobile Learning have been evaluated. The final chapter have also presented the conclusions to the research, followed by the implications and limitations; and concluded by offering recommendations for further research.

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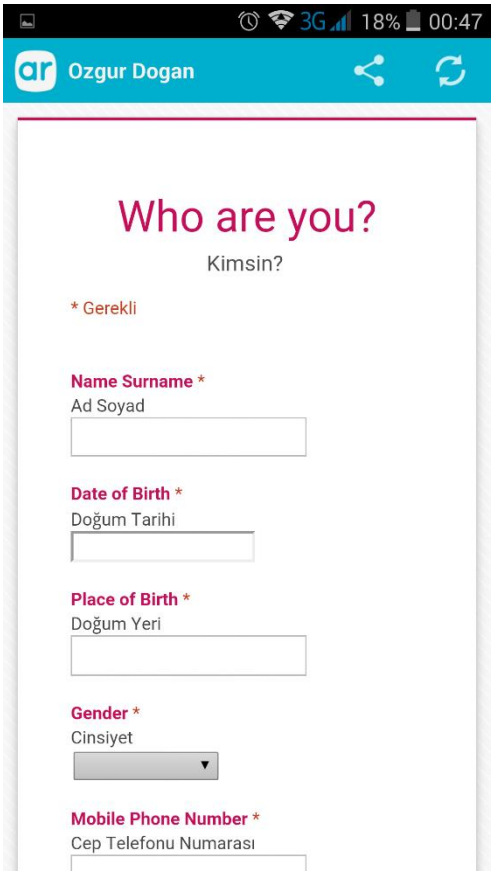
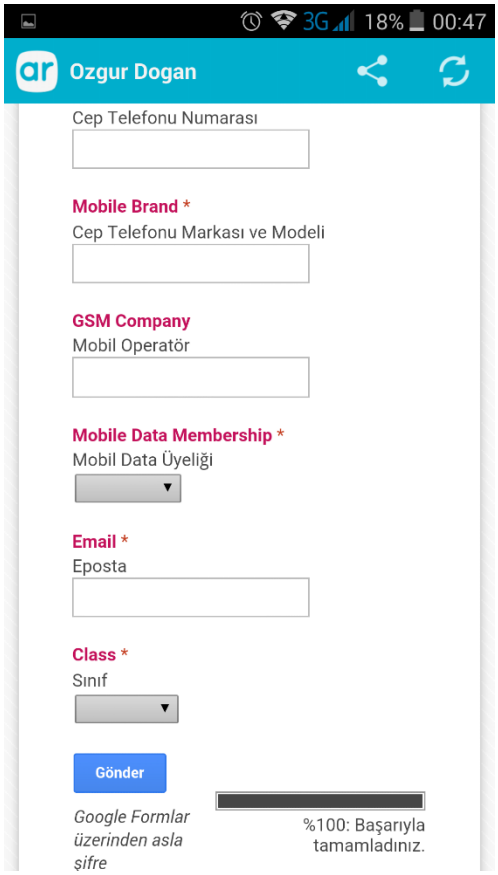
APPENDICES

Appendix A. Demographic Information Survey Screenshot





Appendix B. Vocabulary Knowledge Scale Test

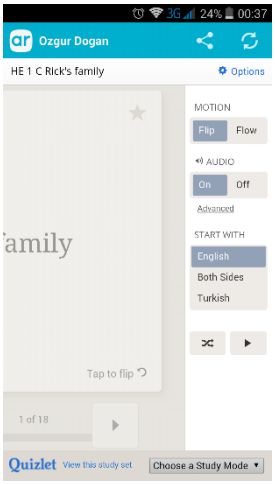
VKS: Headway

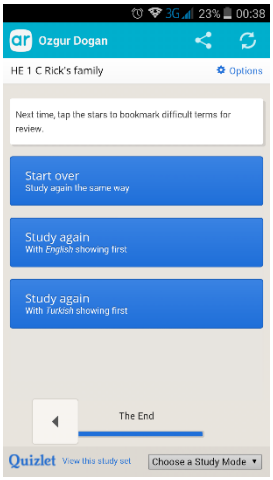
1- Bu kelimeyi daha önceden gördüğümü hatırlamıyorum.
2- Bu kelimeyi daha önceden gördüm, fakat ne anlama geldiğini bilmiyorum.
3- Bu kelimeyi daha önceden gördüm ve bence _____ anlamına geliyor. (eşanlamlısı ya da Türkçe karşılığı).
4- Bu kelimeyi biliyorum. _____ anlamına geliyor. (eşanlamlısı ya da Türkçe karşılığı).
5- Bu kelimeyi bir cümle içerisinde kullanabilirim: _____. (Bir cümle yazınız.) (Eğer bu bölümü yaparsanız, lütfen 4. Bölümü de yapınız.)

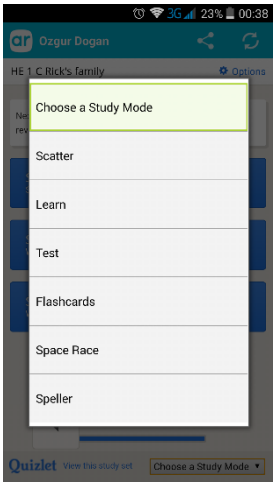
		1	2	3	4	5	Kelime ya da Cümle
1	listen						
2	foreign						
3	poor						
4	week						
5	bath						
6	barefoot						
7	grass						
8	pub						
9	sticky						
10	warm						
11	bilingual						
12	outdoor						
13	takeaway						
14	band						
15	bookstore						
16	cook						

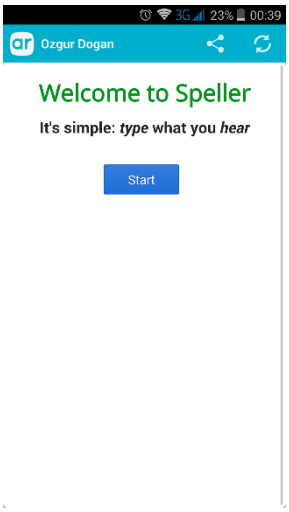
17	earn						
18	exciting						
19	luck						
20	tired						

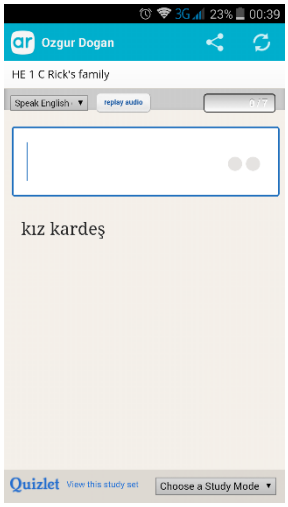
Appendix C. Layar Application and Quizlet Screenshots

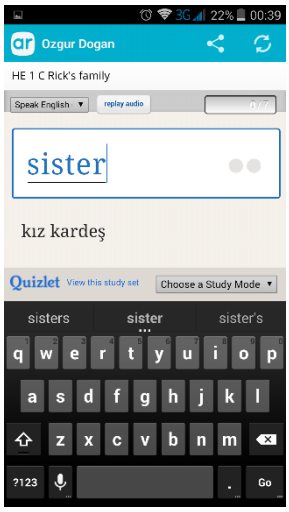


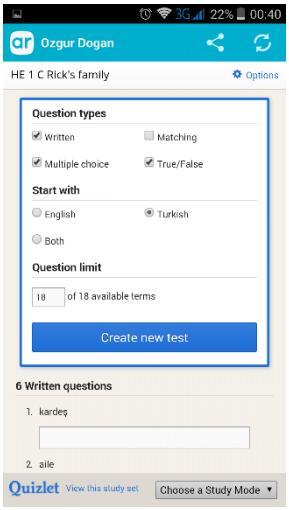




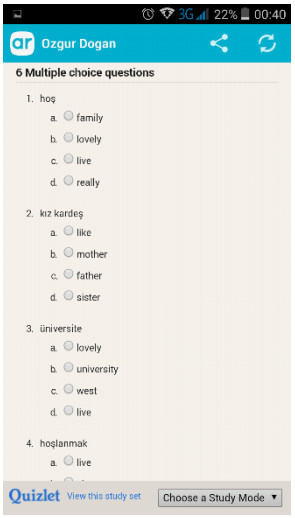

Ozgur Dogan
Welcome to Speller
It's simple: type what you hear
Start

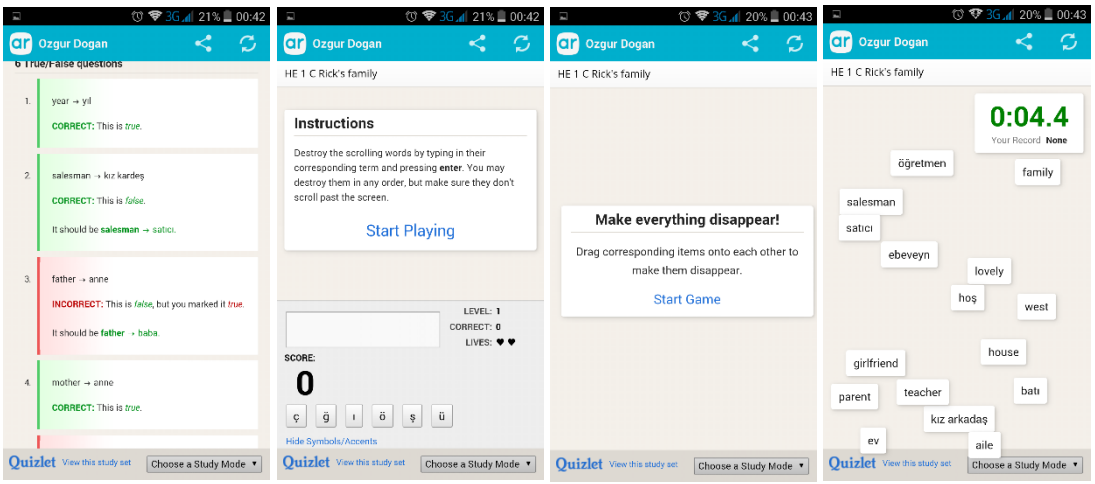

Ozgur Dogan
HE 1 C Rick's family
Speak English
replay audio
kız kardeş
Quizlet
View this study set
Choose a Study Mode

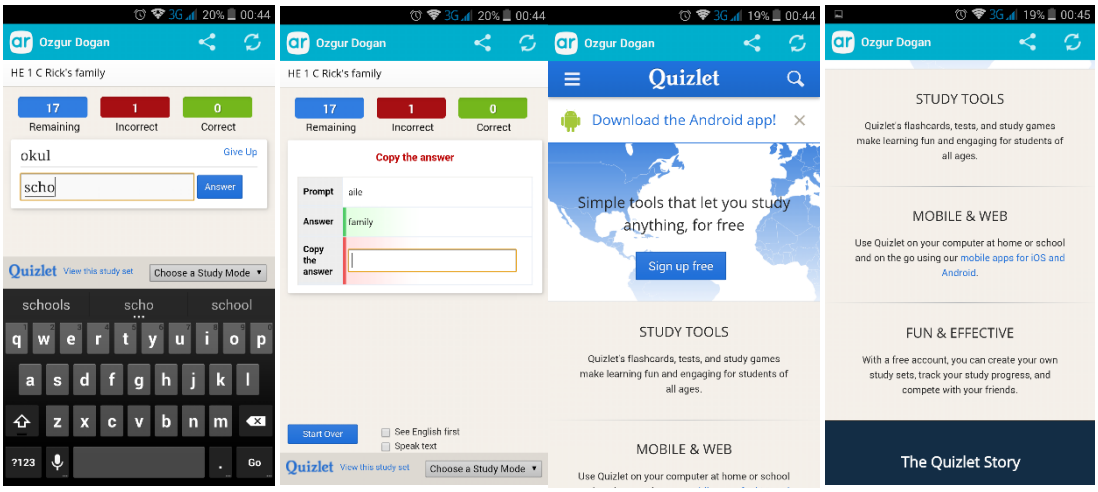

Ozgur Dogan
HE 1 C Rick's family
Speak English
replay audio
sister
kız kardeş
Quizlet
View this study set
Choose a Study Mode
sisters
sister
sister's


Ozgur Dogan
HE 1 C Rick's family
Options
Question types
Written
Matching
Multiple choice
True/False
Start with
English
Turkish
Both
Question limit
18
of 18 available terms
Create new test
6 Written questions
1. kardeş
2. aile
Quizlet
View this study set
Choose a Study Mode


Ozgur Dogan
HE 1 C Rick's family
Options
6 Written questions
1. kardeş
2. aile
3. öğretmen
4. batı
5. ebeveyn
6. kız arkadaş
6 Multiple choice questions
Quizlet
View this study set
Choose a Study Mode


Ozgur Dogan
6 Multiple choice questions
1. hoş
a. family
b. lovely
c. live
d. really
2. kız kardeş
a. like
b. mother
c. father
d. sister
3. üniversite
a. lovely
b. university
c. west
d. live
4. hoşlanmak
a. live
Quizlet
View this study set
Choose a Study Mode


Ozgur Dogan
6 True/False questions
1. year → yıl
CORRECT: This is true.
2. salesman → kız kardeş
CORRECT: This is false.
It should be salesman → satıcı.
3. father → anne
INCORRECT: This is false, but you marked it true.
It should be father → baba.
4. mother → anne
CORRECT: This is true.
Quizlet View this study set Choose a Study Mode
Ozgur Dogan
HE 1 C Rick's family
Instructions
Destroy the scrolling words by typing in their corresponding term and pressing enter. You may destroy them in any order, but make sure they don't scroll past the screen.
Start Playing
LEVEL: 1
CORRECT: 0
LIVES:
SCORE:
0
ç ğ ı ö ş ü
Hide Symbols/Accents
Quizlet View this study set Choose a Study Mode
Ozgur Dogan
HE 1 C Rick's family
Make everything disappear!
Drag corresponding items onto each other to make them disappear.
Start Game
Quizlet View this study set Choose a Study Mode
Ozgur Dogan
HE 1 C Rick's family
0:04.4
Your Record None
öğretmen
family
salesman
satıcı
ebeveyn
lovely
hoş
west
house
girlfriend
parent
teacher
batı
kız arkadaş
ev
aile
Quizlet View this study set Choose a Study Mode


Ozgur Dogan
HE 1 C Rick's family
17 Remaining
1 Incorrect
0 Correct
okul
Give Up
scho
Answer
Quizlet View this study set Choose a Study Mode
schools scho school
Ozgur Dogan
HE 1 C Rick's family
17 Remaining
1 Incorrect
0 Correct
Copy the answer
Prompt aile
Answer family
Copy the answer
Start Over
See English first
Speak text
Quizlet View this study set Choose a Study Mode
Ozgur Dogan
Quizlet
Download the Android app!
Simple tools that let you study anything, for free
Sign up free
STUDY TOOLS
Quizlet's flashcards, tests, and study games make learning fun and engaging for students of all ages.
MOBILE & WEB
Use Quizlet on your computer at home or school
Ozgur Dogan
STUDY TOOLS
Quizlet's flashcards, tests, and study games make learning fun and engaging for students of all ages.
MOBILE & WEB
Use Quizlet on your computer at home or school and on the go using our mobile apps for iOS and Android.
FUN & EFFECTIVE
With a free account, you can create your own study sets, track your study progress, and compete with your friends.
The Quizlet Story

ÖZGEÇMİŞ

1983 yılı Erzincan doğumluyum. İlk ve Orta öğrenimimi Erzincan'da tamamladıktan sonra Lisans eğitimimi Boğaziçi Üniversitesi Yabancı Diller Bölümünde 2005 yılında tamamladım. Şuan Erzincan Üniversitesinde İngilizce Okutmanlığı görevinde bulunmaktayım. Bildiğim yabancı diller İngilizce ve İspanyolca.

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