

INVESTIGATING THE EFFECTIVENESS OF ARCS BASED INSTRUCTIONAL
MATERIALS ENHANCED WITH AUGMENTED REALITY ON ESP
VOCABULARY ACHIEVEMENT AND MOTIVATION

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INSTRUCTIONAL MATERIALS ENHANCED WITH AUGMENTED
REALITY ON ESP VOCABULARY ACHIEVEMENT AND MOTIVATION**

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ABSTRACT

INVESTIGATING THE EFFECTIVENESS OF ARCS BASED INSTRUCTIONAL MATERIALS ENHANCED WITH AUGMENTED REALITY ON ESP VOCABULARY ACHIEVEMENT AND MOTIVATION

Tandoğan, Buket
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The aim of this study was to investigate the effectiveness of instructional materials which were developed regarding ARCS model of motivational design and enhanced with augmented reality (AR) on students' vocabulary achievement and motivation while learning ESP vocabulary in the field of engineering. The study was conducted at the School of Foreign Languages, Gazi University with 67 upper-intermediate level students for a 6-week period. The experimental group learned ESP vocabulary with ARCS based instructional materials by using a mobile AR application, whereas the control group learned the same words without the application. Both groups were given a vocabulary achievement test as a pre-test and post-test. The experimental group took the motivation survey and ten of the students were interviewed at the end of the intervention. In this mixed method study, quasi-experimental design procedures were followed for the quantitative data. Findings of the vocabulary achievement tests revealed that the experimental group significantly performed better than the control group. Likewise, motivation survey demonstrated there was a significant difference for the motivation level in favor of the experimental group. The findings of the semi-structured interviews indicated the students' perceptions were highly positive and they were willing to use it in their future studies, too. They also mentioned the

technological challenges they faced, but they did not find them significant. It is concluded that when instructional materials are presented with mobile AR applications and developed according to ARCS motivational design procedures, it can be effective for ESP vocabulary achievement, motivation and students' positive perceptions.

Keywords: Mobile Learning, Augmented Reality, Vocabulary Learning, ARCS model of motivational design, ESP

ÖZ

ÖZEL AMAÇLI İNGİLİZCE ÖĞRETİMİNDE ARTIRILMIŞ GERÇEKLIK İLE ZENGİNLEŞTİRİLMİŞ ARCS MODEL TABANLI ÖĞRETİM MATERYALLERİNİN ÖĞRENCİLERİN KELİME BAŞARISINA VE MOTİVASYONUNA ETKİSİNİN İNCELENMESİ

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Bu çalışma ARCS model tasarıma göre geliştirilmiş ve artırılmış gerçeklik ile zenginleştirilmiş öğretim materyallerinin, mühendislik alanındaki özel amaçlı İngilizce kelimeleri öğrenirken, öğrencilerin kelime başarısına ve motivasyonlarına olan etkisini incelemeyi amaçlamıştır. Bu çalışma 6 haftalık süreçte, 67 öğrenci ile Gazi Üniversitesi Yabancı Diller Yüksek Okulu'nda gerçekleştirilmiştir. Deney grubu özel amaçlı İngilizce kelimelerini ARCS tabanlı öğretim materyalleriyle mobil bir artırılmış gerçeklik uygulaması kullanarak öğrenirken, kontrol grubu aynı kelimeleri uygulama olmadan öğrenmiştir. İki gruba da kelime başarı testi ön test ve son test olarak verilmiştir. Müdahalenin sonunda deney grubu motivasyon anketini yapmıştır ve öğrencilerin onuyla yarı yapılandırılmış görüşme yapılmıştır. Bu karma metotlu araştırmada, yarı deneysel tasarım yöntemleri, nicel veri için takip edilmiştir. Kelime başarı testleri, ARCS tabanlı öğretim materyalleri ve mobil artırılmış gerçeklik içeren öğrenim ortamına sahip deney grubunun geleneksel öğrenme ortamına sahip kontrol grubundan anlamlı olarak daha iyi performans gösterdiğini ortaya koymuştur. Benzer şekilde, motivasyon ölçeği göstermiştir ki motivasyon seviyelerinde deney grubunun lehine anlamlı bir fark vardır. Görüşmelerin sonuçları göstermiştir ki öğrencilerin algıları oldukça olumludur ve gelecekteki çalışmalarında da artırılmış gerçeklik

uygulamasını kullanmaya heveslidirler. Karşılaştıkları zorluklardan da bahsetmişlerdir, ancak bunları çok önemli bulmamışlardır. Öğretim materyalleri mobil artırılmış gerçeklik ile sunulduğunda ve ARCS model tasarım prosedürlerine göre geliştirildiğinde, özel amaçlı İngilizce kelimelerinin başarısı, motivasyon ve öğrencilerin olumlu algıları için etkili olduğu sonucu çıkarılmıştır.

Anahtar Kelimeler: Mobil Öğrenme, Artırılmış Gerçeklik, Kelime Öğrenme, ARCS Tasarım Modeli, ESP

To My Beloved Mother, Mürüvvet Tandoğan

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TABLE OF CONTENTS

ABSTRACT	v
ÖZ	vii
ACKNOWLEDGEMENTS	x
TABLE OF CONTENTS	xi
LIST OF TABLES	xiv
LIST OF FIGURES	xv
LIST OF ABBREVIATIONS	xvi
CHAPTERS	
1. INTRODUCTION	1
1.1. Introduction	1
1.2. Background of the Study	1
1.3. Purpose of the Study	5
1.4. Research Questions and Hypotheses	5
1.5. Significance of the Study	6
2. LITERATURE REVIEW	9
2.1. Introduction	9
2.2. Mobile Learning	9
2.2.1. Mobile Assisted Language Learning (MALL)	10
2.2.2. Augmented Reality (AR)	12
2.2.2.1. AR in Language Education	14
2.2.2.2. Advantages and Importance of Augmented Reality	15
2.2.2.3. Limitations of Augmented Reality	16

2.3. Motivation.....	17
2.3.1. Motivation in EFL.....	18
2.3.2. ARCS Model of Motivational Design.....	18
2.3.2.1. ARCS Model of Motivational Design in EFL.....	19
2.4. English for Specific Purposes (ESP).....	20
2.4.1. Vocabulary Learning.....	22
3. METHODOLOGY	25
3.1. Introduction.....	25
3.2. Research Questions	25
3.3. Research Design.....	26
3.4. Setting	28
3.5. Participants.....	28
3.6. Instruments.....	30
3.6.1. Vocabulary Achievement Tests.....	30
3.6.2. Instructional Materials Motivation Survey.....	30
3.6.3. Student Interviews	31
3.7. Procedures of the Study	32
3.8. Data Analysis	40
4. RESULTS.....	43
4.1. Introduction.....	43
4.2. Results of the Vocabulary Achievement Tests	43
4.3. Results of the Motivation Survey.....	47
4.4. Results of the Student Interviews.....	52

4.4.1. Strengths of the ARCS based instructional design enhanced with augmented reality.....	54
4.4.2. Weaknesses of the ARCS based instructional design enhanced with augmented reality.....	59
5. DISCUSSION	63
5.1. Introduction	63
5.2. Overview of the Study	63
5.3. Effects on Students' ESP Vocabulary Achievement.....	64
5.4. Effects on ESP Students' Motivation	66
5.5. Students' Perceptions	69
5.6. Conclusions	74
5.7. Limitations.....	75
5.8. Implications for Practice and Recommendations for Future Studies	76
REFERENCES.....	77
CRRGP F KEGU"	
A. VOCABULARY ACHIEVEMENT TEST	95
B. MOTIVATION SURVEY	99
C. INTERVIEW QUESTIONS	102
D. INTERVIEW QUESTIONS IN ENGLISH.....	103
E. INTERVIEW ANSWERS IN TURKISH	104
F. CONSENT FORM.....	109
G. WEEKLY SCHEDULE.....	111
H. APPROVAL OF ETHICAL COMMITTEE	113

LIST OF TABLES

TABLES

Table 3.1. Research Design	27
Table 3.2. Participants According to Their Gender	29
Table 3.3. Participants According to Their Majors	29
Table 3.4. Student Profile in the Interview Process.....	31
Table 3.5. Attention Related Design.....	34
Table 3.6. Relevance Related Design	35
Table 3.7. Confidence Related Design	36
Table 3.8. Satisfaction Related Design.....	37
Table 3.9. Self-evaluation Check List Sample	38
Table 4.1. Descriptive Statistics of Pre-Vocabulary Achievement Test	43
Table 4.2. Normality Test for Pre-Achievement Vocabulary Test.....	44
Table 4.3. Independent Samples t-test for the Pre-Achievement Vocabulary Test...	45
Table 4.4. Descriptive Statistics of Post-Vocabulary Achievement Test	46
Table 4.5. Normality Test for Post-Achievement Vocabulary Test	46
Table 4.6. Independent Samples t-test for the Post-Achievement Vocabulary Test .	47
Table 4.7. Descriptive Statistics Motivation Survey as a Whole	48
Table 4.8. Normality Test for Motivation Survey as a Whole	48
Table 4.9. Independent Samples t-test for Motivation Survey as a Whole	49
Table 4.10. Descriptive Statistics of Attention-Relevance Dimension	49
Table 4.11. Normality Test for Attention-Relevance Dimension.....	50
Table 4.12. Independent Samples t-test for Attention-Relevance Dimension.....	50
Table 4.13. Descriptive Statistics of Confidence- Satisfaction Dimension.....	51
Table 4.14. Normality Test for Confidence-Satisfaction Dimension	51
Table 4.15. Independent Samples t-test for Confidence-Satisfaction Dimension	52
Table 4.16. Results of Student Interviews	53

LIST OF FIGURES

FIGURES

Figure 2.1. Reciprocal co-ordinate model of vocabulary teaching and learning.....	23
Figure 3.1. Buket AR application sample.....	39
Figure 3.2. Buket AR application sample2.....	39

LIST OF ABBREVIATIONS

ICT: Information and Communication Technology

MALL: Mobile Assisted Language Learning

AR: Augmented Reality

ARCS: Attention, Relevance, Confidence and Satisfaction

ELT: English Language Teaching

EFL: English as a Foreign Language

ESL: English as a Second Language

ESP: English for Specific Purposes

EGP: English for General Purposes

CHAPTER 1

INTRODUCTION

1.1. Introduction

In this chapter, the background of the study, the purpose of the study, research questions, and significance of the study are presented respectively.

1.2. Background of the Study

Information and Communication Technology (ICT) has been evolving with a number of new advances for a long time. In the information era - also called as a digital era- ICT has been the focus of stakeholders of education to integrate it in classes. For an ICT integration to be effective, the requirements are listed as technological infrastructure, appropriate curriculum, well-trained instructors, encouraging administration, capable technical staff and talented students (Semerci & Aydın, 2018). The widespread availability and popularity of ICT makes countries take steps for education, make investments by forming policies, supply technological infrastructure and train the teachers. Uluyol (2013) exemplifies the integration process in Turkey by stating that Turkish Ministry of Education has been making investments with the aim of ICT integration in schools since 1998 and has had a peak point with the FATİH Project (Movement to Increase Opportunities and Technology) in 2010. The aim has been to boost the education quality and maintain the equality of opportunities. With the aim of accomplishing the objectives, all classrooms were tried to be equipped with technological items such as computers, projectors, internet providers, etc., students were given tablet and teachers were given in-service training. However, the research by Altın and Kalelioğlu (2015) concluded that FATİH Project failed to achieve most of its objectives while integrating ICT because of the reasons such as technical problems, incompetency of teachers and their negative attitudes towards the

technology. On the other hand, Educational Information Network (EBA) which is a platform to create, store and share instructional materials has been introduced as a component of FATİH Project and has been found efficient (MEB, 2015; 2017a). Considering this integration example, it can be concluded that adopting and integrating a new technology into classrooms need to be well organized beforehand and all the components of ICT need to be designed elaborately. Bingimlas (2009) concludes that if even one of the ICT resources such as software and hardware, time, technical support, and professional development is not provided to teachers, a good teaching is unlikely to be obtained. The barriers which are categorized as lack of confidence, lack of competence and lack of access to resources by Bingimlas (2009) need to be collapsed to have a remarkable integration of ICT in education. ICT is used not only in primary and secondary schools, but also in higher education. The study conducted with 813 faculty members in Turkey confirms that ICT has been favorable in higher education as the number of universities has increased and the universities need to provide both faculty members and students with ICT facilities (Usluel, Aşkar, & Baş, 2008). However, Ateş and Mammadova (2015) declared that the vision, policies and goals couldn't reach the developed countries' levels, the standardization and the quality were not at the expected level, and generalization throughout the country was not at the national degree in terms of ICT integration at higher education in Turkey. Therefore, they proposed that a well-designed system considering future needs is to be established by educating staff and not wasting the sources because by contributing the universities' projects and studies, the use of ICT helps universities gain worldwide reputation and has become a reason to opt for (Ateş & Mammadova, 2015).

Technology-based teaching and learning has more advantages when compared to traditional classrooms in terms of fostering students' learning and the effectiveness of more engaging and more interesting lesson designs (Ghavifekr & Rosdy, 2015). Therefore, the foreign language education and related research has also concentrated on the integration of technology into classrooms. The systematic review of study

which examined the literature from 1996 to 2014 revealed that when ICT was implemented appropriately into English as a Foreign Language (EFL) classes, positive outcomes such as improving motivation, interaction, communication, performance, autonomous learning came out (Azmi, 2017). Besides these benefits, paradigm shift, assessment shift and collaborative learning enhancement were also defined as the advantage of ICT integration in language classes (Riasati, Allahyar, & Tan, 2012). To gain an optimum integration of ICT in EFL classes, some issues need contemplating. Although the schools are fully equipped with the required infrastructure like software and hardware systems, teachers' potential plays a crucial role on the integration process. Contrary to the expectation of high-level usage of technology enhanced learning instruction, the study found that teachers hardly ever made use of technology in English Language Teaching (ELT) classes due to their attitudes for insisting on sustaining their traditional way of teaching, and lack of technological knowledge, support, interest, materials and time (Segni & Davidson, 2019). However, in the literature there are some studies indicating that teachers feel confident enough to integrate the technological tools in their EFL classrooms and they also find the digital tools effective in terms of boosting learners' motivation, improving their performance and long-term retention in the Turkish context (Çelik & Aytın, 2014). The integration of ICT needs to be explored from students' point of view as well as the teachers' perspectives. Sağlam and Sert (2012) emphasized that teachers had positive perceptions about the use of educational technology to enhance language instruction, yet they mentioned the need for ICT training not only for teachers, but also for students. In the literature, it was revealed that college students had a positive attitude towards the implementation of technological tools in their English language classes (Ngo & Eichelberger, 2019).

The technological devices which assist the learning instruction are utilized to provide a smooth learning process and create an efficient learning environment. Thus, studies in the literature indicates that effects of technology integration gain a tremendous interest of both instructors and researchers in the field of foreign language education.

It was expressed that in EFL classes, digital portable devices were preferred more than computer or network tools (Rahimi & Yadollahi, 2011). Mobile learning is not a new terminology, yet its benefits and constraints vary constantly because of the perpetual advances and innovations brought about by new devices and these devices' recent applications. Regardless of time and place, new powerful mobile devices serve as a hardware system supplying the required software providing new remarkable opportunities for education (Godwin-jones, 2011). The widespread usage of mobile devices leads people to expect language learning not to be limited into classroom environment because mobile devices has brought a new breath to how to teach and learn English (Kukulska-hulme, 2009). MALL (Mobile Assisted Language Learning) did not only differ from CALL (Computer Assisted Language Learning) because of the features of devices which are personal and carried by learners, but also its functionality of being used at the time of need when the learners are mobile (Kukulska-hulme & Shield, 2008).

Augmented reality (AR) is one of the remarkable advances of technology which has been integrated in educational environment for many years. As a variation of virtual reality (VR), AR merges the reality with virtual objects by allowing users to see the real world in which they can interact with the superimposed objects (R. T. Azuma, 1997). AR application technology is used in a wide range of subjects and it was explored to be useful for increasing achievement and motivation in most of the different areas such as Maths (Estapa & Nadolny, 2015), Natural Science (Chiang et al., 2014) and language learning (Solak & Cakir, 2015). The study of Ozdemir, Şahin, Arcagök, and Demir, (2018) compared the effect sizes and revealed that AR application technology did not vary in terms of the educational areas such as Social Sciences or Natural Sciences.

All in all, what makes the integration of technology into EFL classrooms successful is not only the technology itself, but a combination of carefully designed pedagogy, appropriate methodology, convenient strategies, well-defined objectives and technological affordances (Azmi, 2017).

1.3. Purpose of the Study

This study aimed to find out the possible effects of instructional materials which were based on ARCS model design and enhanced with augmented reality on ESP learners' vocabulary achievement and motivation. It also aimed to figure out the students' ideas regarding their learning experience. The lesson was designed according to Keller's (2000) ARCS design principles and the materials including ESP words were enriched with a mobile augmented reality application. The objectives of this research are to investigate the effectiveness of ARCS model based instructional materials on ESP students' vocabulary achievement, to investigate the effectiveness of ARCS model based instructional materials on ESP students' motivation and to explore the students' opinions about their experience of learning ESP vocabulary through a mobile augmented reality application.

1.4. Research Questions and Hypotheses

The current study tries to find the answers for the following research questions:

1) What is the effect of ARCS model based instructional materials enhanced with augmented reality on ESP students' English vocabulary learning?

- Is there a statistically significant difference in vocabulary achievement tests between the experimental group which gets mobile AR treatment and the control group?
- H_{10} : There is no statistically significant difference in vocabulary achievement tests between the experimental group which gets mobile AR treatment and the control group.
- H_{1A} : There is a statistically significant difference in vocabulary achievement tests between the experimental group which gets mobile AR treatment and the control group.

2) What is the effect of ARCS model based instructional materials enhanced with augmented reality on ESP students' motivation?

- Is there a statistically significant difference between experimental group's and control group's motivation?
- H2₀: There is no statistically significant difference between experimental group's and control group's motivation.
- H2_A: There is a statistically significant difference between experimental group's and control group's motivation

3) What are the students' perceptions in terms of learning environment enhanced with augmented reality for ESP vocabulary learning?

1.5. Significance of the Study

Vocabulary is considered as one of the most arduous part of a language by most of the learners. It is not astonishing that foreign language learners find the vocabulary learning demanding and they easily lose their motivation during the vocabulary learning process. Especially, learners who get involved in an intensive English learning program such as preparatory school of higher education are exposed to a large amount of vocabulary. Aygün (2017) states that the number of words is a factor which diminishes the learners' motivation in English preparatory classrooms in Turkey and learning only English during a year is also a factor which makes learners find the classes tedious. Frequency of classes in a week is another demotivating factors (Tabatabaei & Molavi, 2012). Although learners are enthusiastic at the beginning of the term, it is observed that their motivation wears off as time goes by (Kurt & Kecik, 2017). Likewise, their achievement has a tendency to decrease. This decrease can be attributed to the positive correlation between motivation and language achievement (Dashtizadeh & Farvardin, 2016). To prevent the drawbacks of the lack of motivation in English as a Foreign Language (EFL) classes, forming the instructional design in accordance with John Keller's (1987) model of motivational design has been proven to be influential in the literature. It was found out that course motivation and

instructional motivation of students significantly increased after they were exposed to 10-week ARCS model of motivational design based lessons (Kurt & Kecik, 2017). While implementing ARCS based on instruction, mobile technologies can be integrated to contribute to the motivational boost. A variety of multimedia can be used to make vocabulary learning more efficient and enjoyable since it was mentioned in the literature that when the information was presented both verbally and visually, the performance got better (Jeung, Chandler, & Sweller, 2007). Augmented reality has the potential of bringing the authenticity and real life elements into classrooms by using mobile devices, which is a priceless opportunity for learners to obtain a more realistic learning environment. In the ESP literature, it is concluded that the use of multimedia is able to enhance learners to acquire or learn foreign languages by providing authentic materials as input and raising output (Bellalem, Neddar, Bouagada, & Djelloul, 2018). There are studies which come to the conclusion that using mobile technologies such as mobile phone applications has a positive influence on vocabulary learning in ESP context (Alkhezzi & Al-Dousari, 2016). There are some studies focusing on augmented reality in language classrooms. However, the number of studies including ARCS based on instruction enhanced with augmented reality in EFL classrooms is limited to only one study in Turkey. There is a gap in the literature because there is no research aiming to study the effect of integrating augmented reality in ESP classes which are based on ARCS motivation design on motivation and vocabulary achievement.

CHAPTER 2

LITERATURE REVIEW

2.1. Introduction

In this part of the study a review of literature related to mobile learning, mobile assisted language learning, augmented reality, motivation, English for specific purposes and vocabulary learning is presented.

2.2. Mobile Learning

Many researchers tend to generate a definition for mobile learning, However, there is no consensus on a definite definition for it. Laouris and Eteokleous (2005) state that some research focus on the mobile part more or others give more attention to the learning part, yet an equal approach is needed without neglecting the mobile devices' features and learning components. To get the optimum results from mobile learning, the things that need attention are elements of mobile learning, learning environment, learning activities, teaching medium and elements of mobile learning. Ozdamli and Cavus (2011) list the basic characteristics of mobile learning as “ubiquitous, portable, blended, private, interactive, collaborative and instant information.”. The trends of m-learning and the way its implementation in education have been altering dramatically due to the constant evolution of technological devices which supply distinct opportunities and communication technologies (Krull & Duarte, 2017).

The devices which are used for mobile learning are various and can be defined as handheld and light enough to carry and use while walking around, so smart phones, pads, pods are in this category, except laptops (Viberg & Grönlund, 2012). Smart phones have a number of features which can ease the learning process in higher education by enabling communication, delivering content and supporting collaborative learning activities (Jarvela, Naykki, Laru, & Luokkanen, 2007).

Upon covering the studies done to investigate m-learning for educational purposes between the years of 2013 and 2014, Bhat and Saleh (2015) revealed that m-learning was implemented in higher education more than elementary levels and it provided positive outcomes. Another systematic review analyzing 101 the studies conducted for higher education between the years of 2000 and 2013 announced that the fields in which m-learning was resorted frequently were language learning, health and computer studies (Pimmer, Mateescu, & Gröbriel, 2016).

Koutropoulos (2011) attracted the attention to the importance of pedagogy by pointing out that it was not the technology's responsibility to make learners want to learn and the important action was to make learners go on with the most appropriate learning strategy while solving a problem. Prevalent educational theories are compatible with the pedagogy of mobile learning. Orr (2010) supported the idea that the theories such as behaviorism, constructivism, situated learning, and collaborative learning were relevant to mobile education theory. Keskin and Metcalf (2011) also mentioned cognitivist learning, problem-based learning, context-awareness learning, socio-cultural theory, conversational learning, life-long learning, informal learning, activity theory, connectivism, navigationism and location-based learning. Since mobile devices and communication technologies enable a lot of functions and opportunities to learners and instructors, mobile learning is based on a wide variety of learning pedagogy.

2.2.1. Mobile Assisted Language Learning (MALL)

The widespread ownership of personal mobile devices, the willingness of learning anywhere and anytime and the necessity of learning a second or foreign language stimulate mobile assisted language learning (MALL). According to Kukulska-hulme and Shield (2008) the things which make MALL different from CALL are that the devices are personal and portable, and this makes it possible to use without a place limitation. The other thing is that wireless network takes the time constraint away because people can access information spontaneously. The devices which are used for

mobile learning are various and can be defined as handheld and light enough to carry and use while walking around, so smart phones, pads, pods are in this category, except laptops (Viberg, & Grönlund, 2012). Mobile learning brings along distinctive learning environments so that learners have the chance to access information face to face, from a distance, or online and they can complete their learning process according to their own self-pace or have a calendar-based schedule (Chinnery, 2006).

Kukulska-hulme (2009) points out an important issue which can be recognized as a threat and also as a benefit. He expresses that MALL has removed the borders and the learning is not limited to teachers' lectures in classrooms, so a challenging design is essential to decide what and how to teach inside and outside the classrooms. In his literature review study, Metruk (2019) summarizes that the advantages of utilizing MALL outweigh its disadvantages despite some drawbacks such as smart phone addiction and incompetent teachers who are not ready or do not have the necessary skills for implementing mobile technologies. The studies conducted so far reveal the concerns about MALL as small screen sizes, restricted audiovisual quality, virtual key-boarding, difficult data entry, finite power (Chinnery, 2006). However, Apple IOS and Android systems have started to solve the technical problems mentioned in the studies until 2007. Godwin-jones (2011) lists the advances of mobile technologies which can be considered resolutions of MALL's previously stated constraints as larger screens, touch screens, larger virtual keyboards or physical mini-keyboards, higher resolutions, featuring of video capture, voice recognition, editing images, faster internet connection through WiFi or 3G or 4G, larger storage, lower cost and higher capacity.

Upon examining 156 articles on Science Direct database, Soykan and Uzunboylu (2015) point out that foreign language education comes first to exploit mobile learning and, in most researches, smart phones and IOS operating systems are used. Likewise, another systematic review conducted on the studies between the years of 2010 and 2016 pointed out that second language domain is the most commonly searched area regarding mobile learning (Crompton & Burke, 2018).

Stockwell and Hubbard (2013), split the key issues to take into consideration while implementing MALL into three categories as physical, pedagogical, psycho-social. Firstly, physical aspect consists of the portable devices' features like screen size, storage capacity, processor speed, battery life and compatibility. Secondly, pedagogical aspect includes the development of tasks regarding the devices' affordances. In other words, tasks or activities need to be developed to benefit from the devices' potential utility because MALL does not solely mean to transfer paper-based tasks into mobile platforms. Thirdly, psycho-social aspect covers MALL from the point of social and personal purposes like communication with others.

Constant development of ICT makes the use of instructional materials enhanced with mobile devices serve higher quality of visuals, graphics, texts, audio and animations, etc. (Saran, Seferoğlu, & Çağıltay, 2009). They state that most of learners possess their personal mobile phones, and they use it to communicate or have fun. They also come to the conclusion that MALL has the power to benefit from mobile phones for educational purposes, which initiates regular study, motivation increase and better pronunciation of words.

In literature, most of the studies based on MALL have positive findings in a variety of areas related to language skills like reading comprehension (Naderi & Akrami, 2018; Taj, Ali, Sipra, & Ahmad, 2017; Wang, 2017), vocabulary (Fageeh, 2013; M. Lu, 2008), writing (Ahmed, 2019), listening (Salih, 2019), speaking (Ahn & Lee, 2016), grammar (Ahmed, 2019; Baleghizadeh & Oladrostam, 2010), learner satisfaction (Wang, 2017), learner autonomy (Hazea & Alzubi, 2018) and motivation (Fageeh, 2013).

2.2.2. Augmented Reality (AR)

Augmented reality (AR) is defined as a system which aims to complement the real environment by displaying virtual objects or removing real objects and addresses to four other human senses besides the sense of sight (R. Azuma et al., 2001). In virtual reality, learners are surrounded by the artificial environment which inhibits them from

seeing the real world around them, yet augmented reality presents a real world on which virtual objects are superimposed (R. T. Azuma, 1997). In AR, new settings which are improbable to exist in merely the real world or merely the virtual world are created (Cuendet, Bonnard, Do-Lenh, & Dillenbourg, 2013). According to Johnson, Levine, Smith, and Stone (2010) AR applications have two versions named as marker-based and markerless. Marker-based one includes a camera which spots and recognizes a visual clue to retrieve the information stored in the software so that 3D-rendered information appears on the screen. On the other hand, in markerless-based AR applications, mobile's global positioning system (GPS) is needed to provide a matching in between the camera's input and images stored in the software. Dunleavy and Dede (2014) categorizes AR into two forms as location-aware and vision-based. In their systematic review study analyzing 105 articles Sirakaya and Sirakaya (2018) reveal that the most commonly preferred mobile AR type in educational settings is marker-based AR (86%) and then location-based AR (11%) and finally the least preferred one is hybrid AR (3%) between 2011 and 2016.

AR has the potential to be used in a variety of disciplines. Pragmatist theories developed by researchers and adoption of applications have made the use of AR in not only in corporate but also in educational settings during the last few decades (Lee, 2012). In his study Lee (2012) states that in terms of adopting the technology, AR has had more users since it is feasible to be applied in a variety of areas ranging from mathematics to biology, from physics to astronomy etc. According to Wu, Lee, Chang, and Liang (2013) during AR's infancy years, teaching science and mathematics studies make up the majority of current literature of AR in education, so more studies are needed to conduct to explore the potential of AR in other learning subjects. In their article, 50 studies analyzed between 2000 and 2012 revealed that AR was found effective for various educational concepts, but by providing more empirical evidence with more sample and valid instrumentation, further studies could shed light on the affordances of AR and help resolve instructional design problems. There is also another study whose findings are similar in that it found science courses such as

mathematics, geometry as the most studied domain, but it also shows studies in social science courses such as language learning form 16.36% of the total number of AR studies (P. Chen, Liu, Cheng, & Huang, 2017). In their systematic review of literature, Akçayır and Akçayır (2017) examining 68 studies revealed that 2007 is the starting point of AR studies in education and there has been a drastic increase in the number of studies since 2011 thanks to mobile phones and portable AR applications which became widespread. The use of mobile hardware anywhere and anytime makes mobile AR more popular than before, so more research is needed to investigate how to use it and explore its full potential (R. Azuma, Billinghurst, & Klinker, 2011). Mobile devices (57%) are preferred rather than desktops, laptops, AR glasses or other devices due to its advantages which make the implementing easier (Sırakaya & Sırakaya, 2018).

AR applications can be integrated into the lesson plans by being involved in a variety of activities. They can be put into practice such as campus tours, directions, content maps, treasure hunts, supplementary for reading, information gap, role-playing, backchannelling and orienting with 360-degree videos activities by using AR mobile applications like HP Reveal, Blippar, Augment Layar etc. while teaching English (Bonner & Reinders, 2018).

2.2.2.1. AR in Language Education

In the systematic literature review (Khoshnevisan & Le, 2018), they examined 19 studies focusing on AR in language education and expressed the delivery methods of this technology as AR pop-up books, AR-based games and Aurasma app for vision-based. They also pointed out that AR is going through its infancy because the number of ready-made applications is limited, so is the number of studies demonstrating the evidence of effectiveness of AR. The study which concentrates on a location-based-design game supported with Aurasma application have observational findings which present the conclusion that AR has the potential to increase learner engagement and challenge high level English language learners with usable and reliable AR application

(Richardson, 2016). With experimental studies when the traditional methods and AR games are compared with regards to teaching vocabulary, the learning progress of children who are exposed to AR games is better than other children (Barreira et al., 2012). Solak and Cakir (2015) found similar findings when the vocabulary was delivered with AR application, there was an increase on learners' academic performance. Likewise, AR was found effective at improving vocabulary acquisition and motivation in an ESL context (Vedadi, Abdullah, & Cheok, 2019). Upon conducting their research Nashirah, Mahadzir, and Phung (2013) put forward the idea that AR pop-up book has got positive effects on learners' motivation which involves four factors identified by Keller such as attention, relevance, confidence and satisfaction. In their case study, Liu and Tsai, (2013) explored that mobile learning based AR materials could help learners access the information easily in an active way in contrast to traditional passive methods and obtain both linguistic and content knowledge, and finally have the chance to improve their writing skills. Besides providing learners with fun, games supported by mobile AR are proved to be beneficial at various concepts such as reinforcing active learning, increasing cultural understanding, and supplying linguistic consciousness (Y. Liu, Holden, & Zheng, 2016).

2.2.2.2. Advantages and Importance of Augmented Reality

Studies which have been carried out so far report that AR enhanced classrooms are advantageous in terms of learning gains and motivation and they are found effective for deepening student engagement, rising enjoyment and positive attitudes.(P. Chen et al., 2017). Upon going through 58 articles concentrating on AR integration in educational fields, Altinpulluk (2019) reveals that academic success and learning motivation have been the most positive effect. Besides these advantages, interaction and collaboration are the areas in which AR has been found effective (Bacca, Baldiris, Fabregat, Graf, & Kinshuk, 2014). Enhancement of concentration, memorizing, satisfaction, less cognitive effort, usability and easily solved technical problems

without diminishing the enthusiasm are found to be the positive effects of AR (Di Serio, Ibáñez, & Kloos, 2013)

The reason lying behind the fact that visuals have an important role on learning is based on Dual Coding Theory which suggests a picture or 3D model is useful to obtain more stimuli for providing the interconnection with the learners' prior knowledge or experiences to recognize a word, as it is stated in improving English vocabulary (Chang, Chen, Huang, & Huang, 2011). Sometimes texts, diagrams or pictures are too complicated to convey the target meaning and even teachers' explanations are not enough to make learners acquire the information. In those cases, 3D models enable learners to manipulate and interact with the target animated information so that they can visualize and improve the learning process in courses which involve abstract things and challenging procedures or difficult processes such as engineering subjects (Liarokapis et al., 2004).

2.2.2.3. Limitations of Augmented Reality

Since AR is an emergent technology, there some limitations and concerns which need taking into consideration while designing and implementing it into classrooms. Technical issues which might result in frustration when learners have trouble with getting the superimposed information, the novelty effect which might fade away as time goes by, the intrusive technology which might be the cause of distraction of learners and teachers' lack of creating content with the technology are some of the limitations of using AR in educational settings (Bacca et al., 2014). Most of the teachers are not competent enough to develop AR technologies themselves because the current technology needs guidance, assistance and working in cooperation with engineers and other experts to create teaching materials (S. J. Lu & Liu, 2015). Although most of the teachers are found willing and have had a high rate of AR technology acceptance, they have the barriers preventing them from integrating this technology into their classes such as lack of IT skills and ICT infrastructures (Alkhatabi, 2017). Learners face global positioning system (GPS) problems, yet

Dunleavy and Dede (2014) foresee that technological advances and modifications are likely to eliminate this problem in the future. Cognitive load is seen as a controversial issue on AR implementation in education because some of the studies come to the conclusion that cognitive load results from AR, whereas few of them support that AR reduces cognitive load (Akçayır, & Akçayır, 2017). To obtain low-level cognitive load is possible with a well-design and well-organized AR implementation by regarding the cognitive load theory principles (Dunleavy & Dede, 2014; Küçük, Yılmaz, & Göktaş, 2014).

2.3. Motivation

According to Keller (2010) motivation has been an intriguing issue in distinctive areas ranging from philosophy to science, from literature to music in order to attempt to find an answer for the questions like what people long to do, what they opt for, how and why they do it. Psychology also does investigations to gain a scientific fundamental to describe human behaviors by generating motivational theories. Self-determination theory, attribution theory, expectancy-value theory and social cognitive theory are some of the theories developed for categorization of motivation.

Pew (2007) presents a summary related to extrinsic and intrinsic motivation types. He mentions that students are said to be externally motivated when there is a desire to get a degree, career goals, fear of failing, keeping themselves away from shame, money issues, and pleasing other people. To the contrary, intrinsically motivated students attribute their success to their own effort, not luck. Their motivation comes from inside, not from external factors.

Dornyei (1994) sees motivation as one of the most important concepts affecting learning achievement in second or foreign languages. Motivation in language field have attracted researchers' attention a lot because it is such a determiner that it can either affect the learning components or be affected by the components like learning achievement. According to Oxford and Shearin (2006) motivation designating how actively learners are involved in the language learning process is the key factor which

leads learners to success. Thus, when learners are unmotivated, they tend to fail to develop their language learning skills.

Al-Hoorie (2017) analyzes language motivation field from a 60-year historical perspective and divides it into three phases as the social-psychological, the situated-cognitive and the current period. According to this study, the studies done during the first phase focused on intergroup relations from a wide perspective. In the situated-cognitive phase, classroom components and cognitive processing of language learning were given more attention in the studies. The final phase includes some new themes which were not covered in previous studies like the dynamic, affective, unconscious and long-term features of motivation in foreign language learning.

2.3.1. Motivation in EFL

EFL stands for learning English as a foreign language which is not the native language of the learners' community (Bley-Vroman, 1990). He puts the attention to the setting which has the practical importance for teachers since it is the cause of the distinction between EFL and ESL (English as a Second Language). Krieger (2005) expresses that there are also some distinctions between these two terms regarding the intrinsic motivation. He explains the relationship between the setting and motivation by stating that intrinsic motivation of EFL learners is low when compared to ESL learners' intrinsic motivation in that ESL learners have the chance to be exposed to the target language in their daily life, outside the classroom and have comprehensible input as stated in Krashen and Terrell's (1995) Natural Theory. However, EFL learners' exposure to target language is limited to classroom environment.

2.3.2. ARCS Model of Motivational Design

ARCS is a motivational model which is resorted by instructional designers to understand major impacts affecting learner motivation, determine and solve related problems (Keller, 1987). The modified and final version of ARCS model includes four main categories as attention, relevance, confidence and satisfaction respectively. According to Keller (2000), each dimension requires specific strategies while

integrating them into the lesson plan. He states that learners need to gain and sustain attention during the lesson by maintaining their curiosity towards the learning materials. Secondly, learning materials need to mean something for learners. In other words, learners need to make a connection between the target information and their interest, previous experiences and aims. Thirdly, when the materials are achievable for learners- not too easy or not too difficult-, they build a confidence for success. Learners are needed to make feel that they can achieve their goals and expected behaviors with their own abilities and efforts. Lastly, satisfaction is needed for reaching the success or having the learning experience. Students need to feel pleased for being a part of that learning process, by being treated fairly, praised, getting promoted or high grades etc. The aforementioned four dimensions are necessary to take into consideration before and while designing an instruction and prepare strategies accordingly in order to motivate learners and make that motivation last throughout the course (Keller, 2010).

The ARCS model of motivational design can be easily applied as a framework in both designing and increasing the quality of motivation in various fields (Small, 1997). Regarding ARCS model's principles, the pilot study of Li, Chen and Vorvoreanu (2014) sheds light to some important issues leading to motivation decrease while learning English with AR. They argue that when the materials cannot make a connection with learners' experiences and interests, when they are too difficult to achieve or when learners encounter technical problems, relevance, confidence, satisfaction and attention problems occur.

2.3.2.1. ARCS Model of Motivational Design in EFL

To design instructional materials and evaluate the rate of motivation occur in that classroom, ARCS Motivational model design and Instructional Materials Motivation Survey (IMMS) consisting of Keller's (1987) motivational principles can be used as M. Johnson (2012) did in his pilot study to make an inference about learners' motivation after they were exposed to two distinct instructional materials in an EFL

setting. Another study conducted by Kurt and Kecik (2017) reveals promising findings which can be inferred that motivation of learners can be boosted when ARCS motivational design model is adapted and integrated in EFL classrooms. After adapting ten steps of ARCS motivational design model in an elementary EFL classroom curriculum, Chiang et al. (2014) found similar findings which prove that ARCS principles could function as a guide for improving motivation. By designing the e-book which is grounded in ARCS strategies and evaluating the motivational effect of multimedia e-book on English as a second language (ESL) learners, Annamalai (2016) reached to the conclusion that learners became more motivated to read and their reading comprehension improved. ARCS motivation model was also found profound when it was implemented in an empirical study focusing on game-based learning while learning English vocabulary (T.-T. Wu, 2018).

2.4. English for Specific Purposes (ESP)

English language learners' needs for communication differ from each other based on their goals, interests, background, current and prospective careers. To learn English by taking the same course with everyone else in the world does not meet the learners' expectations and their future career requirements. In that case, English for Specific Purpose (ESP) shows up as a subcomponent of English Language Teaching (ELT) by bringing along its own approaches for curriculum development, material design, pedagogy, testing and research (Nunan, 2004). ESP aims to construct knowledge related to a particular vocation, occupation or domain upon the knowledge acquired with English for General Purposes (EGP) to meet learners' specific needs with unique methodologies developed for each and every situation (Al-Humaidi, 2017). One of the major differences between EGP and ESP is that main concern is on the context rather than teaching grammar or other language structures in ESP (Rahman, 2015). Dudley-Evans (1998) suggests some characteristics regarding ESP as absolute and variable. For the absolute ones, he comes up with the definition that learners' needs are taken into consideration while designing, methodologies and activities are chosen according to the target disciplines and ESP components are integrated into these activities

regarding the grammar, lexis, genre, discourse, study skills and register. For variable ones, he states that ESP might include specific disciplines and its methodologies might differ from EGP's methodologies. Although target learner profile is adult learners with high level of proficiency in English over intermediate level, Dudley-Evans (1998) emphasizes that under certain circumstances, even false beginners and secondary school students can benefit from ESP courses. Nekrasova-Beker, Becker and Sharpe (2019) emphasize the need of ESP teaching in engineering by stating that getting familiar with concepts in the field is not enough, a specialized language which enables learners to express themselves by using technical and field related language is highly necessary.

Rahman (2015) demonstrates the historical development of ESP by saying that its blooming point goes back to 1945 which is the year associated with the scientific and technological developments, increased number of international students in English speaking countries, widespread use of English in science, technology and business areas, and it has gained much attention since 1960s. The things which make ESP appealing recently in tertiary level are the English Medium of Instruction (EMI), rising attention for English as a Lingua Franca (ELF) and the widespread use of technology in language learning (Sarre & Whyte, 2017). When EGP and ESP are compared, it is seen that ESP has got more challenges (Fălăuș, 2017). In his study, Fălăuș (2017) mentions the course design and the role of teacher as current challenges of ESP because the course needs to include authentic materials, purpose-related orientation and active learners, and teachers have lots of responsibilities. He gives details about the challenges from teachers' perspectives that teachers are called ESP practitioners and they are responsible for providing materials, designing courses, collaborating with specialists in the target field, keeping themselves up-to-date with the advances in their field, and finally testing and evaluating the learning process.

2.4.1. Vocabulary Learning

Vocabulary has been considered the core component of a language by many researchers. Harmer (1991) uses the metaphor of a skeleton for the language structures and he likens the vocabulary to the responsible part supplying the vital organs and flesh of the body. Second language learners find the vocabulary learning essential in that limited vocabulary interferes with the communication (Alquahtani, 2015). As McCarthy (1990) stated that without adequate vocabulary to express meanings, mastered grammar or other four language skills like listening cannot be enough to perform a meaningful communication.

By regarding the research conducted so far, it can be concluded that vocabulary learning might be inefficient in many EFL situations (Siyanova-chanturia & Webb, 2017). Furthermore, it is not always possible to achieve all the goals of formal vocabulary instruction although the lesson is well designed considering the current pedagogical principles (Takac, 2008). Nation and Waring (1997) point out that vocabulary learning in EFL needs to be given much attention when compared to ESL because although they study English for many years, EFL learners' vocabulary size is much less than 5000 words, which makes it impossible to close the gap between their and native speakers' vocabulary size. However, ESL learners can expand their vocabulary size as much as those of native speakers'.

When it comes to vocabulary learning or teaching strategies, it can be said that there is not the best one which satisfies every learner or teacher. Shen (2003) suggests a model guide called 2C-5R regarding vocabulary teaching strategies by pointing out that the more strategies are used, the more benefits can be obtained. 2C stands for contextual and consolidating dimensions. Clarke and Nation (1980) argue that coming across vocabulary inside a native-like or authentic context such as a reading text or listening activity can be helpful for learners to understand the word's meaning and keep it in the long-term memory. However, learning the words based on guessing from a context is controversial because there are some studies which criticize guessing for

being a slow process and taking time (Carter & McCarthy, 1998), and leading inaccurate inferences (Mondria, 2003; Kelly, 1990). Encountering the target words in a context and consolidate them by making use of dictionaries, word lists, gloss, flashcards, games and memorization with association which is controversial in literature might be useful. Shen (2003) elaborates the 5R dimensions which stand for receiving, recognizing, retaining, retrieving, and recycling respectively. Suberviola and Varela Méndez (2002) find the traditional way of teaching vocabulary by giving learners a random word list, translating them and making them be learnt by heart unsuccessful and they emphasize the importance of strategies and mental lexicon which deals with grouping the words to help words settle in the mind.

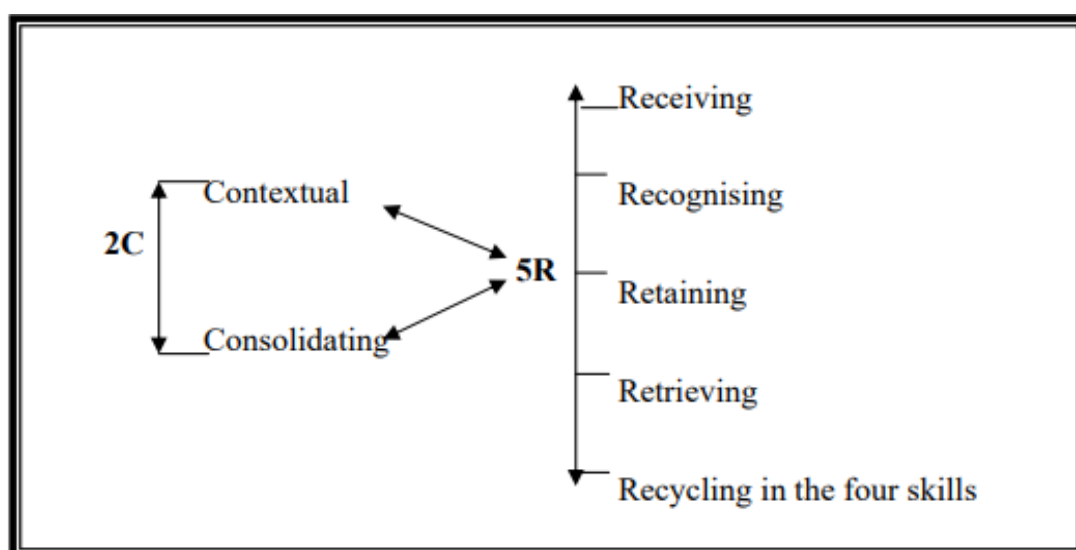


Figure 2.1. Reciprocal co-ordinate model of vocabulary teaching and learning

Therefore, rather than sticking into one strategy, learners benefit more if they learn vocabulary regarding 2C-5R modelling as shown in figure 2.1.

CHAPTER 3

METHODOLOGY

3.1. Introduction

This chapter presents the research questions, design of the study, participants who are involved in the study, data collection procedures, development of instructional materials, data collection instruments, and data analysis procedures.

3.2. Research Questions

The current study tries to answer the following research question:

1) What is the effect of ARCS model based instructional materials enhanced with augmented reality on ESP students' English vocabulary learning?

- Is there a statistically significant difference in vocabulary achievement tests between the experimental group which gets mobile AR treatment and the control group?
- H_{10} : There is no statistically significant difference in vocabulary achievement tests between the experimental group which gets mobile AR treatment and the control group.
- H_{1A} : There is a statistically significant difference in vocabulary achievement tests between the experimental group which gets mobile AR treatment and the control group.

2) What is the effect of ARCS model based instructional materials enhanced with augmented reality on ESP students' motivation?

- Is there a statistically significant difference between experimental group's and control group's motivation?

- H2₀: There is no statistically significant difference between experimental group's and control group's motivation.
- H2_A: There is a statistically significant difference between experimental group's and control group's motivation

3) What are the students' perceptions in terms of learning environment enhanced with augmented reality for ESP vocabulary learning?

3.3. Research Design

In this study, a mixed method approach was employed. The mixed-method study is defined as the one which is conducted for the resorting both qualitative and quantitative data collection methods in a single research (Creswell, 1999). One of the reasons to choose the mixed method is the benefits of methodological triangulation which is categorized as simultaneous or sequential. This study adopts sequential triangulation as it is described in the research of Morse (1991) because there is a deductive approach starting with quantitative data collection and after that, qualitative stage comes subsequently to consolidate the findings or to reveal the unanticipated findings. Furthermore, qualitative data after quantitative data analysis stage can have an active role for interpreting, clarifying, describing, and validating previously obtained quantitative results (Johnson, R. Burke. Onwuegbuzie, J. Anthony. & Turner, 2007).

In the table 3.1. procedures which applied to both groups were presented.

Table 3.1. *Research Design*

	Quantitative Part 1			Quantitative Part 2	Qualitative Part
Groups	Vocabulary Achievement Pre-test	Treatment (6 weeks)	Vocabulary Achievement Post-test	Motivation Survey	Semi- structured Interview
Experimental	✓	✓	✓	✓	✓
Control	✓	---	✓	✓	---

To answer the first research question, the quantitative data was collected through a quasi-experimental research design. The reason of applying quasi-experimental design is that the researcher did not have the chance to do random sampling (Gribbons & Herman, 1997) due to course schedule and programming at the university. Two classrooms were categorized as experimental and control groups and they were asked to have pre-achievement test before the intervention and post-achievement test after the intervention. The main purpose of this quantitative part was to find out whether there was a significant difference on the ESP vocabulary achievement between the control group who had undergone traditional way of learning and the experimental group who had experienced a learning environment in which ARCS model instructional materials were enhanced with augmented reality.

To answer the second research question, another quantitative data was collected after the treatment process was completed. Students in the both experimental and control group were given a motivation test investigating their views on the 6-week learning experience. Motivation of each group was compared regarding their experiences in learning environments including different instructional methods.

To answer the third research question, after the quantitative data collection was completed, students in the experimental group were interviewed with semi-structured questions. Some of the students in the experimental group were chosen randomly for the interview.

3.4. Setting

This study took place at School of Foreign Languages, Gazi University. Department of Basic Foreign Languages offers English teaching for two semesters for a year to students who need to master their English proficiency before they start their majors in their departments. A placement test is done at the beginning of the first semester and students who are eligible start their majors directly and others are placed to classrooms in the Department of Basic Foreign Languages according to their proficiency level as A1, A2 and B1. In the second term, B1 students can pass to their departmental studies if they achieve their final tests. A1 and A2 classrooms are mixed and start to take the same education together. In the second term, classrooms are divided on the condition that their average grade is 70 out of 100, so it can be said that classrooms are homogeneous, and their levels are close to each other. They have 24 hours of lectures in a week. Lectures are integrated. In other words, lectures are not split up in terms of language skills. ESP lectures were given for 4 years and now this year it was given as EAP (English for Academic Purposes). However, for this study, the researcher continued ESP lectures for 6 weeks. To be eligible for studying in their departments, students need to attend 85% of the lessons and get a grade over 60/100 at the end of the term.

3.5. Participants

Participants were EFL students who study at the Department of Basic Foreign Languages. Their level was upper intermediate. Their ages were between 18 and 21. Their departments were all engineering, but none of them started their majors. The ones who managed to get the target grade specified by the school at the end of the second semester had the right to continue their education in their departments or else

they had to repeat the English education for one more year. The number of the students participated in this study was 67 in total. 42 of them were male and 25 of them were female as shown in the table 3.2

Table 3.2. *Participants According to Their Gender*

Participants	<i>Female</i>	<i>Male</i>	<i>Total</i>
Experimental	15	20	35
Control	10	22	32

When their majors are considered, it is seen that there were 19 mechanical engineering, 18 civil engineering, 10 industrial engineering, 7 computer, 7 chemical engineering, and 6 electrical and electronics engineering students. 35 students were involved in the experimental group, and 32 students were involved in the control group.

Table 3.3. *Participants According to Their Majors*

Majors	<i>Number of Participants</i>
Mechanical Engineering	19
Civil Engineering	18
Industrial Engineering	10
Computer Engineering	7
Chemical Engineering	7
Electrical and Electronics Engineering	6

Participants majors differ from each other, but they have some common lectures when they become freshman. Therefore, it was possible for them to learn the same engineering vocabulary together.

3.6. Instruments

Vocabulary achievement tests as a pre-test and post-test, and a motivational survey were applied to gather quantitative data for this study. After that, a semi-structured interview consisting of six questions was conducted to get qualitative data.

3.6.1. Vocabulary Achievement Tests

Vocabulary achievement test was prepared by the researcher who is an English language teacher and has experience of teaching EGP for eight years and ESP for four years. While generating the test, an engineer and two language experts except the researcher were consulted. The modifications and changes were made according to their consultation. The tests include 36 fill-in the blanks questions. All the words were taken from the course material and six of them were covered every week for six weeks (Appendix A).

3.6.2. Instructional Materials Motivation Survey

An adapted version of “Instructional Materials Motivation Survey” (IMMS) developed by J. M. Keller was used in this study. The original survey includes 36 items generated in terms of 4 distinctive factors; attention, relevance, confidence and satisfaction. However, after the translation from English to Turkish, Kutu and Sözbilir (2011) excluded some items, so in their Turkish version IMMS there are 24 items and there are two factors as attention-relevance and confidence-satisfaction. The items consist of 5-point Likert-scale. The statement “I completely agree” counts the score of 5 and the statement “I completely disagree” counts the score of 1. Item number 3., 12., 14., 16. and 18. need to be reversed for the calculation because they are negatively stated. Items listed from number 1 to number 11 are related to attention-relevance factor. Items listed from 12 to 24 are related to confidence-satisfaction factor. The original survey’s reliability coefficient (Cronbach Alpha) is 0.96. The adapted version presented that the reliability coefficient was worked out as 0.83 for the survey with 24 items, 0.79 for attention-relevance part and 0.68 for confidence-satisfaction part. Upon doing analysis on the data, Kutu and Sozbilir (2011) revealed that this Turkish version

of IMMS was valid and reliable to apply and it can be used to examine the effects of instructional materials on college learners' motivation (Appendix B).

3.6.3. Student Interviews

Semi-structured open-ended questions were developed to analysis the learners' experiences after they went through the treatment process. Ten learners in the experimental group were randomly chosen for the interview and recording. The questions were asked to come up with ideas about their perceptions of advantages and disadvantages of the learning environment and the learning materials, challenges of the instruction, self-evaluation of their success and motivation and recommendation for prospective modifications (Appendix C). In the table 3.4. students' profiles regarding their gender, majors and achievement level are presented.

Table 3.4. *Student Profile in the Interview Process*

Students	Gender	Major	Achievement
Interviewee 1	Female	Chemical Eng.	Low
Interviewee 2	Female	Civil Eng.	High
Interviewee 3	Male	Mechanical Eng.	Medium
Interviewee 4	Male	Mechanical Eng.	Low
Interviewee 5	Male	Computer Eng.	High
Interviewee 6	Female	Industrial Eng.	High
Interviewee 7	Male	Civil Eng.	Medium
Interviewee 8	Female	Chemical Eng.	Medium
Interviewee 9	Male	Mechanical Eng.	Medium
Interviewee 10	Male	Electrical Eng.	High

During the development of questions process, two colleagues were consulted, and the questions were altered or modified according to their constructive feedback. To avoid any misunderstanding, a high-quality voice recorder was used while students were answering the questions, and the recordings were listened several times for the accurate transcribing. For the coding process, two colleagues who had experience at qualitative studies and the researcher worked separately to analyze and form the

themes. Then, they gathered to share ideas to complete the qualitative data analysis and reach the final version of the codes.

3.7. Procedures of the Study

An informal pilot study was conducted in the 2018-2019 Fall term for 4 weeks to get a general idea of learners' attitudes and decide on the most usable mobile application. In this pilot study there were 16 EFL students. For four weeks, different mobile augmented reality applications were tried while learning EGP vocabulary. These trials were fruitful because some of them failed to work during intervention or some of them were removed from play store markets. The ready-made applications had some handicaps, so the researcher decided to use a customized mobile augmented reality application which was developed specifically for this study. While developing the new application, learners' feedbacks were taken into consideration. The mobile augmented reality application called Buket AR was designed and developed under the cooperation of an educational technology specialist and a language field expert. The foundation of the application was established by using an augmented reality software development kit (SDK) called Vuforia which was founded on the Unity game motor and developed by the firm PTC. 3D and animated materials which were prepared in the 3D design application called Blender and had fbx extensions were integrated into the foundation form of the application. Besides 3D materials, videos were integrated into the application when they were needed.

A previous study in which reflections of students at Gazi University for ESP courses and an evaluation of their needs regarding their experiences indicated that there was a need to improve the quality of ESP vocabulary, curriculum and course materials (Coşaner & Pakkan, 2014). Therefore, materials used in this study were developed by considering the students' needs.

The main study was conducted in the 2018-2019 Spring term for 6 weeks. The same instructor gave the lecture to both the experimental and the control group. Learners were informed about the coming process and their permission to participate in the

study was obtained with a signed form. It was said that their information would be kept confidential, and all the students in those classes volunteered to join. After the consent forms, students were given the pre-achievement test. Before starting to teach, the mobile augmented reality application was introduced to students by demonstrating how to download the application and how to navigate it. Learners were made acquainted with the new technology before its implementation as a teaching instrument. Each week, printed materials which were adapted from the Engineering Student's Book written by Peter Astley and Lewis Lansford and published by Oxford University Press (2013) were delivered to students. In each printed material, there was a reading text consisting the related context for the target 6 engineering words. Although students' majors were diverse, the content provided was shared by all of them in that it was the fundamental of engineering.

While preparing the instructional design, ARCS Motivational Design methods were adopted. The lesson plans of the courses were designed regarding the ARCS model ten-step design process by Keller (2000).

1. In the first step, there is an inquiry about the course components such as course description, rationale, learning setting and instructor information.
2. In the second step, essential information about audiences' background information about their attitudes towards school or course and their skill levels is gathered.
3. In the third step, audience is analyzed to identify their motivational level.
4. In the fourth step, existing materials are analyzed. The pros and cons are weighed. Possible benefits and drawbacks are determined.
5. In the fifth step, objectives and assessments are listed.
6. In the sixth step, potential tactics are listed with the help of brainstorming for each motivational category.
7. In the seventh step, design tactics are selected regarding the constraints such as time, resources, etc.

8. In the eighth step, the selected tactics are integrated into motivational design.

9. In the ninth step, materials are selected and developed.

10. In the tenth step, finally the motivational design is evaluated by getting students' reactions, determining their satisfaction level and revising accordingly if necessary.

The course design was framed and developed with regards to ARCS model of motivational design. The design procedures to follow are explained in table 3.5, 3.6., 3.7 and 3.8 in terms of the categories of attention, relevance, confidence and satisfaction respectively.

Table 3.5. *Attention Related Design*

Main Category	Sub-Category	Course Design
Attention	Perceptual Arousal	Warm-up questions make learners wonder the topic and ready for the coming context. After finishing reading the text by performing skimming and scanning techniques, students are supposed to use their mobile phones to detect the target words, which captures their interest.
	Inquiry Arousal	Students do not know what they are going to see on their mobile phone screens. It arouses their curiosity. They'd like to see the following media immediately after they see the first one.
	Variability	To keep the attention steady, a variety of sources are used. The mobile augmented reality application presents diverse multimedia such as 3D or videos.

Table 3.6. *Relevance Related Design*

Relevance	Goal Orientation	The words are all related to their majors. Students are aware of the fact that they will come across the chosen words and contexts during their departmental studies or careers. The materials meet their needs.
	Motive Matching	Students are free to work with their peers or individually. Although using mobile phone is recommended after the reading part, they can choose to use it before reading. They also have the chance to benefit from it after classes.
	Familiarity	Students are not familiar with most of the target words because they haven't started their majors yet. However, the multimedia shown in the application enables students to form schemata for the new content. The instructor can prompt questions to activate learners to brainstorm to make an association. Thus, learners can make a connection between the new words and their previous knowledge or experiences. They can fill in the-evaluation check list by writing their associations and drawing the pictures. The pictures can be the same as the one in the 3D model or they can draw a new one which will help store the word in the long-term memory.

Table 3.7. *Confidence Related Design*

Confidence	Learning Requirements	As a reading technique, making learners guess the words' meaning while or after reading the text might be challenging if learners fail to predict the correct meaning. Thus, demonstrating the words as 3D or in a video asserts that students gets the correct meaning, and students can feel that they learn the words with the correct meaning. Moreover, if their predictions and the meaning obtained from multimedia match, they can have a positive expectation for success.
	Learning Activities	A true-false activity and open-ended questions are given to students at the end of each reading text. There is neither grading nor competition. Students are also expected to make sentences by using the words. The aim is to enable students see their own performance and evaluate their competence themselves. By this way, they can feel competent when they see their success, or they can compensate for their failures by studying more.
	Success Attributions	Students can access the materials whenever they want and wherever they are. It's students' responsibility to utilize the words. When they get difficulty at remembering a word, they can use the mobile application easily to retrieve the meaning. The vocabulary quiz is prepared according to their

		level of English proficiency, so it is not too difficult to achieve. If they succeed or fail, it is because of their efforts.
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Table 3.8. *Satisfaction Related Design*

Satisfaction	Self-Reinforcement	Students are given the self-evaluation check list and they evaluate their own performance. Also, the enjoyment and possible accomplishments encourage students to pay more attention on the task, which reinforces intrinsic motivation.
	Extrinsic Rewards	The active participation and effort of students are praised. There is no extra grade or prize. Students know that there is a quiz grade for active participation as it is in all lessons at the department. Knowing the core vocabulary before they start their major studies at their own departments can extrinsically motivate students because they believe that these words will help them get higher grades in engineering classes.
	Equity	The teaching is based on fair activities. All students in the experimental group have the mobile application. They all take the same pre and post- achievement tests.

Table 3.9. *Self-evaluation Check List Sample*

Self-Evaluation Check List / Week 1				
Target Words	Did I get the meaning?	How does the word associate with my experience?	My sample sentence	My drawing that will remind me of the word
1) force				
2) tension				
3) deflection				
4) compression				
5) shear				
6) gauge				

Moreover, students were given a self-evaluation check-list as presented in the table 3.9.

In the lesson plan, the lecture is divided into three stages as pre-reading, while reading and post reading. As vocabulary is the study's main focus, it is given in a reading context and more concentration is given to while-reading process in which learners encounter the new vocabulary. Rather than being presented in a list in the pre-reading stage, the target words were delivered in the text and students were expected to acquire the meaning by predicting after they performed skimming and scanning techniques. Some of the words include challenging processes which are difficult to visualize in the mind. Therefore, students were asked to use their mobile phones to check whether their predictions match the multimedia shown on the mobile phone. With the help of augmented reality, students could interact with the 3D objects. They had the chance

to see the movement of the objects and the changes on their shapes when they moved, which was not possible with only texts or pictures. In the figure 3.1. and 3.2. the visual for the target words were demonstrated.

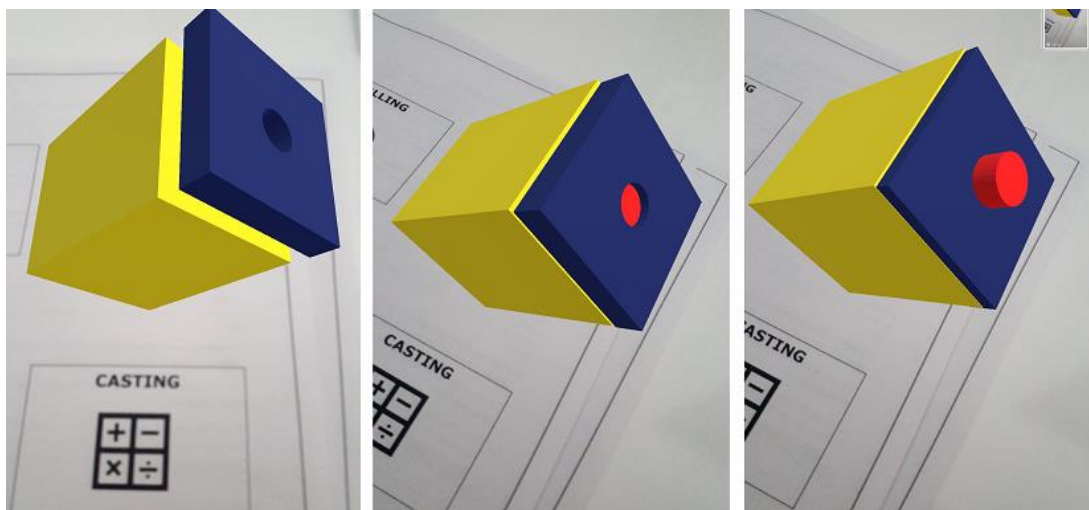


Figure 3.1. Buket AR application sample

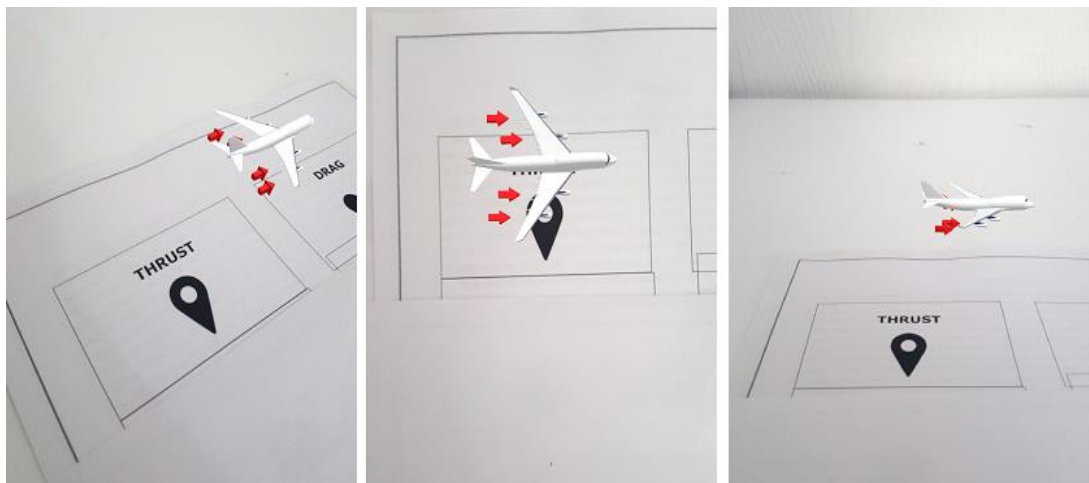


Figure 3.2. Buket AR application sample2

In the post-reading stage, they were asked to do the activities involving the target vocabulary such as fill-in the blanks activity. Students were given the self-evaluation check list at the end of each week. They evaluated their own learning and progress

that they had made. They wrote the target vocabulary, put ticks if they got the meaning, wrote some clues which would help them make an association with their experiences or previous knowledge, wrote a sample sentence and drew a simple picture. This was the procedure for the experimental group. The control group had the same reading text, but ARCS motivation design was not adopted in their lessons, they did not have the self-evaluation check list and they did not have the mobile augmented reality application, either (Appendix G). They also learned the same target words from the same instructor.

At the end of the 6-week treatment, students in both experimental and control group were asked to take the post-achievement test which was identical to pre-achievement test. After that, students in the experimental group took the IMMS survey. Finally, 10 students from the experimental group were interviewed about their perceptions for this learning experience.

3.8. Data Analysis

In this mixed method study, the data from the quantitative part was analyzed by using IBM SPSS 22 (Statistical Package for Social Sciences) program. The mean values (M) and standard deviations (SD) of the data for each test were computed via this program. To compare the achievement scores gained from vocabulary achievement tests and motivational scores of the students gained from the IMMS survey, inferential statistics were used. Independent sample t-test was used to find out whether there was a significant difference between the control and experimental groups' vocabulary achievement scores. It was also used for the same purpose with students' motivational scores. While conducting independent sample t-test, the level of significance was set to .05. Independent sample t-test is used in parametric studies, so the assumptions were checked whether the data was appropriate for using this t-test. Levene's Test for equality of variances was conducted and other individual observations were done to test the normality assumptions.

In the qualitative process, the data was gathered from ten students from experimental group via recorded interviews. Then the interviews were transcribed for the content analysis. Students answered the questions in their mother tongue. Therefore, their answers were translated into English. Two language instructors checked the translation. The analysis of the data was carried out through content analysis (Miles & Huberman, 1994). After the open coding process which enabled jotting down the headlines and notes while reading the transcriptions, the codes were divided into categories (Burnard, 1991). The main and sub-themes were identified and finally they were interpreted.

CHAPTER 4

RESULTS

4.1. Introduction

This chapter reveals the analysis of the quantitative data obtained from vocabulary achievement test applied before and after the treatment, and the quantitative data gathered from IMMS motivational survey and qualitative findings got from semi-structured interviews of 10 students in the experimental group.

4.2. Results of the Vocabulary Achievement Tests

Before the treatment, a pre-vocabulary achievement test was administered to check whether there was a significant difference between experimental and control groups' proficiency levels. The number of participants in the experimental group was 35 initially, but due to the cheating suspect and submitting the test problems 27 students' tests were taken into consideration. The number of students in control group stay the same as 32. The descriptive statistics of the results of pre-vocabulary achievement test are presented in the table 4.1. It is seen that the students' test scores in the experimental group ($M = 7.77$, $SD = 4.06$) are higher than the students' test scores in the control group ($M = 5.96$, $SD = 3.36$). However, independent sample t-test is needed to verify whether this score difference between two groups is significant or not.

Table 4.1. *Descriptive Statistics of Pre-Vocabulary Achievement Test*

Groups	N	Mean	Std. Deviation	Std. Error Mean
Experimental	27	7.7778	4.06990	.78325
Control	32	5.9688	3.36475	.59481

Before the t-test, the normality check for distributions was conducted. In the table 4.2, Kolmogorov- Smirnov test revealed that the distributions were normal ($p > .05$) for the experimental and control groups' pre-vocabulary achievement scores.

Table 4.2. *Normality Test for Pre-Achievement Vocabulary Test*

Groups	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Experimental	.160	27	.074	.942	27	.135
Control	.100	32	.200	.974	32	.630

After that, Levene's test for equality for variance was administered. It indicated that the data had an $F = 2.036$ and a significance of $p = .159$. as shown in the table 4.3. Regarding these results, it was concluded that there was not a significant difference in the variances of two groups' scores and variances could be assumed equal while performing the independent sample t-test. After these preliminary steps were taken, independent sample t-test was conducted and its findings revealed that there was no significant difference between the experimental and control group $t(57) = 1.869$, $p = 0.67 \geq .05$. All in all, it can be inferred that these two groups' pre-achievement test scores for ESP vocabulary do not differ, and any significant difference which might come out at the end of the treatment can be deemed to the contributions of ARCS model based instructional materials enhanced with augmented reality. (table 4.3.)

Table 4.3. *Independent Samples t-test for the Pre-Achievement Vocabulary Test*

	Levene's Test for t-test for Equality of Means Equality of Variances				
	F	Sig.	t	df	Sig. (2-tailed)
Equal variances assumed	2.036	.159	1.869	57	.067

To find out whether there was a significant difference between control and experimental groups' post-achievement test scores after 6-week treatment, an independent sample t-test was applied. The descriptive statistics of post-achievement scores of experimental and control groups are presented in the table 4.4. The experimental group had a sample size of 27, a mean score (M) of 22.37, a standard deviation (SD) of 7.338 and a standard error of the mean (SEM) of 1.412. The control group had a sample size of 32, a mean score (M) of 14.9, a standard deviation (SD) of 7.6, and a standard error of the mean of 1.34. The experimental groups' post-achievement mean scores were higher than the control groups. To figure out whether this difference was significant or not, independent sample t-test was needed.

Table 4.4. *Descriptive Statistics of Post-Vocabulary Achievement Test*

Groups	N	Mean	Std. Deviation	Std. Error Mean
Experimental	27	22.3704	7.33877	1.41235
Control	32	14.9063	7.60034	1.34356

Before the independent samples t-test application, the normality check was done to test whether the distributions were normal. Kolmogorov- Smirnov test. Table 4.5 presented that the scores were normally distributed ($p > .05$).

Table 4.5. Normality Test for Post-Achievement Vocabulary Test

Groups	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Experimental	.110	27	.200	.974	27	.702
Control	.071	32	.200	.970	32	.507

Then the data was analyzed to check the equality of variances by using Levene's test. The table 4.6 shows that the data had an $F = .078$ and a significance of $p = .781 > .050$. According to this result, variances were assumed to be equal.

Finally, the assumptions were made and the independent sample t-test to examine the null hypothesis for the first research question was done. The null hypothesis (H_{10}) argued that there was no significant difference between the vocabulary achievement scores of experimental group and control group. The independent t-test (table 4.6) revealed that the mean difference was statistically different, so the null hypothesis (H_{10}) was rejected, $t(57) = 3.818$, $\eta^2 = 0.999$, $p = .000 < .05$.

Table 4.6. Independent Samples t-test for the Post-Achievement Vocabulary Test

	Levene's Test for Equality of Variances		t-test for Equality of Means		
	F	Sig.	t	df	Sig. (2-tailed)
Equal variances assumed	.078	.781	3.818	57	.000

Regarding the statistical results of the independent sample t-test, it can be concluded that the learning environment in which ARCS based instructional materials enhanced with AR are applied has a large effect size on the post-achievement vocabulary test results and it explains 99% of the total variance.

4.3. Results of the Motivation Survey

At the end of 6-week treatment, IMMS survey was delivered to both experimental and control groups to explore the effect of instruction on their motivation during their learning process. There were two types of analysis for the motivation. The motivation survey consisted of two sub factors named as attention-relevance and confidence-satisfaction. Initially the motivation survey was dealt with as a whole. Then its factors were analyzed separately.

Before applying the independent sample t-test, it was checked that whether the data met the assumptions. First of all, the data was examined to figure out if it was distributed normally or not. To achieve normally distributed data, 2 students' scores from experimental group and 2 students' scores from the control group were excluded since those were outliers. In terms of motivation, after the outliers were eliminated mean scores of students were compared between experimental and control groups

again. The treatment group had a sample size of 33, a mean score of 4.287, a standard deviation of .556 and standard error mean of .096, whereas the control group had a sample size of 30, a mean score of 3.166, a standard deviation of .584 and a standard error mean of .106 as it is shown in table 4. 7.

Table 4.7. *Descriptive Statistics Motivation Survey as a Whole*

Groups	N	Mean	Std. Deviation	Std. Error Mean
Experimental	33	4.2879	.55682	.09693
Control	30	3.1667	.58426	.10667

Kolmogorov-Smirnov test was taken into consideration and it was seen that the data was normally distributed after the exclusion of outliers.

Table 4.8. *Normality Test for Motivation Survey as a Whole*

Groups	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Experimental	.109	33	.200	.936	33	.051
Control	.088	30	.200	.982	30	.886

After that, it was checked whether equal variances existed or not by examining each group's variances. Levene's test for homogeneity of variance was adopted for the statistical test of homogeneity. The table 4.9. shows that the data had an $F = .019$ and a significance of $p = .891 > .050$. Therefore, variances were assumed equal. After the preliminary analysis were done, independent sample t-test was applied to check the second research question. The null hypothesis argued that there was no significant difference between the control group and experimental group in terms of motivation after the treatment. The independent t-test (table 4.9.) revealed that the mean

difference of motivations of two groups was statistically different, so the null hypothesis was rejected, $t(61) = 7.797$, $p = .000 < .05$.

Table 4.9. *Independent Samples t-test for Motivation Survey as a Whole*

	Levene's Test for Equality of Variances		t-test for Equality of Means		
	F	Sig.	t	df	Sig. (2-tailed)
Equal variances assumed	.019	.891	7.797	61	.000

A further analysis was done to check whether there was a significant difference between the mean scores of experimental group and control group related to sub factors of motivation. The first sub factor to analyze was Attention-Relevance dimension. The descriptive statistics in the table 4.10 indicated that the attention-relevance mean scores were higher in favor of experimental group (Experimental M= 4.4490; Control M= 3.3121).

Table 4.10. *Descriptive Statistics of Attention-Relevance Dimension*

Groups	N	Mean	Std. Deviation	Std. Error Mean
Experimental	33	4.4490	.48048	.08364
Control	30	3.3121	.62195	.11355

To test whether the prerequisites were met, the data of attention-relevance dimension was analyzed in terms of normal distribution initially. According to results of Kolmogorov Smirnov test shown in the table 4.11, normality assumption was violated for neither control nor experimental group ($p > .050$).

Table 4.11. *Normality Test for Attention-Relevance Dimension*

Groups	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Experimental	.126	33	.200	.916	33	.014
Control	.094	30	.200	.977	30	.737

After the normality test, both groups' variances were examined to check if they were equal. Levene's test for equality of variance in the table 4.12 demonstrated that the data had an $F = 1.732$ and a significance of $p = .193 > .050$. It was determined that the variances could be assumed equal on the light of this statistics. Finally, the independent sample t-test was conducted, and it revealed that the difference between the attention-relevance sub factor mean scores of experimental group and control group was statistically significant, $t(61) = 8.161$ $p = .000 < .050$ as shown in table 4.12. The mean scores of attention-relevance scores in the experimental group were higher than the control group.

Table 4.12. *Independent Samples t-test for Attention-Relevance Dimension*

	Levene's Test for		t-test for Equality of Means		
	Equality of Variances				
	F	Sig.	t	df	Sig. (2-tailed)
Equal variances assumed	1.732	.193	8.161	61	.000

The second sub factor was confidence-satisfaction dimension. The descriptive statistics in the table 4.13, demonstrates that confidence-satisfaction mean scores were

higher in favor of experimental group (Experimental M= 4.1515, SD= .66017; Control M= 3.0436, SD =.66316).

Table 4.13. *Descriptive Statistics of Confidence- Satisfaction Dimension*

Groups	N	Mean	Std. Deviation	Std. Error Mean
Experimental	33	4.1515	.66017	.11492
Control	30	3.0436	.66316	.12108

To determine whether the confidence-satisfaction mean scores of both groups were normally distributed, Kolmogorov-Smirnov test was adopted as shown in the table 4.14. Normality assumption was not violated $p > .050$. Therefore, it can be said that the confidence-satisfaction mean scores of both experimental and control group were normally distributed.

Table 4.14. *Normality Test for Confidence-Satisfaction Dimension*

Groups	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Experimental	.099	33	.200	.941	33	.073
Control	.110	30	.200	.963	30	.376

Test of Homogeneity for confidence-satisfaction mean scores represented the results from the Levene's Test for equality of variance. It was determined that the data had an $F = .017$ and a significance of $p = .897$ in the table 4.15. On the light of these results, it was revealed that there was not a significant difference in the variances of the two groups at the $\alpha = 0.05$ level. Therefore, variances could be assumed to be equal, which supported the assumptions to conduct the independent sample t-test. The last step was to implement the independent sample t-test after checking the preliminary

requirements. As the descriptive statistics declared, confidence-satisfaction mean scores of the experimental group outweighed the control group. However, whether the mean score difference between them was statistically significant or not was needed to be analyzed. In the table 4.15, the independent sample t-test result reported that the difference between confidence-satisfaction sub factor mean scores of experimental group and control group was statistically significant, $t(61) = 6.638$, $p = .000 < .050$

Table 4.15. *Independent Samples t-test for Confidence-Satisfaction Dimension*

	Levene's Test for		t-test for Equality of Means		
	Equality of Variances				
	F	Sig.	t	df	Sig. (2-tailed)
Equal variances assumed	.017	.897	6.638	61	.000

Regarding the results declared above, it is possible to assume that after the treatment, the changes in terms of ESP vocabulary achievement and higher scores in terms of motivation in the experimental group might be deemed as the existence of ARCS based instructional design enhanced with augmented reality.

4.4. Results of the Student Interviews

Students' perceptions about their experience gathered via interviews are grouped and presented with their frequency in the table 4.16.

Table 4.16. *Results of Student Interviews*

Strengths						Weaknesses			
Instructional Methods				Instructional Materials		Technological Constraints		Content	
Achievement	f	Motivation	f	Utility	f		f		f
→permanent learning	7	→attention	8	→operated without internet	7	→weekly frequent update	2	→getting difficulty at identifying the visuals	1
→meaningful learning	5	→satisfaction	6	→easy to use	5	→mobile phone freeze	1		
		→confidence	3	→time-saving	2	→being operated only in Android	3		
				→fast	1	→other distracting mobile phone features	1		
				→fun	3				

The qualitative data was gathered with the help of semi-structured interviews conducted with ten students in the experimental group who experienced ESP vocabulary in a learning environment providing ARCS based instructional design enhanced with augmented reality. Through content analysis, the data were analyzed

on the basis of strengths and weaknesses, and students' feedback to improvise the instruction, and it was aimed to obtain students' perceptions on the use of augmented reality while learning ESP words. There are six main questions to figure out students' opinions after experiencing a new motivational design-based classroom applying augmented reality for learning ESP vocabulary and further ideas to develop better instructional designs to improve motivation and vocabulary achievement. In this part, the data was categorized as strengths and weaknesses of the experience and further suggestions.

4.4.1. Strengths of the ARCS based instructional design enhanced with augmented reality

First of all, students who were interviewed expressed that they were highly pleased to experience the new instructional design and the new technology. They stated that they found the lessons useful and efficient. Because they are engineering students, they are open to new technologies, and coming across new technologies and getting benefit from them in a classroom environment makes them feel excited.

The first interview question asked what students thought about their experience of learning ESP vocabulary with augmented reality application. All of the students found their experience positive in general. Students' achievement level was given in parenthesis.

Interviewee 1 (Low): *"It was a very good experience for me. I believe that it helped me keep the words in my mind."*

Interviewee 2 (High): *"Well, I'm interested in technology and especially mobile technology in that I'm going to study engineering. I'm a kind of person who spends lots of time on the phone. I have already used mobile applications to contribute to my English outside the class, but I really like the integration of this. I believe that using technology in the class is very useful because it attracts our attention more than normal lessons."*

Interviewee 3 (Medium) : *“The words which we learn in this lesson will be necessary when we start our majors. We will use them when we start working, too, of course. It has been better to learn them now. I think, it has been more permanent when we learn with the help of the application. I think, I will remember most of these words next year. Well, even though their Turkish equivalence does not come to my mind, their visuals come to my mind. Thus, I’m pleased to have learnt by this way.”*

Interviewee 4 (Medium): *“I did not know that augmented reality could be available with mobile phones. I used to think that was possible with expensive items such as Google Glasses. When I learned that we were going to use our mobile phones, I felt excited, and I think it was beneficial for vocabulary learning.”*

The first question included a sub-question asking students’ opinions for the advantages of the instructional materials enhanced with augmented reality compared to traditional teaching methods. The majority of the students, 7 out of 10, mentioned the permanency effect. They believed that their ESP vocabulary would last long in their long-term memory.

Interviewee 2 (High): *“Normally, in the past we used to infer the meaning from the context or look up in a dictionary for Turkish meanings while learning words. However, I cannot keep words in my mind while learning by this way. I keep the things which I see in my mind. Words have become more permanent since there were lots of visual things in this new application.*

Interviewee 5 (Medium): *“In my opinion, learning with traditional method is not permanent. Now, we face the visuals of important words in this application. Well, how can I say, we form an interaction with those words. By turning or moving the mobile phone, we can see that what shape the movement which the term explains gives to the object. Thus, it is difficult to forget.”*

Another advantage was stated as meaningful learning. Five students mentioned that with the help of new method, they could find out the function of the word, how and where to use it, which was quite difficult by only inferring from the text or looking up a dictionary especially for engineering terms.

Interviewee 10 (High): *“Engineering words were different from daily words. For example, when I saw the word ‘turning’, I predicted that it was a word about something like turning around or changing. I couldn’t infer the exact meaning from the reading text. However, when I launched the application, I realized that it had another meaning. I wouldn’t have understood how this word was used in engineering with any other techniques because it explained how a machine gave shape to an object. Even if there had been the picture of it, I would not have inferred the meaning.”*

Interviewee 5 (Medium): *“I think, learning vocabulary is not just learning its Turkish equiveillance because we haven’t started our majors yet. If I look a term up in a dictionary, it does not mean anything to me because I haven’t heard of its Turkish equiveillance. Therefore, we have learned the words in a more comprehensible way.”*

The third advantage was declared as utility. Seven students were pleased because the application was able to work without the internet connection. For the updates, the internet was needed, but for other functions could be reached without internet. Five students found the application useful and mentioned that learning the vocabulary became easier with the help of the application. Also, it was time-saving for them because the only thing they did was to open the application and hold the mobile phone on the page. They did not need to push any button or write anything.

Interviewee 9 (Low): *“Well, since we are students, our internet quota finishes quickly. That it was an application which worked without internet was the biggest advantage because there is no WiFi at school.”*

Interviewee 8 (Medium): *"I think, using the application was rather easy. When we put the mobile phone over the word, its visual emerged immediately. We did not need to do anything else. We did not lose time to look up in a dictionary."*

Interview 10 (High): *"I like seeing the visual of the words quickly."*

The last advantage is the fun that the application provided to students. Three of the students found the application enjoyable.

Interviewee 4 (Medium): *"It was fun to use the application."*

Interviewee 6 (High): *"I enjoyed using the application."*

In the second question, students were asked to express their opinions about how the learning experience affected their achievement. All the students stated that their experience had a positive influence on their success. They believed that they would be more successful when they learned the ESP vocabulary with augmented reality.

Interviewee 3 (Medium): *"In my opinion, learning the words by this way affected my success positively because the words are visualized in my mind directly. When we learned the words in a conventional way and I did not remember their Turkish equivalents, nothing came out in my mind. However, now if you ask me their Turkish, maybe I cannot know, but when I hear the English word, I can know what it is about. I think, this is real learning. In other way, we just memorize pointlessly."*

Interviewee 6 (High): *"To be frank, I think that it affected my achievement positively because we strived for the words a lot. We saw the visuals of them and they were like real. For instance, a force was being applied to the object that we saw. When we held the mobile phone up and down the paper, we could see how the bottom part of the objects' shape changed and what happened to the upper part of it. Therefore, I think that I learned that word very well."*

The third question inquired about students' opinions for the motivational effect of the ESP vocabulary learning experience with augmented reality. Most of the students felt themselves motivated to learn ESP words by using augmented reality.

Interviewee 10 (High): *"Learning the words with this application increased my motivation. It was the part of the week that I liked most."*

Interviewee 1 (Low): *"Since I use my mobile phone a lot normally, using it in the lesson attracted my attention. Moreover, a different visual came out for each word. Frankly, I wondered what kind of a thing would appear on my mobile phone screen."*

Interviewee 4 (Medium): *"In fact I don't like studying a lot, of course, but these words will be necessary for me in the future. I'm aware of that. Moreover, I was able to see the words in the way that I will see them in the real life or else I would need to go to industrial sites or laboratories. Thus, it attracted my attention."*

Interviewee 9 (Low): *"I think weekly self-evaluation forms were beneficial. Actually, I found them boring and unnecessary at the beginning because I thought that I learned the word immediately. However, during the self-evaluating stage I noticed that I couldn't learn them thoroughly. While I was going to the dormitory on the bus, I turned on the application and looked through the words. Normally I do not look at even my vocabulary notebook actually."*

Interviewee 3 (Medium): *"In the coming weeks, we remembered most of the words when we asked the words to each other with our friends. When we did not remember their Turkish meanings, we told each other, well, we saw it in that way in the application in order to remind. When we realized that we were able to remember, we understood that we could relay learned and our self-confidence increased."*

Interviewee 7 (High): *"I liked this application more because I do not like the applications including competitions. I feel nervous then. In this application there was nothing like that. I mean, it was just for learning. Learning is up to you. If you just read the words and pass, you cannot learn. You learn it for yourself, and not for gaining points. Therefore, I could participate more actively in the lesson."*

4.4.2. Weaknesses of the ARCS based instructional design enhanced with augmented reality

When it comes to the weaknesses of the learning environment enhanced with augmented reality, students mentioned some of the disadvantages of the learning process. Three students were not contented because the application was compatible with Android, operating system and these students had IOS operating system. They had to use someone else's mobile phones during the intervention and because they were not familiar with the interface of the operating system, it took a while for them to get used to. Also, the researcher and the engineering expert uploaded the material into the application software weekly. Therefore, students were supposed to update their applications when they had the internet. Some of the students were upset because they forgot to update before the class. They preferred a less frequent update system.

Interviewee 3 (Medium): *"Because I use Iphone, it took me for a while to get used Android. It disturbed me a little to use another phone."*

Interviewee 10 (High): *"I do not have mobile internet and because I'm a student, I can only have the internet at the dormitory. The application was required to update every week and I forgot that a few times. It would have been better, if there had been less frequent updates."*

In the fourth question, students were asked to talk about the challenges they faced while learning ESP vocabulary with augmented reality. Some students said they did not have any challenges. Some of them expressed that they experienced some problems caused by the technology itself or caused by the content presented in the

application. Therefore, it can be concluded that the technology itself is not enough to convey the meaning, and further explanations and activities are needed.

Interviewee 1 (Low): *“Sometimes, I couldn’t get the meaning of the words from the visuals because I was not familiar with them and I had not seen such a topic before. However, I managed to understand better later on when we talked about the word and related process and gave examples.”*

Interviewee 7 (High): *“As I said, I use my mobile phone a lot, my friends were always writing something to me on whatsapp or I got distracted when a notification came from Instagram. Of course, these difficulties were caused by me, not by the application’s difficulty.”*

Interviewee 10 (High): *“There were times when the application froze since my mobile phone was a little bit old. At those times, I use my friend’s phone, so it was not a big deal.”*

In the fifth question, students were asked to give recommendations to improve the application. They stated that updating issue needed to be dealt with, the number of words could be increased, a visual glossary could be added, a notification system to remind the words to students could be available and a student version which enabled them to produce their own augmented reality feature could be added.

Interviewee 2 (High): *“We learned six words in each lesson. We could have learned more.”*

Interviewee 4 (Medium): *“It would have been better if there had been a separate part inside the application and we had seen the previous weeks’ visuals without holding the mobile phone over the pages.”*

Interviewee 6 (High): *“It would have been better, if we had got a notification to remind the old words and we had clicked on them and seen their visuals.”*

Interviewee 2 (High): *“It would have been better if there had been another version of it, too. For example, it would have been more creative if we had been able to add our visuals.”*

In the last question, students were asked whether they wanted to add further comments. Four students said that they wanted to use this application in EGP and other subjects, too.

Interviewee 2 (High): *“It would be very good, if we learned not only ESP, but also daily English words with this way.”*

Interviewee 7 (High): *“I hope that we will use this kind of applications in other lessons in our departments. I think it becomes very beneficial.”*

CHAPTER 5

DISCUSSION

5.1. Introduction

This chapter presents the discussion of the findings obtained with regards to 3 main research questions, the implications for practice and recommendations for future studies and limitations of the study by making a comparison with the previous studies.

5.2. Overview of the Study

In this study, the effects of ARCS based instructional materials enhanced with augmented reality on engineering students' ESP vocabulary learning achievement, motivation and their perceptions were investigated. This study aimed to figure out what level the learners' motivation would be, how their vocabulary achievement would be affected and how they would perceive this learning environment when the lesson was designed regarding Keller's (1987) motivational design theory called ARCS and materials were developed by benefitting from technology such as augmented reality. The lesson plan was prepared by considering the attention, relevance, confidence and satisfaction themes. Vocabulary teaching strategies of Shen (2003), also called as 2C-5R, were implemented. In the quasi-experimental part of the study, quantitative data were collected via a vocabulary achievement pre-test and post-test. The scores of experimental group and control group were compared to find out whether the groups were similar before the treatment, and whether a significant difference between two groups occurred after the treatment. Then the IMMS survey was conducted for the experimental group. The aim was to determine the effect of instructional materials on students' motivation. Finally, the qualitative data was gathered and analyzed. It was aimed to inquire about students' perceptions on the use

of augmented reality while learning ESP vocabulary and get feedback from them to ameliorate the application.

5.3. Effects on Students' ESP Vocabulary Achievement

The first research question tried to find out whether a significant vocabulary achievement difference existed between the experimental and control group when their instructional materials were arranged as technology enhanced and without technology respectively while they were learning ESP vocabulary. As the technological supplement, mobile augmented reality application was adopted in the experimental group's learning process. Keller's (2000) lesson plan integration strategies were followed to create a learning environment which could motivate students, and achievement obliquely. Initially, it was tested whether two groups' ESP vocabulary achievement levels were similar. Independent sample t-test indicated that before the treatment there wasn't a significant achievement difference between two groups. Therefore, it was concluded that any achievement difference between these two groups could be referred to the new instructional materials' effect. After 6-week treatment of ESP vocabulary learning process, post-achievement test was applied to both groups to see whether there became any difference between them. Independent sample t-test results demonstrated that there was a significant difference between two groups in favor of experimental group. The experimental group which benefitted from ARCS model based instructional materials by using a mobile augmented reality application performed better and got higher scores in the ESP vocabulary achievement post-test. The result of this study aligns with previous studies which concluded that mobile applications had a positive impact of the performance of ESP vocabulary (Alkhezzi & Al-Dousari, 2016) such as the one with Whatsapp application (Alhawiti, 2015) and the one with Twitter application (Pérez-Sabater & Montero-Fleta, 2015). However, this study's finding contradicts with the findings of Alemi, Sarab and Lari (2012) and Yafei and Osman (2016) because they did not find a significant difference in the post-test between the experimental group which adopted mobile phone applications and the control group which adopted conventional activities while

learning vocabulary. On the other hand, they found that mobile phone applications were more effective in vocabulary retention by bringing out a significant difference between two groups in the delayed post-tests.

In this study, words were introduced to students in a subject related ESP reading text to enable students to guess the meaning from the context and acknowledge the form and functions of the words in terms of where and how to use them. Atay and Ozbulgan (2007) stated that learners needed to be exposed to the words in a variety of different contexts and then they needed to be guided for vocabulary learning strategies to choose the most appropriate one for themselves. Xhaferi (2010) summarized his study findings with similar conclusions expressing that ESP vocabulary should be taught in a context for syntactic and semantic benefits and guessing from the text which is the most frequent vocabulary learning strategy should be used. It is better to provide students with a variety of vocabulary learning strategies and to make them eligible to choose the best one regarding the individual differences. Likewise, computer-assisted online vocabulary learning was able to supply different vocabulary learning strategies to students, so it was found more useful than traditional vocabulary learning (Kılıçkaya & Krajka, 2010). Similarly, the mobile augmented reality used in this study also gave learners the opportunity to interact with the words with a different learning strategy by not limiting the learning inside the classroom and it was found more successful than vocabulary learning without technology.

In the literature, there were some studies conducted to perform the need analysis of engineering students to learn ESP vocabulary and the researchers found the prevalent classroom resources insufficient in that they lacked the internet and multimedia facilities (Hossain, 2013). Therefore, to enhance the learning environment with a technological supplement, a mobile augmented reality application was exploited in this study. It was found that augmented reality based learning materials were effective to increase EFL learners' vocabulary breadth (P. E. Liu & Tsai, 2013). Similarly, this study's findings revealed that when the materials were supplemented with augmented reality, students' ESP vocabulary achievement increased. The reason for the increase

of the vocabulary achievement could be explained with dual-coding theory of multimedia learning. According to this theory, if a word is illustrated, a student is more likely to remember it because s/he has the stimuli which interconnects the word with the student's previous knowledge or experience (Mayer & Sims, 1994). With the help of multimedia provided for the words, learners' vocabulary recognition increases, so their vocabulary enlarges efficiently (Hai-peng & Li-jing, 2007). In this study, after presenting the words in a context and passing through the guessing process, visual representations of the target words were demonstrated via the mobile augmented reality application. Thus, students had the chance to make an association between the 3D images and the words. Another cause for the success might be attributed to the usage of mobile phones outside the classroom. Although Kukulska-hulme (2009) found this feature skeptical in that it was beyond the teacher's control, in this study augmented reality enhanced materials which students could reach after class were kept under the control.

Since there is no other study which concentrated on the effects of using mobile augmented reality in ESP vocabulary learning environment on students' achievement, it is not possible to make a direct comparison for the time being. However, making a comparison between this study and others which focused on the mobile assisted language learning and especially mobile augmented reality in EFL classrooms might contribute to the discussion. In a study done with pre-school children had similar conclusions with this study about the effectiveness of mobile-based augmented application on students' vocabulary achievement (He, Ren, Zhu, Cai, & Chen, 2014).

5.4. Effects on ESP Students' Motivation

The second research question tried to figure out whether ARCS model based instructional materials enhanced with augmented reality caused a significant difference between the experimental group and the control group in terms of ESP students' motivation. For the quantitative data collection, a motivation survey called Instructional Materials Motivation Survey (IMMS) and developed on the basis of

Keller's (1987) ARCS model of motivational design were distributed to both the experimental group and the control group after the 6-week treatment process. Originally this motivation survey consists of 4 dimensions called attention, relevance, confidence and satisfaction. However, after the translation, validity and reliability processes, dimensions were merged into two main sub-categories called attention-relevance and confidence-satisfaction in the Turkish version of the IMMS (Kutu & Sozbilir, 2011). The data was analyzed in three aspects as the survey as a whole and regarding the two sub-categories separately. First of all, an independent sample t-test was applied, and the results of the test demonstrated that experimental group had significantly higher overall mean scores of motivation than the control group. It was concluded that the materials arranged according to ARCS instructional design and enhanced with augmented reality contributed to the learners' high motivation. In the literature there are a number of studies whose results are consistent with this study in terms of ARCS instructional design and its effects of increasing motivation in education. The integration of instructional strategies grounded on ARCS motivational model into the lessons contributed to the increase of students' motivational levels (Song & Keller, 2001). Huang and Hew (2016) found that when the technology was integrated into the lesson design, the motivation level of students increased. In their study massive open online course was deployed as the instructional material and the ARCS based items in the IMMS survey revealed that a positive motivation came out. This study's findings are alike the previous findings because it was designed with ARCS instructional design strategies and it enhanced the learning environment with an augmented reality technology. Therefore, the increasing motivation level might be attributed to the ARCS instructional strategies and well integration of technology. The study embracing the principles of ARCS motivational design by also consisting of a technology such as mobile game-based learning discovered that higher motivation was one of the benefits obtained while reviewing English vocabulary (T.-T. Wu, 2018).

As Kurt and Kecik (2017) mentioned that in the preparatory schools, students' motivation decreases as time goes by. Although they start learning English with great

enthusiasm at the beginning of the first semester, they tend to fail to keep up with the curriculum and reach the intended proficiency level. Therefore, this study was conducted in the second term when students were expected to have lower motivation and the instructional materials which were inclined to boost motivation was more necessary than any time of the year.

For a deeper understanding, dimensions of the IMMS survey were analyzed separately. Firstly, attention-relevance sub category results were compared and it was seen that experimental group's scores ($M= 4,44$; $SD= .48$) were significantly higher than the control group ($M=3.31$; $SD= .621$). Based on the survey results, it can be said that learners in the experimental group were attracted by the instructional materials which were supplemented by the mobile augmented reality application, curious for the upcoming visual images for the target vocabulary and sustain their interest during the treatment. Similar results were come across in the study of Nashirah et al. (2013) which revealed that the augmented reality pop-up book gained and maintained the learners' interest and mitigate their curiosity towards the lesson. It might be concluded that fulfilling the attention dimension was a great contributor to increase motivation. In terms of relevance, on the light of the survey results, it can be inferred that instructional materials were able to meet the students' needs, match their interests and make the vocabulary familiar to them by connecting the instruction with the learners' previous knowledge. In this study pre-defined augmented reality materials were used, and they were found effective. However, this result contradicts with the findings of the study (Li et al., 2014) which explained that the pre-defined augmented reality materials failed to generate relevance to students' interests and experiences. The high scores of students for the relevance dimension in this study might be because they were aware of the fact that those words would be necessary in their faculty studies. Also, the self-evaluation check list involved a column in which students were supposed to draw something which would form an association between the visuals and their former knowledge.

Secondly, confidence-satisfaction sub-category results were compared, and it was explored that experimental group's scores ($M=4,15$; $SD=.66$) were significantly higher than the control groups' scores ($M=3,04$; $SD=.66$). Based on this result, it can be inferred that students in the experimental group became successful, this success made them gain self-confidence and they were aware of the fact that the reason behind this achievement was their own efforts. Nashirah et al. (2013) summarized similar ideas by stating that learners had the confidence after they took the control of their own learning and the upcoming accomplishment was not because of luck or lack of challenge. To the contrary in their study Li et al. (2014) found that students' confidence was diminished since they failed to achieve learning objectives because of the difficulty of the instructional materials. Therefore, it is crucial to prepare the instructional materials which match the students' level- not too easy or not too difficult – to help the learners construct self-confidence. With regards to satisfaction, Keller (2010) emphasizes that learners can feel satisfied when they are treated fairly, when they feel the joy of accomplishment or when they are extrinsically rewarded such as grades or prizes. In this study, the high satisfaction scores might be devoted to the features of the instructional design in which students did not feel competitive as there was not a game or competition. Rather than their achievement level, their effort to active participation was graded, which inhibited the fear of failure. Moreover, they had the chance to self-evaluate themselves to see their own progress. In the literature, it was found that if there were technical problems such as delays of the trigger images, it could result in the decrease of students' satisfaction and they were identified as distractions leading to loss of interest (Li et al., 2014). However, in this study, students' satisfaction scores were high in the experimental group, which could be inferred that technical problems were not significant enough to decrease students' satisfaction.

5.5. Students' Perceptions

The third research question aimed to inquire about experimental group students' perceptions after they experienced a learning environment with a mobile augmented

reality application while learning ESP vocabulary. Semi-structured interview questions related to their 6-week learning process were asked to ten of the experimental students. Their overall answers indicated that positive affordances of the learning design with augmented reality outweighed the negative ones. Their feedback was precious to determine the possible challenges to make modifications and revisions, and implications for the future practices.

When students were asked to compare the advantages of the traditional way of learning and mobile augmented reality enhanced learning, they expressed that their vocabulary learning became more permanent. Their idea is supported by a study in the literature stating that learning becomes permanent and real when it's connected with students' lives not only in academic environment but also outside the school with the help of mobile devices (Godwin-jones, 2011).

Making students perceive their learning meaningful is possible by offering them the contextual material so that they can establish a connection with their real lives, and the content and activities which can respond to their linguistic needs (Cad, 2014). In this study, most of the students defined their learning as meaningful. The reason of gaining meaningful learning in this study could be devoted to structure mapping in which learners generate a mental representation for the words that they are given and another representation for the visuals provided for the words and finally make a connection between these two representations in the memory (Mayer & Sims, 1994). Furthermore, the verbal information and their visuals were presented concurrently rather than successively, and it might contribute to the meaningful learning as stated in the study of Mayer and Anderson (1991).

From the students' answers to the semi-structural interview questions, it was inferred that they found the mobile augmented reality application useful for increasing their motivation. Their perception is supported in the study of Chang, Morreale and Medicherla (2010) which gives reference to the literature by stating that learners can reinforce their motivation and prosper their learning with reality-based exercises like

virtual and augmented reality. The feature of easy access to learning materials providing the ubiquitous learning is found to enhance students' motivation, which is also categorized as one of the strengths of MALL (H. Kim & Kwon, 2012). Students' comments were consistent with Keller' ARCS motivational design dimensions. The interviews indicated that the mobile augmented reality increased students' interest towards the new vocabulary and students became curious to learn. This finding is aligned with another study conducted with pre-school children by He et al. (2014) declaring the increase of interest towards learning English vocabulary emerged when the materials were presented with a visual picture. In terms of relevance, the interview responds pointed out that students were able to identify the logic behind why they were learning the words and what the prospective benefits of learning those words in the future. Furthermore, they had the chance to control when to review the words by using the application and they were able to make a relation to their experience with the new words. These conclusions are compatible with the relevance factor of ARCS developed by Keller (1987). However, the overall motivation increase does not necessarily mean that all the sub-dimensions also increase. While using augmented reality mobile application increased the three factors of motivation as attention, confidence and satisfaction, it did not cause an increase for the relevance factor (Khan, Johnston, & Ophoff, 2019).

The comments of the students related to the interview questions might lead us to conclude that they gained confidence throughout the treatment process. They were aware of the fact that they were responsible for their own success, neither chance, nor the lack of challenge as Keller (1987) stated. The findings of this study which refer to the increase of students' confidence are similar to Huisinga's (2017) study findings which asserted that 80% of the participants perceived that their confidence increased when the materials were enhanced with AR.

In the interviews, students in this study perceived themselves as satisfied after experiencing the 6-week treatment. They explained that availability of self-evaluation criteria, non-competitive learning environment, fair attitude of the instructor and the

joy supplied with learning materials made them satisfied. Likewise, Di Serio et al. (2013) declared that students in their study had the sense of fulfillment of their needs and the source of enjoyment, so they were satisfied of using AR technology in their learning environment.

Most of the students found the mobile AR application favorable due to its utility features. The mobile AR application used in this study has the feature of being operated without internet connection. In other words, after the updates are done via internet, students do not need the internet to use the application. Students found this feature as one of the main advantages of the application because most of them have limited internet storage and the school does not provide students with Wi-Fi connection. In the literature, this kind of an advantage was not mentioned. Students expressed that the application was easy to use and the difficulties they came across while operating the system were insignificant. There are other studies in the literature which came up with the similar conclusions. Liu, Tan, and Chu (2007) suggested that 2D barcodes and augmented reality are useful in English language learning and the participants in their study also found the technological application easy to use. The students described their learning process as fun and entertaining, which made them complete the tasks without being bored and made their motivation last for a long time. The same ideas were presented as an advantage of using AR in education by stating that AR made the learning process fun and fruitful at the same time (Safar, Al-Jafar, & Al-Yousefi, 2017). The students were contented with the fact that they did not lose time to type the words to look up in an online dictionary. They did not need to wait for the visuals to appear, either. They put their smart phones over the printed material on which the target words were written and with the help the camera, they were able to see the visuals as soon as the application identified the trigger image. This fast access made them pleased. This unique feature was also mentioned in the literature. (López, 2018) listed the benefits of learning vocabulary via AR applications and pointed out that the easy and fast access to resources with the help of internet and computer software made it distinct from other applications.

Although the benefits of the mobile AR application in education outweigh its challenges, the challenges need contemplating to optimize the prospective learning environment. Usability issue which is also seen as a benefit is discussed again while describing the weaknesses of this learning environment. The difficulty at using the AR technology is the most reported challenge (Akçayır & Akçayır, 2017). In this study, technical problems such as frozen screen and frequent updates were mentioned. All these features stem from the deficiency of students' mobile phones because the students who complained about these problems stated that their mobile phones were old to keep up with the new application technologies. Another challenge was the obligation of having Android system to upload the AR application. Since the other ready-made AR applications were inconvenient to use at the time of the treatment, a new mobile application was developed specifically for this study, and unfortunately it was not compatible with IOS operating system. Those students were given Android mobile phones and it was difficult for them to get used to. Fast and easy use was a benefit for most of the users, yet the minority of students lost time because of the operating system as Akçayır and Akçayır (2017) discussed in their study.

While the majority of students found the instructional method easy to use and beneficial for improving their achievement and motivation, a few students mentioned that they had some difficulty at identifying some of the visuals, which could negatively affect their learning. Regarding the literature, the reason of this difficulty might be attributed to focusing on the technology rather than the content (Erbaş & Demirer, 2019).

One student suggested that he easily lost his concentration and became distracted when he got notifications from Instagram or whatsapp chat application. Although he mentioned this problem as a personal one, this problem is common in the literature. Katz and Macklin (2007) expressed that students might deal with something else in which they are interested such as responding e-mails, chatting with friends or playing games instead of doing the tasks and this might occur because the current instructional strategies fail to make the learner engaged and meet their perceived needs.

According to Cheng and Tsai (2014) augmented reality could result in the decrease of motivation level and mitigation of the cognitive load because of the AR technology and the complex learning tasks. Contrary to their findings, in this study students did not mention such challenges. Moreover, the small-screen mobile devices, which were used to be thought as disadvantageous, were found advantageous for averting the cognitive overload because the amount of information to convey at a time is limited (Yafei & Osman, 2016). In other words, mobile learning supplies the right amount of information by not including any extra things to inhibit processing the information in the memory. The theory of multimedia learning (Mayer, 2001) was taken into consideration while developing the instructional materials that for each target word, one visual representations as 3D or video was offered to students in order to diminish the cognitive overloading in students' working memory. As Sweller, van Merriënboer, and Paas (1998) stated, short memory capacity is very limited, and to decrease the cognitive load and to transmit the information from short term memory to long term memory, target vocabulary was preferred to be presented with visuals rather than in isolation in this study.

5.6. Conclusions

Although AR' history dates back to 1960's, the related research is not sufficient to come to conclusions about its effectiveness in educational environments and it is still in its infancy (Khoshnevisan & Le, 2018). The devices which were exploited for AR implementation have been going through a transformation for many years and now they are portable and small enough to carry in the pockets and use anywhere and anytime. However, the number of ready-made AR applications are limited for the time being and to integrate AR into a language classroom, instructors need to cooperate with experts to develop and design the learning process. In the designing process, the materials need to be prepared on the basis of a framework such as the Keller's (2010) ARCS instruction design strategies to get the optimum benefit from the mobile AR technology because if the lesson is not well-designed regarding the pedagogies, merely the technology itself cannot make a positive difference on the learners'

performance (Azmi, 2017). Furthermore, ESP vocabulary is far more challenging than EGP vocabulary, and the use of AR could be useful to deal with these challenges by presenting a motivating and engaging learning environment. The findings of this study revealed that when the lesson was designed grounding the motivational strategies, and AR application was used for learners to acquire ESP vocabulary, learners' vocabulary achievement could improve better than the vocabulary learning without technology. Likewise, when the same procedures were applied, learners' motivation could increase. Finally, it indicated that learners' perceptions about learning ESP vocabulary with the help of AR technology could be positive. In conclusion, this study fills in the gap in the literature by pointing out the positive effects of AR integration in ESP classes.

5.7. Limitations

Although it was planned, a delayed post-test couldn't be conducted because of scheduling problems. It would have been better if it had been examined whether the significant difference in the experimental and control group's ESP vocabulary achievement in the post test would sustain as time went by or not. In a previous study, it was found that there was no significant difference between two groups in terms of post-test vocabulary achievement test, yet a delayed-post test revealed a significant difference in favor of experimental group which benefitted from a mobile phone application technology (Yafei & Osman, 2016).

Another limitation is that the mobile augmented reality application developed for this study was only operated with Android operating system. Therefore, few students who possessed Iphones with IOS operating system couldn't use their own mobile phones.

Moreover, the pre-achievement test and post-achievement post tests were identical. It would have been better to ask the same words in a test which had a different format.

5.8. Implications for Practice and Recommendations for Future Studies

In this study pre-defined AR materials developed by the field expert and language instructor were used. They were found successful to generate relevance and lead to meaningful learning. Besides this type of material, AR materials which are generated by students could be used to increase engagement and student-centered learning as it was confirmed to have positive outcomes in the study of Slussareff and Boháčková (2016). However, it is still perceived as a difficult task to create 3D materials for both teachers and students due to the lack of technical knowledge (Yuen, Yaoyuneyong, & Johnson, 2011). It is expected that software firms and entrepreneurs will come up with new advances in the field of developing augmented reality applications which enable even novice learners to create materials as time goes by. Researchers can benefit from new AR applications in the classes.

Researchers who aim to investigate the effects of AR in classes need to design and develop their classes related to pedagogies. Adopting merely the technology does not guarantee the accomplishment.

In this study, the participants were university students whose ages ranged from 18 to 21. The practitioners can opt for a different population who are younger or older. Moreover, the participants in this study were all prospective engineers. Practitioners can apply the ARCS based instructional materials and benefit from AR technology in other occupational studies. In this study, the words were all related to engineering and they involved movement and they were concrete words. In the future, practitioners can teach vocabulary for other majors which require abstract vocabulary.

In this study, AR was exploited for vocabulary which was embedded into reading texts. In the future, practitioners can benefit from this technology in other skills of English and they can investigate whether it is also useful for other skills, too.

In this study, the mobile AR application was only operated with Android operating system. For future studies, it is recommended to choose an application which is compatible with students' mobile devices.

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APPENDICES

A. VOCABULARY ACHIEVEMENT TEST

Name and Surname:

Grade:

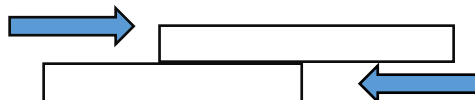
Classroom Number:

Engineering Vocabulary Achievement Test

A) Fill in the blanks by using the words from the box.

compression	deflection	tension	force	gauge	shear
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1. When two pulling forces which directly oppose each other stretch an object and try to pull it towards their directions, it is called _____.
2. Pressing two ends of a spring together is a good example for _____. When this force is applied to the spring, its shape becomes compacted and when the force is removed, it turns back to its normal shape.
3. _____ is an instrument that is used to measure during the testing process.
4. When a load is applied to a structural element, the element is displaced to a degree which is called _____.
5. _____ is the name of the action applied to an object in order to move it and change its way or its shape.
6. The following image demonstrates the _____ force.



B) Fill in the blanks by using the words from the box.

acceleration	deceleration	drag	weight	lift	thrust
---------------------	---------------------	-------------	---------------	-------------	---------------

7. _____ is a kind of force on the plane which is created by the engines to move it forward through the air.
8. _____ means the air force pushing against a vehicle such as an aircraft which moves forward.
9. When there is a decrease of velocity in a unit of time, it is called _____.
10. _____ means the upward force of fluid such as air on a moving solid such as a flying aircraft.
11. It can be said that a car has a/n _____ when it speeds up.
12. _____ is measured in Newtons to determine how much gravity pulls downward.

C) Fill in the blanks by using the words from the box.

elastic	brittle	durable	ductile	malleable	plastic
----------------	----------------	----------------	----------------	------------------	----------------

13. Glass is _____. It is easily broken into pieces.
14. A /n _____ material can be easily stretched without losing its strength.
15. A /n _____ material turns back to its original shape after being stretched.
16. A/n _____ material does not turn back to its original form. It maintains the new shape after being stretched or bent.
17. A /n _____ material can be hammered into shape.

18. If a material is _____, it can be used for a long time and it does not wear out.

D) Fill in the blanks by using the words from the box.

turning	forging	extrusion	casting	welding	rolling
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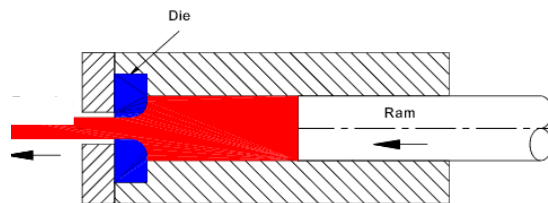
19. _____ is used on a machine so that a part of the material can be removed to give the correct shape.

20. _____ means to combine two pieces using very high temperature.

21. _____ is used to make ductile materials such as aluminum and copper thinner like sheet.

22. _____ is a manufacturing method including melting a metal, pouring into desired shapes' mold and allowing it to solidify.

23. A compressive force is used to push the material to create a long and straight piece. It is called _____ and it is shown in the following image.



24. A metal is heated. Then a desired shape is given by hammers or weights. This manufacturing process is called _____.

E) Fill in the blanks by using the words from the box.

deposition	sublimatio n	endothermi c	vaporizatio n	condensati on	exothermic
-------------------	-------------------------	-------------------------	--------------------------	--------------------------	-------------------

25. When the temperature and pressure of a substance are changed, the substance which is in a gaseous state transforms into a liquid state in _____ process.
26. When a substance in a liquid form turns into gaseous state, _____ process occurs.
27. A substance in a solid form turns into its gas form by skipping the liquid phase in _____ process.
28. In the _____ process, a substance in a gas form directly turns into its solid state without passing through the liquid phase.
29. To melt the ice, heat is applied, so this process is _____.
30. _____ reactions release energy, so the temperature of those surroundings increases.

F) Fill in the blanks by using the words from the box.

combustion	compressor	exhaust gases	intake	turbine	combustor
-------------------	-------------------	--------------------------	---------------	----------------	------------------

Here are the principles of an aero plane's heat engine. At first, in the (31) _____ stage, cold air comes into the engine. In the next stage, the pressure of the air is increase with the help of (32) _____. In the (33) _____ stage, the high pressurized air and igniter gas are mixed, and these are ignited in the (34) _____. This process helps the gases to expand. The (35) _____ blades are turned by those expanding gases. Eventually, the hot (36) _____ are released in the final stage.

B. MOTIVATION SURVEY

Değerli katılımcılar, bu anket derslerde kullanılan öğretim materyallerinin derse karşı olan motivasyonu nasıl etkilediğini ölçmeyi hedefleyen 24 maddeden oluşmaktadır. Anketi cevaplarken, lütfen her bir ifadenin, karşısında yer alan Tamamen Katılıyorum (5), Çok Katılıyorum (4), Orta Derecede Katılıyorum (3), Az Katılıyorum (2), Hiç Katılmıyorum (1) seçeneklerinden size en uygun olanını işaretleyiniz. Tüm soruları kendi görüşlerinize göre eksiksiz tamamlamanız beklenmektedir. Not: Bu ankette kullanılan “derste kullanılan materyaller” ifadesi ders içinde ve dışında öğretmeniniz tarafından verilen çıktı, makale, sunu, artırılmış gerçeklik mobil uygulaması, web sayfası vb. her türlü derse yardımcı kaynakları ifade etmektedir. Katılımınız için teşekkür ederiz.

		5	4	3	2	1
1	İçeriğini ilk öğrendiğimde, bu derste dikkatimi çeken ilginç bazı şeylerin olduğunu gördüm.					
2	Dersin işleniş şekli ve derste kullanılan materyaller dikkat çekiciydi.					
3	Derste kullanılan materyallerde yeterli bilgi yoktu.					
4	Derste kullanılan materyallerde bilgilerin işleniş şekli dikkat çekiciydi.					
5	Bu derste dikkat çekici şeyler vardı.					
6	Derste bazı dikkat çekici yeni bilgiler öğrendim.					
7	Alıştırmaların, materyallerin, sunumların çeşitliliği dikkatimi derse vermeme yardımcı oldu					
8	Derste kullanılan materyallerde işlenen konunun önemini					

	gösteren hikâyeler, resimler ve örnekler vardı.					
9	Derste kullanılan materyaller benim için uygundu.					
10	Derste öğrendiğimiz bilgilerin nasıl uygulamaya yansıtılabileceğine dair açıklama ve örnekler vardı.					
11	Derste kullanılan materyallerin gerek içeriği gerek sunumu konularının öğrenilmeye değer olduğu izlenimini uyandırıyor.					
12	Dersi anlamak beklediğimden daha zor oldu.					
13	İçeriğini ilk incelediğimde, bu ders kapsamında neler öğreneceğimi anladım.					
14	Derste kullanılan materyallerde çok fazla bilgi verildiğinden nelerin önemli olduğunu ayırt edemedim.					
15	Verilen ödevleri yaptıkça konuları öğrenebileceğime dair kendime güvenim arttı.					
16	Dersteki alıştırmalar ve uygulamalar oldukça zordu.					
17	Ders konularını çalıştıktan sonra, bu dersten geçebileceğime dair güvenim arttı.					
18	Ders kapsamındaki konuların birçoğunu tam olarak anlayamadım.					
19	Dersteki konu diziliminin iyi olması dersi öğrenebileceğime dair güvenimi artırdı.					
20	Dersteki uygulamaları/alıştırmaları tamamlamak bende başarı hissi uyandırdı.					

21	Dersten zevk aldığım için, dersteki konular hakkında daha çok şey öğrenmek istiyorum.					
22	Derse zevk alarak çalıştım.					
23	Ödev sonrasındaki dönütler ve dersteki diğer yorumlar emeğimin karşılığını aldığım hissini verdi.					
24	Dersi başarıyla tamamlamaktan mutluluk duydum.					

Tamamen Katılıyorum (5), Çok Katılıyorum (4), Orta Derecede Katılıyorum (3), Az Katılıyorum (2), Hiç Katılmıyorum (1)

C. INTERVIEW QUESTIONS

Görüşme Soruları

1. Artırılmış gerçeklik uygulamasıyla İngilizce mühendislik kelimeleri öğrenme deneyiminiz hakkında ne düşünüyorsunuz?
 - a. Bu yöntemi geleneksel kelime öğrenme metotlarıyla kıyaslarsak, artırılmış gerçeklikle zenginleştirilen ders materyalinin avantajları nelerdir?
 - b. Bu yöntemi geleneksel kelime öğrenme metotlarıyla kıyaslarsak, artırılmış gerçeklikle zenginleştirilen ders materyalinin dezavantajları nelerdir?
2. Yeni yöntemle İngilizce kelime öğrenmek başarınızı hangi yönde etkiledi? (Olumlu-Olumsuz neden?)
3. Yeni yöntemle öğrenmek sizin dersle ilgili motivasyonunuzu nasıl etkiledi?
4. Bu yöntemle öğrenmede sizi en çok zorlayan şeyler nelerdi?
5. Sizce yeni yöntemde geliştirilmesi gereken şeyler nelerdir?
6. Başka eklemek istediğiniz bir şey var mı?

D. INTERVIEW QUESTIONS IN ENGLISH

1. What do you think about your experience of learning engineering vocabulary in English via augmented reality application?
 - a. What are the advantages of instructional materials enhanced with augmented reality when this method is compared to traditional vocabulary learning methods?
 - b. What are the disadvantages of instructional materials enhanced with augmented reality when this method is compared to traditional vocabulary learning methods?
2. In what way has the learning English words with this new method affected your success? (In a positive way or in a negative way and why?)
3. How has the learning with the new method affected your motivation about the lesson?
4. What were the most challenging things for you at learning with this method?
5. What do you think needs improvement in this new method?
6. Is there anything that you want to add?

E. INTERVIEW ANSWERS IN TURKISH

General Opinions:

Interviewee 1: *“Benim için çok güzel bir tecrübeydi. Kelimeleri akılda tutmama yardımcı olduğunu düşünüyorum.”*

Interviewee 2: *“Yani mühendislik okuyacağım için benim teknolojiye ve özellikle mobil teknolojilere çok ilgim var. Telefonla da çok vakit geçiren birisiyim. Okul dışında da İngilizce’me katkısı olsun diye mobil uygulama kullanıyordum ama bunun derse entegre edilmesi çok hoşuma gitti. Derste teknoloji kullanmak bence çok faydalı, çünkü ilgimizi normal dersten daha çok çekiyor.”*

Interviewee 3: *“Bu derste öğrendiğimiz kelimeler bize bölüme geçtiğimiz zaman lazım olacak. İşe girdiğimizde de kullanacağız tabi. Önceden öğrenmemiz iyi oldu. Uygulamayla öğrenince bence daha kalıcı oldu. Bence seneye bu kelimelerin çoğunu hatırlarım. Yani Türkçesi aklıma gelmese bile görseli aklıma gelir. O yüzden bu şekilde öğrenmekten memnunum.”*

Interviewee 4: *“Ben telefonla arttırılmış gerçeklik uygulaması yapılabildiğini bilmiyordum. Hep google gözlük gibi pahalı aletlerle oluyor zannediyordum. Bunu derste kendi telefonumuzla kullanacağımızı öğrenince heyecanlandım ve bence kelime öğrenmeye faydası oldu.”*

Strengths mentioned:

Interviewee 2: *“Normalde eskiden kelimeleri öğrenirken ya parçadan anlamını çıkarıyorduk, ya da sözlükten Türkçe anlamına bakıyorduk. Ama böyle öğrenince kelime aklımda pek kalmıyor. Ben gördüğüm şeyleri aklımda daha iyi tutabiliyorum. Bu yeni uygulamada da görsel şeyler çok olduğu için daha kalıcı oldu kelimeler.”*

Interviewee 5: *“Geleneksel metodla öğrenmek bence çok kalıcı olmuyor. Biz şimdi bu uygulamada önemli kelimelerin görsellerini görüyoruz. Yani nasıl desem, o kelimelerle etkileşim kuruyoruz. Telefonu çevirip o terimin anlattığı hareket nesneye hangi şekli vermiş onu görebiliyoruz. O yüzden bunu unutmak zor.”*

Interviewee 10: *“Mühendislik kelimeleri normal, günlük kelimelerden farklıymış. Mesela ‘turning’ kelimesini gördüğümde ben dönmekle ya da değişimle ilgili bir kelime gibi tahmin etmiştim.Okuma parçasından da anlamını tam çıkaramadım. Ama uygulamaya girince bambaşka bir anlamı olduğunu gördüm.Bu kelimenin mühendislikte nasıl kullanıldığını başka türlü anlayamazdım çünkü bir makinanın bir cisme nasıl şekil verdiğini anlatıyor. Resim bile olsa tam anlamını çıkaramazdım.”*

Interviewee 5: *“Bence kelimeyi öğrenmek sadece Türkçe karşılığını öğrenmek değil. Çünkü biz daha bölümümüze gitmedik. Bir terimi sözlükten baksam ben onun Türkçe’sini bile hiç duymamışım, bana bir şey ifade etmez. O yüzden kelimeleri bu uygulamayla daha kapsamlı öğrenmiş olduk.”*

Interviewee 9: *“Yani şimdi öğrenci olduğumuz için internetimiz hemen bitiyor. Okulda da wi-fi olmadığı için internetsiz çalışan bir uygulama olması en büyük avantajıydı.”*

Interviewee 8: *“Uygulamayı kullanmak bence baya kolaydı. Kelimenin üstüne telefonu tutunca hemen görseli çıktı. Başka hiçbir şey yapmamıza gerek yoktu. Kelimeyi sözlükten bulmakla vakit kaybetmedik.”*

Interviewee 10: *“Kelimenin görselini hızlıca görmek hoşuma gitti.”*

Interviewee 4: *“Uygulamayı kullanmak eğlenceliydi.”*

Interviewee 6: *“Uygulamayı kullanmaktan keyif aldım.”*

Interviewee 3: *“Bence kelimeleri bu şekilde öğrenmek benim başarıımı olumlu yönde etkiledi çünkü kelimeler direkt zihnimde canlanıyor. Eski türlü öğrendiğimizde kelimenin Türkçe’sini hatırlayamadığımda aklımda hiçbir şey belirmiyordu. Ama şimdi tam Türkçe’sini sorsanız belki bilemem ama İngilizce’sini duyduğumda o kelime neyi anlatıyor bilebilirim. Bence gerçek öğrenmek bu, öbür türlü sadece boş boş ezberlemiş oluyoruz.”*

Interviewee 6: *“Açıkçası benim başarıımı olumlu etkilediğini düşünüyorum. Çünkü kelimelerle çok haşır neşir olduk. Telefonda görselini gördük, canlı gibiydi. Mesela gördüğümüz nesneye bir kuvvet uygulanıyordu. Biz telefonu kağıdın altına üstüne doğru tuttuğumuzda o nesnenin altının şekli nasıl değişti, üst tarafına ne oldu görebildik. O yüzden o kelimeyi çok iyi öğrendiğimi düşünüyorum.”*

Interviewee 10: *“Bu uygulamayla kelime öğrenmek benim motivasyonumu arttırdı. Haftanın en sevdiğim kısmıydı.”*

Interviewee 1: *“Normalde de telefonumu çok kullandığım için, derste telefonumu kullanmak ilgimi çekti. Bir de her kelime için farklı bir görsel çıkıyo. Telefonumda nasıl bir şey belirecek açıkçası merak ettim.”*

Interviewee 4: *“Aslında ders çalışmayı pek sevmiyorum tabi ama bu kelimeler bana ileride lazım olacak. Bunun farkındayım. Bir de bu kelimeleri gerçek hayatta göreceğim şekliyle görmüş oldum sınıfta. Yoksa sanayiye ya da laba gitmek gerekirdi. O yüzden ilgimi çekti.”*

Interviewee 9: *“Haftalık olarak kendimizi değerlendirme formları bence faydalı oldu. Başta çok sıkıcı ve gereksiz bulmuştum aslında. Çünkü kelimeleri hemen öğrendim zannetmiştim. Ama kendimi değerlendirme kısmında fark ettim ki ben bu kelimeleri tam öğrenememişim. Otobüsle yurda giderken uygulamayı açıp tekrar baktım. Normalde kelime defterime bile bakmam aslında.”*

Interviewee 3: *“Sonraki haftalarda önceki haftaların kelimelerini arkadaşlarımla birbirimize sorduğumuzda çoğunu hatırlıyorduk. Türkçe karşılıkları aklımıza gelmediğinde de birbirimize diyorduk hatırlatmak için işte hani telefonda şu şekilde görmüştük ya gibi. Bunları hatırlayabildiğimizi fark edince gerçekten öğrenebildiğimizi anladık ve kendimize olan güvenimiz arttı.”*

Interviewee 7: *“Bu uygulamayı daha çok sevdim çünkü ben böyle rekabet içeren uygulamaları sevmiyorum. Öyle olunca geriliyorum. Bunda öyle bir şey yoktu. Sadece öğrenmeye yönelikti yani. Öğrenmek de senin elinde. Kelimeyi oku ve geç yaparsan öğrenemezsin. Kendin için öğreniyorsun yani puan kazanmak için değil. O yüzden derse daha aktif katılabildim.”*

Weaknesses mentioned:

Interviewee 3: *“Ben Iphone kullandığım için Androide alışmak biraz zaman aldı. Bir de başka telefon kullanmak beni biraz rahatsız etti.”*

Interviewee 10: *“Benim mobil internetim yok öğrenci olduğum için sadece yurttan internete girebiliyorum. Her hafta güncelleştirmek gerekiyordu uygulamayı ama ben birkaç kez unuttum. Daha az sıklıkla güncelleme olsa daha iyi olurdu.”*

Interviewee 1: *“Bazen görsellerden kelimenin anlamını tam anlayamadığım oldu. Çünkü hiç aşına değildim. Daha önce de böyle bir konu görmemiştim. Ama sonra kelime ve süreç hakkında konuşunca, örnek verince daha iyi anlayabildim.”*

Interviewee 7: *“Dediğim gibi telefonu çok kullandığım için arkadaşlarım dersteyken sürekli whatsapp'tan yazıyorlardı ya da instagramdan bildirim geldiğinde dikkatim dağıldı. Tabi bunlar uygulamanın zorluğundan değil benden kaynaklanan bir zorluktu.”*

Interviewee 10: *“Benim telefonum biraz eski olduđu için uygulamanın donduđu zamanlar oldu. Ama o zaman da arkadaşımın telefonunu kullandım. Yani çok önemli bir sorun değildi.”*

Recommendations mentioned:

Interviewee 2: *“Her derste altı kelime öğrendik. Daha fazla kelime öğrenebilirdik.”*

Interviewee 4: *“Uygulamanın içinde ayrı bir bölüm olsa oradan kelimelere tıkladığımızda önceki haftaların görsellerini kağıda tutmadan görebilsek güzel olurdu.”*

Interviewee 6: *“Bize her gün bildirim gelse eski kelimeleri hatırlatmak için, ona tıkladığımızda görselleri görebilsek güzel olurdu.”*

Interviewee 2: *“Başka bir versiyonu daha olsaydı iyi olurdu. Mesela biz kendimiz görsellerimizi ekleyebilseydik daha yaratıcı olabilirdi.”*

Interviewee 2: *“Sadece ESP için değil de günlük İngilizce kelimeleri de bu şekilde öğrensek çok güzel olur.”*

Interviewee 7: *“İnşallah bu tarz uygulamaları bölümdeki derslerde de kullanırız. Bence çok faydalı olur.”*

F. CONSENT FORM

ARAŞTIRMAYA GÖNÜLLÜ KATILIM FORMU

Bu araştırma, ODTÜ Bilgisayar ve Öğretim Teknolojileri Eğitimi Bölümü Yüksek Lisans öğrencisi Buket Tandoğan tarafından Doç. Dr. Ömer Delialioğlu danışmanlığındaki yüksek lisans tezi kapsamında yürütülmektedir. Bu çalışmayla, artırılmış gerçeklikle zenginleştirilen ARCS motivasyon modeli esaslı öğretim metodunun, öğrencilerin özel amaçlı İngilizce derslerindeki kelime başarısına ve öğretim materyalleri motivasyonu üzerine olan etkisi araştırılacaktır. Araştırma altı hafta sürecektir. Araştırmaya katılmayı kabul ederseniz, çalışma başlamadan önce kelime ön testi, araştırma sonrasında kelime son testi ve öğretim materyalleri motivasyon anketi uygulanacaktır. Çalışmanın devamında deney grubunda iseniz deneyimleriniz hakkında görüşlerinizi almak için bireysel görüşmeler yapılacaktır. Mülakat cevaplarınızın içerik analizi yapılabilmesi için ses kaydı alınacaktır. Soruların hiçbirinde kişisel rahatsızlık verecek içerik bulunmamaktadır. Ancak kendinizi herhangi bir nedenden ötürü rahatsız hissederseniz, çalışmayı kendi isteğinizle yarıda bırakabilirsiniz.

Bu araştırmaya olan katılımınız tamamen gönüllülük esasına dayanmaktadır. Kimliğiniz, cevaplarınız ve ses kaydınız gizli tutulacak ve sadece araştırmacı tarafından değerlendirilecektir. Elde edilen bilgiler bilimsel yayımlarda kullanılacaktır.

Araştırmaya yönelik sorularınızı yöneltmek için araştırmacıyla doğrudan iletişime geçebilirsiniz. Aşağıda araştırmacının iletişim bilgileri verilmiştir.

Araştırmacının adı: Buket Tandoğan

Adres: ODTÜ Bilgisayar ve Öğretim Teknolojileri Eğitimi Bölümü Üniversiteler Mah. Dumlupınar Blv. No:1 06800 Çankaya/ Ankara

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Yukarıdaki bilgileri okudum ve bu çalışmaya tamamen gönüllü olarak katılıyorum.

(Formu doldurup imzaladıktan sonra uygulayıcıya geri veriniz).

İsim Soyad

Tarih

İmza

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G. WEEKLY SCHEDULE

Date	Course Content	Experimental Group	Control Group
14.04.2019	Testing in Engineering Target words: *compression *tension *shear *force *deflection *gauge	*The reading text 1 *motivation through ARCS *mobile AR application *self-evaluation check-list *activities: fill-in the blanks, open-ended questions, drawing pictures, forming sentences, discussion	*The reading text 1 *no ARCS design *no mobile AR application *no self-evaluation check list *activities: fill-in the blanks, open-ended questions, discussion
19.04.2019	Movement Target words: *thrust *drag *lift *weight *acceleration *deceleration	*The reading text 2 *other procedures are the same as week 1	*The reading text 2 *other procedures are the same as week 1
26.04.2019	Properties of Materials Target words: *ductile *brittle *elastic *plastic *durable *malleable	*The reading text 3 *other procedures are the same as week 1	*The reading text 3 *other procedures are the same as week 1
03.05.2019	Industrial Processes Target words: *rolling *extrusion *forging *casting *turning *welding	*The reading text 4 *other procedures are the same as week 1	*The reading text 4 *other procedures are the same as week 1

10.05.2019	States of Matter Target words: *vaporization *condensation *sublimation *deposition *endothermic *exothermic	*The reading text 5 *other procedures are the same as week 1	*The reading text 5 *other procedures are the same as week 1
17.05.2019	Aeroplane's Gas Turbine Target words: *intake *compressor *combustion *combustor *exhaust gases *turbine	*The reading text 6 *other procedures are the same as week 1	*The reading text 6 *other procedures are the same as week 1

H. APPROVAL OF ETHICAL COMMITTEE

Uygulanalı Etik Araştırma Merkezi
APPLIED ETHICS RESEARCH CENTER



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09 Nisan 2019

Konu: Değerlendirme Sonucu

Gönderen: ODTÜ İnsan Araştırmaları Etik Kurulu (İAEX)

İlgili: İnsan Araştırmaları Etik Kurulu Başvurusu

Sayın Doç.Dr. Ömer DELİALIOĞLU

Danışmanlığınızı yaptığınız Buket TANDOĞAN'ın "Özel Amaçlı İngilizce Öğretiminde Artırılmış Gerçeklik ile Zenginleştirilmiş ARCS Model Tabanlı Öğretim Materyallerinin öğrencilerin Kelime Başarısına ve Öğretim Materyalleri Motivasyonuna Etkisinin İncelenmesi" başlıklı araştırması İnsan Araştırmaları Etik Kurulu tarafından uygun görülmüş ve 192-ODTÜ-2019 protokol numarası ile onaylanmıştır.

Saygılarımızla bilgilerinize sunarız


Prof. Dr. TULİN GENÇÖZ

Başkan


Prof. Dr. Ayhan SOL
Üye


Prof. Dr. Ayhan Gürbüz DEMİR (Y.)
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