EXPLORING FACTORS THAT PREDICT PRE-SERVICE ENGLISH TEACHERS' INTENTIONS TO USE AUGMENTED REALITY USING DECOMPOSED THEORY OF PLANNED BEHAVIOR

Cemil Gökhan KARACAN

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EXPLORING FACTORS THAT PREDICT PRE-SERVICE ENGLISH TEACHERS' INTENTIONS TO USE AUGMENTED REALITY USING DECOMPOSED THEORY OF PLANNED BEHAVIOR

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Approval of the Graduate School of Educational Sciences

Assist. Prof. Enisa MEDE
Director

I certify that this thesis satisfies all the requirements as a thesis for the degree of Master of Arts.

Assist. Prof. Hatime ÇİFTÇİ
Coordinator

This is to certify that we have read this thesis and in our opinion it is fully adequate, in scope and quality, as a thesis for the degree of Master of Arts.

Assist. Prof. Mustafa POLAT
Supervisor

Examining Committee Members

Assist. Prof. Mustafa POLAT	(BAU, ELT)	
Assist. Prof. Enisa Saban MEDE	(BAU, ELT)	
Assist.Prof. Tuncer CAN	(IUC, ELT)	

I hereby declare that all information in this document has been obtained and presented in accordance with academic rules and ethical conduct. I also declare that, as required by these rules and conduct, I have fully cited and referenced all material and results that are not original to this work.

Name, Last Name : Cemil Gökhan Karacan

Signature :

ABSTRACT

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Karacan, Cemil Gökhan
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The present study explored the factors that predict pre-service English teachers' intentions to use augmented reality (AR) in their future language classes. For this purpose, this study applied a mixed methods design.

The quantitative phase of the study consisted of 5-point Likert-type scale of Decomposed Theory of Planned Behavior administered to pre-service English teachers (N=141) after the implementation process which included training and discussion session on augmented reality technology in education and language classes. The qualitative phase of the study consisted of the semi-structured interviews (N=15) conducted with pre-service English teachers and reflection papers (N=55). Results indicated that attitude variable with a very high rate of perceived usefulness construct was the most significant predictor of pre-service English teachers' intentions to use augmented reality in their future classes, and qualitative data showed that nearly all pre-service English teachers held positive attitudes toward augmented reality and they intend to use this technology in their future classes mainly because of perceived usefulness and student influence. Additional findings put forward that attention-grabbing and motivation-providing were the two most frequently stated advantages of AR from pre-service English teachers' perspectives. Moreover, pre-service English teachers' transformational changes were found to be caused mainly by perceived ease

of use. This study offers implications for teacher educators, curriculum designers, teacher education program developers and teachers.

Keywords: Augmented Reality, pre-service English teachers, Decomposed Theory of Planned Behavior

ÖZ

AYRIŞTIRILMIŞ PLANLI DAVRANIŞ TEORİSİ İLE İNGİLİZCE ÖĞRETMENİ ADAYLARININ ARTTIRILMIŞ GERÇEKLİK TEKNOLOJİSİ KULLANIMI NİYETLERİNİ ETKİLEYEN FAKTÖRLERİN İNCELENMESİ

Karacan, Cemil Gökhan
Yüksek Lisans, İngiliz Dili Eğitimi Yüksek Lisans Programı
Tez Yöneticisi: Dr.Öğr.Üyesi Mustafa POLAT

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Bu araştırma İngilizce öğretmeni adaylarının geleceklerinde dil öğretimi derslerinde artırılmış gerçeklik teknolojisi kullanım niyetlerini etkileyen faktörleri incelemiştir. Bu amaç doğrultusunda, karma yöntem kullanılmıştır.

Araştırmanın nicel veri toplama aşaması, İngilizce öğretmeni adaylarına (N=141) eğitimde ve yabancı dil derslerinde artırılmış gerçeklik teknolojisi üzerine verilen eğitim ve tartışma seansından sonra uygulanan likert tipi Ayrıştırılmış Planlı Davranış Teorisi ölçeğinden oluşmaktadır. Nitel veri toplama aşamasında ise yarı yapılandırılmış görüşmeler (N=15) ve yansıma yazıları (N=55) kullanılmıştır. Bu araştırmanın sonuçları gösterdi ki yüksek orana sahip algılanan faydalılıkla beraber tutum, İngilizce öğretmeni adaylarının artırılmış gerçeklik teknolojisi kullanımı niyetlerini etkileyen en önemli faktör olarak bulunmuştur. Dahası, nitel bulgular neredeyse bütün İngilizce öğretmeni adayları artırılmış gerçeklik teknolojisine yönelik pozitif tutumlar sergilediğini ortaya koydu. Aynı zamanda nitel bulgular, İngilizce öğretmeni adaylarının artırılmış gerçeklik teknolojisini gelecekteki sınıflarında kullanmalarında en çok yararlılık ve öğrenci etkisinin payı olduğunu ortaya koydu. Bulgular, artırılmış gerçeklik teknolojisinin motivasyon sağlayıcı ve dikkat çekici özelliklerinin hizmet öncesi İngilizce öğretmenlerinin bakış açısından en çok dile

getirilen avantajlar olduğunu ortaya koymuştur. Bu çalışma öğretmen eğiticileri, müfredat planlayıcıları, öğretmenlik programları geliştiricileri ve öğretmenler için çeşitli öneriler barındırmaktadır.

Anahtar Kelimeler: Artırılmış Gerçeklik, İngilizce Öğretmeni Adayları, Ayrıştırılmış Davranış Teorisi

To W.W. My star, my perfect silence.

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LIST OF ABBREVIATIONS

AR	Augmented Reality
VR	Virtual Reality
DTPB	Decomposed Theory of Planned Behavior
CALL	Computer Assisted Language Learning
MALL	Mobile Assisted Language Learning
ELT	English Language Teaching
ICT	Information and Communication Technologies

Chapter 1

Introduction

This study, first, aims to identify which factors best predict pre-service English teachers' intentions to use augmented reality technology in their future language classes using Decomposed Theory of Planned Behavior (DTPB). Additionally, it examines pre-service English teachers' perspectives toward augmented reality technology in language teaching with a focus on creating augmented reality experiences and developing AR application. This study also focuses specifically on training pre-service English teachers on using and creating AR experiences and developing AR application for vocabulary teaching since vocabulary teaching is the most suitable language component that can be practiced with augmented reality technology. The upcoming chapter focuses on background that constructs the study along with the statement of the problem, the purpose of the study, research questions, and significance of the study that is followed by the definition section.

1.1 Theoretical Framework

As a theoretical framework, Decomposed Theory of Planned Behavior (DTPB) model was employed in this research to explore the factors that best predict pre-service English teachers' intention to use augmented reality (AR) technology in their future classes. Behavioral intention theories emerged first in social psychology to explain or predict an intention toward a tool or behavior. User intention theories and the DTPB emerged from studies on diffusion of innovation. Prior to DTPB, Theory of Planned Action (TRA) was employed along with Technology Acceptance Model (TAM) to investigate students' intention to use word processing program and their intention of use (Davis, Bagozzi, & Warshaw, 1989). Ajzen and Madden (1996) developed The Theory of Planned Behavior as a theory that predicts people's intention to perform behavior in the future. The theory consisted of 6 constructs that included attitudes, behavioral intention, subjective norms, social norms, perceived power, and perceived behavioral control. Even though this theory was successfully used for investigating intentions, it missed underlying constructs that lead to these main constructs.

Addressing that situation, DTPB model was developed by Taylor and Todd (1995). In this theory, lower constructs create stronger relationship between variables and thus, providing a more reliable result. In conclusion, DTPB model served as the foundation for the development of scale and of this study.

1.2 Statement of the Problem

Technology has been advancing at an unprecedented speed and field of education especially language pedagogy has applied various technological innovations. Employment of technology has increased in-class instruction (Tondeur, Pareja Roblin, Van Braak, Voogt, & Prestridge, 2016) and technology has been changing the educational practices both in minor and major perspectives. Ranging from multimedia technologies and mobile devices to virtual worlds, new technological tools have started to be implemented, which has even changed the way a course is delivered. New approaches in course delivery have emerged with the technological advancements (Barrett et al., 2002). For instance, Şimşek and Can (2015) delivered a departmental course named Comparative Education in a virtual world game called Second Life. In addition to that, 3D virtual worlds including language learning and math activities were created in Istanbul University (Elia, Can, & Şimşek, 2017; Şimşek & Can, 2016). The advent of technological tools into education appeals to new generation since they spend their entire lives surrounded by mobile phones, tablets, computers and gaming consoles (Prensky, 2001).

Educators need to catch up with the requirements technology brings and they are trying to follow the trends in the area (Han, 2012). Various technology tools are adopted in classes. Even though it is not prevalent, augmented reality technology has started to be utilized in education and language teaching lately. While technology progresses at extremely high speed, research studies that explore and assess them proceed at a slower pace (Polat, 2016).

Today's generation has been in close contact with technology and children of today allocate a great deal of time to technological tools ranging from mobile phones to game consoles (Prensky, 2001). It is further suggested that today's students are not the same students that our education system was designed to teach (Prensky, 2001).

Polat (2016) supported that idea by stating that language learners' way of learning, playing, communicating and socializing dramatically changed with advancements technology brought. The gap between students and teachers should not be widening for students to still respect and see their teachers as a gold mine of information. At that point, teachers need to keep up with the requirements technology brings (Pilgrim & Martinez, 2015). Various technological educational tools are utilized in education and language teaching. Recently, virtual technologies such as virtual reality and augmented reality have started to be implemented as well.

Augmented reality is a new-generation technology that allows video, picture and 3D objects to be visualized or audio to be played upon scanning a marker picture on mobile devices. Augmented reality has been at use in different lines of work for a long time now. Among these sectors, there are tourism (Fritz, Susperregui, & Linaza, 2005), assembly and maintenance field (Webel et al., 2013), medicine (Devernay, Mourgues, & Coste-Manière, 2001; Shuhaiber, 2004), engineering, construction and architecture (Chi, Kang, & Wang, 2013; Thomas, Piekarski, & Gunther, 1999) and even archaeology (Vlahakis et al., 2001). Even though various sectors are taking advantage of AR, only recently has the field of education started to look for ways to utilize AR.

Augmented reality has entered different lines of education and in the literature, there have been quite a few studies regarding the use of educational augmented reality (Chookaew, Howimanporn, Sootkaneung, & Wongwatkit, 2017; Erbas & Demirer, 2014; Küçük, 2014). Even though it is not prevalent, language learning and teaching with AR has been mentioned in the literature as well. These studies generally focused on the effectiveness of AR experiences on motivation and learning outcomes. Perceptions of pre-service teachers toward AR technology were investigated as well (Delello, 2014; McNair & Green, 2016). A digitally literate teacher must not be the consumer of technological products only, he/she also needs to be able to effectively create and apply digital multimedia in his/her classes (Demirekin, 2014; Jacobs et al., 2014). Research on AR in education is rather wide but an investigation of exploring pre-service language teachers' intentions to use augmented reality technology in their future classes and their perspectives are not described in the literature. This study is going to explore the factors that predict pre-service English language teachers'

intentions to use AR in their future classes and to investigate their perspectives toward AR.

1.3 Purpose of the Study

With the above-mentioned background information and the need for this research, the purpose of this study is twofold; to explore which factors best predict pre-service English teachers' intentions to use AR technology in their future classes and to explore pre-service English teachers' perspectives. Under the perspectives, this study aimed to explore the advantages and disadvantages of AR. Transformational changes in pre-service English teachers were also examined. In order to achieve these aims, an adapted DTPB scale was administered, pre and post interviews were conducted, and analyzed reflection papers that students wrote after the implementation.

1.4 Hypotheses / Research Questions

In this section, research hypotheses and research questions were presented. Research hypothesis for every DTPB variable and construct were designed.

1.4.1 Attitude. Attitude can be defined as someone's feelings toward performing a specific behavior (Ajzen, 1991). In this study, attitude refers to pre-service English teachers' feelings about using AR in their future classrooms. In the literature, there have been studies that found strong relationships between attitude and technology use (Al-Zaidiyeen, Mei, & Fook, 2010; Park, 2009; Teo, 2009). Hence, it is predicted that pre-service English teachers' positive attitudes toward AR will be linked positively to their intentions to use AR. The main construct of attitude is subdivided into constructs such as perceived usefulness, perceived ease of use and compatibility. Perceived usefulness is defined as the concept that helps teachers to perform their objectives better or to help students in the learning process. Perceived ease of use, on the other hand, is defined as the level of easiness in using a particular tool. Technology cannot enhance teachers' quality of job or performance as long as they find that specific technology as being difficult to use (Baek, Jung, & Kim, 2008). Perceived usefulness and ease of use are the two important factors affecting teachers' intention of use (Teo, 2011; Teo, Luan, & Sing, 2008).

Compatibility, in this specific framework and study, refers to the idea of how well this technology fits into the activities, tasks, and courses. Moreover, it is also connected to students' needs and objectives. It is estimated that compatibility of augmented reality technology impacts behavioral intentions.

In the literature, attitudes of teachers toward technology were found to be a crucial factor for creating effective technology integration (Bitner & Bitner, 2002). Attitude toward using augmented reality technology in future classrooms would give positive results in the case of higher perceived usefulness, ease of use and compatibility. Attitudes toward using AR in classes is likely to become positive in the case of higher perceived usefulness, ease of use, and compatibility (Ajjan & Hartshorne, 2008).

H1: Attitudes of pre-service English teachers toward the use of AR positively affects their behavioral intentions.

H1a: Perceived usefulness positively affects attitudes to use AR.

H1b: Perceived ease of use positively affects attitudes to use AR

H1c: Perceived compatibility positively affects attitudes to use AR

1.4.2 Subjective norms. Subjective norms category describes an individual's perceptions as to whether or not others believe they should be undertaking a specific behavior (Ajzen, 1991). In an educational setting, teachers' intentions to use a specific technology might depend on his/her colleagues as well as other people that are important for them. Subjective norms, in this study's framework, refers to perceptions of superiors, peers, and students toward a concept or tool. Subjective norms have been regarded as one of the key factors in determining teachers' intentions to use technology (Burton-Jones & Hubona, 2006; Sugar, Crawley, & Fine, 2004). It is anticipated that subjective norms of pre-service English teachers are positively related to their behavior intentions. In accordance with previous statement, the hypotheses below are proposed:

H2: The subjective norms of pre-service English teachers toward the use of AR positively affects their behavioral intentions.

H2a: Superiors influence to use AR positively affects the subjective norms of pre-service English teachers.

H2b: Peer influence to use AR positively affects the subjective norms of pre-service English teachers.

H2c: Student influence to use AR positively affects the subjective norms of pre-service English teachers.

1.4.3 Perceived behavioral control. Perceived behavioral control is defined as people's perceptions of their ability to perform a given behavior. Innovative technologies are more likely to be adopted if teachers believe in their skills as well as with the presence of technological infrastructure (Albion, 1999; Teo, 2009; Wang, Ertmer, & Newby, 2004). Studies show that pre-service teachers likely to have positive attitudes toward technology (Cullen & Greene, 2011; Lei, 2009; Teo, 2009). Intention to use technology depends mostly on teachers' beliefs in themselves and the possibility of use is likely to rise if he/she has a belief of having control over technology. Perceived behavioral control, in this framework, is decomposed into self-efficacy, the facilitative conditions of technology and facilitative conditions of resources. Self-efficacy is the perception of an individual's to perform behavior (Bandura, 1982). In this framework and study, pre-service English teachers' self-efficacy can be described as their perceptions of using AR in their future classrooms. Teachers' technology self-efficacy is a strong determiner of his or her technology acceptance (Gong, Xu, & Yu, 2004; Holden & Rada, 2011; Hu, Clark, & Ma, 2003; Yuen & Ma, 2008). Teachers who hold positive attitudes, positive perceptions and high self-efficacy toward technology are likely to employ technology for their classes (Holden & Rada, 2011). Facilitative conditions are external factors affecting the intention of a teacher to adopt a technology. (Groves & Zemel, 2000; Teo et al., 2008). Access to Wi-Fi, suitable hardware and software as well as time can be examples of facilitative conditions. When facilitative conditions are positive, teachers' intention to adopt technology is likely to be higher (Oliveira & Martins, 2011). Therefore, the following hypotheses are introduced:

H3: The perceived behavioral control of pre-service English teachers to use AR positively affects behavioral intentions.

H3a: Pre-service English teachers' self-efficacy of using AR positively affects perceived behavioral control.

H3b: Facilitating technology conditions positively affect pre-service English teachers' perceived behavioral control.

H3c: Facilitating resource conditions positively affect pre-service English teachers' perceived behavioral control.

1.4.4 Behavioral intention. In this framework; attitude, subjective norm, and perceived behavioral control variables constitute behavioral intention which refers to motivational factors in connection with pre-service English teachers' intention to use AR. Behavioral intention has been observed to be one of the leading factors in the prediction of behavior for performing an action (Ajzen, 1991; Liaw, 2008; Park, 2009; Park, Nam, & Cha, 2012). Based on this close connection between intention and behavior; in the literature, behavioral intention has been employed to predict a specific behavior (Ajjan & Hartshorne, 2008; Hartshorne & Ajjan, 2009). There might be a positive relationship between intention and the actual behavior of pre-service English teachers and thus; the following hypothesis is introduced:

H4: Pre-service English teachers' behavioral intentions to use AR positively affects their behavior.

Based on current research and place of AR technology in pre-service teacher education, this study focuses on the following research questions:

1-What factors best predict English pre-service English teachers' intentions to use augmented reality technology in their future classes?

2-What perspectives do pre-service English teachers' have toward the use of augmented reality technology in their future classes?

a) What are the factors that affect pre-service English teachers' intention of AR adoption in their future classes based on DTPB framework?

b) What are pre-service English teachers' perspectives on the advantages and disadvantages of AR in language teaching & learning?

c) What are the underlying reasons for pre-service English teachers' transformational changes in adoption of AR?

1.5 Significance of the Study

The integration of technology into language teaching and learning has always been studied. Students enjoy using technology for their learning outcomes. Most of the teachers willingly integrate technology into their instruction since it eases the teaching process. New technologies hit the market every day and field of education and language teaching takes a share of it without a doubt. Various technological innovations have found themselves in foreign language instruction ranging from MP3 players, projectors, video players and computers to virtual worlds and augmented reality. Augmented reality technology has entered the field of education and it has yielded various outcomes in terms of motivation, academic success, interaction, collaboration, and retention of information in the area of language learning (Radu, 2014). When these points are taken into consideration, it might be beneficial to employ augmented reality technology into language teaching instruction and for it to be effectively integrated into language teaching instruction, first pre-service English teachers' intention of use along with underlying reasons needs to be explored and they should be given a fundamental training on the use of AR in language classes. Hereby, they can effectively integrate this technology in their future classes.

This research study is unique in 3 perspectives. The first one is that it is one of the few studies that employ Decomposed Theory of Planned Behavior in language pedagogy. Moreover, the adapted DTPB model which is very comprehensive and established model has not been employed for pre-service English teachers in the literature.

The second unique aspect of this study is that it gives training to pre-service English teachers on the use of AR. Furthermore, they are expected to create AR content and develop an AR mobile application for vocabulary teaching purposes.

The other unique aspect of this study is that it reveals pre-service English teachers' perspectives on potential advantages and disadvantages of AR in language learning and teaching.

This study also offers a very comprehensive literature review on educational augmented reality with a specific focus on language learning and teaching.

As a result, this study aims to explore the factors that best predict pre-service English teachers' intentions to use augmented reality technology in their future classes and moreover, pre-service English teachers create AR experiences using ready platforms and develop a stand-alone AR application both of which have never been experienced or experimented by pre-service English teachers up to now. The researcher aims to contribute to foreign language education literature by investigating pre-service English teachers' intention to use AR, determining AR's advantages and disadvantages from pre-service English teachers' perspectives and training pre-service English teachers' to use and create AR experiences and develop an AR application along with investigating their transformational changes related to before and after the implementation. The present study may guide teachers, teacher trainers, teacher education curriculum planners and course book designers.

1.6 Definitions

Computer-Assisted Language Learning (CALL): It is "the use of computer software for learning languages" (Macmillan English Dictionary, 2002).

Augmented Reality: It is a new-generation technology allowing video, picture, 3D objects to be visualized or audio to be played upon scanning a marker picture on mobile devices (Ro, Brem & Rauschnabel, 2018).

Virtual Reality: the computer-generated simulation of a three- dimensional image or environment that can be interacted with in a seemingly real or physical way by a person using special electronic equipment, such as a helmet with a screen inside or gloves fitted with sensors (Oxford English Dictionary, 2019).

User Intention Theories: Initially developed in the area of social psychology, user intention theories aim to predict one's actual behavior in adopting a specific technology or innovation

Chapter 2

Literature Review

2.1 Introduction

This chapter provides a detailed overview of augmented reality technology in terms of its history, its use in education and language learning/teaching with references to its' advantages and disadvantages and its related extensions such as material design, vocabulary teaching, and pre-service teacher education.

2.2 Language Teaching and Technology

English language teaching/learning has been benefiting from technology for a long time now and technology has the ability to provide students with the tools that enable them to take advantage of language learning opportunities which makes language learning more effective. Use of computers as a teaching aid in language teaching has been an integral part of instruction. The use of computer instruction in education actually dates back to early 1960s when movies, phonographs and tape recorders started to be used for English teaching and during 1970s it was regularly utilized in European schools (Davies, 2011). During the period of the 1970s, audio and video courses were utilized with the advent of slide show technology. In the following decade, language labs were equipped with computers, tape recorders, overhead projectors. Ahmad (2012) stated that in the millennial age, media technologies such as pictures, videos, conferencing, animation-creation, computer games, chat rooms, and social networking sites ranging from Penpals to Facebook have affected the way we learn and teach languages. With such tools, learners now have endless opportunities to learn languages and he further stated that these technologies made language learning and teaching more enjoyable and productive (Ahmad, 2012). As stated before, even the instructors' way of course-delivery has changed with the advent of technological tools (Şimşek & Can, 2015).

Organizations and journals devoted to technology and language learning such as EUROCALL, Language Learning & Technology, ReCALL, and CALICO Journal have started to influence language teaching society. Emerging technologies in

language learning have started to be employed extensively (Godwin-Jones, 2015). Technology-enhanced learning has included emergent technologies from social networks, games to VR and AR (Johnson et al., 2014).

2.2.1 Information and communication technology (ICT). ICT has brought a new dimension to education. It has opened new horizons not only for learners but also for teachers since teachers' role is not the same as it was a decade ago. Furthermore, students can learn the content knowledge in a more contextual way with the help of rich media that ICT provides. It is also possible to work flexibly around the projects given and create even multi-authored texts (Ghasemi & Hashemi, 2011). ICT can provide active learning (Dori & Belcher, 2005), collaborative learning (Warschauer, 1997) and it can also improve instructional methods (Goodyear, 2005).

Role of ICT in language teaching and learning cannot be denied (Akpabio & Ogiriki, 2017). ICT even provides students with an opportunity to interact with native speakers of other communities through the use of video conference or social networking sites; moreover, students are encouraged at that point to use the language for meaningful purposes and in real contexts. ICT provides room for interactive teaching and it generates opportunities for creativity in addition to appealing to all learning styles. It also leads students to work independently and make use of language in an autonomous way. Language learners employing ICT can access to information easily, review and evaluate their work and improve efficiency (Ghasemi & Hashemi, 2011). The aforementioned opportunities ICT offers have made ICT a crucial part of education and an essential element of the curriculum as well (Papanastasiou & Angeli, 2008).

2.2.2 CALL. Technology has dramatically affected the way people live, behave and interact with each other (Roberge, Long, & Burnham, 2002). In recent years, a day without computers cannot even be thought of (Goh, Quek, & Lee, 2010). Being a very integrated part of our lives, computers have naturally infiltrated into education (Goh, Quek, & Lee, 2010). Use of computers specifically in language has been defined as Computer-Assisted Language Learning (CALL). CALL has been in use and center of focus since the advent of computers (Nunan & Carter, 2001). CALL has become a vital part of the language learning process and its effect has been felt in every area of

education. Levy (1997) defined CALL as "the search for and study of application on the computer in language teaching and learning" (p.1). In simple terms, CALL is a language learning or teaching activity performed with computers (Schofield, 1995).

In the literature, teachers' positive attitudes toward CALL have already been touched upon (Aydın, 2012; Park & Son, 2011) even though positive attitudes toward CALL do not necessarily mean that teachers are going to implement it (Egber, Paulus & Nakamichi, 2002). In addition to teachers' attitudes, students in various studies have reported positive attitudes toward CALL (Almekhlafi, 2006; Ayres, 2000; Escalada & Zollman, 1997; Robert, 2002). Warschauer (1996) categorized CALL in three phases namely, structural CALL, communicative CALL, and integrative CALL in accordance with technological advancements and period of time.

Behavioristic CALL ranged between the 1970s and 1980s and it based its activities onto Grammar-Translation and Audio-Lingual method paradigms while embracing a structural view toward language learning. The aforementioned activities generally were drills and practices with a focus on accuracy.

The phase ranging from the 1980s to 1990s was defined as Communicative CALL in which Communicative Language Teaching paradigm was adopted with the adoption of cognitive view toward language. Communicative activities which focused on fluency and intelligible communication were adopted.

With the advent of Multimedia and Internet in the millennial era, CALL of 2000s was defined as Integrative CALL and it adopted content-based paradigms with an emphasis on authenticity. Socio-cognitive theory view focusing on social interaction and meaningful exchange also played a role in Integrative CALL era. Interactive call, with the help of internet and media technologies, sought to integrate task-based, project-based and content-based approaches along with integrated language skills. Brooks defined multimedia as the combined use of various media components such as image, audio, video, and slides (as cited in Ghanizadeh, Razavi, & Hosseini, 2018). Multimedia technology provides endless opportunities and it has found to be an effective factor in language learning (Shi, 2017). Warschauer (1997) commented that multimedia technology can improve students' motivation and reduce anxiety by creating a relaxing and familiar environment for this generation of students. Angers

and Machtmes (2005) put forward that classrooms needed to incorporate technology and learning experience should also be supported by technological tools. With the advent of mobile devices into our daily lives, the focus has started to shift from computer-assisted language learning (CALL) to mobile assisted language learning (MALL).

2.2.3 MALL. Mobile learning has been defined as the learning conducted through the use of small computing devices including handheld devices and smartphones (Mcconatha, Praul, & Lynch, 2008). Mobile technologies allow users to embed learning into their daily lives. These technologies are intended to be taken advantage of at anytime and anywhere. Jarvis and Achilleos' (2013) study showed that consumers and students are in favor of mobile learning and learners emphasized their preference in employing mobile language learning. Kukulska-Hulme (2005) favored MALL for its great potential since it can provide students with real-time, collaborative, contextual and life-long learning in and outside of the classroom. Use of MALL in education has also found to be motivating for students (Palalas, 2011). Effectiveness of MALL and students' attitudes have been studied in the literature (Biçen, 2015, Liu & Chen, 2015). In addition to the positive attitudes of students, pre-service teachers had positive attitudes toward MALL as revealed by studies conducted in Turkey (Oz, 2014; Serin, 2012; Uzunboylu & Özdamlı, 2011).

Language learning and teaching is one of the areas that has been well investigated in mobile learning (Viberg & Grönlund, 2012). Mobile phones have been identified as supportive tools for language teaching and the learning process (Demouy, Kukulska-Hulme, 2010). Keegan (2003) believed that mobile learning would shape the future of learning. Today, we observe that this is the case because millions of people are learning a language with mobile applications such as Duolingo, Busuu, and Babbel (Rosell-Aguilar, 2018). Lee (2011) stated that MALL had ties to Web 2.0 technologies such as wikis, blogs, synchronous blogging, vlogging, moblogging, audio blogging, Facebook & social networking, and Flickr. MALL has generally been implemented with vocabulary or grammar learning purposes employing behaviorist and structuralist teaching approaches (Burston, 2014).

Virtual technologies such as virtual reality and augmented reality have the potential to create more motivating learning environments (Kerawalla, Luckin, Seljeflot, & Woolard, 2006). VR has been implemented in nearly every line of education (Merchant et al., 2014) and studies conducted revealed that virtual reality provided motivation and better academic performance (Di Serio, Ibanez, & Kloos, 2013; Martin-Gutierrez & Meneses, 2014; Holley, Hobbs, & Menown, 2016). Sykes (2018) even proposed that VR could be implemented in micro units of the existing curriculum or it could also be integrated in each chapter as a component. Moreover, there are seventeen courses on VR/AR delivered by well-known universities both at undergraduate and graduate levels worldwide.

The fact that mobile phones of today are equipped with various sensors and they are powerful enough to run augmented reality technologies (Mota, Ruiz-Rube, Dodero, & Arnedillo-Sánchez, 2018) paves the way for it to be employed for in in-class instruction. AR technology which is also referred to as part of mobile technology has become widely used and less expensive over time (Kerawalla, Luckin, Seljeflot, & Woolard, 2006). The emergence of mobile technology and augmented reality resembles since both faced difficulties while finding their place in education. Today, nearly a decade later of its appearance, mobile learning has become an integral part of education and it continues to grow at speed. Greenwood and Wang (2017) stated that AR might have to go through a similar roadmap.

2.3 Augmented Reality Technology

AR is so widely used that its applications are in the hands of millions of people every day at unawares. Even though most people are not familiar with the concept of augmented reality, they have probably used it in some part of their lives. For example, adding virtual glasses or monkey mask on your face on Snapchat or Instagram Stories is actually a basic example of AR since the reality is augmented by these filters. People generally confuse the terms augmented and virtual reality; thus, a distinction needs to be made. Azuma (1997) defined this distinction by saying “AR supplements reality, rather than completely replacing it” (p.2). Virtual reality immerses the user into a whole environment with the help of VR glasses or headsets (Moore, 1995). Augmented reality is a new-generation technology allowing video, picture, 3D objects to be

visualized or audio to be played upon scanning a marker picture on mobile devices (Ro, Brem & Rauschnabel, 2018) and it bridges the gap between real and virtual space (Manuri & Sanna, 2016). Even though AR technology has been around for a long time, it has recently been under much interest since affordable smart mobile devices have been made available to the public (Wu et al., 2013). Augmented reality has been utilized in tourism (Fritz, Susperregui, & Linaza, 2005), assembly and maintenance field (Webel et al., 2013), medicine (Devernay, Mourgues, & Coste-Manière, 2001; Shuhaiber, 2004), engineering, construction and architecture (Chi, Kang, & Wang, 2013; Thomas, Piekarski, & Gunther, 1999) and even archaeology (Vlahakis et al., 2001). For instance, by wearing the AR headset, workers in car and maintenance industry are provided with highlighted hints on real objects which provide information of what to do and in which order (Regenbrecht, 2005). AR technology can be facilitated without a financial budget and it can save time and money in the cases where otherwise expensive tools would need to be set up (Gavish et al., 2015). It can provide educators with the resources instead of buying expensive and unsustainable equipments (Fjeld & Voegtli, 2002).

Figure 1. Virtual Reality Headset

Education field offers numerous opportunities for the integration of augmented reality technology and applications in both learning and teaching (Wang, Callaghan, Bernhardt, White, & Peña-Rios, 2017). Since ubiquitous learning involves smartphones (Joseph & Uther, 2009), AR might be a supportive tool for ubiquitous learning in authentic environments (Dede, 2011). Johnson, Smith, Willis, Levine, and Haywood (2011) stated in their study that AR could be one of the new technologies that can also have pedagogical applications. The following sections will discuss AR's pedagogical implications.

2.3.1 Learning theories and augmented reality. Basing an educational augmented reality application onto a suitable learning theory depends on the desired learning outcomes as well as to context. If an AR application is used for informal learning context, the theory of situated learning might come into play. When an application is employed in science classes, it may as well be based on problem-based or experiential learning theories. Dunleavy and Dede (2014) argue that AR technology is accredited with situated learning theory and constructivist learning theory and further elaborates on this statement by saying:

> "...as it positions the learner within a real-world physical and social context while guiding, scaffolding and facilitating participatory and metacognitive learning processes such as authentic inquiry, active observation, peer coaching, reciprocal teaching and legitimate peripheral participation with multiple modes of representation" (p.735).

Various studies related to AR have benefitted from different learning theories. These studies are stated below with related theories.

Situated learning theory argues that learning is the outcome of relationships between people and integrating prior knowledge with contextual learning that is mostly authentic, informal and accidental (Stein, 1998). Squire and Klopfer (2007) employed situated learning theory for their science project which positioned students with a problem-solving framework in the real-world.

Theory of constructivism puts forward that learning is an active and constructive process constructed by people and with their subjective representations. New information in this theory is associated with prior knowledge (Ertmer & Newby, 1993). Augmented environment switches its course from a teacher-centered environment to a student-centered learning environment in which students construct new information upon their existing knowledge; thus, bringing constructivism into play (Delello, McWhorter & Camp, 2015). Echeverria et al. (2012) facilitated a collaborative learning activity in which students worked as a group to reach a specific goal and naturally, the theory of computer-supported collaborative learning stemming from constructivism was applied.

Cognitive information processing theory can be defined as basically information processing. Despite not being a single theory, it is used for various theoretical perspectives including sequence and execution of cognitive events. AR applications adopt cognitive information processing theory as well because displayed image, video or 3D object might transfer to short term memory and further practice might transfer the knowledge into working memory and when the knowledge is mastered, the information might pass on to long term memory (Chen & Tsai, 2012).

Cognitive theory of multimedia learning argues that learning from words and associations such as picture, audio and video provides deeper learning when compared to learning from words only (Mayer, 2001). A group of researchers investigating situated vocabulary learning has applied multimedia learning their as a framework for developing educational AR application (Santos, 2016).

Game-based learning theory refers to a type of game playing that has already determined learning outcomes in mind (Shaffer, Halverson, Squire, & Gee, 2015). Squire and Jan (2007) based their study on game-based learning theory which led them to integrate elements of encouragement, challenge, physicality, multiple representation, and social interaction. In their study, Furio, Gonzâlez-Gancedo, Juan, Seguî, and Costa (2013) developed an AR game that is based on Gardner's multiple intelligence and Kolb's (1984) theory of experiential learning as well. The following section will discuss augmented reality's place in education.

2.3.2 AR in education. Education systems are constantly in need of change with the time and requirements it brings. Today's generation has been bombarded with technological advancements. Thus, it is easier for this generation to adapt to the latest technology since they already center their life on technology (Lee, 2000). Students of this generation who are also referred to as 'digital natives' constantly involved with technology from the day they were born (Prensky, 2001). Prensky (2001) further emphasized that students spent their entire lives with mobile phones, computers, video games, music players and video cams. Prensky (2001), nearly twenty years ago, highlighted the characteristics of today's children by stating "our students have changed radically, and today's students are no longer the people our educational system was designed to teach" (p.1). In parallel with the previous statement, a $300

million study that is backed up by National Institute of Health has recently revealed that video games, smartphones and tablets are physically altering the adolescents' brains (Lisdahl et al., 2018). Twenty-years after Prensky's remarks, the situation is much more serious now. In the last decade, with the advent of smartphones with affordable prices into our lives, not only teenagers but also elderly people have drastically immersed themselves in digital worlds as well (Doğruel, 2015). Every technological innovation that is not developed specifically for education has actually been implemented in educational areas ranging from computers, blogging, podcasting, SMS to virtual environments. Augmented reality is continuing to gain recognition in the field of education (Atwood-Blaine & Huffman, 2017). It has started to be applied in both teaching and learning and has found itself a place nearly in every area of education (Chookaew, Howimanporn, Sootkaneung, & Wongwatkit, 2017; Erbaş & Demirer, 2014; Küçük, 2014). Digital natives that Prensky talked about respond positively to augmented reality technology in education (Wang et al., 2017).

Augmented reality is such a powerful tool in education that it even has enabled students to see the life cycle of butterflies (Tarng & Ou, 2012). With the affordability of high-tech devices in recent years, there is an increase in the adoption of augmented reality in education (Lee, 2012) and this naturally has led to an increase in AR enhanced educational activities. AR enhanced activities refer to the activities that employ augmented reality technology. AR can foster curiosity and lead students to discover more when engaged in a task or the learning process (Di Serio, Ibáñez & Kloos, 2013). AR is said to "engage students with complex problem-solving and higher-order thinking for deeper learning" (Wang et al., 2017, p.1400). It was also found to be an effective educational tool for improving learning (Lin et al., 2016; Manuri & Sanna, 2016). Augmented reality has been facilitated in different educational settings since it makes learning and teaching more engaging and interesting (Chookaew, Howimanporn, Sootkaneung & Wongwatkit, 2017).

There have been quite a number of studies related to AR in education and most of them were conducted in the areas of formal and natural sciences such as mathematics, geometry, engineering and also other fields of study such as architecture, medicine, biology, physics and chemistry (Chen, 2006; Chi, Kang, & Wang, 2013; Duarte, Cardoso & Lamounier, 2005; Kamarainen et al., 2013; Gillet, Sanner, Stoffler,

Goodsell, & Olson, 2004; Redondo et al., 2012; Kaufmann & Schmalstieg, 2002). AR technology is not limited to any specific set of areas and it has even reached to special education, especially for hearing impaired and visually impaired students (Dieker, Hynes, Hughes, & Smith, 2017).

The advantages, disadvantages as well as limitations, effectiveness and features of augmented reality in various educational settings are going to be scrutinized in the following sections.

2.3.2.1 AR advantages. Depending on the aforementioned studies in the previous chapter, it can be stated that augmented reality is a practical and effective educational tool. In the Horizon Report 2012, it was stated that AR had strong ties to powerful, contextual and situational learning experiences along with the discovery of embedded virtual information in the real-world (Johnson et al., 2012). Radu (2004), in his study, put forward that AR technology provided long-term memory retention, higher motivation, and increased content understanding. It has also been experimented for building up 21st-century skills (Schrier, 2006; Chang, Morreale, & Medicherla, 2010; Qian & Klark, 2016; Dede, 2010). A study has even focused on teaching practices of AR/VR (Klimova et al., 2018). Augmented reality in education has been studied on in regard to various factors such as motivation, retention, academic success, learning environment, interaction, and collaboration.

2.3.2.1.1 Motivation. "Motivation is a star player in the cast of characters assigned to L2 learning scenarios around the world" (Brown, 2014, p.158). The crucial role of motivation in language learning has been agreed upon by a number of researchers (Ahmed, Aftab & Yaqoob, 2015; Ahmed, Esmail & Noreen, 2015; Atta & Jamil, 2012; Axton, 2012; Dornyei & Csizér, 2006; Mahmoud & Tanni, 2014; Martin, 2003; Prensky, 2001; Redzuan, Buda & Abdullah, 2014). Moreover, motivation is the fundamental element to learning, Weiner (1985) stated. On the other hand, lack of motivation is one of the most critical academic problems today's generation face (Legault, Green-Demers & Pelletier, 2006). In a number of studies, researchers found out that AR technology provided motivation regardless of students' level and area (Aziz et al., 2012; Billinghurst & Duenser, 2012; Bujak et al., 2013; Chang et al., 2014; Cheng, 2017; Di Serio, Ibáñez, & Kloos, 2012, 2013; Jara et al., 2011; Juan et al.,

2010; Kaufman & Dünser, 2007; Liu & Chu, 2010; Liu, Tan & Chu, 2009; Mahadzir, 2013; O'Brien & Toms, 2005; Perez-Lopez & Contero, 2013; Sotiriou & Bogner, 2008; Sumadio & Rambli, 2010; Tarng & Ou, 2012). In the light of the findings of a study, AR technology was found to be a motivational tool by first-year primary school students. Researchers of the study further suggested that augmented reality technology could even be more immersive and phenomenal, thus; improving students' performance (Mahadzir, 2013). Mumtaz et al.'s study (2017) investigated students' learning and motivation in an experimental manner including a blended and traditional classroom context. Students using augmented reality systems had a higher motivation when compared to those in the traditional classroom context. Findings also pointed out that the experimental group's learning performance was higher. In another study, Perez-Lopez and Contero (2013) studied the effect of AR technology in a science class and findings revealed that AR was the main factor in promoting learners' motivation and interest. Furthermore, AR group performed better on the post-test and retained the knowledge in a longer period. Even if it is not related to social sciences or languages, a study conducted in a visual art course found out that middle-school students' motivation highly improved with the use of AR technology. This study considered four motivational factors: attention, relevance, confidence, and satisfaction. Attention and satisfaction factors in an augmented-reality-based learning environment were better rated when compared to ratings obtained in the slides-based learning environment (Di Serio, Ibáñez, & Kloos, 2013). Motivation alone is not sufficient for learning. Restoring the information and using it accordingly also assist the learning process.

2.3.2.1.2 Retention of information. In addition to motivation, there have been studies investigating the retention of information, understanding of the content knowledge and knowledge acquisition in the process of employing AR. Understanding of the content in every area of education poses great importance. Most of the studies regarding AR in education conclude that it has a profound effect on understanding of the content (Ivanova & Ivanov, 2011; Kaufmann & Schmalstieg, 2003; Klopfer & Squire, 2008; Núñez et al., 2008; Zhou, Cheok, Pan, & Li, 2004; Shelton, & Hedley, 2002; Echeverrîa, 2012). In addition to the understanding of the content, AR was also helpful in providing authentic and meaningful contextual support (Clarke & Dede, 2007; Dunleavy, Dede & Mitchell, 2009; Elford, 2013; Ivanova & Ivanov, 2011;

Johnson et al., 2011). A few studies found out that students experiencing the course content with AR had better retention and understanding of the target knowledge. (Santos et al., 2016; Solak & Çakır, 2015; Doğan, 2016). Their studies' results have also been supported with an experimental study which concluded that augmented reality was a leading factor in increasing content retention (Ibáñez, Di Serio, Villarán, & Kloos, 2014). With its feature of integrating virtual objects onto real world, augmented reality builds a bridge between theory and practice resulting in better learning and retention (Sayımer & Küçüksaraç, 2015). Research studies conducted in the area of AR in education indicate that AR-based experience provides long-term content retention when compared to other multimedia systems or traditional classroom environments (Vincenzi et al., 2003; Valimont et al., 2002; Macchiarella et al., 2005). Knowledge acquisition and retention level of people who participated in a study showed that AR had a positive effect on these variables (Sommerauer & Müller, 2014). In a study conducted by Shea (2014), comprehension level of content along with its effect on language and communication showed favorable improvements. In a study conducted in a primary school level, the results revealed that AR technology consisting of multimedia content provided a greater retention of knowledge when compared to the traditional approach (Cascales, Pérez-López, & Contero, 2013). Zhang et al. (2014) put forward that AR technology enhanced students learning of content, increased their interest and led them to be more active and engaged in interactions when compared to students in control group.

2.3.2.1.3 Interaction. AR applications created for supporting teaching and learning process improve teacher-student and student-student interactions (Manuri & Sanna, 2016). Long (1996) defined interaction as something that "facilitates language acquisition because it connects input (what learners hear and read); internal learner capacities, particularly selective attention; and output (what learners produce) in productive ways" (as cited in Muho & Kurani, 2014, p.48). It provides students with more input some of which might be a good example of helping them to make a change in their own linguistic output. A number of studies found that AR technology increased the interaction level (Ivanova & Ivanov, 2011; Kesim & Özarslan, 2012; Nincarean, Alia, Halim & Rahman, 2013; Wojciechowski & Cellary, 2013). In a study, AR technology was also found to improve peer interaction and communication among

fourth graders (Chiang, Yang, & Hwang, 2014). As the student's interaction with other student or teacher increases, the level of learning may also improve as suggested by Vygotsky's (1978) social cognitive development theory. In addition to improving the effectiveness of the teaching-learning process, AR bolsters the student-content interaction and it improves learning performance (Joo-Nagata et al., 2017; Hwang et al., 2015). In an experimental study conducted by Al-Yousefi (2015), the results showed that students in the experimental group practicing AR as a means of teaching instruction had a higher degree of interaction in addition to higher test scores contingently with the level of interaction.

2.3.2.1.4 Learning outcomes. Augmented reality has found to improve learning outcomes in different areas such as designing, language, visual art and science (Chang, Wu, & Hsu, 2013; Kamarainen et al., 2013; Redondo et al., 2012). Since equipment is really expensive for science classes, other means of instructions have been considered and AR has found to be more favored in several branches of science while areas such as social sciences, business, law, and administration education rarely make use of augmented reality technology (Özdemir, 2017). Academic success, part of learning outcomes, is one of the most extensively researched constructs in educational research and it poses great importance (York, Gibson, & Rankin, 2015).

2.3.2.1.5 Academic success. Various studies conducted on the use of AR in education have emphasized that AR technology has been an important factor in academic success at every level of education ranging from kindergarten to higher education (Barreira et al., 2012; Hsieh & Lee; 2008; Vate-U-Lan, 2012). In an overview realized by Akçayır and Akçayır (2017), it was revealed that enhanced learner achievement was the most frequent educational benefit of augmented reality. Yang (2013) stated that AR could improve learning outcomes. Likewise; in a study conducted by Redondo Dominguez et al. (2017), it was found out that the group employing AR had a higher academic performance in addition to higher motivation. A study conducted by Freitas and Campos (2008) revealed interesting results; in their study, academically good students did not show a sign of improvement but students with lower academic success showed a greater improvement. AR games were reported to be motivating and easily-understandable by the students (Schrier, 2006). A research study employed an AR game that was designed to teach animal vocabulary for students

learning English in Portugal. In this experimental study, researchers compared the results from MOW (Matching Objects and Words) and reached the conclusion that students using AR game had a "superior English learning progress" than the other group employing traditional methods (Barreira et al., 2012, p.6). In addition to retention improving feature, AR technology was found to help students understand complex concepts (Ivanova & Ivanov, 2011). A study investigated students' academic success and satisfaction levels through the use of augmented reality application in Ottoman Turkish reading. In this experimental study conducted with 60 students in total, findings showed that experimental group had a higher scores in academic success along with positive attitudes toward the use of AR in Ottoman Turkish readings (Özcan, Özkan, & Şahin, 2017). A mixed-method study aimed to investigate how an AR application affected learners' knowledge construction behaviors and learning performances. Results indicated that learners implementing AR system showed significantly better learning achievements when compared to those who learned with the traditional 2D simulation system (Lin, Duh, Li, Wang, & Tsai, 2013). In an experimental study applied to ninth-grade 82 students (Ibanez, Di-Serio, Villaran-Molina, & Delgado-Kloos, 2016), the group employing AR outperformed in learning performance compared to the control group. In another study, researchers developed an AR application to see whether static and dynamic content had a differential effect on students' science learning. Results indicated that dynamic content helped students to enhance their learning perception and performance (Montoya, Diaz, & Moreno, 2017).

2.3.2.1.6 Multimedia. Educational augmented reality applications provide users with relevant multimedia such as text, picture, sound, video or a 3D object (Wang, Kim, Love, & Kang, 2013). Interactive multimedia feature of AR can lead students to acquire more meaningful input. Augmented reality systems provide students with rich-media embedded in real-world environment whenever and wherever it is needed. This can reduce the cognitive load by providing students with "perfectly situated scaffolding " (Bower, Howe, McCredie, Robinson, & Grover, 2013, p.1). Augmented reality, an active technology, helps students to construct new understanding based on interactions they perform with the virtual hypermedia (Johnson, Adams, & Cummins, 2012).

2.3.2.1.7 Collaboration. Collaboration can be defined as teaching and learning strategies that allow for collaboration of students in small groups with the purpose of increasing their own and others' learning (Johnson & Johnson, 1999). According to the studies conducted, AR technology was found to improve collaboration between students (Billinghurst, Belcher, Gupta, & Kiyokawa, 2003; Freitas & Campos, 2008; Morrison et al., 2009).

2.3.2.1.8 Creativity. In addition to collaboration, AR might help widening students' horizon by injecting creativity into the learning process (Giannakos et al., 2015). Creativity can improve students' engagement in the learning process (Jones & Richards, 2013). Creativity is such a crucial element in education that China regards it as a national priority and Chinese schools are pursuing a problem-based learning approach in schools which lead to innovative thinking and creativity (Westknights, 2017). In align with the previous statement, a number of studies state that AR technology is an effective instructional tool for promoting creativity (Ivanova & Ivanov, 2011; Klopfer & Yoon, 2005; Rosli et al., 2010; Yuen, Yaoyuneyong, & Johnson, 2011; Zhou, Cheok, Pan, & Li, 2004). In addition to creativity, visualization or more specifically visualization of information may help learners to acquire the target knowledge (Kraidy, 2002).

2.3.2.1.9 Visualization. Visualization has become an integral part of education ranging from kindergarten to distance learning (Veřmiřovský, 2013). Some studies concluded that educational AR was able to help students visualize complex relationships especially in science education (Arvanitis et al., 2007; El Sayed, Zawed, & Sharawy, 2011; Kaufmann & Schmalstieg, 2002; Shelton & Hedley, 2002; Wu, Lee, Chang, & Liang, 2013). Similarly, a number of studies conducted in different parts of the world and at different learner levels have revealed that AR technology has the ability to concretize abstract concepts with the help of overlaying text, picture, audio, video or a 3D model (Cabero & Barroso, 2016; Dori & Belcher, 2005; Wang et al., 2017; Wojciechowski & Cellary, 2013). Visualizing educational content such as magnetic field and the coordinate plane has also been possible with AR (Ibáñez, Di Serio, Villarán, & Delgado-Kloos, 2014). AR technology can help students realize abstract concepts that may lead to better developed spatial and cognitive skills (Joo-Nagata, Martinez Abad, García-Bermejo Giner, & García-Peñalvo, 2017). Similarly,

Özdemir (2017) states that teaching becomes easier in the event of concept visualization through AR.

2.3.2.1.10 Learning environment. In order to actively engage in the learning process, it is crucial for a learner to be in a safe learning environment. Many studies point out that AR technology offers a safe learning environment for students (Aziz et al., 2012; Schrier, 2006; Ying Li, 2010). Accordingly, Wei and Elias (2011) examined the relationship between students' perception of classroom environment and their English language learning motivation. They found a strong relationship between classroom environment and motivation. Use of different instructional tools such as virtual and augmented reality provides more creative learning environments and derail from rote learning. AR technology provides students with a natural experience (O'Brien & Toms, 2005; Sumadio & Rambli, 2010). Kamarainer (2013) pointed out that AR technology supported student-centered learning along with its positive effect on motivation and engagement. In a study, students stated that AR facilitated an entertaining environment for practicing what they are learning (Chiang, Yang, & Hwang, 2014). Findings of the studies conducted in relation to AR in education suggested that children preferred AR environment to real environment (Juan, Llop, Abad, & Lluch, 2010; Juan, Toffetti, Abad, & Cano, 2010).

2.3.2.1.11 Effectiveness and attractiveness. In the studies related to educational augmented reality, it is also concluded that it has the capacity to make the lesson more effective and attractive (Chang, Chen, Huang, & Huang, 2016; Kesim & Özarslan, 2012). Since AR immerses students in a specific situation, students are more likely to have higher attention (Kirkley & Kirkley, 2005; Stapleton, Smith, & Hughes, 2005). A study conducted by Wojciechowski and Cellary (2013) found that students, in this case second grade, perceived AR as an attractive tool for learning. The study also reached the conclusion that students' intention to use a tool depended much more on perceived enjoyment than on usefulness. Inevitably, augmented reality has found itself a place in children books as well. In a study conducted by Dünser and Hornecker (2007), it was pointed out that AR-based interactive storybook was effective, and it made learning attractive for young students. A relatively similar study carried out by Zhou, Cheok and Pan (2004), the concept of storytelling was taken under investigation and their results confirmed the previous study's findings that AR employing 3D

graphics and audio made learning effective and attractive. Somyürek (2014) affirms that augmented reality is able to arouse the attention of Z generation in the learning process. AR has been found to be an important factor in increasing the attention of students at different levels (O'Brien & Toms, 2005). Surprisingly, AR is also reported to raise the attention of students who are even struggling with attention deficit hyperactive disorder (Aziz et al., 2012).

2.3.2.1.12 Fun. Several other studies conducted in different branches of education have identified AR as fun while learning (Arino, Juan, Gil-Gomez, & Molla, 2014; Chiang, Yang, & Hwang, 2014; Yoon, Elinich, Wang, Steinmeier, & Tucker, 2012).

Apart from the aforementioned advantages of AR, there have been a few statements in the literature that portrayed the challenges and disadvantages occurring in the process of learning or teaching with AR.

2.3.2.2 Limitations of augmented reality. Just like every method or technological education tool, AR has its challenges including; a) lack of technical standards and b) the difficulty in generating meaningful content (Pena-Rios, Hagras, Gardner, & Owusu, 2017). The lack of meaningful content in AR can be prevailed if pedagogical AR content is created by teachers and course book designers with professional assistance from developers and designers when needed. Cuban (2001) stated that accessibility to technological devices was one of the issues impacting the technology integration in education. However, the ubiquitous ownership of smartphones may overcome this inaccessibility problem (Burston, 2018). According to teachers, another concern is AR games' probability of causing students to have cognitive overload as some AR simulations require a great deal of processing along with completing required tasks and collaborating with peers (Kaenchan, 2018). In the studies, it has been stated that issues regarding AR's usability are also present and this downsize generally stems from the studies employing head-mounted AR displays (Billinghurst et al., 2003; Juan, Tofetti, Abad & Cano, 2010; Kaufman & Dünser, 2007). Head-mounted AR display is a display device that is worn on the head and lets users experience augmented reality in an immersive environment. Tunnel vision is one of the possible side effects of AR technology in the learning process. Students might

focus on the technology and visual itself rather than focusing on its potential educational benefit (Billinghurst et al., 2003; Morrison et al., 2009; Tang, Owen, Biocca, & Mou, 2003).

Apart from the aforementioned limitations, AR has been well-implemented in various lines of education and it has been found to positively contribute to students. The area of language teaching and learning has also been utilizing AR in its practices.

2.3.3 Language teaching & learning with augmented reality. English language teaching area has always benefited from the opportunities technology has offered. Technological tools such as computers, mobile phones, and tablets bring powerful opportunities to language teaching and learning (Altun, 2015). Use of computers as a teaching aid in language teaching has been an integral part of instruction for a long time. In addition to computers, mobile technologies have been implemented as well. Mobile phones have been identified as supportive tools for language teaching and learning process (Demouy & Kukulska-Hulme, 2010). Emerging technologies such as social networking sites, mobile learning, digital games, virtual assistants, wearable technologies, and online language learning platforms, massively open online courses, virtual reality and augmented reality (Polat, 2016) are implemented for language teaching and learning. In a study conducted by Dudeney and Hockly (2012), it was stated that mobile technology, AR, and game-based learning would have a positive impact on English Language Teaching. With its feature of visualizing the content in the context-rich environment, AR provides students with "meaningful associations between the content and the real environment" that eventually eases the process of vocabulary learning (Santos et al., 2016, p.6). Augmented reality simulations might yield motivating experiences pleasure (Taşkıran, 2018). Media components such as audio, video, animation and interactivity facilitate language learning by reducing anxiety (Hwang & Huang, 2010). Augmented reality has been facilitated in regard to various language skills even though they are not prevalent (Liu, 2009; Liu & Tsai, 2013).

There have not been enough studies investigating speaking and listening skills in augmented reality environments. In Liu's (2016) study, a learning course called as "My Campus" was created to enhance English listening and speaking skills by using

a sensor and handheld controller. Augmented reality supported ubiquitous learning environment in the name of Handheld English Language Learning Organization (HELLO) was created and participants' improvement was observed. Students involved in this study showed desirable improvements in English listening and speaking skills.

Writing is another skill employed with AR and it induced students to write better, longer and more creative texts (Yılmaz & Göktaş, 2016). In order to investigate the effectiveness of AR technology on writing tasks, Wang (2017) conducted an experimental study with a total of 30 twelfth-grade students. The experimental group showed better results and AR helped them with their content control, article structure, and wording. AR is even implemented for translation purposes. For their study, Rose and Bhuvaneswari (2014) developed an application for word recognition to implement English to Tamil translation. This application is able to capture an English written text and translate into Tamil the language in real-time.

AR has also been applied for reading comprehension. It offered greater motivation and interest in the reading process. Another example of AR in reading skill is an application called "Letters Alive" that teaches how to read to children aged 4-8 by using animal and vocabulary cards with relevant sentences and 3D like animations (Johnson et al., 2012).

Similarly, in an experimental study conducted for the children aged 4-6, Majid, Arshad and Yunus (2018) developed two different AR-based applications for letter recognition in pre-literacy phase. While one of the applications was static and non-interactive, the other one had multimedia components such as audio, video and 3D object visuals. The children showed positive attitudes toward both applications, but multimedia-rich AR application was stated to receive more positive feedbacks. Researchers of the study suggested that proper interaction could be provided with more multimedia components in accordance with the target learning element. Furthermore, researchers developed an augmented reality application for pre-literacy students focusing on alphabet letters. Results suggested that both students and teachers had positive attitudes toward the implementation of AR instruction materials (Majid et al., 2016). In another study conducted for kindergarten level, Hsieh and Lee (2008) prepared English learning flashcards onto which augmented reality objects would pop

up. The study was carried out in order to propose marked-based augmented reality learning system. Researchers further commented that this could help to have more fun and improve interaction among students.

As can be seen from the aforementioned studies, augmented reality technology has been utilized for language skills such as speaking, listening, writing, and reading; however, these studies are extremely scarce. As language teachers improve themselves to be more digitally competent teachers; the number of AR studies, AR-enhanced activities, lesson content, and language learning applications will definitely go higher. In order to master the language skills mentioned above, good size of vocabulary knowledge as well needs to be built up.

2.3.4 Vocabulary learning. Vocabulary learning has long been regarded as the key component of learning a language according to researchers, teachers, and students (Elgort, 2018). Yang (2012) proposed that mastery in a foreign language requires a wide range of vocabulary knowledge that is necessary for speaking, listening, and reading and writing. Learning second language depends heavily on vocabulary acquisition and insufficiency of vocabulary knowledge is the main source of problems (Huckin, 1995). Meara (1980) also supports Huckin's idea by labeling vocabulary as the greatest source of problems in language production.

Various technological methods have been adopted in the literature in order to support vocabulary learning ranging from hypertext annotations (Chen et al., 2013), flashcards (Li & Tong, 2019; Saeidi & Mozaheb, 2012), texting (Li, Cummins, & Deng, 2017), pictorial glosses (Alavinia & Qoitassi, 2013) to use of cartoon films (Munir, 2016) and even augmented reality applications (Ibrahim et al., 2018). Providing students with a context of a new vocabulary item helps them to create stronger associations between the word and what it reflects in the real-world (Ogata et al., 2011). Several studies have found vocabulary learning to be effective with CALL (Allum, 2004; Lin, Chan, & Hsiao, 2011; Oberg, 2011) and MALL (Ahmad, Sudweeks, & Armarego, 2015; Gürkan, 2018; Wang & Shih, 2015) which are going to be discussed in greater detail in the following section.

2.3.4.1 Vocabulary learning in CALL and MALL. Vocabulary learning has strong ties to CALL for a long time (Cobb, 2013). There have been countless studies

regarding vocabulary acquisition with CALL in the literature. Gholinia (2010) found out that CALL provided higher retention of words in both short and long term. Additionally, students participating in the study held positive attitudes toward vocabulary learning with CALL. In Bekleyen and Yılmaz's (2011) study, students stated positive attitudes toward vocabulary learning with CALL. Other studies have also had positive results both academic and attitude wise (Akhlaghi & Zareian, 2015; Noeparast & Khatami, 2014). Before the social network era, MALL has witnessed vocabulary learning through SMS (Alemi, Sarab, & Lari, 2012; Attawell, 2005; Motallebzadeh, Beh-Afarin, & Daliry Rad, 2011; Tabatabaei & Goojani, 2012). With the advent of instant messaging, even instant messaging application WhatsApp has started to be used as a tool for vocabulary learning. A study conducted by Jafari and Chalak (2016) investigated the effect of WhatsApp as an instructional tool for vocabulary learning. Results suggested that there was not a significant difference between two groups; yet, the experimental group learners remarked positive attitudes toward learning vocabulary through WhatsApp. From the studies mentioned above, it can be stated that technological innovations are known for making their way into education and language learning sooner or later.

Various mobile language learning environments to improve vocabulary lexicon have been developed in the studies (Chen & Chung, 2008; Thornton & Houser, 2005). The use of flashcards in vocabulary learning has constantly been applied (Başoğlu & Akdemir, 2010; Li & Tong, 2019; Oberg, 2011). With the advent of technological tools, the use of flashcards in vocabulary learning has taken a new shape. Technology can improve the effectiveness of flashcard employment because Nakata (2011) proposed that since repeating words is already effective, technology might take advantage of algorithms for automated management of digital flashcards. Nikoopour and Kazemi (2014) investigated the difference in vocabulary gain between digital and non-digital flashcards. Results established that the experimental group performed significantly better than the control group. In addition to that, there have been many studies employing digital flashcards (Alnajjar & Brick, 2017; Davie & Hilber; 2015; Zhu, Fung, & Wang, 2012). New era brought a new shape to vocabulary learning as virtual reality and augmented reality have started to enter language learning and teaching area. Vocabulary teaching in virtual environments was tried in the previous

studies in the literature (Morrison, 2017; Lloyd, Rogerson, & Stead, 2017). In their study Solak and Çakır (2015) designed a Virtual Reality environment to teach vocabulary. Immersive virtual reality environment was also found to be an effective factor in teaching vocabulary items (Legault et al., 2019).

2.3.4.2 Vocabulary learning in augmented reality. Reflections of AR technology have seen in vocabulary learning. Most of the studies related to vocabulary learning with AR technology have revealed increased motivation (Abad & Lluch, 2010; Çakır & Tan, 2016; Hashim, 2018; Juan, Llop, Hsieh, & Lin, 2010). Moreover, the effectiveness of AR applications on vocabulary learning has well been documented in the literature (Hwang, Wu, Chen, & Tu, 2015; Solak & Çakır, 2015). Two studies have reached the conclusion that AR applications have been established to have high usability (Hsieh & Lin, 2010; Santos et al., 2016). Vedadi et al. (2018) proposed in his study that augmented reality would be a powerful tool for "increasing language learners' vocabulary size due to its capacity for multimedia presentation" (p.5).

Hsu (2016) developed and compared two augmented reality educational games for third graders to learn English vocabulary in free and situated surroundings. Students didn't show significant differences in terms of learning effectiveness. Students employing situated learning had lower anxiety when compared to students doing self-directed learning. Findings also confirmed that a little learning anxiety might be helpful for learning.

Augmented reality applications are utilized in learning and practicing vocabulary. In a study, researchers developed AREVLS, augmented reality English vocabulary learning system to practice target vocabulary. Results showed that AREVLS had positive usability and students showed positive attitudes toward it (Hsieh & Lin, 2010).

Solak and Çakır (2015) conducted quasi-experimental research to investigate the effectiveness of AR application in a language class at the elementary level in Turkey. Findings of the study suggested that the use of AR in an elementary level increased academic performance and made vocabulary learning more effective when compared to the traditional methods.

In a semi-experimental study conducted with 60 university level students, Çakır and Tan (2016) reached the conclusion that in vocabulary learning, students in the experimental group employing AR technology outperformed the control group employing traditional instruction. Furthermore, students using AR had a higher motivation level when compared to the control group.

In another study (Santos et al., 2016), researchers treated AR as a type of multimedia situated in real life environments and applied multimedia learning theory for developing their educational applications. They decided to use it for situated vocabulary learning for Filipino and German languages and it was reported that their application had good system usability. Their results also showed that AR provided better retention of words in the post and delayed-post tests in addition to increased student attention and satisfaction. They conducted this research with a small number of students and they further suggested that a replicate study with a larger sample size should be conducted for more reliable results.

In a study conducted with thirty-two children, researchers developed an AR game for learning words. The developed AR game was accepted by %81 of the children. Therefore, it was suggested that AR could be a useful tool for learning words (Juan, Llop, Abad, & Lluch, 2010). Similarly, in an experimental study conducted with 26 eight-year-old students, researchers developed an AR-enhanced board game to teach vocabulary. Results of the study revealed that students employing AR-enhanced board game performed better on post-test. Furthermore, the experimental group indicated higher motivation levels (Hwang, Wu, Chen, & Tu, 2015)

English vocabulary memory can be improved with a visual object such as a picture, video or 3D object which help students to gain more stimuli for connecting the word and his/her background knowledge (Chang, Chen, Huang, & Huang, 2016)

In another study conducted with 3rd graders in an elementary school located in Portugal, Barrereira et al. (2012) found out that audio and video features of AR technology increased the level of vocabulary learning in addition to the positive experience stemming from AR environment.

Not every AR application for vocabulary learning works in a behavioristic way. In a study, productive vocabulary application employing speech recognition system was developed, tested and found to have a positive user satisfaction in early education (Hashim, Majid, Arshad, & Obeidy, 2018). In a thesis conducted on the effectiveness of augmented reality-enhanced materials on vocabulary learning and retention, Doğan (2016) concluded that AR-enhanced materials enabled students to gain and construct the content knowledge better. As observed in Doğan's (2016) study AR-enhanced course materials might have positive outcomes for students.

2.3.5 Pre-service language teacher education. We live in a world that is changing every second, and it has become a necessity now to equip new generations with knowledge, skill, and characteristics in order for them to deal with rapid changes. This can be reached with education and teachers who are fundamental component of education. At this point, teacher education plays an important role. Pre-service teacher education provides students with thinking and ideas that help them to realize their profession (Kennedy, 1999).

2.3.5.1 Pre-service language teacher education in Turkey. Turkish education system witnessed various languages throughout its history. Arabic, for example, was once a dominant foreign language and taught for religious purposes (Nergis, 2011). French gained popularity and started to be taught as well (Nergis, 2011). Even though the first English language education program in a systematic way started with Robert College, an Anglo-American private school founded in 1863 (Kırkgöz, 2011). With the establishment of Turkish Republic, English has started to take its place at the center of foreign language education (Aygün, 2008).

In Turkey, teacher candidates receive 4 years of undergraduate education at the education faculties of universities. After completing the program, pre-service teachers take a statewide public personnel selection examination (KPSS) to be appointed as in-service teachers to state schools (Seferoğlu, 2004). Graduates who want to be English teacher despite having studied departments such as Linguistics, English Language and Literature, American Language and Literature or Translation can take sporadic pedagogical formation courses offered by education faculties and pursue a career in English teaching.

This study took place in Turkey. In Turkey, English Language Teacher education programs are called English Language Teaching (ELT) departments. All departments in the faculty of education follow the standardized and compulsory curriculum designed by the Council of Higher Education. Nonetheless, the selection of materials and resources to be implemented depends on the lecturers' style and view. In May 2018, the Higher Education Council in Turkey has put forward a new 4-year English language teaching department curriculum along with other teacher education programs. With this new curriculum, every English Language Teaching department in Turkey is to follow the same curriculum. Courses in this new curriculum include Reading Skills, Writing Skills, Listening and Pronunciation, Oral Communication Skills, Structure of English, Linguistics, English Literature, Second Language Acquisition, Teaching English to Children, Literature and Language Teaching, Teaching Language Skills, Translation Studies, and Course Content Development and in English Teaching. Pedagogical courses such as education philosophy, education psychology, Turkish Education system and history, classroom management and assessment and evaluation etc. In the fourth year, students go to practicum schools, observe classes and teach under the supervision of their professors. English language teaching programs in Turkey have their weaknesses such as lack of departmental philosophical basis and conflicts between Ministry of National Education and the Higher Education Institution (Seferoğlu, 2004).

2.3.5.2 Technology use in pre-service English teacher education in Turkey. Teacher education programs including ELT recognized the challenges and integrated innovative strategies for teachers to use technology effectively (Angeli & Valanides, 2009). Teacher education programs around the world made efforts to remold curriculums in order to prepare future ELT teachers who can effectively integrate technology (Tondeur, Pareja Roblin, van Braak, Fisser, & Voogt, 2013). Language teachers need to learn how to implement technology in their classes and integrate it into their teaching skills (Altun, 2015). ICT has been supplementing the training programs and pre-service teachers are taught how to use interactive boards and digital technologies that might provide more meaningful and media-rich input for learners. Many institutions around the world have embedded Introductory Technology lessons to their curriculums (Polly, Mims, Shepherd, & İnan, 2010). In Turkey, English teacher

education programs encompass technology with Information Technologies I and Information Technologies II in the first year. In the following years, pre-service English teachers are introduced to Instructional Technologies and Material Development courses. Braul (2006) emphasized that technology training in pre-service teacher education usually had elements that teach how to use technology rather than how to integrate it into instruction. He further argued that these technological tools should be taught in a way that helps students acquire the language and provide teachers with better teaching opportunities. Similarly, Angers and Machtmes (2005) put forward that classes need to incorporate technology and learning experience should also be supported by technological tools. Supporting Braud's ideas, Göktaş and Aybat (2006) pointed out that technology courses in teacher education programs in Turkey focus on teaching technology rather than teaching with technology. They further suggested a solution to this problem by stating the importance of more opportunities for technology integration throughout the curriculum. In the case of higher exposure to technology, pre-service teachers will have more confidence of technology use and higher intention of integration (Watson, 2006). Higher technology exposure and more positive technology-related experiences in pre-service education have shown to be important factors for teachers' adoption of technology (Agyei & Voogt, 2011). There have been studies regarding the adoption of educational technological tools by teachers (Karakaya, 2010; Luan & Teo, 2011; Parkman, Litz, & Gromik, 2018; Teo, 2009; Teo, 2014; Teo, 2015). These studies found out that acceptance or adoption of a technological tool depended on various factors such as facilitating conditions, ease of use, self-efficacy, and usefulness. Teo (2009) looked into the relationship between computer self-efficacy and intention of technology use of pre-service teachers. Results showed that perception and ability to use were the main factors of their intention of use in their future careers.

Karakaya (2010) looked into in-service English language teachers' attitudes toward technology and their employment of technology in their classes. Teachers indicated positive attitudes, but they stated that they did not know how to integrate technology in an effective way. Consequently, effective integration of technology into classroom instruction is now a necessity.

Akçaoğlu (2008) tried to investigate the technology integration of 120 in-service and 62 pre-service English teachers. Results of his study suggested that teachers rarely used computers in the class and they rather perceived computers as teacher tools for preparing for the lessons and exams. He further suggested that due to inadequate training in ICT, pre-service teachers choose not to integrate technology in their future classes. In cohesion with the previous statement, Dawson (2008) emphasized that pre-service and beginning teachers rarely use technology in their instruction. Kay (2006) argues that pre-service teachers' expectations and their in-service employment of technology sometimes do not pair off since insufficiency of technological infrastructure in school for instance Wi-Fi might hinder in-service teachers' effective use of technology. Since furnishing schools with technology tools does not guarantee a better quality of instruction and more effective learning environments (Gülbahar & Güven, 2008), pre-service teachers should get integrated technology courses encompassing pedagogy and technology skills (Braul, 2006). ICT supported teacher training that can meet the needs and demands of this digital generation is of great importance since it can provide pre-service teachers with better field knowledge and skills (Mutlu, Yelken, & Atay, 2018).

2.3.6 Material design in language teaching.

In education, materials play an important role but they cannot be seen as the only source of instruction (Garton & Graves, 2014). Materials are a fundamental part of education. Materials can be classified as anything that is employed by teachers or learners in order to aid the learning of a foreign language (Tomlinson, 1998). It is a surprising fact for foreign language teaching that material design was not an area of focus until the mid-1990s. Prior to that, material design was perceived as a branch of methodology. During the mid-1990s and in the following years, books on material design in language teaching (Cunningsworth, 1995; McDonough & Shaw, 1993; Tomlinson, 1998, 2003) paved the way for universities and institutions to implement material design courses in their curriculum. Tomlinson and Avila (2007) laid out some principles for materials development and they argued that teachers should make use of activities helping students to visualize or use inner speech in the process of experiencing the written or spoken text and also in the process of using the language.

Technology plays a huge role in the development of language learning materials, both in creating content and delivering it. Tomlinson, in 2012, stated that there had been radical developments in the employment of new technologies in language learning/teaching materials. White and Reinders' (2010) suggested that Computer based or not, CALL materials help to the development of authentic materials by presenting contextual real-life contents. Since CALL materials resemble to the electronic contents today's generation faces with, they are more likely to be attracted to activity. Moreover, CALL materials simply create interaction that can be between two humans or human-computer exchange. Use of various modes of media enriches the learning environment that brings new types of activities along. In his closing paragraph, Tomlinson (2009) stated that materials should be designed in such a way that teachers wouldn't need to follow their content as a script rather exploit them in accordance with their students' needs.

2.3.6.1 Material design with augmented reality. Today's generation is already known with their interest and ability in technology and today's pre-service teachers pose as a vital component in the future educational system which is going to require for technologically-competent educators. In using new tools of technology, pre-service teachers remain less skilled and less knowledgeable when compared to students (Demirekin, 2014). The gap between teachers' technological skill and knowledge and students' is widening. Thus, the teaching profession increasingly demands technologically-competent and efficient teachers who can keep up with 21st-century requirements. Hence, developing technology integrated teaching materials is going to be one of the skills of a teacher, especially a language teacher should possess. Since traditional instruction in education cannot always keep up with the pace of information and technology era, a change in the educational process including the omission of traditional methods might be necessary (as cited in Safar et al., 2016). Bozdoğan and Özen (2014) proposed that teachers also need to be following technological developments so that they can successfully implement technology integration in their lessons. In alignment with the previous statement, Rana (2013) put forward that "teachers need to stop following the same old ways of teaching and experiment and acknowledge that the world is changing, and we need education that augments that change" (p.10).

Various educational technology tools are currently employed in language learning and teaching including emerging technologies such as virtual and augmented reality. With the advent of augmented reality systems allowing users to create their own triggers and overlays, educators started to look for ways to incorporate AR in their lessons for higher engagement and motivation. Augmented reality is no longer a flashy technological phenomenon but a practical tool of instruction (Duh & Klopfer, 2013). Even though it is practical, it has not spread over enough in language learning. Manuri and Sanna (2016) stated that educational AR has had problems spreading over primarily because of teachers' not being able to "develop deployable content" (p.25). To address this problem, Kesim and Özarslan (2012) argued the need for teachers to design learning activities in AR. With the help of AR platforms such as Blippar, Aurasma HP Reveal, Augment, ZAPWorks, UniteAR, HOLO, and Layar, it has become quite easy to create AR experiences for learning. These applications are closed-systems and thus, there is a lack of flexibility because authoring tools are limited (Manuri & Sanna, 2016). Manuri and Sanna (2016) stated that teachers and educators make use of augmented reality technology in order to provide their students with more effective and interesting course materials. However, not all the AR applications and their contents are in alignment with every lecturers' teaching purposes and lecturers are having difficulty adapting content to their students' needs (Manuri & Sanna, 2016). Teachers are not able to adapt rigid AR applications or their AR content to their students' needs (Manuri & Sanna, 2016) and AR content needs to be flexible so that educators make adaptations in accordance with their students' needs (Kerawalla, Luckin, Seljeflot, & Woolard, 2006). Thus, it is important for pre-service teachers to get a grasp of how to create AR experiences and how to develop their own applications to provide motivation, attention, better learning environments, higher academic success and content retention in their students. Even though it is very easy and practical to create AR experiences through ready applications, Manuri and Sanna (2016) indicated that it was not easy for teachers to develop an augmented reality application. Kaenchan (2018) described that training on the use of AR technology was required for educators, educational technologists and instructional designers wishing to implement AR in their classes. More importantly, he put forward that professional training and development workshops regarding the integration of technological

innovations were prerequisite. With the help of Spanish Ministry of Economy, Mota et al. (2018) have conducted a study in which the researchers gave workshops to lecturers about using an authoring tool employing block-based programming language for building Android applications. Participant lecturers of the study have shown a high the level of acceptance of VEDILS, the authoring tool. AR mobile learning applications developed by lecturers have also been assessed by their students and results have also shown high acceptance from students. In parallel with the previous remark, a study investigated primary school teachers on their acceptance of augmented reality technology in their classes. Results of this study reveal that not only they accept this technology, but they also would like to use it in their future teaching (Alkhattabi, 2017). As can be seen from the aforementioned studies, in-service teachers and students are in favor of AR. In a study conducted by Chookaew et al., (2017), the motivational levels of pre–service teachers have also increased after developing an AR experience on the Aurasma platform.

Augmented reality is an extraordinary instructional tool furnishing teachers with opportunities to create, personalize and mounting authentic, engaging and interactive learning experiences (Wang et al., 2017). AR offers a chance to transform a traditional and stable textbook into a multimedia enhanced one (Önder, 2016). In recent years, teachers are starting to shift away from traditional lecturing and course books to more practical and interactive visual forms enhanced with AR technology (Huang et al., 2016). A digitally literate teacher must not be the consumer of technological products only, he/she also needs to be able effectively create and apply digital multimedia in his/her classes (Demirekin, 2014; Jacobs, Castek, Pizzolato, Reder, & Pendell, 2014). In order to have better results, educational AR applications and activities should be developed with the partnership between educators and learning designers so that innovative technology and sound pedagogy can be combined to have better learning outcomes (Kesim & Özarslan, 2012; Manuri & Sanna, 2016).

2.3.6.2 Augmented reality enhanced language learning/teaching materials.Chou and Chanlin (2012) suggested that in the future standard textbooks would be AR-enhanced books which have 3D graphics and information pop-ups. AR-enhanced materials arouse more interest and motivation in students when compared to traditional teaching materials such as course books, picture books and even physical

interaction (Hung et al., 2017). In a descriptive survey model study, Taşkıran (2018) investigated the language learners' subjective experience in implementation of AR-enhanced English language learning materials. Findings of the survey showed that most of the students regarded the AR-enhanced materials and activities as highly motivating and enjoyable. In a similar study, Hsieh, Kuo and Lin (2014) investigated the motivation and acceptance level of students toward AR-enhanced language learning materials. Findings suggested that AR enriched contents were highly useful and practical. Researchers also implemented Teaching Material Motivation questionnaire which revealed students' high interest, concentration and reliability scores.

Solak and Çakır (2015) conducted a study with 130 undergraduate students to determine the motivational level of students toward a course material designed with augmented reality. Results suggested that the use of AR in the vocabulary learning process improved undergraduate students' motivational levels. Furthermore, findings signified that there was a positive significant correlation between academic achievement and the motivation in the use of AR-based course materials. Chen (2013) also highlighted the effectiveness of AR-enhanced English course books on students' achievement compared to traditional course books.

In Taşkıran's study (2018), almost all the participants indicated that the use of learning material enriched by AR was highly motivating. Furthermore, it was stated that AR provided interest, motivation, and joy in English language classes. In his Affective Filter hypothesis, Krashen (1984) highlighted the importance of emotional variable in the learning process. AR's feature of providing motivation, joy and convenience might remove possible affective barriers in the process of learning. More importantly, learning materials designed with AR application were also found to be effective, convenient and highly interactive. Answers given to the open-ended questions also showed that AR enhanced materials were regarded as something that provided active engagement, learning by doing, motivation, and enjoyment along with providing more interaction and communication (Taşkıran, Koral, & Bozkurt, 2015).

In a study conducted with 122 fifth-grade students from different parts of secondary schools in Erzurum, it was found that secondary school students were very

content with learning English using AR-enhanced materials and they reported to have low anxiety and high user intention for the future (Küçük, Yilmaz, & Göktaş, 2014). Learning English using AR applications is said to boost the motivation of students while hold positive attitudes (Mahadzir & Phung 2013; Vate-U-Lan, 2012; Wei & Elias, 2011).

In an experimental study, AR-enhanced materials were found to be conveying the content to students more-easily and quickly in a flipped learning context as well (Liou, Bhagat, & Chang, 2016).

AR books are now in the market and they have been found to assist students' level of information retention in a study conducted by Dünser, Walker, and Bentall (2012) in New Zealand. In quasi-experimental research conducted with 484 3rd graders 99 of which purposively chosen for piloting in the research and development process, Vate (2012) aimed to design a 3D pop-up book enhanced with AR technology in order to see its effectiveness on student learning. Results suggested that this teaching material could be used, and it could stir excitement amongst students as it did in this study. Another positive result of the study was the increased attention of students toward learning. In the interviews, students stated highly positive comments toward the use of augmented reality 3D pop-up book. In a similar study, Mahadzir and Phung (2013) examined the function of AR pop-up books in improving academic success and motivation in English learning. They developed a pop-up book via ZooBurst, a software for AR developing. Findings of this study suggested that AR technology improved academic performance in addition to providing more motivating AR-based learning environment.

From the studies mentioned above, it is seen that AR enhanced materials can improve learning, boost motivation and attention and provide longer retention periods. These features of AR enhanced materials might pave the way for AR integration in courses of teacher education programs.

2.4 User Intention Theories (TRA, TPB, DTPB)

There have been quite a lot of studies concerning with adoption of technological innovations in various lines of businesses from IT to marketing (Taylor & Todd, 1995; Hansen, Jensen, & Solgaard, 2004). Technology has been used in education and language learning since the 1960s (Warschauer & Healey, 1998). Several studies have been carried out on adoption of educational technology and individual acceptance behavior of information technology (Chow, Herold, Choo, & Chan, 2012; Teo, 2011, 2009; Park, 2009; Shen & Eder, 2009). In the studies conducted, the use of technology has been found to have roots in teachers' intentions (Salleh & Albion, 2004; Shiue, 2007). Gauld and Shotter (1977) stated that even though it is nearly impossible to provide a single definition for intention, it generally can be defined as a person's readiness to act in a particular way in the future. Researchers have investigated the factors affecting intention since intentions have been found to predict actual use (Wu, Chang, & Guo, 2008). A number of theories have been put forward to investigate students' and teachers' acceptance of innovative technologies and their intention to use.

2.4.1 Theory of diffusion of innovations. Theory of Diffusion of Innovations that is one of the oldest social psychology theories explains how a product can diffuse through a specific population (Rogers, 1995). Adoption of a new idea or a new technological tool does not immediately spread over the population rather it proceeds gradually. While some people immediately adopt to it, others may decide to wait. It is crucial to assess the general characteristics of the population you are introducing your new idea or tool to. There are five established adopter categories in which the majority of people fall into the middle class while early adopters take only %13.5 of the pile. Innovators are the people who would like to try an innovation for the first time. They are ready to take risks, and they are often the first people to come up with new ideas. Early adopters are the people representing the leaders of opinions who enjoy leadership roles and embrace opportunities. They are very adaptive toward new ideas and aware of the need for the change. People in the group of early majority are barely leaders but they have the tendency to adopt innovation before it reaches to general population. They look for the effectiveness of innovation before trying it out. Late majority people

are skeptical when it comes to innovation and change. They tend to adopt a technology tool only after it is accepted and tried out by the majority. The category of laggards refers to the people who are very conservative and skeptical of innovation and change. This group of people is the hardest to engage in when it comes to adoption of new technology.

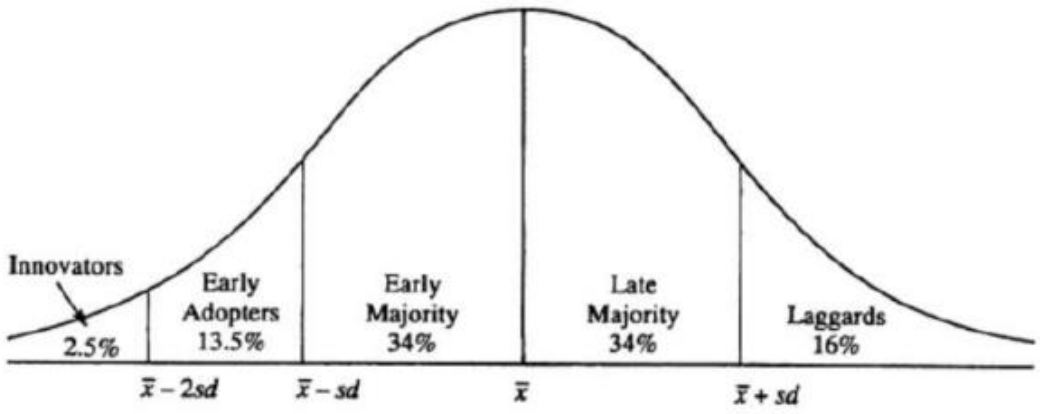


Figure 2. Adopter Categorization on the Basis of Innovativeness (Rogers, 2003)

2.4.2 Theory of reasonable action (TRA). The Theory of Reasonable Action (TRA) defines the links between beliefs, attitudes, norms, intentions, and behaviors of individuals (Fishbein & Ajzen, 1975). TRA is concerned with behavior; however, this theory emphasizes that there are some factors that might limit the influence of attitude on behavior. Attitude is defined as "a learned predisposition to respond in a consistently favorable or unfavorable manner with respect to a given object" (Fishbein & Ajzen, 1975, p.6). TRA anticipates behavioral intention that is a midpoint between attitude prediction and actually predicting behavior. Davis, Bagozzi, and Warshaw (1989) used TRA and TAM to investigate students' intention to use word processing program and their intention of use in future and they found that TRA and TAM predicted behavioral intention well. Results further revealed that perceived usefulness was the most influential factor.

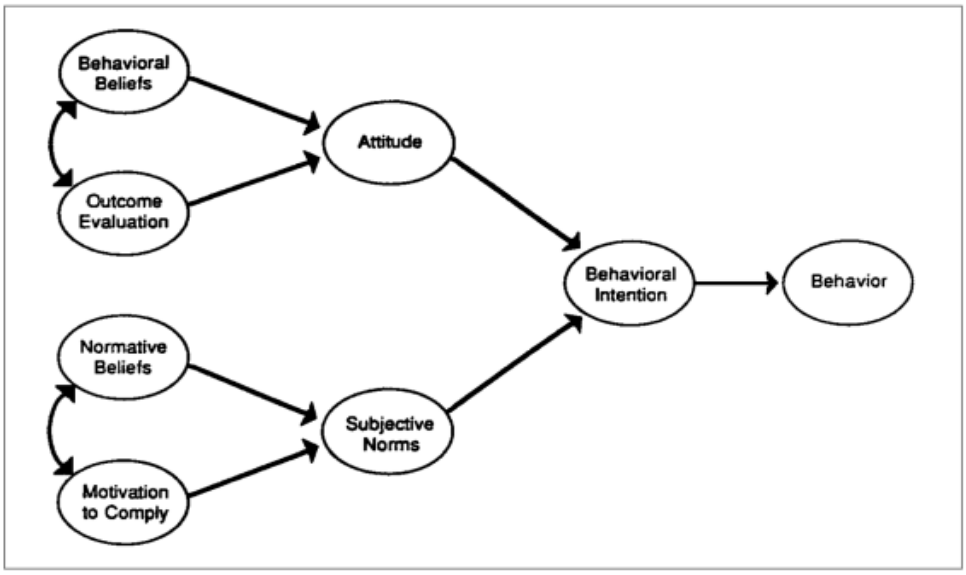


Figure 3. Theory of Reasoned Action (Davis, 1989)

2.4.3 The theory of planned behavior. The theory of Planned Behavior (Ajzen & Madden, 1986) predicts people's intention to perform behavior at a specific time and a place in the future and it offers variables related to intentions which predict the potential use in future. Theory of Planned Behavior (TPB) consists of 6 constructs which are attitudes, behavioral intention, subjective norms, social norms, perceived power and perceived behavioral control (Ajzen, 1985, 1991). In the literature, TPB has been utilized to explore teachers' intention as well (Crawley, 1990; Zint, 2002). K12 school teachers' intention toward educational technology usage was investigated in the related literature (Salleh & Albion 2004; Sugar, Crawley, & Fine, 2004). While Sugar, Crawley and Fine (2004) found out that behavioral intention was influenced by the attitude toward behavior, Salleh and Albion (2004) found attitude and subjective norm to be significant predictors of intention.

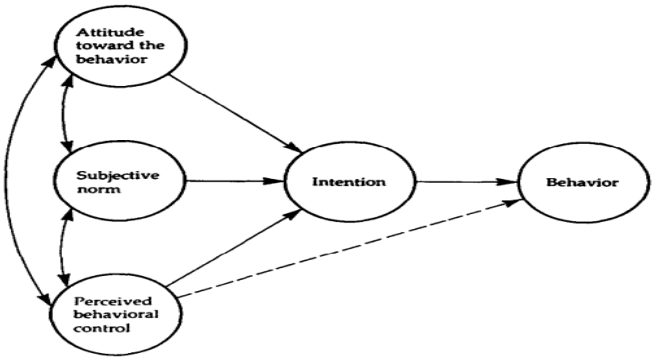


Figure 4. Theory of Planned Behavior (Ajzen, 1991)

2.4.4 Decomposed theory of planned behavior (DTPB). The Decomposed Theory of Planned Behavior (DTPB) is used for understanding a group of people's intentions to use a tool. This theory originally emerged from the theory of planned behavior (TPB) that states people's actions are governed by their behavioral intentions and perceived behavioral control (Ajzen,1991). This theory paves the way for a better understanding of the aforementioned constructs' relationship. It also shows the specific factors impacting the adoption of a new technological tool and it provides a thorough understanding of the intention of use (Taylor & Todd, 1995).

DTPB consists of three main constructs of attitude, subjective norm and perceived behavioral control and all main constructs have lower level constructs (Taylor & Todd, 1995).

2.4.4.1 Attitude. Attitude is the degree of favor of an individual toward the behavior that is in question (Ajzen, 1991). There are three attitudinal components: perceived ease of use, perceived usefulness, and compatibility.

2.4.4.1.1 Ease of use. Ease of use displays the degree of an innovation's easiness. Technologies less complex to use have greater opportunities for potential users to accept and use. In addition to attitude, ease of use has been found to be a significant determining factor in the adoption of new technology or innovation.

2.4.4.1.2 Perceived usefulness. Perceived usefulness is one's beliefs regarding which extent a technology would enhance his or her performance (Rogers, 2003). It is more likely for a person to adopt an innovation in the case of higher perceived usefulness (Rogers, 2003).

2.4.4.1.3 Compatibility. Compatibility can be defined as the chemistry between the new technology and the way a teacher teaches.

2.4.4.2 Subjective norms. Subjective norms are the social pressures that lead a person to perform a specific behavior (Ajzen, 1991). When it comes to the adoption of a new technology or an innovation, different groups of people might hold various opinions (Taylor & Todd, 1995). Under subjective norms, there are 3 groups namely, superiors, peers and students. These groups' opinion of a particular technology use might affect a user's adoption.

2.4.4.2.1 Student influence. Student influence refers to students' influence on teachers' adoption of a technology.

2.4.4.2.2 Peer influence. Peer influence refers to influence of teachers' peers in adoption of a technology. Peers in this example are other teachers or lecturers.

2.4.4.2.3 Superior influence. Superior influence refers to influence of superiors on teachers' adoption of a technology. Superiors in this case might be principals, university professors or experienced teachers.

2.4.4.3 Perceived behavioral control. Perceived behavioral control is defined as people's perceptions of their ability to perform a given behavior. Perceived behavioral control, in this framework, is decomposed into self-efficacy, the facilitative conditions of technology and facilitative conditions of resources.

2.4.4.3.1 Self-efficacy. Self-efficacy is the perception of a person to perform behavior (Bandura, 1982). In this framework and study, pre-service English teachers' self-efficacy can be described as their perceptions of using AR in their future classrooms.

2.4.4.3.2 Facilitating condition- resources and technology. Facilitating condition- resources and technology refers to perceived level of resources such as availability of technological tools when employing a technology.

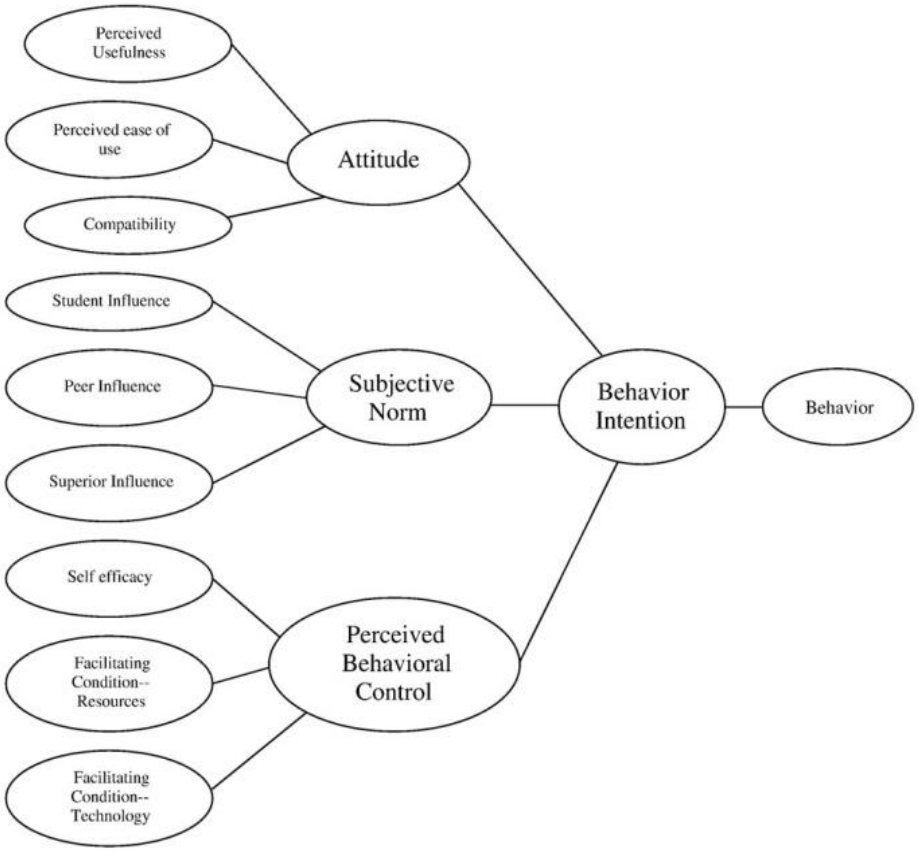


Figure 5. Decomposed Theory of Planned Behavior. (Taylor & Todd, 1995)

2.4.5 Technology acceptance model. In addition to those mentioned above, Technology Acceptance Model that investigates a potential user's intention to use a technological innovation was developed (Davis, Bogozzi & Warshaw, 1989). Technology acceptance is linked to intentions for predicting usage behavior (Venkatesh, Morris, Davis, & Davis, 2003). Venkatesh and Davis (1996) developed final version of TAM and TAM 2 (Venkatesh & Davis, 2000). TAM2 consists of two constructs first of which is "perceived usefulness" and the second is "perceived ease of use". There are also social effect encompassing subjective norms, voluntariness and image and cognitive instrumental processes encompassing job relevance, results demonstrability and perceived ease of use (Vankatesh & Davis, 2000).

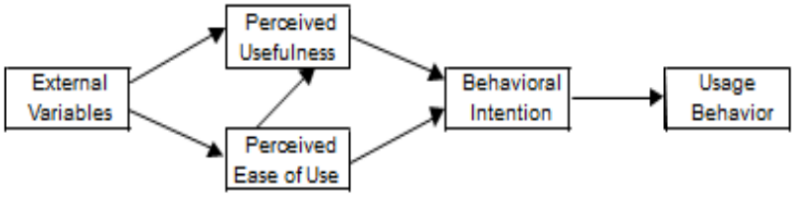


Figure 6. Technology Acceptance Model. (Venkatesh & Davis, 1996)

In conclusion, there have been various user intention theories applied in the literature. These user intention theories aim to predict a behavior or an intention. Different models try to predict behaviors or intentions by using different components in related with the theory they are based on.

Chapter 3

Methodology

This chapter aims to detail the methodology of the study by describing the research design, setting, demographics and participants, limitations. The procedures part compasses data collection instrument, data collection procedures and data analysis. The goal of the study was to explore the factors that predict pre-service English teachers' intentions to use augmented reality technology in their future classes along with investigating advantages and disadvantages of augmented reality from pre-service English teachers' perspectives and their transformational changes prior to and after the implementation.

3.1 Research Design

In this study, a mixed-method research design was utilized. A mixed-method research design makes use of both qualitative and quantitative data collection and analysis approaches in order to investigate the topic in more depth (Creswell & Clark, 2011).

The reason to apply a mixed-method research design in this study was to support quantitative findings and to have a greater insight into pre-service English teachers' intention to use AR technology in their future classes along with their perspectives toward it.

Table 1

Research Questions, Methods and Instruments Used in the Study

Research Question	**Instrument**	**Analysis Method(s) & Procedure(s)**
1-What factors best predict English pre-service English teachers' intentions to use augmented reality technology in their future classes?	Decomposed Theory of Planned Behavior (Taylor & Todd, 1995)	QUAN: Path Analysis
2-What perspectives do pre-service English teachers' have toward the use of augmented reality technology in their future classes?		
a) What are the factors that affect pre-service English teachers' intention of AR adoption in their future classes based on DTPB framework?	Semi-structured Interviews and Reflection Papers	QUAL: Descriptive Analysis
b) What are pre-service English teachers' perspectives on the advantages and disadvantages of AR in language teaching & learning?	Semi-structured Interviews and Reflection Papers	QUAL: Content Analysis
c) What are the underlying reasons for pre-service English teachers' transformational changes in adoption of AR?	Semi-structured Interviews and Reflection Papers	QUAL: Descriptive Analysis

3.2 Setting and Participants

This research was conducted in two universities one of which is a private university whilst the other is a state university both of which located in Istanbul, Turkey. Participants in the sophomore year of English Language Department were selected. The reason to select two different settings was to represent diverse

educational background, language levels, and technology acceptance as well as to reach a minimum number of participants in user intention research.

This study was carried out with sophomore year pre-service English language teachers from both private university and a state university in the academic year of 2018-2019. 141 pre-service English teachers from each university attended to the study. They were mostly aged between 18-21 years old. These pre-service English language teachers enrolled at university in the year of 2017. In the state university, they did not take an English proficiency exam in the beginning. On the other hand; in the private university, while half of them passed the English proficiency exam and attended instantly, some of them could not pass the proficiency and they studied in the English preparation school for a year. In the current study, it was aimed to reach the number of 140 students since in the intention studies employing DTPB, it is crucial to have minimum 10 participants per predictor variable (VanVoorhis & Morgan, 2007). The education pre-service English Language Teachers get in Turkey is scrutinized in the literature review chapter.

3.2.1 Demographics. In the following tables, gender, and age demographics of pre-service English teachers partaking in this study are presented. A total number of 141 participants involved in the study. The number of female participants was 97 and the number of male participants was 44 at varying ages (see Table 2 and Table 3).

Table 2

Demographics of Participants: Gender

	Frequency	Percent
Female	97	68,8
Male	44	31,2
Total	141	100,0

Table 3

Demographics of Participants: Age

	Frequency	Percent
18-19	33	23,4
20-21	87	61,7
22-23	15	10,6
24-30	6	4,3
Total	141	100,0

3.3 Procedures

Procedures section of this study examines data collection instrument, data collection procedures, and data analysis procedures.

3.3.1 Data collection instruments. In this research study; (a) DTPB scale, (b) semi-structured pre and post interviews and (c) reflection papers were used as data collection instruments.

3.3.1.1 DTPB scale. A five-point DTPB scale was taken from a previous study by Sadaf, Newby and Ertmer (2012) who examined pre-service teachers' intention to use Web 2.0 technologies. Variables and wording in the DTPB scale have not been altered except for changing Web 2.0 technologies wording to AR technology. The scale was given in English since pre-service English language teachers are very competent in the target language. The scale consists of 34 items. Items are placed under three main variables namely attitude, subjective norms and perceived behavioral control. Under attitude variables, there are constructs of ease of use, perceived usefulness and compatibility. As for the subjective norms, student influence, peer influence and superior influence are present. Under the perceived behavioral control variable, there are self-efficacy, facilitating conditions-resources and facilitating conditions- technology constructs. These three main variables explain behavioral intention which in the end explains behavior.

3.3.1.2 Interviews. With the purpose of providing in-depth analysis for the quantitative data, semi-structured interviews were conducted with randomly selected pre-service English teachers regarding their perspectives and intention of use toward augmented reality technology in language teaching. There were 4 questions in the pre-interview and 5 in post-interview. In the pre-interview, questions were constructed in order to gain a general understanding of pre-service teachers' knowledge regarding AR. The semi-structured questions in post-interviews were developed in parallel with the research questions. Moreover, interviews conducted with participants provided insightful data since it gave them the opportunity to talk about the things that were outside of quantitative test items. Interviewer chose a non-threatening atmosphere for the interviews and interviewees were not stressed out.

3.3.1.3 Reflection papers. Students were also told to write a reflection paper upon their experiences and beliefs about the use of augmented reality technology in their future classes and the factors that might facilitate or hinder their use in order to deeply analyze the data that are not obtainable from the scale.

3.3.2 Data collection procedure. Data collection process started during the fall academic semester of 2018-2019 academic year. Prior to implementation, permission to use the scale was obtained from scale's developers. After the permission for scale was granted, the head of English Language Department was contacted to ask for a permission to conduct the study there and permission was granted. Following that, the researcher contacted ethics committee at the university study took place and submitted all the required documents. The research was approved by the committee. Sophomore pre-service English teachers were chosen as the target population since they had taken Information Technologies I, II, Instructional Technologies and technology-based Drama courses and they had interest and familiarity toward technology. They are currently taking a course named Material Design with ICT. The students were proposed to participate in the study and they excitedly wanted to partake in it. They were informed about the details and procedures of the study along with what outcome would be reached.

As for the interviews, 15 pre-service English teachers were selected randomly, and they were asked semi-structured questions regarding AR in education. With the

beginning of intervention process, and pre-service English teachers had one session of course that lasted 3 hours on augmented reality and its implications for education and language teaching/learning along with a discussion part. In the following week, students were given brief training on how to create AR experiences by using applications available at the digital stores. Subsequently, animals unit from an English course book that is employed in every state school countrywide was selected to experiment augmented reality technology on. Vocabulary items related to animals were equally distributed to groups of 3 in the class. Students were then instructed to create AR experiences for their assigned vocabulary items. In the following week, students shared their AR experiences with other groups in the class. These AR experiences included 3D models, related videos or highlighted text of the scanned vocabulary images (Figure 7). Students exchanged information on how to do what. Exchanging of ideas on the use of AR for language teaching/learning broadened their ideas on what could be done with such technology.

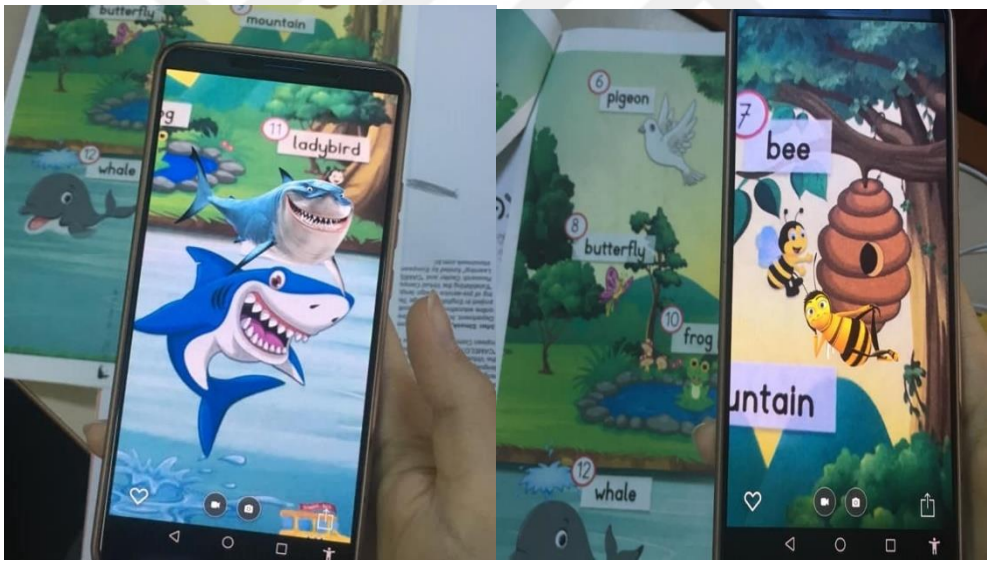


*Figure 7.*AR experiences created with HPReveal

In the second phase of the research, students were taught how to develop their own augmented reality application, especially for vocabulary teaching purposes. A pool of scanned animal photos, 3D models and videos was created on Google Drive in order to ensure consistency with the previous phase. A game developing software called Unity was used with a special augmented reality add-on named Vuforia. Subsequently, scanned animal photos from course book were basically hooked up to 3D models or videos found online. After hooking scanned pictures with multimedia

components in the software, the process was done. At the end, a stand-alone AR application for vocabulary teaching/learning based on 3rd grade English course book was developed (see Figure 8).

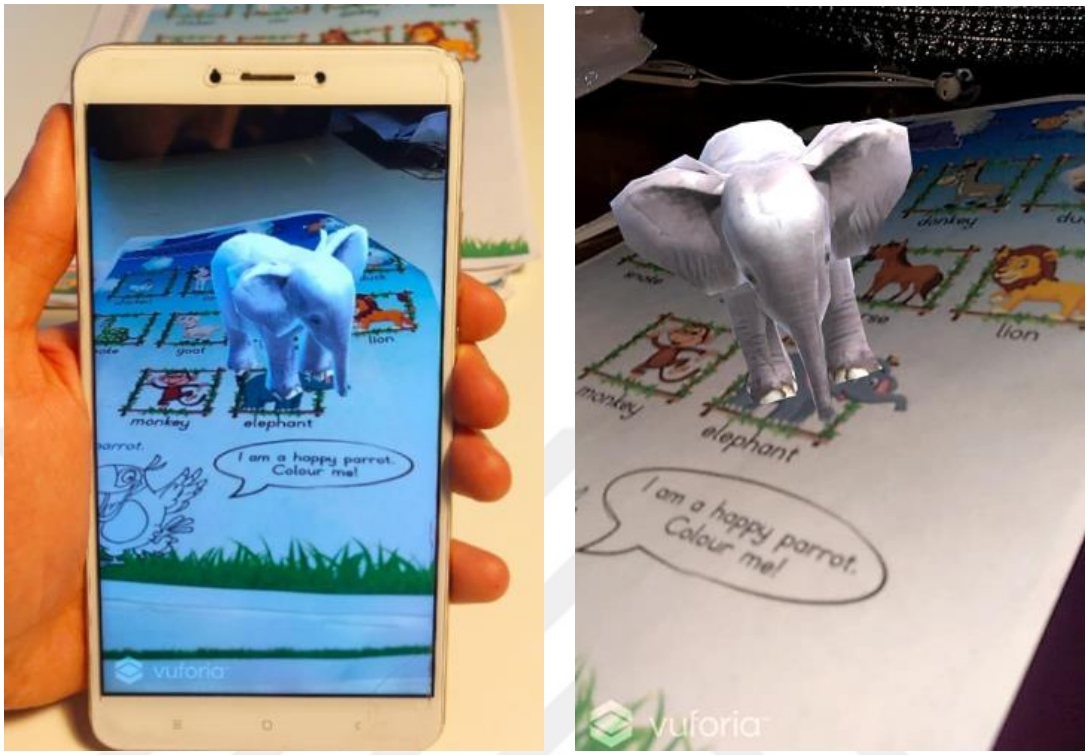


Figure 8. Stand-alone AR app developed by pre-service English teachers

After the intervention process, DTPB scale was distributed by hand and teacher candidates were asked if they needed any clarification. At the end of the intervention process, students were assigned to write a reflection paper regarding AR in language education, their perspectives, intention of use and their experiences in creating AR content and developing AR apps.

Table 4

A Summary of the Procedures Followed in the Present Study

Steps	Description
Step 1	-The appropriate group of pre-service English teachers was determined
Step 2	- Three-hour session on augmented reality and its implications for education and language teaching/learning along with a discussion part was covered.
Step 3	- Students were given brief training on how to create AR experiences by using applications available at the digital stores.
Step 4	-English course book's Animals unit was selected to experiment augmented reality on. Vocabulary items related to animals were equally distributed to groups of 3 in the class. Students were then instructed to create AR experiences for their assigned vocabulary items.
Step 5	-Pre-service English teachers shared their AR creations with the researcher and other groups in the class.
Step 6	-Training on developing stand-alone AR app was given and the application was developed with students.
Step 7	-Participants were assigned to write a reflection paper.
Step 8	-DTPB scale was administered.
Step 9	-Interviews were conducted and reflection papers were written.

The same procedure was followed in both universities.

3.3.3 Data analysis procedures. Mixed method design is applied for acquiring both quantitative and qualitative data in order to minimize possible problems that might stem from applying a single method.

Quantitative data were collected through DTPB scale distributed to pre-service English teachers. DTPB results were analyzed using path analysis to explore the relationship between the variables that determine the intention to adopt augmented reality technology. Path analysis is an advanced form of multiple regression statistical analysis method that examines the relationship between a dependent variable and two or more independent variables (Allen, 1997). Magnitude and significance of causal connections between variables can be estimated with this method. Path analysis provides the researcher to isolate real effects from fake effects (Wright, 1921). It further provides the researchers with a better understanding of causal relationships between different variables.

The qualitative data were gathered through the semi-structured interviews conducted with pre-service English teachers. Interviews are used in educational research studies for acquiring data such as motivations, feelings, attitudes, accomplishments, and experiences of people which cannot be inferred from the quantitative data (Gall, Borg, & Gall, 1997). Semi-structured interviews were conducted with a total number of 15 pre-service English students. Participants' real names were not presented in the study. As for the research question 2A and 2C, descriptive analysis was utilized since Decomposed Theory of Planned Behavior was selected as the framework. Interviews were transcribed completely, and thematic or categorical patterns were diagnosed to analyze these transcriptions. After checking transcripts thoroughly, the collected data were clustered under DTPB's categories such as attitude, subjective norm and perceived behavioral control. As for the research question 2B which was to explore advantages and disadvantages of AR from pre-service English teachers' perspectives, content analysis was utilized since there was not any framework to place themes under. Upon analyzing the data, different codes were themed under related emerging categories such as pedagogical contribution, academic outcomes, and affective factors.

In the life of an educator, reflection is critical (Van Manen, 1995). It helps to create meaning from the past and employ it to shape future experiences (Boud, Keogh, & Walker, 2013; Daudelin, 1996). Reflection papers that pre-service English teachers wrote were thoroughly analyzed to diagnose thematic or categorical patterns. These thematic patterns provided backup for the quantitative data emerged from the interviews and helped the researcher understand the phenomenon, which in this case is intention, in more depth.

3.3.4 Limitations. All studies have some limitations regardless of how well they are conducted (Arslanoğlu, 2015). Limitations are the deficiencies that cannot be controlled by the researcher. One of the limitations of this study was the lack of literature on the topic of user intention of AR. In the literature, AR has always focused on students' motivations and effectiveness of vocabulary learning. There was not a single study conducted with teachers or pre-service English teachers and in the beginning of the study, this situation led us to think that there could be unprecedented problems during the process. Fortunately, this was not the case and nearly everything went smooth.

One of the limitations was the indifference of some participants. During the AR course and training, some of the participants seemed reluctant and some of the interviewees did not talk enough in the interviews. They answered the semi-structured questions with one-sentence responses. At that point, the researcher did not want to push them to talk more and he passed on to other questions.

Another limitation during the training was that some of pre-service English teachers were not able to connect to Wifi and some of them did not have enough memory space on their phones to download AR tools; however, this problem was solved with practical solutions.

Applications on the digital markets did not always meet their needs and there was at least one shortcoming in nearly all of the ready applications. Researcher of the study wanted pre-service teachers to realize that applications on the market would not always meet their students' levels and needs and their content were not adaptable. Having realized such shortcomings, pre-service English teachers were recommended to develop their own AR applications by the researcher. At the beginning, they were

shocked because they did not have any experience and confidence. When they were told that it would be quite easy to do that, and they had the ability to do so, they were motivated and wanted to go for it.

During the development of AR application, pre-service English teachers faced some limitations such as; texture, scaling and finding the relevant object on the internet. It was observed that pre-service English teachers were quite able to overcome these limitations by employing practical solutions themselves.

Another limitation was the fact that pre-service English teachers seemed to misunderstand the nature of reflection paper. Instead of reflecting what they learned onto their current and future teaching practices, some of them preferred to give encyclopedia knowledge and introduce AR-based mobile applications from the market.

Chapter 4

Findings

4.1 Introduction

The purpose of this study was to identify which factors best predict pre-service English teachers' intentions to use augmented reality technology in their future language classes and to explore pre-service English teachers' perspectives of advantages and disadvantages of augmented reality in language teaching along with exploring their transformational changes. The researcher aimed to gain a deeper understanding of the phenomenon by implementing both quantitative and qualitative methods along with triangulation of qualitative data. Collection of data was in two phases: In the first phase, 5-point Likert scale was administered to collect quantitative data. In the second phase of the study, qualitative data were collected through semi-structured interviews with pre-service English teachers and reflection papers. The quantitative phase covers descriptive statistics and the qualitative phase consisted of two parts one of which includes descriptive analysis while the other part includes content analysis.

Research questions of the present study constitute the organization of this chapter. The quantitative data were analyzed in SPSS and AMOS software packages. The qualitative data were collected through semi-structured interviews and reflection papers. Thematic analysis was administered, and some themes were developed for the semi-structured interviews and reflection papers by the researcher and the researcher revised these themes with his thesis supervisor.

4.2 Descriptive Analysis Regarding the Characteristics of the Participants

The instrument employed for gathering quantitative data related to the research questions in the current study were consisted of 2 sections. The first section was the demographic inventory created for acquiring participants' demographic characteristic. Participants' gender and age are gathered in this section. A total number of 141 pre-service English teachers (*N*=141) participated in the study. %68.8 (*N*=) 97 of the students were female while %31.02 (*N*=44) were male.

In terms of age, %61.7 (*N*=87) of the participants were aged between 20-21, %23 (*N*= 33) of the participants aged 18-19, while %10 of participants (*N*=15) between 22-23, %4 (*N*=6) were aged 24-30 (See Figure 9).

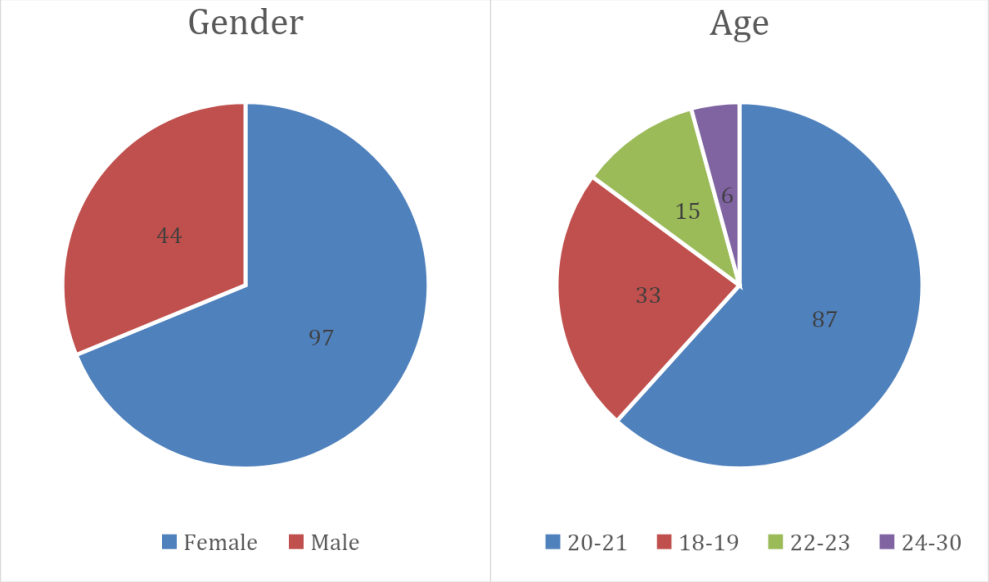


Figure 9 Graph for Gender and Age

4.3 Research Question 1: What Factors Best Predict English Pre-Service English Teachers' Intentions to Use Augmented Reality Technology in their Future Classes?

Having laid out the demographic data related to pre-service English teachers participating in this research, the following section will present the quantitative data findings gathered from the scales distributed to pre-service English teachers following the implementation. The aim of this quantitative research question was to examine the dynamics affecting pre-service English teachers' intentions to adopt augmented reality technology. With the aim of exploring pre-service English teachers' intentions to adopt AR in their future classes, quantitative data were gathered through 5-likert point DTPB scale. The adapted DTBB scale in this study is consisted of 14 variables which are measured by 33 survey items.

Path analysis models were employed to test the relationship between variables. By employing path analysis, real effects are very likely to be isolated from fallacious effects. The purpose of the path analysis is to estimate the magnitude of the link

between variables. These estimates were used to offer information on inherent correlational processes (Hartshorne & Ajjan, 2009).

The DTPB has always been functional model to explain the variation in the adoption of various innovations. In this research, the adapted DTPB model from Ajjan and Hartshorne (2008) was useful in explaining much of the variance in pre-service English teachers' intention of AR use in their future language classes. Moreover, most paths in the model were found to be statistically significant. The findings related to statistically significant relationships between the factors influencing pre-service English teachers' intentions to use AR were presented (see Figure 10 and Table 5).

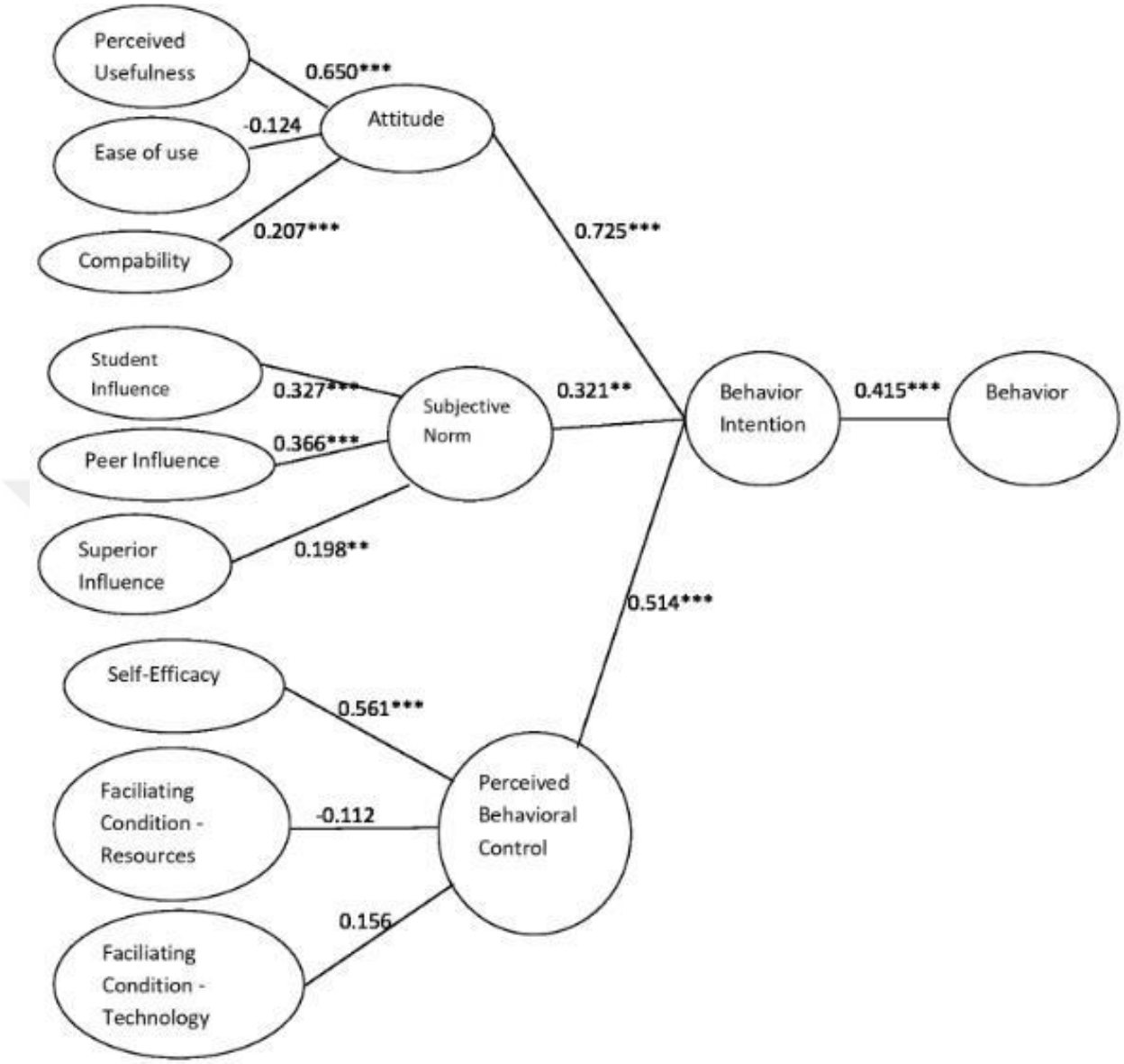


Figure 10. Path analysis of factors that influence pre-service English teachers' adoption of AR in their future classes

***p > 0.01 level

** p > 0.05 level

Table 1

Path Analysis of Factors that Influence Pre-Service English Teachers' Adoption of Augmented Reality in their Future Classes

Equation	R2 (adjusted *R2*)	Path Coefficients	β (t scores)**
Behavior (B)	0.1535 (0.1474)		
B = BI			
BI		.0415***	0.2953(5.02)***
Behavior intention (BI)	0.3504 (0.3362)		
BI = A + SN + PBC			
A		0.725***	0.3997(5.86)***
SN		0.321**	0.1400 (3.36)***
PBC		0.514***	0.0453 (0.63)
Attitude (A)	0.4360 (0.4236)		
A= PU + EOU + C			
PU		0.650 ***	0.2941(7.12)***
EOU		-0.124	-0.1324 (-1.72)
Comp		0.207***	0.2189 (4.22)***
Subjective norm (SN)	0.3971 (0.3839)		
SN = PI + SUPI + SI			
PI		0.366***	0.6280 (3.75)***
SUPI		0.198**	0.4193 (2.96)***
SI		0.327***	0.5107 (3.41)***
Perceived behavior control (PBC)	0.2846 (0.2659)		
PBC = SE+FRC + FTC			
SE		0.561***	0.1692 (3.51)***
FRC		-0.112	0.4284 (3.19)***
FTC		0.156	0.1783 (1.27)

Notes. * Figures shown are path coefficients***p* < 0.05 ****p* < 0.01 *****p* < 0.001.

B=behavior, BI=behavior intention, A= Attitude, PU=perceived usefulness, EAU=ease of use, C=compatibility, SN= subjective norm, PI=peer influence, SUPI= superior influence, SI=student influence, PBC=perceived behavior control, SE=self-efficacy, FRC=facilitative resource conditions, FTC=facilitative technology conditions.

4.3.1 Behavioral intention. Regression results confirmed that the three factors combined namely—attitude, subjective norm, and perceived behavioral control—explained a significant variance (33.6%) in behavioral intention (adjusted R2). Path analysis results indicate that all factors, attitude (β =0.725), subjective norm (β =0.321), and perceived behavioral control (β =0.514), with attitude having the greatest effect. In addition to strong linkage between behavioral intention and attitude, linkage between behavioral intention and subject norm as well as behavioral intention and perceived behavioral control were confirmed by path analysis findings ($p<0.01$). In accordance with the findings given above, research hypothesis 4 which states pre-service English teachers' behavioral intentions to use AR positively affects their behavior was confirmed.

Even though it has a positive effect on behavioral intention, subjective norm (β =0.321) has the lowest effect when compared to attitude and perceived behavioral control. These results imply that pre-service English teachers' intentions to adopt augmented reality technology are likely to be affected by their own attitudes, their perceived behavioral control which refers to their self-efficacy and availability of resources, and people around them who are their peers, superiors or students. However, as stated above, subjective norm is not influential as the other two factors.

4.3.2 Attitude. In this study, attitude is the variable with the highest influence on behavior intention. Regression results confirmed that three factors combined—perceived usefulness, ease of use and Compatibility—explained a significant variance (42.3%) in attitude (adjusted R2). Thus, research hypothesis 1 which suggested attitudes of pre-service English teachers toward the use of AR positively affects their behavioral intentions was confirmed. Path analysis results indicate that perceived usefulness (β=0.650, *t*: 7.12) had a highly significant effect on attitude. Thus, research hypothesis #1a was confirmed. Compatibility (β=0.207, *t*: 4.22) construct had a weak positive effect on attitude. Hence, research hypothesis #1c was confirmed. However, ease of use (β=-0.124, *t*: -1.72) construct had a weak negative effect on attitude. Hereafter, H1c research hypothesis stating ease of use's positive effect on attitude was not confirmed. These findings reveal that whether pre-service English teachers consider augmented reality technology as useful and compatible with their teaching style is likely to affect their attitude toward adoption of AR in their future language

classes. In the light of this study's results, ease of use, as stated above, is not likely to have an effect on pre-service English teachers' adoption of augmented reality technology.

4.3.3 Subjective norm. Regression results confirmed that the three factors combined —student influence, peer influence, and superior influence —explained a significant variance (38.3%) in subjective norm (adjusted *R2*). Thus, H2 research hypothesis which states the subjective norms of pre-service English teachers toward the use of AR positively affects their behavioral intentions was confirmed. In this study, subjective norm (β =0.321) was the second highest influential factor in behavioral intention. Path analysis results indicate that student influence (β=0.327, *t*: 3.41) and peer influence (β=0.366, *t*: 3.75) had a moderate effect on subjective norm. Thus, H2A and H2B research hypothesizes regarding students' and peers' effect on AR adoption were confirmed. On the other hand, superior influence (β=0.198, *t*: 2.96) had a low positive effect on subjective norm. Despite having a highly low influence on subjective norm, H2A research hypothesis regarding superiors' influence was also confirmed. Peer influence and students influence have been found to be the most influential variables affecting subjective norm in the adoption of AR. Superior influence was not a strong determining factor when compared to other two variables. These results indicate that pre-service English teachers are likely to be influenced by their peers and students when they adopt AR technology.

4.3.4 Perceived Behavioral Control. Regression results confirmed that all factors in perceived behavioral control namely self efficacy, facilitating conditions — resources, and facilitating conditions—technology, explains a meaningful variance (26.89%) in perceived behavioral control (adjusted *R2*). Perceived behavioral control (β =0.514) has been found to have a strong effect on behavioral intention. Thus, H3 research hypothesis regarding perceived behavioral control's positive effect on behavioral intention was confirmed. Path analysis results has revealed that self-efficacy (β =0.561, *t*: 3.51) has had a significant effect on perceived behavioral control; thus, confirming the research hypothesis H3A. However, facilitating conditions-technology (β=0.156, *t*: 1.27) does not have a significant effect on perceived behavioral control. Despite having a low positive effect on perceived behavioral control, research hypothesis H3b regarding facilitating conditions-technology

construct was confirmed. On the other hand, facilitating conditions-resources construct (β=-0.112, *t*: 3.19) has been found to have a weak negative relationship with perceived behavior control; thus, H3C research hypothesis was not confirmed.

4.4 Research Question 2: What Perspectives do Pre-Service English Teachers have toward the Use of AR in their Future Classes?

In the qualitative part, it was aimed to gain a deeper understanding toward the phenomenon. Qualitative data were gathered through semi-structured interviews (*N*= 14) and reflection papers (*N*= 55). The qualitative data was utilized to support the quantitative data and to reach an in-depth understanding on the phenomenon. The semi-structured interviews were conducted in Turkish so that participants could fully reflect what they were thinking. Interviews were transcribed using intelligent verbatim transcription type. Transcriptions of the interviews were translated into English, as well. On the other hand, reflection papers were in English.

This research question aimed to explore pre-service English teachers' perspectives of augmented reality. Quantitative data analysis results showed various significant relationships between variables and most hypotheses were confirmed. The purpose of qualitative data collected through semi-structured interviews and reflection papers was to triangulate quantitative data having the adapted DTPB scale and provide more comprehensive understanding of several variable functioning in the DTPB model.

Under the second research question, there are three following sub-questions:

1) What are the factors that affect pre-service English teachers' intention of AR adoption in their future classes based on DTPB framework?
2) What are pre-service English teachers' perspectives on the advantages and disadvantages of AR in language teaching & learning?
3) What are the underlying reasons for pre-service English teachers' transformational changes in adoption of AR?

4.4.1 What are the factors that affect pre-service English teachers' intention of AR adoption in their future classes based on DTPB framework?

The sub-question A aimed to explore pre-service English teachers' intention of use based on DTPB scale in a qualitative manner so that deeper understanding into the matter can be reached. As for the sub question A, descriptive analysis was utilized, and the responses received from interviewees were themed under the constructs of adapted DTPB scale that was used in the quantitative part, as well. Interview data (N= 15) revealed that all of the interviewees except for one portrayed positive attitudes toward augmented reality technology and they stated that they would use this technology in their future classrooms. In the following subsections, pre-service English teachers' intentions to use AR will be examined in regards to underlying reasons of their intention. The ordering of the subsections are arranged from high to low frequency.

4.4.1.1 Perceived usefulness. Interviews and reflection papers have established perceived usefulness as the most referred construct in intention of AR use. There are numerous benefits of AR in education and language teaching. AR's being full of benefits and advantages leads pre-service English teachers to adopt this technology in their future classes. Pre-service English teachers taking part in the interviews stated that they would employ AR technology in their future language classes because of various reasons. In the interviews, 14 out of 15 pre-service English teachers emphasized that they would use AR technology mostly because of its usefulness. Thus; in this section, pre-service English teachers' intentions to employ AR technology were themed under perceived usefulness, one of the DTPB constructs. Pre-service English teachers have put forward potential benefits of employing AR in language classes. Among these advantages, there have emerged categories of academic outcomes, pedagogical contributions and affective factors.

Academic outcomes category includes concepts such as effectiveness, retention of information, aiding vocabulary, understanding and better comprehension of the content. Pre-service English teachers' interviews and reflection papers revealed that their intentions of AR use are determined by AR's academic outcomes.

As for the concepts of retention of information, aiding vocabulary and understanding of the content, a pre-service English teacher wrote in his reflection that:

> *When my lecturer showed me AR examples, I really was impressed and my primary school years came into my mind. If I had learned English with AR, I would have been more creative. In future, I will definitely use AR in my class. My students will see more detail instead of envisage. So, the subject will be permanent in their minds and they will use this information in their lives. AR is so useful in terms of understanding deeply and using in our lives effectively. We can learn real-world with virtual objects.* (S1, reflection paper, April 15, 2019)

As part of this study, training on AR was given to pre-service English teachers at both universities. They held a very positive attitude toward AR in language classes and some of these teacher candidates even tried this AR technology they had just learned in their classes or private lessons. A teacher candidate highlighted his intention of use because of perceived usefulness which is the effectiveness of vocabulary teaching with AR and he wrote in his reflection:

> *I want to share my own experience, as well. I have tried AR with my students. It caught their attention pretty much and they have learned the target vocabulary easily. I'm using AR technology from this day forth to make the learning process more meaningful and effective for my students. My final thought is that AR is a living tool, we can do things beyond what we think.* (S2, reflection paper, April 15, 2019)

Pre-service English teachers highlighted the benefit of AR in providing better retention of information. A pre-service English teacher's intention of AR use in his future classes seems to be stemming from AR's feature of better retention providing which can be themed under the construct of perceived usefulness. In his reflection, he wrote, "*I'd use this technology with my beginner level students and target information would be more permanent that way*".

The Pedagogical Contributions category is another category that has emerged under the advantages of AR in language teaching & learning. This category includes concepts or features of AR such as attention-grabbing, different learning environment, usefulness, visualization, more attractive course book with AR, creativity, interactive, authenticity, multimedia, excitement and meaningfulness. Pre-service English

teachers revealed in the interviews and reflection papers that their intentions of AR use are determined by its pedagogical contributions as well as academic outcomes. In the following paragraphs, teacher candidates' intention of uses along with accompanying reasons are going to be provided and supported with their own words.

Attention-grabbing effect of AR is the most frequently uttered concept under the category of pedagogical contributions. Presenting his intention of use, one of the pre-service English teachers, wrote *"In my future class, I'll use AR to motivate my students and increase their attention"*. Another example of attention-grabbing effect of AR in the adoption of it was pointed out by one of the pre-service English teachers who wrote:

> *In my future classrooms, I'll definitely use technology and technological tools, such as AR. It can make lessons more interesting and catchier. Students especially younger students are keen on technology and teachers should use it for catching the attention of students* (S3, reflection paper, April 16, 2019).

In parallel with the statement above, another English teacher candidate addressed his intention of AR use and wrote in his reflection paper that:

> *I will use AR in my future classes because AR animated content in lessons could catch students' attention. Adding visual 3D models...gives students a wider understanding of topics. Teachers can catch their students' attention and motivate them better in this way* (S4, reflection paper, April 15, 2019).

In addition to attention-grabbing feature of AR, multimedia feature was seen as one of the reasons leading them to employ this technology and one of the pre-service English teachers pointed out *"I intend to use this technology in future because we are able to add audio, video, 3D object and text via AR"*. Another teacher candidate referred to multimedia feature of AR when stating her intention of use and wrote, *"I would use AR since kids are more motivated when they have visuals and sounds around them rather than adults depicting things"*.

4.4.1.2 Student influence. In the adoption of technology, student influence has been an important factor affecting teachers. Interviews and reflection papers have established student influence as the most frequently referred construct along with

perceived usefulness in intention of AR use. Pre-service English teachers taking part in the interviews stated that they would employ AR technology in their future language classes because of their future students' influences. Teacher candidates partaking in this study think that their future students' perspectives toward AR will definitely affect their intention of use. Thus; in this section, pre-service English teachers' intentions to employ AR technology were themed under student influence, one of the DTPB constructs.

Pre-service English teachers are in common ground when it comes to student influence in intention of AR use. In the interviews conducted, they emphasized student influence as one of the two leading factors in AR adoption. One of the pre-service language teachers pointed out *"I'm going to use this technology in my future classes and I'll be hero in the eyes of my students. I'll inspire them and change the way of learning"*. One of the pre-service English teachers said: "*I'd employ AR because it'd attract students' attention and it keeps them engaged and employment of this technology ensures that teacher is loved, respected by students. Students would be more enthusiastic*". Pre-service English teachers are aware of the fact that today's children are not the students our educational system was designed to teach. Some of the interviewees stated that children of tomorrow would be tech-savvy. This situation becomes one of the reasons impacting teacher candidates to adopt AR. One of the participants stated:

> *As a future educator, I'll be teaching to digital natives which means that their understanding for any topics could be different as well as their expectations. Moreover, AR can be used in every learner groups... All learners can find it appealing and interesting* (S5, personal communication, April 18, 2019).

Another teacher candidate underlined the importance of this generation of children and said, "*We need to use this technology to keep up with the students of this new era"*. Teacher candidates are aware of the fact that they need to keep up with the requirements technology brings (Pilgrim & Martinez, 2015). A teacher candidate beautifully summarized the student influence factor in the adoption of technology and she further emphasized children of today and future by saying:

Think about it. These children are creating content at their homes, they are uploading videos to YouTube and creating blogs, vlogs etc. and when they see that their teacher is not even able to control the smartboard, they stop respecting them. These kids were born into this technology era and they grew up with video games and virtual reality technology. We as teachers need to develop ourselves so that they shouldn't look at us like we were brick head old schoolers (S6, personal communication, April 20, 2019).

The pre-service English teacher mentioned above puts an emphasis on digital productivity of today's children by giving references to their characteristics and perspectives. Another pre-service English teacher said, "*In my future classrooms, I'll definitely use technology and technological tools including AR. It can make lessons more interesting and catchier. Students are keen on technology and teachers should use it for catching the attention of students".*

Another reference related to today's generation was made by one of the teachers who said*" This could be the thing that today's children are looking for. Because today, children are much more dynamic when compared to previous generations. This could engage them in the class".*

In one of the interviews, researcher of the study has witnessed how greatly student influence is the leading factor in technology adoption. In this interview, the teacher candidate was asked the most influential factor in their intention of AR use for their future language classrooms. The interviewee replied:

The most important thing is my students, how they feel about it and whether they like it or not. I don't care anything else. I wouldn't care about what my peers or superiors be thinking as long as it is liked and wanted by my students and as long as I get positive feedback from my students. Moreover, I'd use this technology to see my students going wow!!! (S7, personal communication, April 16, 2019).

Another pre-service English teacher showed a similar approach to the topic and partake in the following dialogue with the researcher of the study:

Researcher: Does students' perspectives affect your intention of use?

Teacher: Students' perspective is the most important thing. If students are not feeling relaxed, we cannot yield efficient results. Students' point of view is the main thing for me. I'd introduce this technology for easing their learning process.

Researcher: Do other teachers' perspectives affect your intention of use?

Teacher: The important thing is the student.

Researcher: Do your superiors' perspectives affect your intention of use?

Teacher: The important thing is the student. (S8, personal communication, January 15, 2019).

One of the pre-service English teachers said: "*I'd employ this technology. If majority of the students do not want it or if they have the tendency to be distracted by AR, I wouldn't use it*". Even though perceived usefulness has found to be a stronger factor in adoption of AR, student influence is the hidden power that can put perceived usefulness away. If students are not in favor of the new technological tool, it does not matter how useful this new technology might be.

4.4.1.3 Perceived ease of use. In the quantitative part of the study, path analysis findings put forward that ease of use construct was not a determining factor in adoption of AR technology in language classes. Qualitative results revealed that after perceived usefulness and student influence, perceived ease of use was the third most frequently mentioned underlying reason in the adoption of AR. Ten pre-service English teachers highlighted the importance of ease of use in the adoption of AR technology for their future classes. One of the pre-service English teachers said, *"Since this technology is easy to use and applicable, I'd like to use it in my future classes".* Pre-service English teachers were good to go right after they downloaded the application. One of them said: *"Actually, we can create such experiences. These are so easy to do, we thought it was hard before the training"*. Contrary to their previous thoughts, they easily were able to create AR experiences for language teaching. A teacher candidate said: *"I and my friends thought that it was going to be hard beforehand, then we have come to realization that it was actually very simple".* Another teacher candidate put an emphasis on easiness of applications and displayed her intention of use by referencing

to importance of time and experience for better creations. She said: "*These are not complicated applications. Even people who are not very keen on technology can employ this. With time and experience, I think I'll be able to create content with this technology".* In parallel with the previous statement, one of the interviewees said: *"I believe that I can employ this technology with the information I have now. It is a simple application...and I realized that it's a useful application"*

4.4.1.4 Self-efficacy. Self-efficacy can be defined as an individual's belief in their abilities. 4 out of 15 interviewees described their intentions to use AR with making reference to their ability. One of them said: *"I believe I can create AR experiences with HPReveal and alternative applications"*. In align with the previous statement, a candidate teacher displayed his intention of use by saying *"I will definitely use this technology in the future since I'm a guy who likes tech stuff. It's interesting, exciting and great way of developing self-growth".* Another teacher candidate pointed out *"I'm open to innovations, I wouldn't mind employing what's newest"*. At the end of the interviews and their analyses, it was observed that students had confidence in themselves even after a fundamental training on AR.

Some pre-service English teachers stated that they could create better AR experiences if they had known just a bit more. One of them said: *"When I know enough, then I can believe in my ability to create better AR experiences"* Another pre-service English teacher uttered nearly the same words by saying, *"With time, I believe my expertise in teaching and technology will improve so I'll be able to create content with technology".* Once again, another candidate teacher said, *"When I have enough experience and knowledge then I can trust my skill"*. From the last three remarks, it is seen that pre-service English teachers feel that they need to know a bit more to trust their abilities.

One of the pre-service English teachers summarized the importance of self-efficacy in the adoption of new technologies and said:

> *I'm definitely going to use AR in my future classes. I'm interested in advanced technology, we are in a different era... There is a very limited number of teachers who know about this stuff. I have teacher friends working all over the country and they don't know anything about these new technologies…*

Teachers need to gain this technological perspective. If teachers' self-efficacy is improved, they will have more confidence in themselves and teach with these new technological tools which is going to lead to impacting more students. (S9, personal communication, January 15, 2019)

4.4.1.5 Peer influence. In the quantitative results, peer influence in the adoption of AR was not a determining factor. Qualitative results are in alignment with this situation. In the interviews conducted, pre-service English teachers, in their adoption of AR, did not give importance to their peers' perspectives and thoughts. As stated before, pre-service English teachers regard perceived usefulness, student influence and perceived ease of use as the most important determining factors in their adoption of AR. One of the pre-service English teachers said: "*I only care about my students and benefits this technology might provide, not what others think*". Similar thoughts were uttered during the interviews. One of the interviewees said*: "I would not care about others. When other people see that this is working, they might change their mind"*. From the last two remarks, it can be stated that pre-service English teachers in this study do not give importance to what their peers might be saying about their AR adoption.

4.4.1.6 Superior influence. In the quantitative results, superior influence was not found to be a determining factor in the adoption of AR. Two of the pre-service English teachers have intentions to use AR because, along with other reasons, it was introduced by someone whom they greatly respect and love which in return, puts them in a better position in the eyes of their professor.

Other constructs of DTPB scale such as compatibility, facilitating condition-resources, facilitating condition-technology were also uttered when revealing their intention of use. However, the frequency of these variables was very low when compared to other variables mentioned above. Thus, pre-service English teachers' utterances regarding these constructs were not stated.

4.4.2 What are pre-service English teachers' perspectives on the advantages and disadvantages of AR in language teaching & learning?. This section will examine the second sub-question of the second research question by focusing on pre-service English teachers' perspectives on potential advantages and disadvantages of

AR technology in language classrooms. As for the sub question B, content analysis was utilized, and the responses were coded. In accordance with the codes, recurring themes were noted down, codes and themes were edited, and findings were defined and interpreted. From pre and post interviews and reflection papers, potential advantages and disadvantages of AR were recurrently touched upon/mentioned by pre-service English teachers. Upon analyzing the transcriptions of these data, three categories under advantages and two categories under disadvantages emerged.

4.4.2.1 Advantages of augmented reality. Advantages category represents pre-service English teachers' perspectives on potential contributions of AR technology in language classes. After a thorough analysis of interviews and reflection papers, the sub-topics of Academic Success, Pedagogical Contributions and Affective Factors emerged under the umbrella of Advantages category.

4.4.2.1.1 Academic outcomes. Academic Outcomes sub-category represents the possible academic contributions of AR technology in language classes from pre-service English teacher taking part in this research. Under the sub-category of Academic Outcomes, concepts such as "effectiveness" (*N*=15), "retention of information" (*N*=14), "aiding vocabulary" (*N*=7), "understanding of the content" (*N*=4) and "better comprehension of the content" (*N*=2) emerged.

As for the concept of "effectiveness", pre-service English teachers referred to both in-class and summative performances. They stated that AR could be effective in aiding learning process. Namely, one of the pre-service English teachers said, *"Learners especially children will love this idea and they will be excited to try this technology and if they are excited and curios, it's going to be nothing but effective"*.

The concept of "retention of information" was mentioned frequently in the interviews and reflection papers. Pre-service English teachers uttered this concept by supporting their ideas with making references to multiple intelligences and multimedia learning theories. A pre-service English teacher stated, "*Learning by seeing makes information more permanent, and if it is possible to add sound, it makes information more permanent and easier to learn*".

As for the "aiding vocabulary" concept, pre-service English teachers argued that AR could be used for teaching vocabulary. The emergence of this concept in the qualitative data was rather natural because of the nature of the study since in the practice phase, it tried to transform a traditional course book unit into an AR-enhanced unit with an opportunity to practice words in a multimedia-rich manner. One of the pre-service English teachers wrote "*With the help of HPReveal, AR experiences can easily be created by teachers and it greatly contributes to vocabulary learning process of students"*. Vocabulary learning is commonly practiced in AR-based applications and materials. One of pre-service English teachers wrote *"Vocabulary can be learned effectively because while teaching a vocabulary item, teachers can use AR to present vocabulary item in a realistic simulation which makes vocabulary more permanent "*. Most of the interviewees emphasized that vocabulary learning with AR provides a permanency since there are more than one input. One of the pre-service English teachers said, "*It would be catchier if you let students see an object, for example a pen in a 3D format*". Expressively, another pre-service English teacher stated, *"With AR and these platforms, we can enhance our students' motivation levels and let them understand the lesson permanently since they will be using their visual intelligence as well"*. From these utterances, it can be inferred that pre-service English teachers regard AR as aiding more than one sense which in result might provide stronger relations in learning.

The other concepts such as "understanding of the content" and "better comprehension of the content" are similar in their nature. Pre-service English teachers pointed out the importance of AR in aiding learning process. It either helps to understand content or comprehend it better. This perception might be resulting from multimedia feature of this technology. Following section will present pedagogical contributions of AR from pre-service English teachers' perspectives.

4.4.2.1.2 Pedagogical contributions. Pedagogical Contributions sub-category refers to pedagogical benefits that AR provides. These pedagogical benefits maximize the learning process. Under the sub-category of Pedagogical Contributions, there have emerged 12 concepts which are going to be scrutinized in the following paragraphs. These pedagogical contribution concepts that emerged after the qualitative data analysis are namely; attention-grabbing (N=22), different learning environment

(*N*=17), useful (*N*=15) , visualization (*N*=8), more attractive course book with AR (*N*=7), creativity (*N*=:7), interactive (*N*=5), authenticity (*N*=3), multimedia (*N*=3) excitement (*N*=2), meaningful (*N*=1).

Attention-grabbing effect of AR in language classes was mentioned frequently. Pre-service English teachers emphasized that AR technology and AR-enhanced materials are such tools that they can attract students' attention which might lead to more concentration and interest in the class. In her reflection paper, one of the pre-service English teachers wrote "*AR in education can make teaching and learning processes more fun and satisfying and it'd make lessons more fun and attract students' attention*". Another interviewee stated *"Thanks to AR, boring course books can be more interesting. When students scan their course books; images, videos, links or texts can appear on the screen real-time. It can attract students' attention and they might become more willing to learn".* Attention-grabbing effect of AR and AR-enhanced materials seems to be one of the reasons for pre-service English teachers' possible intention of AR use in their future classrooms. In the reflection papers, it was written by one of the participants that *"In my future classrooms, I'll definitely use technology and technological tools including AR. It can make lessons more interesting and catchier. Students are keen on technology and teachers should use it for catching the attention of students".* Attention brings motivation along, according to some pre-service English teachers participating in this study. One of the pre-service English teachers wrote *"AR animated content in classroom lessons could catch students' attention. Adding visual 3D models...give students a wider understanding of topics. Teachers can catch their students' attention and motivate them better in this way".* In the following excerpt, an amazing experience of one of the pre-service English teachers who participated in the study is presented:

> *I want to share my own experience, as well. I have tried AR with my students. It caught their attention pretty much and they have learned the target vocabulary easily. I'm using AR technology from this day forth to make the learning process more meaningful and effective for my students. My final thought is that AR is a living tool, we can do things beyond what we think.* (S10, personal communication, April 22, 2019)

Different learning environments can be provided with AR technology, pre-service English teachers established. By different learning environments, pre-service English teachers referred to alternative teaching practices other than traditional practices. They also highlighted the importance of in-class environment with AR where there could be more excitement and interest. One of the pre-service English teachers wrote, *"The era of technology gives a new perspective for the teachers and educators to make an effective environment in the classroom. Creating such environment can be provided with AR"*. Moreover, an interviewee said: "*The advantages of using AR utterly outweigh the disadvantages. Thus, teachers should implement AR for creating a rich classroom environment*". Other interviewees also stated that the use of AR could create an effective learning environment.

Usefulness of AR technology was stated 15 times. Pre-service English teachers believe that AR technology is useful for both teachers and students. Following the implementation, a pre-service English teacher said, *"Though it was the first time we tried it, we were able to do it right away and it was highly useful for us teachers and it was user-friendly"*.

Visualization feature of AR was also mentioned frequently in the interviews and reflection papers. Pre-service English teachers acknowledged that visualization of information and especially vocabulary items can enhance the learning and help learners to retain the words for longer periods. One of the pre-service English teachers said, *"Learning by seeing is much more possible. You must know what you are learning, and AR adds visuals which help learning process".*

Attractive course books that are enhanced with AR were also stated as pedagogical benefit. Pre-service English teachers stressed that traditional course books are not able to attract students. They further suggested that AR-enhanced course books might attract their attention and keep them engaged in the lesson. One of the pre-service English teachers wrote, *"Augmented reality will replace paper textbooks and course books. It offers portable and less expensive teaching materials. Because of that, education becomes more accessible and mobile".* One of the teacher candidates wrote:

> *One of the simplest use of AR in education is its introduction in the traditional classroom. Supporting course books with AR experiences adds another*

> *dimension to the learning process- a process that will become a hybrid of the traditional approach and innovative practical illustrations of complicated concepts… I was given a butterfly photo from a course book unit to transform it to AR-enhanced object and I had the butterfly flying on my laptop. It was very real though I can't touch it. I showed it to my 7 years old nephew, and his expression was worth seeing and I asked him how you would feel if your books had consisted of these kind of creations. He said that they were so fun to partake in books and added that he would never bored with this kind of course book.* (S11, reflection paper, January 15, 2019)

In parallel, a pre-service English teacher stated, *"…we can make dull course books more attractive, fun and educational with the help of AR technology"*.

Creativity is another concept that emerged from qualitative data findings. It was emphasized by pre-service English teachers that AR technology and AR-enhanced course books could enhance students' creativity since they would be able to see objects in detail and sometimes they could see the video related to topic. One of the pre-service English teachers emphasized "*If I had learned English with AR, I would have been more creative*". A participant wrote:

> *AR can be used every part of education such as biology, chemistry, math, and physics. In addition, it can be used for language education especially vocabulary learning and oral communication skill to help learners in a learning process and enhance their creativity.* (S12, reflection paper, January 15, 2019)

AR technology in language classes was identified as interactive in the interviews conducted with pre-service English teachers. Interaction can be between student-student, student-teacher and device-student. Interviewees did not specify the types of interactions but rather stated AR's being interactive. The researcher of this study observed in the trainings he gave that the level of interaction between pre-service English teachers went up significantly in the AR experience creation phase.

Authenticity is another emerging concept under the umbrella of pedagogical contributions of AR in language classes. Pre-service English teachers perceived AR

technology as authentic since it provided students with authentic materials which were more real in visualized forms.

Multimedia feature of AR was recognized by pre-service English teachers in the interviews. They regarded AR as a technology that provides multimedia components such as music, image, video or 3D graphics. Teacher candidates argued that multimedia could enhance their future students' learning.

The other emerging concept under pedagogical contributions of AR is excitement. Pre-service English teachers highlighted that AR could arouse excitement in students, especially in young learners. Moreover, pre-service English teachers frequently stated that they were very excited to use this technology with their students. One of the pre-service English teachers stated that, "*AR is very exciting, it is very exciting for students; hell, it is an excitement for me as a teacher, as well*". Another pre-service English teacher wrote, "*AR shed a light on the new era of education which actually makes me very excited about using it with my students*". One of the pre-service English teachers said:

> *This is an exciting technology and most probably students are going to see it for the first time. The fact that they are going to experience it for the first time excites me and my students. It is an excitement to be the first*. (S13, personal communication, January 15, 2019)

In addition to academic and pedagogical contributions, AR was regarded to contribute to students' selves.

4.4.2.1.3 Affective factors. Affective Factors sub-category refers to emotional factors and attitudes that influence learning. Interviews and reflection papers revealed concepts such as motivation (*N*=17), fun (*N*=9), self-confidence (*N*= 2) and curiosity (*N*=2).

All the interviewees pointed out AR's motivational effect and it was mentioned 17 times. Pre-service English teachers believe that their students' motivation levels would go up if they were to employ AR in their classes. Lack of motivation is one of today's and this generation's most crucial academic problems. It is necessary for a teacher to provide motivation for their students. In her reflection paper, one of the pre-

service English teachers wrote *"In my future classes, I can create AR experiences to motivate my students and increase their attention to lessons"*. A pre-service English teacher wrote, *"The first reason is that it can increase learners' motivation because our learners will be digital users which means employing AR motivates them and make them more active".*

Pre-service English teachers find AR technology and AR-enhanced course books to be fun, especially for young learners. The fun factor was mentioned 9 times in the interviews. One of the pre-service English teachers wrote in his reflection that "*It can be easier and more fun to learn with AR... In my future class, I'd like to use this technology... In education, students can learn with fun that comes with AR"*. In cohesion with the previous comment, another teacher candidate said, *"Students might be skeptical at first, but when they realize that they're having fun, they'll probably use it as well".*

Self-confidence of students are believed to improve if AR is employed since they would be taking advantage of latest technology.

Even though not being emphasized enough, curiosity levels of students are believed to go higher in case of AR employment. One of the pre-service English teachers wrote "*With AR, students are able to explore and learn more about what they find interesting. Creativity and curiosity would definitely be fed and also AR is the perfect way to improve your students' imagination"*.

4.4.2.1.3 Other advantages. In the qualitative data analysis, some of the concepts were not suitable for any of the sub-categories mentioned above. Thus, this category named other advantages was created. In addition to advantages mentioned above, pre-service English teachers perceived AR technology as having features such as accessibility, time-saving, language skills developing and being helpful.

4.4.2.2 Disadvantages. Disadvantages category represents the drawbacks of AR technology in language classes from the perspectives of pre-service English teachers. Since nearly all the participants portrayed positive attitudes toward AR and stated its' potential benefits, there is not enough data on AR's disadvantages. From interviews

and reflection papers, two sub-themes emerged under the topic of Disadvantages. These are called “Pedagogical Limitations” and “Other Disadvantages”.

Pedagogical Limitations category refers to deficiencies and drawbacks of this technology in educational sense. AR was said to be “decreasing attention” (*N*= 2) and “distractive” (*N*=2). Even though they were uttered only once, AR was also perceived as “not attractive” (*N*=1) and “not useful” (*N*=1).

Decreasing attention drawback of AR was mentioned 2 times in the reflection papers and one of the pre-service English teachers wrote, “*Besides its benefits, it can also decrease the attention of the students. Possibly, AR might distract young learners. They might not concentrate on what teacher is saying… So, this technology needs to have limited time of use*”. Contrary to this idea, one of the pre-service English teachers highlighted *“The students may be distracted but the teacher should be able to handle this situation”.*

During the implementation, participants in the second university used HPReveal and in the interview one of the participants said, “*Language learning with AR needs to develop because now it is close-ended technology and it will be great once it reaches open-endedness*”. Similarly, another pre-service English teacher said: “*It was easy to create AR experiences via HP Reveal, but it was a limited universe which is a problem. It has an adaptive and useful structure, but it has a long way to go*”.

One of the pre-service English teachers said, *“This technology needs to develop a lot… seeing or learning something with the help of a small screen device might not be effective. I believe there shouldn’t be a screen in between”.* In the following minutes of this interview, he again stated, *“This technology is very promising, but the screen in between makes everything harder, but it will be legendary”.*

AR technology is perceived as something that can lower the imagination of students. One of the English pre-service English teachers pointed out, “*Imagination can decrease if we use this technology...seeing a ready object instead of imagining it might lower thinking*”.

Only interviewee who portrayed negative attitudes toward AR also recapitulated in the reflection paper that:

> *As a teacher candidate, I don't think children should be involved in technology too much and for this, I think AR is really very opposite to my beliefs. But for high-schoolers, AR can be useful in terms of providing motivation... I don't think AR is really needed. What would seeing texts in 3D format provide? I don't think it would be useful but only fun and that is maybe. And for now, I think our technology is not enough to provide learners with this kind of thing. At least for now.* (S14, reflection paper, January 15, 2019)

In addition to disadvantages mentioned above, AR's being "close-ended" (*N*= 1) and "not useful" (*N*=1) was only mentioned once out of 15 interviews and 60 reflection papers.

Table 6

Reported advantages & disadvantages of AR in Language Classes

Sub-category	Frequency	Percentage (%)
Attention-Grabbing	21	12
Different Learning Environment	17	10
Usefulness	15	8
Visualization	8	4
More Attractive Course book with AR	7	4
Creativity	7	4
Interactive	5	3
Authenticity	3	2
Multimedia	3	2
Excitement	3	2
Meaningful	3	2
Academic Outcomes		
Effectiveness	15	8
Retention of Information	14	8
Aiding Vocabulary	7	4
Understanding of the Content	4	4
Better Comprehension of the Content	2	2
Authenticity	3	2

Table 6 (cont'd)

Affective Factors		
Motivation	10	17
Fun	9	5
Self-Confidence	2	2
Curiosity	2	1
Other Advantages		
Accessibility	1	1
Time-Saving	1	1
Developing Language Skills	1	1
Helpful	1	1
Disadvantages		
Decreasing Attention	2	1
Distractive	2	1
Not Attractive	1	1
Not Useful	1	1
Close-ended	1	1

4.4.3 What are the underlying reasons for pre-service English teachers' transformational changes in adoption of AR? In this part of qualitative data analysis, transformational changes in pre-service English teachers' will be touched upon. Pre-service English teachers' knowledge and ideas regarding AR before and after the implementation will be presented in detail. Thus, the changes pre-service

English teachers have gone through are going to be clearer when told from their own perspectives and in relation to DTPB scale. Once interview transcripts were analyzed, participants' transformational changes were discovered. These transformational changes were mainly related to Perceived Behavioral Control and Attitude variables of DTPB. As for the attitude variable, perceived ease of use was the most referred construct. As for the perceived behavioral control variable, it was the construct of self-efficacy.

As for the attitude variable, participants' ideas and utterances will be taken into account to further explore the transformations they have gone through. Three of the pre-service English teachers who were interviewed thought of AR to be extremely difficult before the training and they had no idea what that meant even though they knew that it was a technology concept. After the AR training, they emphasized that it was far too easy than what they had thought. In cohesion with the previous statement, one of the pre-service English teachers said: *"We can do these stuff, too. It was too easy, we thought it was going to be hard"*. While they were very skeptical at first, the participants who had no idea before now have high intention to use it in their future classrooms. Another pre-service English teacher revealed how impactful the training was by saying:

> *The week before your presentation, our university professor told us that a researcher was going to visit us and give training on augmented reality. I and my friends thought that it would be hard to understand that thing. I thought it was going to be extremely difficult because I didn't know this stuff, you know. However though! My horizon was broadened up!!! By what you showed us. It was extremely easy to apply this technology, which I certainly didn't know.* (S14, personal communication, January 18, 2019).

As for the perceived behavioral control variable, self-efficacy was the most referred construct. Three of the pre-service English teachers had preliminary information regarding AR. This preliminary information can be explained as the knowledge of the concept and what it is about yet no information or idea regarding its' use in education or language teaching. Some of the pre-service English teachers emphasized that they heard AR and they knew what it meant. However, their

knowledge and perspective of AR were quite limited. After the AR training, they stated that their knowledge extended to more general spectrum especially in education and language teaching. They emphasized that they learned how AR could be made use of and how it could be integrated into their future classes. One of the pre-service English teachers said:

> *At first, I had hearsay information about this technology, but I didn't know how to use it. I thought it was not needed at all. I didn't even know the difference between AR&VR. After I had the training on AR &Language teaching, my mind completely changed. Even though I'm not in close relationship with technology, I realized that I need to use AR in my future classrooms.* (S15, personal communication, January 17, 2019)

One of the teachers emphasized that prior to the training, he just had a conceptual idea of what AR meant. In the interview conducted, he said:

> *I did have an idea about what AR was but that was it. Now, I know what I can do with AR. I think we should be doing material design with AR. AR-enhanced course books can be worked on as well. More interactivity would be great for these course books.* (S16, personal communication, January 19, 2019)

The transformation of the pre-service teacher above is inspiring. He went from knowing nothing to designing AR-enhanced course books.

As a result, in the cases above where there is a change and intention of use, attitude and perceived behavioral control were the two occurring variables of DTPB. Pre-service English teachers have gone through noticeable changes in this procedure. In these changes, their intention of use mainly originated from the changes related to their attitude and perceived behavioral control. The following chapter will discuss the findings in relation to related literature.

Chapter 5

Discussion

5.1 Discussion of Findings for Research Questions

The results of the current study were presented in the previous chapter. The primary aim of the study was to predict which factors best influence pre-service English teachers' adoption of AR in their future language classes. This study also aimed to gain deeper insight into the main research question by conducting semi-structured interviews and analyzing reflection papers. Moreover, it was aimed to determine advantages and disadvantages of AR from pre-service English teachers' perspectives. Transformational changes in pre-service English teachers were also examined through qualitative data at hand. This chapter discusses the results of each research question in comparison with the relevant literature.

The upcoming section will discuss the implications of the findings and present suggestions for future research.

5.1.1 Discussion of Findings for the RQ1: What factors best predict English pre-service teachers' intentions to use augmented reality technology in their future classes?

In this section, the first research question was analyzed, and its findings were compared and corroborated with the findings acquired from RQ2, specifically sub-question A which asked the same question in a qualitative manner. The purpose of the first research question was to explore the factors that best predict pre-service English teachers' intentions to use AR in their future classes.

In the literature, technology acceptance of pre-service and in-service teachers have frequently been studied (Holden & Rada, 2011; Hu, Clark, & Ma, 2003; Teo, Lee, & Chai, 2008). To specify, a number studies were conducted to explore both pre-service and in-service teachers' adoption of various technological tools such as learning management systems (De Smet, Bourgonjon, De Wever, Schellens, & Valcke, 2012), Web 2.0 technologies (Capo & Orellana, 2011; Sadaf, Newby, & Ertmer, 2012;) digital learning environments (Pynoo et al., 2012), computer use

(Smarkola, 2008), blogs (Lai & Chen, 2011), web-based learning systems (Gong, Xu, & Yu, 2004) and tablet computers (Montrieux, 2014). Various user intention theories have been adopted to predict students' or teachers' intentions to use a specific technology. Among user intention theories, most frequently used ones are Theory of Reasoned Action (TRA) suggested by Fishbein and Ajzen (1975), Theory of Planned Behavior (TPB) proposed by Ajzen (1991), Technology Acceptance Model (TAM) suggested by Davis, Bogozzi, and Warshaw (1989). More advanced version of TPB, Decomposed Theory of Planned Behavior (Taylor & Todd, 1995) has been utilized in this study. DTPB has been applied in different areas; however, there has not been a single study based on pre-service English teachers' adoption of any technology let alone augmented reality.

Both quantitative and qualitative findings regarding pre-service English teachers' adoption of AR revealed that attitude and perceived behavioral control were strong determinants in behavior intention. In the following subsections, DTPB variables' path analysis findings were described and corroborated with the findings acquired from qualitative data including semi-structured interviews and reflection papers.

5.1.1.1 Attitude. Results of the path analysis revealed that behavioral intention (41.5%) has a strong influence on behavior itself. Among the variables affecting behavior intention, attitude (72.5%) has been found to be the most influential factor with perceived usefulness being the most powerful construct and this finding is in alignment with the related literature as well as qualitative data. In the qualitative data analysis, attitude variable was found to be the most influential factor with 33 references made by participants which is 8 instances more than subjective norm, the second most influential. A similar study in terms of participants and technology adoption; Sadaf, Newby and Ertmer (2012) found that attitude had the strongest influence on pre-service teachers' adoption of Web 2.0 technologies. They also highlighted the powerful influence of perceived usefulness construct on the attitude variable. In the literature, attitude has frequently been justified to be the most influential variable affecting behavior intention in explaining pre-service and in-service teachers' intention to use various technologies (Capo & Orellana, 2011; Ma et al. 2005; Sadaf, Newby, & Ertmer, 2012; Smarkola 2008; Teo, Zhou, & Noyes, 2016; Teo 2009, 2010). In

addition to pre-service and in-service teachers' intentions, students' intentions to use various technologies has also been investigated and attitude has also been found to have a strong positive influence on intention of tablet use (El-Gayer & Moran, 2007) and on Web 2.0 applications (Hartshorne & Ajjan, 2009).

In this study, perceived usefulness (65%) and compatibility (20.7&) had a positive effect on attitude while ease of use (-12.4%) had a negative effect. This is in alignment with this study's qualitative data which reveal perceived usefulness as the most expressed construct in pre-service English teachers' adoption of AR. In the literature, similar findings were obtained. Montrieux et al. (2014) found that perceived usefulness had a greater effect than perceived ease of use in explaining intention. Moreover, perceived usefulness was found to be the most influential factor affecting attitude in the adoption of various technologies (Hartshorne & Ajjan, 2009; Hu, Clark & Ma, 2003; Ma, Andersson, & Streith, 2005; Sadaf, Newby, & Ertmer, 2012; Teo, 2009). Additionally, in Capo and Orellana's (2011) study, perceived usefulness was found to be a strong determinant on attitude which is in parallel with this study's quantitative and qualitative results.

In the quantitative data analysis, perceived ease of use construct was found to have a negative impact on the attitude variable. In the previous studies employing DTPB and having pre-service teacher participants, perceived ease of use has never been found to have a negative impact on the attitude variable (Ajjan & Hartshorne, 2008; Sadaf, Newby, & Ertmer, 2012; Shiue, 2007). Even though these studies did not show a negative impact, reported impact of perceived ease of use was rather low when compared to other constructs. Contrary to quantitative findings, interview data suggested that perceived ease of use was the third most expressed construct in pre-service English teachers' adoption of AR.

5.1.1.2 Subjective norm. Subjective norm (32.1%) variable in this study had a rather low influence on behavior intention when compared to attitude and perceived behavioral control. This finding is in align with the related literature but in contrast with the qualitative data which concluded subjective norm as the second most influential variable on behavioral intention. Other studies have found subjective norm to be the weakest factor influencing behavior intention (Ajjan & Hartshorne, 2008;

Sadaf, Newby, & Ertmer, 2012; Shiue, 2007). Moreover, subjective norm was found to have no significant effect on the behavioral intention of teachers in the adoption of tablet computers (Davis et al. 1989; Mathieson 1991; Montrieux et al., 2014; Sugar et al. 2004). Hartwick and Barki (1994) argued that subjective norm's having low effect on behavioral intention could be because of that technology's not being mandatory. In cases where it is mandatory to use that technology, subjective norm is likely to have a stronger effect on behavioral intention.

In the interviews conducted and reflections papers, pre-service English teachers attached much importance to their future students' attitudes. They expressed that they would employ AR mostly because their future students' would like it. In the qualitative analysis, student influence was found to be the most frequently expressed factor in intention of use which can be corroborated by findings of Sadaf, Newby and Ertmer's (2012) study which also found student influence as the most influential factor in subjective norm in pre-service teachers' adoption of a new technology tool. During the interviews, pre-service English teachers frequently expressed their intention of use would be affected by digital native students. One of the interviewees said, "*As a future educator, I'll be teaching to digital natives which means that their understanding for any topics could be different as well as their expectations. Moreover, AR can be used in every learner groups...All learners can find it appealing and interesting".* In parallel with the literature, one of the pre-service teachers in Sadaf, Newby and Ertmer's (2012) study said,*"that's what kids are used to, you know, it's more comfortable for them to use those kinds of things so I think it would be easier and they would be more excited about learning"* and another teacher candidate commented on the same topic by saying, *"Students live on Facebook and they live on the computer. It's just so natural for them. So I feel like we are connected to future generations more than giving a lecture for 25 minutes".* From the statements given above, it can be asserted that AR or a new technology tool would be adopted by pre-service English teachers mainly because of their future students' influence.

5.1.1.3 Perceived behavioral control. Results of this study suggested that attitude (72.5%) and perceived behavioral control (51.4%) had strong influences on behavioral intention along with weak influence from subjective norm (32.1%). Similar results have been noted in the literature. For example, in their study, Ajjan and

Hartshorne (2008) investigated faculty decisions to adopt Web 2.0 technologies and found that attitudes and perceived behavioral control had strong positive influences on behavioral intention in the employment of Web 2.0 technologies, whilst subjective norm's influence on behavioral intention was rather weak. Another striking similarity is the fact that in both studies, self-efficacy was the only strong determinant in perceived behavioral control variable while facilitating condition- resources and facilitating condition- technology had little or no effect. Self-efficacy can positively influence teachers' intentions to use technology (Giallamas & Nikolopoulou, 2010). In parallel with the previous findings, this study's qualitative findings also support that self-efficacy is the most influential construct on perceived behavioral control variable while other constructs namely, facilitating conditions-resources and facilitating condition-technology have little or no effect. In Sadaf, Newby and Ertmer's (2012) study, self-efficacy construct was also found to be the strongest determinant in pre-service teachers' perceived behavioral control variable. As a result, both in this and Ajjan and Hartshorne's (2008) studies, variables of attitude and perceived behavioral control especially its' self-efficacy construct were found to be strong predictors of their behavior intention. As stated above, self-efficacy in this study was found to be the most influential factor on perceived behavioral control. On the other hand, facilitating conditions- resources was found to have no effect on perceived behavioral control which is in alignment with Ajjan and Hartshorne's (2009) study as well as qualitative findings of the current study which pointed out that self-efficacy was the only construct that had influence on perceived behavioral control. Other studies in the literature also highlighted self-efficacy's strong influence (Hu et al., 2003; Kao, Wu & Tsai, 2009, Teo, 2009).

5.1.2 Discussion of findings of RQ 2: What are pre-service English teachers' perspectives on the advantages and disadvantages of AR in language teaching & learning? In the light of interviews and reflection papers, advantages and disadvantages of augmented reality from pre-service English teachers' perspectives have been noted down. There have emerged three categories namely; academic outcomes, pedagogical contributions and affective factors. The following chapter will present these categories with references from the related literature.

5.1.2.1 Academic outcomes. Pre-service English teachers stated various academic outcomes of augmented reality technology in education and language classes.

Interviewees' most common perspective toward advantages of AR was the concept of effectiveness. They stated that they found AR as an effective tool in language learning and teaching. Pre-service English teachers put forward that AR could be effective in the learning process. In alignment with their statements, studies conducted emphasize that AR has been an effective technology in academic success at every level of education from kindergarten to higher education (Barreira et al., 2012; Hsieh & Lee; 2008; Vate-U-Lan, 2012).

Retention of information concept has been frequently uttered by pre-service English teachers. They put forward that AR provides better retention of information since it can address to multiple senses and take advantage of multimedia learning theory. This qualitative finding is in alignment with the current literature. AR-related studies conclude AR's powerful effect on understanding of the content (Echeverrîa, 2012; Kaufmann & Schmalstieg, 2002; Klopfer & Squire, 2008; Ivanova & Ivanov, 2011; Núñez et al., 2008; Zhou, Cheok, Pan, & Li, 2004; Shelton, & Hedley, 2002;). One of the participants said, *"Learning by seeing makes information more permanent, and if it is possible to add sound, it makes information more permanent and easier to learn"*. Previous comment can be corroborated by a study which revealed multimedia enriched AR technology could provide a greater retention of knowledge (Cascales, Pérez-López, & Contero, 2013).

One of the advantages of AR from the perspectives of pre-service English teachers' is its feature of aiding vocabulary. Pre-service English teachers believe that AR can be used for vocabulary teaching. This qualitative finding is in alignment with the related studies which revealed the effectiveness of vocabulary teaching with AR (Hwang, Wu, Chen, & Tu, 2015; Solak & Cakir, 2015). One of the pre-service English teachers stated, "*Vocabulary can be learned effectively because while teaching a vocabulary item, teachers can use AR to present vocabulary item in a realistic simulation which makes vocabulary more permanent"*. This statement can be corroborated by Vedadi's (2018) study which concluded that AR would be powerful

tool for improving vocabulary capacity because of AR's ability for multimedia presentation.

5.1.2.2 Pedagogical outcomes. In addition to academic outcomes, the category of pedagogical contributions has emerged. Under the pedagogical contributions category, there have emerged 12 concepts namely attention-grabbing, different learning environment, usefulness, visualization, more attractive course book with AR, creativity, interactive, authenticity, multimedia, excitement, meaningfulness.

Pre-service English teachers highlighted AR and AR-enhanced materials as attention-grabbing. This insight can be supported with the current literature. In the studies conducted, it was observed that students had a higher attention rate when AR was employed (Kirkley & Kirkley, 2005; Stapleton, Smith, & Hughes, 2005).

Different learning environment concept is one of the reported advantages of AR from the perspectives of pre-service English teachers. They put forward that AR enhanced learning environments could stir excitement and interest in learning environments which is in alignment with the Chiang, Yang and Hwang's (2014) study.

Usefulness is another emerging concept that is seen as an advantage of AR from the perspectives of pre-service English teachers. Usefulness can be defined as AR's being able to provide functionality or practicality. Pre-service English teachers advocated that AR could be useful in education and language teaching. Wang, Kim, Love and Kang (2013) pointed out that AR was useful since it could provide users with relevant multimedia components such as text, picture, sound, video or a 3D object.

Visualization has frequently been uttered by pre-service English teachers as one of the advantages of AR. They acknowledge that visualization of information can enhance learning and improve retention which can be supported with the studies from related literature (Cabero & Barroso, 2016; Dori & Belcher, 2005; Wang et al., 2017; Wojciechowski & Cellary, 2013). Some of the pre-service English teachers stated that visualization helps learners to retain vocabulary better and for longer periods. This finding is in alignment with the studies in the related literature (Barrereira et al., 2012; Hwang, Wu, Chen, & Tu, 2015; Santos et al., 2016; Solak & Cakir, 2015). For instance, Solak and Cakir (2015) concluded that vocabulary retention of the students

in the experimental group employing AR was significantly higher than the control group employing traditional methods.

Another reported advantage of AR is the concept of attractive course books. Pre-service English teachers believe AR-enhanced materials are attractive and can keep students engaged. Huan et al. (2017) concluded that AR-enhanced materials aroused more interest in students when compared to traditional teaching materials. Pre-service English teachers also argued that AR-enhanced coursebooks could boost motivation up. This presumptive advantage of AR is actually in alignment with the studies in the related literature (Taşkıran, 2018; Taşkıran, Koral, & Bozkurt, 2015; Mahadzir & Phung 2013; Solak & Cakir, 2015; Vate-U-Lan, 2012; Wei & Elias, 2011). In Taşkıran's (2018) study nearly all of the students highlighted AR-enhanced materials as highly motivating.

Creativity is another emerging advantage of AR from the perspectives of pre-service English teachers. They proposed that AR and AR-enhanced course books could enhance students' creativity as they would inspect objects in detail and watch related videos. Giannakos et al. (2015) stressed that AR could widen students' horizon and inject creativity. One of the participants in the current study put forward that AR could be used in every part of education ranging from biology to language learning. Related literature shows that AR is used in every part of education, studies (Chookaew, Howimanporn, Sootkaneung & Wongwatkit, 2017; Erbas & Demirer, 2014; Küçük, 2014). A pre-service English teacher stated that " *AR can be used for language education especially vocabulary learning and oral communication skill to help learners in a learning process and enhance their creativity*". This statement can be justified with the study which proposed that AR technology could be an effective instructional tool for promoting creativity (Klopfer & Yoon, 2005; Ivanova & Ivanov, 2011; Rosli et al., 2010; Yuen, Yaoyuneyong, & Johnson, 2011; Zhou, Cheok, Pan, & Li, 2004).

Interactiveness is another reported advantage of AR. Pre-service English teachers stressed that AR could enhance the interaction between student and teacher as well as between students. In the literature, AR was proved to enhance interaction between teacher-student and student-student (Alia, Halim, & Rahman, 2013; Ivanova

& Ivanov, 2011; Kesim & Özarslan, 2012; Manuri & Sanna, 2016; Nincarean, Wojciechowski, & Cellary, 2013). Researcher of the current study observed that during the AR implementation, interaction level between students greatly increased. Yousefi (2015) concluded in his experimental study that experimental group employing AR had a higher degree of interaction when compared to control group.

Authenticity is another reported advantage of AR from pre-service English teachers' perspectives. They stated that AR provided students with authentic materials that looked more real in visualized forms. Pre-service English teachers' insights are in alignment with the studies which concluded AR's being helpful in providing authentic and meaningful contextual support (Clarke & Dede, 2007; Dunleavy, Dede & Mitchell; Elford, 2013; Ivanova & Ivanov, 2011; Johnson et al., 2011, 2009).

Multimedia feature of AR is regarded as one of the advantages from pre-service English teachers' perspectives. A study argued that educational AR applications could provide users with multimedia components such as text, picture, audio, video or even a 3D object which lead to better learning opportunities (Wang, Kim, Love, & Kang, 2013).

Teacher candidates portrayed excitement as one of the advantages AR could present. They further suggested that AR could stir excitement especially in young learners. In alignment with the previous statement. Vate (2012) observed that AR and AR-enhanced materials could stir excitement in class. It can also be inferred from the interviews that pre-service English teachers are excited to try this technology in their future classes. One of them even said: "*AR is very exciting, it is very exciting for students; hell, it is an excitement for me as a teacher, as well"*.

5.1.2.3 Affective factors. In the light of interviews conducted, affective factors category emerged in addition to academic outcomes and pedagogical contributions. Under the category of affective factors, there are motivation, fun, self-confidence and curiosity sub-categories.

Motivation is one of the advantages of AR under the affective factors category. AR's effect on motivation has been indicated by pre-service English teachers in the interviews conducted. Most of the teacher candidates stated that they would use AR in

their future classes since it could improve students' motivation. Teacher candidates repeatedly stated that AR could enhance motivation. One of them said: "*The first reason is that it can increase learners' motivation because our learners will be digital users which means employing AR motivates them and make them more active*" and another one said, "*In my future classes, I can create AR experiences to motivate my students*". These qualitative findings are in alignment with the studies in the literature. AR was found to enhance motivation of students at all levels and areas (Aziz et al., 2012; Billinghurst & Duenser, 2012; Bujak et al., 2013; Chang et al., 2014; Cheng, 2017; Di Serio, Ibáñez, & Kloos, 2012, 2013; Jara et al., 2011; Juan et al., 2010; Kaufman & Dünser, 2007; Liu & Chu, 2010; Sumadio & Rambli, 2010; Liu,Tan, & Chu, 2009; O'Brien & Toms, 2005; Sotiriou & Bogner, 2008; Tarng & Ou, 2012).

One of the advantages of AR is fun factor from pre-service English teachers' perspectives. In the light of the interviews conducted, AR and AR-enhanced materials were perceived to be fun. Current literature supports this perspective with studies emphasizing that AR and AR-enhanced materials to be fun (Arino, Juan, Gil-Gomez, & Molla, 2014; Yoon, Elinich, Wang, Steinmeier, & Tucker, 2012).

Interviews showed that self-confidence of students is said to be improved when AR is employed. However, this perspective of pre-service English teachers about AR's improving self-confidence cannot be corroborated by related literature.

Despite of not being touched upon frequently, curiosity is referred to as one of the advantages of AR from candidate English teachers' perspectives. They emphasize that AR could foster curiosity. In alignment with the previous statement, Di Serio, Ibanez and Kloos (2013) stated that AR could raise curiosity and pave the way for more discovery learning in tasks or learning processes.

In addition to these advantages, AR was said to be accessible, time-saving and language skills developing technology any of which was not mentioned in the related literature.

5.1.2.4 Disadvantages. In the light of the interviews conducted and reflection papers, pre-service English teachers demonstrated disadvantages of AR from their

perspectives. Reported disadvantages of AR are grouped under two categories namely, pedagogical limitations and other disadvantages.

Under the category of pedagogical limitations, there are sub-categories such as not useful, not attractive, distractive and decreasing attention.

From the perspectives of pre-service English teachers, AR was believed to have a possibility to decrease especially young learners' attention and distract them since the technology itself is a flashy one. In the literature, this situation is called tunnel vision and it has been stated that students' might focus only on technology rather than its potential educational benefit (Billinghurst et al., 2003; Morrison et al., 2009; Tang, Owen, Biocca, & Mou, 2003).

One of the pre-service English teachers classified close-endedness as one of the disadvantages of AR. He said, "*Language learning with AR needs to develop because now it is close-ended technology and it will be great once it reaches open-endedness*". The statement he made probably was the result of deficiency of AR library in the HPReveal, the AR tool that was used in the implementation. This reported disadvantage is in alignment with the related literature. In their study, Pena-Rios, Hagras, Gardner, and Owusu (2017) asserts that the difficulty in generation meaningful content can be classified as AR's limitation.

5.1.3 Discussion of the findings of RQ2: What are the underlying reasons for pre-service English teachers' transformational changes in adoption of AR? In this question, it was aimed to explore the underlying reasons for pre-service English teachers' transformational changes in adoption of AR. Pre-service English teachers' interview transcriptions were analyzed. Their perspectives and knowledge of AR prior to implementation and after the implementation were identified and associated with related DTPB variables. Their transformational processes were expressed accompanying with their own words. In the findings section, pre-service English teachers' knowledge and ideas regarding AR before and after the implementation has been noted.

In the literature, studies employing DTPB scale have never examined participants' transformational changes. In that sense, comparing this section's findings

with the literature is not possible. However, these changes pre-service English teachers went through are themed under the DTPB variables of perceived behavioral control and attitude.

For perceived behavioral control variable, self-efficacy was the most expressed construct which means in the adoption of AR, pre-service English teachers valued their future students' attitudes and stated that their thoughts regarding AR would play the biggest role in AR adoption. These findings of transformational changes in pre-service English teachers are in alignment with the quantitative findings of the current study which revealed that perceived behavioral control variable was the second most influential variable with powerful influence of behavioral intention. Path analysis findings supported previous statements by revealing that self-efficacy construct was the most influential factor on perceived behavioral control variable.

As for the attitude variable, perceived ease of use was the most referred construct in the transformational change regarding adoption of AR. Pre-service English teachers highlighted that they would adopt AR because of its' easiness and applicability. On the contrary, quantitative findings did not find a positive influence of perceived ease of use on the attitude variable. Even though pre-service English teachers highlighted the importance of easiness in the interviews, the quantitative findings revealed the otherwise.

5.2 Conclusions

The present study contributes to the literature by exploring pre-service English teachers' intentions to use augmented reality in their future classes. This study collected data from 141 pre-service English teachers from two English Language Teaching departments at state and private universities in Turkey. It reached the conclusion that pre-service English teachers' positive attitudes, perceived usefulness and self-efficacy beliefs are critical factors that can be used to predict their adoption of augmented reality technology in their future classes. These findings are corroborated with the qualitative data and related literature. Second, this study discovered augmented reality technology's potential advantages and disadvantages related to language teaching from pre-service English teachers' perspectives. The most

frequently reported advantages of AR were motivation and attention-grabbing. Third, this study also explored the transformational changes in pre-service English teachers and suggested that the main reason for their transformation and thus, their intention of use was DTPB variable of perceived ease of use, which is augmented reality's being easier than what they supposed before.

Higher technology exposure and more positive technology related experiences in pre-service education have shown to be important determinants for teachers' adoption of technology (Agyei & Voogt, 2011). Pre-service English teachers participating in this study also remark that they are willing and ready to try new technologies for their future classes. As long as they are given the opportunity to learn and practice new technologies and related uses of these technologies, their attitudes and competences will likely to increase. In the case of AR's being incorporated into teacher education curriculum, more positive attitude, as stated by Agyei and Voogt (2001) and this study's findings, is likely to affect behavioral intention, and thus actual use. When AR is used in the classrooms, the aforementioned advantages of AR ranging from motivation to attention will be at the disposal of students. The gap between students and their teachers in technological sense will also likely to close and teachers are also likely to catch up with their students and requirements technology constantly brings.

5.3 Pedagogical Implications

The results of this study offer implications especially for teacher educators preparing pre-service English teachers to use emerging technologies, especially augmented reality technology in their future classrooms. According to the results of this study which concluded positive attitudes and perceived usefulness to be the significant predictors of pre-service English teachers' intentions to use augmented reality technologies. Thus, teacher educators should give importance to sparking positive attitudes towards augmented reality and show the affordances of augmented reality. In an environment where positive attitudes are sparked toward augmented reality, pre-service English teachers are more likely to grow intention of use.

The results of this study also offer implications for teacher education program designers and decision-makers. Teacher training programs need to integrate virtual technologies especially augmented reality into their curriculum and provide opportunities for pre-service English teachers to experiment and develop augmented reality enhanced lesson materials and AR-based language learning applications. Such materials can attract their future students' attraction to learn and provide motivation in the class as related literature and results of this study suggested. Higher exposure to AR related experiences is likely to pave the way for more positive attitudes toward augmented reality technology. As seen from the previous studies and also findings from this study, positive attitudes toward augmented reality will increase behavioral intention of AR use. Thus, pre-service English teachers are likely to implement this technology in their future classes which might result in better learning environment as suggested by both related literature and findings of this study.

This study also presents implications for curriculum designers and material developers. Augmented reality experiences can be embedded on English course books as an additional materials. Today's students who are digital natives are likely to react to it very positively as suggested by Huan et al. (2017) and Taşkıran (2018) who concluded that AR-enhanced materials were found to be interesting and highly motivating by students. Moreover, pre-service English teachers taking part in this study also stated potential positive effect of AR enhanced English course books on their students.

This study offers a number of implications for classroom teachers. In this study, advantages and disadvantages of AR in language classes were noted unlike any other study in the literature. Reported advantages and disadvantages were compared and corroborated with the related literature to provide credibility. Since this study includes a very detailed literature review and a qualitative section on AR's advantages and disadvantages, it may pose as a guidebook for teachers who are indecisive to implement AR in their classes.

Another pedagogical implication for the current study could be that teachers need to be more technologically competent since the gap between students and teachers is widening. Moreover, teachers must not be the consumers of technology but

rather create and integrate digital technologies into his/her instruction (Demirekin, 2014; Jacobs et al., 2014). In the qualitative section called transformational changes, it was observed that pre-service English teachers in the beginning did not suppose that they could create augmented reality experiences. However, a little bit of encouragement and training, they were able to create AR experiences and moreover AR applications for their future language classes along with designing an AR-enhanced course book unit. Teachers need to be one step ahead of their students and by implementing latest technologies such as AR in education, students are more likely to look up to their teachers and perceive them as a gold mine of information.

5.4 Recommendations

The current study has several recommendations for further research. Firstly, this study explored the factors that predict pre-service English teachers' intentions to use augmented reality in their future language classes. Similar studies might be conducted with different pre-service groups and various emerging technologies such as virtual reality, mixed reality, artificial intelligence and big data, coding, mobile learning and 3D printing. This might help pre-service teachers to broaden their viewpoints of every-changing world. Similar studies can also be conducted with higher number of participants so that more accurate results from path analysis can be drawn.

References

Ab Aziz, N. A., Ab Aziz, K., Paul, A., Yusof, A. M., & Noor, N. S. M. (2012, February). *Providing augmented reality based education for students with attention deficit hyperactive disorder via cloud computing: Its advantages.* Paper presented at 2012 14th International Conference on Advanced Communication Technology (ICACT), PyeongChang, South Korea

Abdüsselam, M. S., Karal, H.(2015). Artırılmış Gerçeklik, Eğitim Teknolojileri Okumaları, ISBN: 978- 605- 318- 126- 2, 149 – 170.

Agca, R. K., & Özdemir, S. (2013). Foreign language vocabulary learning with mobile technologies. *Procedia - Social and Behavioral Sciences, 83,* 781-785. doi:10.1016/j.sbspro.2013.06.147

Agyei, D. D., & Voogt, J. M. (2011). Exploring the potential of the will, skill, tool model in Ghana: predicting prospective and practicing teachers' use of technology. *Computers & Education, 56*, 91–100.

Ahmad, J. (2012). English language teaching (ELT) and integration of media technology. *Procedia-Social and Behavioral Sciences*, *47,* 924-929.

Ajjan, H., & Hartshorne, R. (2008). Investigating faculty decisions to adopt Web 2.0 technologies: Theory and empirical tests. *Internet and Higher Education*, 11, 71-80.

Ajzen, I. (1985). From intentions to actions: A theory of planned behavior. In J.Kuhl & J.Beckman (Eds), *Action control from cognition to behavior*, (pp. 11-39). Springer, Berlin, Heidelberg.

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes, 50*(2), 179-211. doi:10.1016/0749-5978(91)90020-t

Ajzen, I., & Madden, T. J. (1986). Prediction of goal-directed behavior: Attitudes, intentions, and perceived behavioral control. *Journal of Experimental Social Psychology, 22*(5), 453-474. doi:10.1016/0022-1031(86)90045-4

Akcaoğlu, M. (2008). *Exploring technology integration in English language teaching: Defining the competence, perceived barriers, attitudes, usage frequencies and educational value of technology integration for pre-service and in-service ELT teachers* (Unpublished master's thesis), METU, Ankara, Turkey.

Akcaoğlu, M. E. T. E. (2008). *Exploring technology integration approaches and practices of pre-service and in-service English language teachers.* (Unpublished masters thesis). Middle East Technical University, Ankara, Turkey. *Retrieved from http://etd. lib. metu. edu. tr/upload/12609579/index. pdf*.

Akçayır, M., & Akçayır, G. (2017). Advantages and challenges associated with augmented reality for education: A systematic review of the literature. *Educational Research Review*, *20*, 1-11. doi:10.1016/j.edurev.2016.11.002

Akhlaghi, M., & Zareian, G. (2015). The effect of powerpoint presentation on grammar and vocabulary learning of Iranian pre-university EFL learners. *Academic Research International*, *6*(1), 160.

Akpabio, E., & Ogiriki, I. B. (2017). Teachers use of information and communication technology (ICT) in teaching English language in senior secondary schools in Akwa Ibom State. *Equatorial Journal of Education and Curriculum Studies*, *2* (2), 28-33.

Alavinia, P., & Qoitassi, K. (2013). On the viability of vocabulary learning enhancement through the implementation of MALL: The case of Iranian EFL learners. *Journal of Language Teaching and Research*, *4*(2). doi:10.4304/jltr.4.2.412-426

Alemi, M., Sarab, M. R., & Lari, Z. (2012). Successful learning of academic word list via MALL: mobile assisted language learning. *International Education Studies*, *5*(6). doi:10.5539/ies.v5n6p99

Alkhattabi, M. (2017). Augmented Reality as E-learning Tool in Primary Schools' Education: Barriers to Teachers' Adoption. *International Journal of*

Emerging Technologies in Learning (iJET), *12*(02), 91. doi:10.3991/ijet.v12i02.6158

Allen, M. P. (1997). *Understanding regression analysis*. New York: NetLibrary, Inc.

Allen, M. P. (2004). *Understanding regression analysis*. Springer Science & Business Media.

Allum, P. (2004). Evaluation of CALL: Initial vocabulary learning. *ReCALL*, *16*(02). doi:10.1017/s0958344004001624

Alnajjar, M., & Brick, B. (2017). Utilizing computer-assisted vocabulary learning tools in English language teaching: Examining in-service teachers' perceptions of the usability of digital flashcards. *International Journal of Computer-Assisted Language Learning and Teaching (IJCALLT), 7*(1), 1-18.

Altun, M. (2015). The integration of technology into foreign language teaching. *International Journal on New Trends in Education and Their Implications*, *6*(1), 22-27.

Al-Zaidiyeen, N. J., Mei, L. L., & Fook, F. S. (2010). Teachers' attitudes and levels of technology use in classrooms: The case of Jordan schools. *International education studies*, *3*(2), 211-218.

Angeli, C., & Valanides, N. (2009). Epistemological and methodological issues for the conceptualization, development, and assessment of ICT–TPCK: Advances in technological pedagogical content knowledge (TPCK). *Computers & education*, *52*(1), 154-168.

Angers, J., & Machtmes, K. L. (2005). An ethnographic-case study of beliefs, context factors, and practices of teachers integrating technology. *The Qualitative Report*, *10*(4), 771-794.

Arino, J. J., Juan, M. C., Gil-Gómez, J. A., & Mollá, R. (2014). A comparative study using an autostereoscopic display with augmented and virtual reality. *Behaviour & Information Technology*, *33*(6), 646-655.

Arvanitis, T. N., Petrou, A., Knight, J. F., Savas, S., Sotiriou, S., Gargalakos, M., & Gialouri, E. (2007). Human factors and qualitative pedagogical evaluation of a mobile augmented reality system for science education used by learners with physical disabilities. *Personal and Ubiquitous Computing*, *13*(3), 243-250. doi:10.1007/s00779-007-0187-7

Attewell, J. (2005). Mobile technologies and learning. *London: Learning and Skills Development Agency*, *2*(4), 44-75.

Atwood-Blaine, D., & Huffman, D. (2017). Mobile gaming and student interactions in a science center: The future of gaming in science education. *International Journal of Science and Mathematics Education*, *15*(S1), 45-65. doi:10.1007/s10763-017-9801-y

Aydin, S. (2013). Teachers' perceptions about the use of computers in EFL teaching and learning: the case of Turkey. *Computer Assisted Language Learning*, *26*(3), 214-233. doi:10.1080/09588221.2012.654495

Ayres, R. (2002). Learner attitudes towards the use of CALL. *Computer Assisted Language Learning Journal*, *15*(3), 241-249.

Baek, Y., Jung, J., & Kim, B. (2008). What makes teachers use technology in the classroom? Exploring the factors affecting facilitation of technology with a Korean sample. *Computers & Education*, *50*(1), 224-234.

Bandura, A. (1982). Self-efficacy mechanism in human agency. *American Psychologist, 37*(2), 122-147. doi:10.1037//0003-066x.37.2.122

Barnett, M., Harwood, W., Keating, T., & Saam, J. (2002). Using emerging technologies to help bridge the gap between university theory and classroom practice: Challenges and successes. *School Science and Mathematics, 102*(6), 299-313.

Barreira, J., Bessa, M., Pereira, L. C., Adão, T., Peres, E., & Magalhães, L. (2012, June). *MOW: Augmented reality game to learn words in different languages. Case study: Learning English names of animals in elementary school*. Paper

presented at the 7th Iberian Conference on Information Systems and Technologies (CISTI).

Basoglu, E. B., & Akdemir, O. (2010). A comparison of undergraduate students' English vocabulary learning: Using mobile phones and flash cards. *Turkish Online Journal of Educational Technology-TOJET*, *9*(3), 1-7.

Bicen, H. (2015). The role of social learning networks in mobile assisted language learning: Edmodo as a case study. *Journal of Universal Computer Science, 21*(10), 1297-1306.

Bicen, H., & Bal, E. (2016). Determination of student opinions in augmented reality. *World Journal on Educational Technology*, *8*(3). doi:10.18844/wjet.v8i3.642

Billinghurst, M., & Duenser, A. (2012). Augmented reality in the classroom. *Computer*, *45*,56 – 63.

Billinghurst, M., & Kato, H. (2002). Collaborative augmented reality. *Communications of the ACM*, *45*(7), 64-70.

Billinghurst, M., Kato, H., & Poupyrev, I. (2001, January). *MagicBook: Transitioning between reality and virtuality.* Paper presented at *CHI'01 extended abstracts on Human factors in computing systems,* Seattle, Washington doi: 10.1145/634086.634087

Billinghurst, M., Belcher, D., Gupta, A., & Kiyokawa, K. (2003). Communication behaviors in collocated collaborative ar interfaces. *International Journal of Human-Computer Interaction*, *16*(3), 395-423. doi:10.1207/s15327590ijhc1603_2

Bjork, R.A. (1989). Retrieval inhibition as an adaptive mechanism in human memory. In H. L. Roediger III, & F. I. M. Craik (Eds.), Varieties of memory & consciousness (pp. 309-330). Hillsdale, NJ: Erlbaum.

Boud, D., Keogh, R., & Walker, D. (2013). *Reflection: Turning experience into learning*. New York, USA: Routledge.

Bower, M., Howe, C., McCredie, N., Robinson, A., & Grover, D. (2013). *Augmented reality in Education — Cases, places, and potentials.* Paper presented at 2013 IEEE 63rd Annual Conference International Council for Education Media (ICEM), Singapore. doi:10.1109/cicem.2013.6820176

Bozdogan, D., & Özen, R. (2014). Use of ICT technologies and factors affecting pre-service ELT teachers' perceived ICT self-efficacy. *Turkish Online Journal of Educational Technology-TOJET, 13*(2), 186-196.

Braul, B. (2006). *ESL teacher perceptions and attitudes toward using computer-assisted language learning (CALL): Recommendations for effective CALL practice (*Unpublished master's thesis). University of Alberta, Edmonton, Alberta, Canada.

Bujak, K. R., Radu, I., Catrambone, R., MacIntyre, B., Zheng, R., & Golubski, G. (2013). A psychological perspective on augmented reality in the mathematics classroom. *Computers & Education, 68,* 536-544. doi:10.1016/j.compedu.2013.02.017

Burston, J. (2014). The reality of MALL: Still on the fringes. *Calico Journal, 31*(1), 103-125.

Burston, J. (2018). MALL: Global Prospects and Local Implementation. *Computer Assisted Language Learning- Electronic Journal, 18*(1), 1-8.

Burton-Jones, A., & Hubona, G. S. (2006). The mediation of external variables in the technology acceptance model. *Information & Management, 43*(6), 706-717.

Cabero Almenara, J., & Barroso, J. (2016). The educational possibilities of Augmented Reality. *New Approaches in Educational Research, 5*(1), 44-50.

Çakır, R., Solak, E., & Tan, S. S. (2016). Artırılmış Gerçeklik Teknolojisi İle İngilizce Kelime Öğretiminin Öğrenci Performansina Etkisi [Effect of AR-enhanced Vocabulary Teaching on Students' Performance], *Gazi Eğitim Bilimleri Dergisi, 1*(2), 45-58.

Cameron, L. (2001). *Teaching languages to young learners*. Ernst Klett Sprachen.

Can, T. (2016, May 10). *Tuncer Can Talks about Virtual Reality in Education* [Video file]. Retrieved from https://www.youtube.com/watch?v=PjFnvSvGyyM

Can, T., & Şimşek, I. (2015). The use of 3D virtual learning environments in training foreign language pre-service teachers. *Turkish Online Journal of Distance Education*, *16*(4), 114-124.

Cascales, A., Pérez-López, D., & Contero, M. (2013). study on parent's acceptance of the augmented reality use for preschool education. *Procedia Computer Science*, *25*, 420-427. doi:10.1016/j.procs.2013.11.053

Chang, G., Morreale, P., & Medicherla, P. (2010, March). *Applications of augmented reality systems in education.* Paper presented at Society for Information Technology & Teacher Education International Conference.

Chang, Y., Chen, C., Huang, W., & Huang, W. (2011). *Investigating students perceived satisfaction, behavioral intention, and effectiveness of English learning using augmented reality*. Paper presented at 2011 IEEE International Conference on Multimedia and Expo, Barcelona, Spain. doi:10.1109/icme.2011.6012177

Chang, H., Hsu, Y., & Wu, H. (2014). A comparison study of augmented reality versus interactive simulation technology to support student learning of a socio-scientific issue. *Interactive Learning Environments*, *24*(6), 1148-1161. doi:10.1080/10494820.2014.961486

Chang, K., Chang, C., Hou, H., Sung, Y., Chao, H., & Lee, C. (2014). Development and behavioral pattern analysis of a mobile guide system with augmented reality for painting appreciation instruction in an art museum. *Computers & Education*, *71*, 185-197. doi:10.1016/j.compedu.2013.09.022

Chapelle, C. A. (2001). *Computer applications in second language acquisition*. Cambridge University Press.

Che Hashim, N., Abd Majid, N. A., Arshad, H., & Khalid Obeidy, W. (2018). User satisfaction for an augmented reality application to support productive

vocabulary using speech recognition. *Advances in Multimedia*, *2018*, 1-10. doi:10.1155/2018/9753979

Chen, Y. (2006, June). *A study of comparing the use of augmented reality and physical models in chemistry education*. Paper presented at 2006 ACM International Conference on Virtual reality Continuum and its Applications - VRCIA '06, Hong Kong, China. doi:10.1145/1128923.1128990

Chen, Y. C. (2013). *Learning protein structure with peers in an ar-enhanced learning environment* (Doctoral dissertation). Retrieved from https://www.learntechlib.org/p/124052/.

Chen, C., & Chung, C. (2008). Personalized mobile English vocabulary learning system based on item response theory and learning memory cycle. *Computers & Education*, *51*(2), 624-645. doi:10.1016/j.compedu.2007.06.011

Chen, C., & Wang, C. (2015). Employing augmented-reality-embedded instruction to disperse the imparities of individual differences in earth science learning. *Journal of Science Education and Technology*, *24*(6), 835-847.

Chen, I., & Yen, J. (2013). Hypertext annotation: Effects of presentation formats and learner proficiency on reading comprehension and vocabulary learning in foreign languages. *Computers & Education*, *63*, 416-423. doi:10.1016/j.compedu.2013.01.005

Cheng, K. (2017). Reading an augmented reality book: An exploration of learners' cognitive load, motivation, and attitudes. *Australasian Journal of Educational Technology*. *33*(4), 53-69. doi:10.14742/ajet.2820

Chi, H., Kang, S., & Wang, X. (2013). Research trends and opportunities of augmented reality applications in architecture, engineering, and construction. *Automation in Construction*, *33*, 116-122. doi:10.1016/j.autcon.2012.12.017

Chiang, T. H. C., Yang, S. J., & Hwang, G. J. (2014). An augmented reality-based mobile learning system to improve students' learning achievements and motivations in natural science inquiry activities. *Educational Technology & Society*, *17*(4), 352-365.

Chiang, T. H.C., Yang, S. J., & Hwang, G. J. (2014). Students' online interactive patterns in augmented reality-based inquiry activities. *Computers & Education, 78,* 97-108. doi:10.1016/j.compedu.2014.05.006

Chookaew, S., Howimanporn, S., Sootkaneung, W., & Wongwatkit, C. (2017). *Motivating Pre-service Teachers with Augmented Reality to Developing Instructional Materials through Project-Based Learning Approach.* Paper presented at 2017 6Th IIAI International Congress on Advanced Applied Informatics (IIAI-AAI), Hamamatsu, Japan. doi: 10.1109/iiai-aai.2017.106

Chou, T., & ChanLin, L. (2012). Augmented reality smartphone environment orientation application: A case study of the fu-jen university mobile campus touring system. *Social and Behavioral Sciences, 46,* 410-416. doi:10.1016/j.sbspro.2012.05.132

Chow, M., Herold, D. K., Choo, T., & Chan, K. (2012). Extending the technology acceptance model to explore the intention to use Second Life for enhancing healthcare education. *Computers & Education, 59*(4), 1136-1144. doi:10.1016/j.compedu.2012.05.011

Clarke, J., & Dede, C. (2007). *MUVEs as a powerful means to study situated learning.* Paper presented at the 8th international conference on Computer supported collaborative learning - CSCL'07, New Jersey, USA. doi:10.3115/1599600.1599627

Cobb, T. (2012). Technology and Learning Vocabulary. The Encyclopedia of Applied Linguistics, C. A. Chapelle (Ed.). doi:10.1002/9781405198431.wbeal1190

Crawley, F. E. (1990). Intentions of science teachers to use investigative teaching methods: A test of the theory of planned behavior. *Journal of Research in Science Teaching, 27*(7), 685-697. doi:10.1002/tea.3660270708

Cuban, L. (2001). *Oversold and Underused: Computers in the Classroom.* Cambridge: Harvard University Press.

Cullen, T. A., & Greene, B. A. (2011). Pre-service teachers' beliefs, attitudes, and motivation about technology integration. *Journal of Educational Computing Research, 45*(1), 29-47.

Cunningsworth, A. (1995). *Choosing your coursebook.* Oxford, England: Heinemann.

Daudelin, M. W. (1996). Learning from experience through reflection. *Organizational dynamics, 24*(3), 36-48.

Davie, N., & Hilber, T. (2015, March). *Mobile-Assisted Language Learning: Student Attitudes to Using Smartphones to Learn English Vocabulary*. Paper presented at the International Association for Development of the Information Society (IADIS) International Conference on Mobile Learning, Madeira, Portugal.

Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1989). User acceptance of computer technology: A comparison of two theoretical models. *Management Science, 35*(8), 982-1003. doi:10.1287/mnsc.35.8.982

Dawson, V. (2008). Use of information and communication technology by early career science teachers in Western Australia. *International Journal of Science Education, 30*(2),203–219.

Dede, C. (2011, September). *Emerging technologies, ubiquitous learning, and educational transformation.* Paper presented at European Conference on Technology Enhanced Learning, Berlin, Heidelberg.

Dede, C. (2013). EcoMOBILE: Integrating augmented reality and probeware with environmental education field trips. *Computers & Education, 68,* 545-556. doi:10.1016/j.compedu.2013.02.018

Delello, J. A. (2014). Insights from pre-service teachers using science-based augmented reality. *Journal of Computers in Education, 1*(4), 295-311.

Demirer, V., & Erbaş, Ç. (2015). Mobil Artırılmış Gerçeklik Uygulamalarının İncelenmesi ve Eğitimsel Açıdan Değerlendirilmesi [Investigation of Mobile Augmented Reality Applications and Evaluation of Educational

Perspective]. *Mersin Üniversitesi Eğitim Fakültesi Dergisi, 11*(3), 802.813. doi:10.17860/efd.29928

Demouy, V., & Kukulska-Hulme, A. (2010). On the spot: Using mobile devices for listening and speaking practice on a French language programme. *Open Learning: The Journal of Open, Distance and e-Learning, 25*(3), 217-232. doi:10.1080/02680513.2010.511955

Devernay, F., Mourgues, F., & Coste-Manière, È. (2001). Towards endoscopic augmented reality for robotically assisted minimally invasive cardiac surgery. In *Medical Imaging and Augmented Reality, 2001. Proceedings. International Workshop on* (pp. 16-20). IEEE.

Di Serio, Á., Ibáñez, M., & Kloos, C. (2013). Impact of an augmented reality system on students' motivation for a visual art course. *Computers & Education*, *68*, 586-596. doi: 10.1016/j.compedu.2012.03.002

Doğan, Ö. (2016). *The effectiveness of augmented reality supported materials on vocabulary learning and retention* (Doctoral dissertation, Abant Izzet Baysal University, Bolu, Turkey).

Dogruel, L., Joeckel, S., & Bowman, N. D. (2015). The use and acceptance of new media entertainment technology by elderly users: Development of an expanded technology acceptance model. *Behaviour & information Technology, 34*(11), 1052-1063.

Dori, Y. J., & Belcher, J. (2005). How does technology-enabled active learning affect undergraduate students' understanding of electromagnetism concepts?. *The Journal of the Learning Sciences*, *14*(2), 243–279.

Dori, Y. J., & Belcher, J. (2005). Learning electromagnetism with visualizations and active learning. *Visualization in Science Education*, 187-216. doi:10.1007/1-4020-3613-2_11

Duarte, M., Cardoso, A., & Lamounier, E. (2005, July). *Using augmented reality for teaching physics*. Paper presented at WRA'2005-II Workshop on Augmented Reality.

Dudeney, G., & Hockly, N. (2012). ICT in ELT: How did we get here and where are we going? *ELT Journal*, *66*(4), 533-542. doi:10.1093/elt/ccs050

Duh, H. B., & Klopfer, E. (2013). Augmented reality learning: New learning paradigm in co-space. *Computers & Education, 68,* 534-535. doi:10.1016/j.compedu.2013.07.030

Dunleavy, M., Dede, C., & Mitchell, R. (2008). Affordances and Limitations of Immersive Participatory Augmented Reality Simulations for Teaching and Learning. *Journal of Science Education and Technology*, *18*(1), 7-22. doi:10.1007/s10956-008-9119-1

Dünser, A., & Hornecker, E. (n.d.). An observational study of children interacting with an augmented story book. *Technologies for E-Learning and Digital Entertainment*, 305-315. doi:10.1007/978-3-540-73011-8_31

Dünser, A., Walker, L., Horner, H., & Bentall, D. (2012). Creating interactive physics education books with augmented reality. *Proceedings of the 24th Australian Computer-Human Interaction Conference on - OzCHI '12*. doi:10.1145/2414536.2414554

Echeverría, A., Améstica, M., Gil, F., Nussbaum, M., Barrios, E., & Leclerc, S. (2012). Exploring different technological platforms for supporting co-located collaborative games in the classroom. *Computers in Human Behavior*, *28*(4), 1170-1177. doi:10.1016/j.chb.2012.01.027

Egbert, J., Paulus, T. M., & Nakamichi, Y. (2002). The impact of CALL instruction on classroom computer use: A foundation for rethinking technology in teacher education. *Language Learning & Technology, 6*(3), 108-126.

El Sayed, N. A., Zayed, H. H., & Sharawy, M. I. (2011). ARSC: Augmented reality student card. *Computers & Education*, *56*(4), 1045-1061. doi:10.1016/j.compedu.2010.10.019

Elford, M. D. (2013). *Using tele-coaching to increase behavior-specific praise delivered by secondary teachers in an augmented reality learning*

environment (Doctoral dissertation). Retrieved from https://search.proquest.com/docview/1353110650

Elgort, I. (2018). Technology-mediated second language vocabulary development: A review of trends in research methodology. *CALICO JOURNAL*, *35*(1), 1-29.

Elia, A., Can, T., & Şimşek, İ. Dil eğitimini düşünmek: İstanbul Üniversitesi'nde sürükleyici oyunla kelime öğretimi [Thinking language education: teaching vocabulary with immersive games in Istanbul University]. *RumeliDE Dil ve Edebiyat Araştırmaları Dergisi*, (10), 40-49.

Erbaş, Ç. & Demirer, V. (2014). Eğitimde artırılmış gerçeklik uygulamaları: Google glass örneği [Augmented reality applications in education: An example of google glass]. *Journal of Instructional Technologies & Teacher Education*, *3*(2), 8-16.

Fatih Özcan, M., Özkan, Â., & Şahin, N. (2017). The influence of the augmented reality application on students' performances in Ottoman Turkish readings. *Universal Journal of Educational Research*, *5*(12B), 27-33. doi:10.13189/ujer.2017.051403

Fishbein, M., & Ajzen, I. (1977). Belief, attitude, intention, and behavior: An introduction to theory and research.

Fjeld, M., & Voegtli, B. (2002, October). *Augmented chemistry: An interactive educational workbench*. Paper presented at International Symposium on Mixed and Augmented Reality. doi:10.1109/ismar.2002.1115100

Freitas, R., & Campos, P. (2008, January). *SMART: a SysteM of Augmented Reality for Teaching 2nd grade students.* Paper presented at 22nd British HCI Group Annual Conference on People and Computers: Culture, Creativity, Interaction

Fritz, F., Susperregui, A., & Linaza, M. T. (2005, November). *Enhancing cultural tourism experiences with augmented reality technologies.* Paper presented at 6th International Symposium on Virtual Reality, Archaeology and Cultural Heritage (VAST).

Furió, D., González-Gancedo, S., Juan, M., Seguí, I., & Costa, M. (2013). The effects of the size and weight of a mobile device on an educational game. *Computers & Education, 64*, 24-41. doi:10.1016/j.compedu.2012.12.015

Gall, M.D., Borg, W.R., & Gall, J.P. (1996). Educational research: an introduction, (Sixth Edition). USA: Longman.

García, P., Schiaffino, S., & Amandi, A. (2008). An enhanced Bayesian model to detect students' learning styles in Web-based courses. *Journal of Computer Assisted Learning*, *24*(4), 305-315. doi:10.1111/j.1365-2729.2007.00262.x

Garton, S., & Graves, K. (2014). Materials in ELT: Current issues. In *International perspectives on materials in ELT* (pp. 1-15). Palgrave Macmillan, London.

Gauld, A., & Shotter, J. (1980). *Human action and its psychological investigation*. London, England: Routledge.

Gavish, N., Gutiérrez, T., Webel, S., Rodríguez, J., Peveri, M., Bockholt, U., & Tecchia, F. (2015). Evaluating virtual reality and augmented reality training for industrial maintenance and assembly tasks. *Interactive Learning Environments*, *23*(6), 778-798.

Ghanizadeh, A., Razavi, A., & Hosseini, A. (2018). TELL (Technology-enhanced language learning) in Iranian high schools: A panacea for emotional and motivational detriments. *International Journal of Applied Linguistics and English Literature, 7*(4), 92-100.

Giannakos, M. N., Divitini, M., Iversen, O. S., Koulouris, P., Center, P. I., & Agogi, E. (2015, September). *Make2Learn: Fostering Engagement and Creativity in Learning through Making*. Paper presented at Make2Learn@ ICEC.

Gillet, A., Sanner, M., Stoffler, D., Goodsell, D., & Olson, A. (2004, October). *Augmented reality with tangible auto-fabricated models for molecular biology applications*. Paper presented at the IEEE Visualization 2004. doi:10.1109/VISUAL.2004.7

Godwin-Jones, R. (2015). Emerging technologies the evolving roles of language teachers: trained coders, local researchers, global citizens. *Language, Learning and Technology, 19*(1), 10-22.

Goh, J.W.P., Quek, C. J., & Lee, O. K. (2010). An investigation of students' perceptions of learning benefits of weblogs in an East Asian context: A rasch Analysis. *Educational Technology & Society, 13* (2), 90–101.

Göktaş, Y. (2016). Using augmented reality technology in storytelling activities: examining elementary students' narrative skill and creativity. *Virtual Reality, 21*(2), 75-89. doi:10.1007/s10055-016-0300-1

Goodyear, P. (2005). Educational design and networked learning: patterns, pattern languages and design practice. *Australasian Journal of Educational Technology, 21*(1), 82–101.

Groves, M. M., & Zemel, P. C. (2000). Instructional technology adoption in higher education: An action research case study. *International Journal of Instructional Media, 27*(1), 57-57.

Gu, P. Y. (2003). Vocabulary learning in a second language: Person, task, context and strategies. *TESL-EJ, 7*(2), 1-25.

Gulbahar, Y., & Guven, I. (2008). A survey on ICT usage and the perceptions of social studies teachers in Turkey. *Educational Technology & Society, 11* (3), 37-51.

Gürkan, S. (2018). The effects of a mobile assisted vocabulary learning application on vocabulary learning. *Turkish Online Journal of Qualitative Inquiry, 9*(3), 288-311. doi:10.17569/tojqi.407512

Han, J. (2012). Emerging technologies: Robot assisted language learning. *Language Learning & Technology, 16*(3), 1-9.

Hansen, T., Jensen, J. M., & Solgaard, H. S. (2004). Predicting online grocery buying intention: A comparison of the theory of reasoned action and the theory of planned behavior. *International Journal of Information Management, 24*(6), 539-550.

Hartshorne, R., & Ajjan, H. (2009). Examining student decisions to adopt Web 2.0 technologies: Theory and empirical tests. *Journal of Computing in Higher Education, 21*(3), 183-198.

Hassan Taj, I., Ali, F., Aslam Sipra, M., & Ahmad, W. (2017). Effect of technology enhanced language learning on vocabulary acquisition of EFL learners. *International Journal of Applied Linguistics and English Literature*, *6*(3), 262. doi:10.7575/aiac.ijalel.v.6n.3p.262

Holden, H., & Rada, R. (2011). Understanding the influence of perceived usability and technology self-efficacy on teachers' technology acceptance. *Journal of Research on Technology in Education*, *43*(4), 343-367.

Holley, D., Hobbs, M., & Menown, C. (2016). The augmented library: motivating stem students. *Networks*, 19, 77-84.

Hsieh, M. C., & Lee, J. S. (2008, March). *AR marker capacity increasing for kindergarten English learning.* Paper presented at International MultiConference of Engineers and Computer Scientists, Hong Kong, China.

Hsieh, M. C., & Lin, H. C. K. (2010). Interaction design based on augmented reality technologies for English vocabulary learning. *Proceedings of the 18th International Conference on Computers in Education* (pp. 558-562). Putrajaya, Malaysia.

Hsieh, M. C., Kuo, F. R., & Lin, H. C. K. (2014). The effect of employing AR interactive approach on students' English preposition learning performance. *Journal of Computers and Applied Science Education*, *1*(1), 45-60.

Hsu, H., Wenting, Z., & Hughes, J. E. (2018). Developing elementary students' digital literacy through augmented reality creation: Insights from a longitudinal analysis of questionnaires, interviews, and projects. *Journal of Educational Computing Research*, *0*(0), 1-36. doi:10.1177/0735633118794515

Hsu, T. (2016). Learning English with Augmented Reality: Do learning styles matter? *Computers & Education*, *106*, 137-149. doi:10.1016/j.compedu.2016.12.007

Hu, P. J. H., Clark, T. H., & Ma, W. W. (2003). Examining technology acceptance by school teachers: A longitudinal study. *Information & Management*, *41*(2), 227-241.

Huang, H., Wu, C., & Chen, N. (2012). The effectiveness of using procedural scaffoldings in a paper-plus-smartphone collaborative learning context. *Computers & Education*, *59*(2), 250-259. doi:10.1016/j.compedu.2012.01.015

Huang, T., Chen, C., & Chou, Y. (2016). Animating eco-education: To see, feel, and discover in an augmented reality-based experiential learning environment. *Computers & Education*, *96*, 72-82. doi:10.1016/j.compedu.2016.02.008

Huckin, T. N., Haynes, M., & Coady, J. (1993). *Second language reading and vocabulary learning*. New York, NY: Ablex Publishing Corporation.

Hung, Y., Chen, C., & Huang, S. (2017). Applying augmented reality to enhance learning: a study of different teaching materials. *Journal of Computer Assisted Learning*, *33*(3), 252-266. doi: 10.1111/jcal.12173

Hwang, G., Wu, P., Chen, C., & Tu, N. (2016). Effects of an augmented reality-based educational game on students' learning achievements and attitudes in real-world observations. *Interactive Learning Environments*, *24*(8), 1895-1906. doi:10.1080/10494820.2015.1057747

Hwang, Y., & Huang, N. P. (2010). A study of EFL college students' language anxiety in multimedia environments. *The International Journal of the Humanities: Annual Review*, *8*(2), 367-378. doi:10.18848/1447-9508/cgp/v08i02/42860

Ibáñez, M. B., Di Serio, Á., Villarán, D., & Kloos, C. D. (2014). Experimenting with electromagnetism using augmented reality: Impact on flow student experience and educational effectiveness. *Computers & Education*, *71*, 1-13.

Ibanez, M., Di-Serio, A., Villaran-Molina, D., & Delgado-Kloos, C. (2016). Support for augmented reality simulation systems: The effects of scaffolding on learning outcomes and behavior patterns. *IEEE Transactions on Learning Technologies*, *9*(1), 46-56. doi:10.1109/tlt.2015.2445761

Ibrahim, A., Huynh, B., Downey, J., Höllerer, T., Chun, D., & O'donovan, J. (2018). ARbis Pictus: A study of vocabulary learning with augmented reality. *IEEE Transactions on Visualization And Computer Graphics*, 24(11), 2867-2874.

Ivanova, M., & Ivanov, G. (2011). Enhancement of learning and teaching in computer graphics through marker augmented reality technology. *International Journal on New Computer Architectures and Their Applications*, *1*(1), 176-184.

Jacobs, G. E., Castek, J., Pizzolato, A., Reder, S., & Pendell, K. (2014). Production and consumption. *Journal of Adolescent & Adult Literacy*, *57*(8), 624-627. doi:10.1002/jaal.293

Jafari, S., & Chalak, A. (2016). The role of WhatsApp in teaching vocabulary to Iranian EFL learners at junior high school. *English Language Teaching*, *9*(8), 85. doi:10.5539/elt.v9n8p85

Jara, C. A., Candelas, F. A., Puente, S. T., & Torres, F. (2011). Hands-on experiences of undergraduate students in Automatics and Robotics using a virtual and remote laboratory. *Computers & Education*, *57*(4), 2451-2461. doi:10.1016/j.compedu.2011.07.003

Jarvis, H. A., & Achilleos, M. (2013). From computer assisted language learning (CALL) to mobile assisted language use. *The Electronic Journal for English as a Second Language*, *16*(4), 1-18.

Jee, M. J. (2011). Web 2.0 technology meets mobile assisted language learning. *IALLT Journal of Language Learning Technologies*, *41*(1), 161-175.

Jerry, T., & Aaron, C. (2010). *The impact of augmented reality software with inquiry based learning on students' learning of kinematics graph*. Paper presented at 2nd International Conference on Education Technology and Computer (ICETC).

Johnson, D. W., & Johnson, R. T. (1999). Making cooperative learning work. *Theory Into Practice, 38*(2), 67-73.

Johnson, L., Adams Becker, S., Estrada, V., & Freeman, A. (2014). *Horizon report 2014 - Higher education edition*. Austin, TX: The New Media Consortium

Johnson, L., Adams, S., & Cummins, M. (2012). *NMC Horizon Report: 2012 K-12 Edition*. Austin, Texas: The New Media Consortium. Available: http://www.nmc.org/publication/nmc-horizon-report-2012-higher-ed-edition/

Johnson, L., Smith, R., Levine, A., & Haywood, K. (2010). The 2010 Horizon report: Australia – New Zealand ed. Austin, TX: T.N.M. Consortium.

Joo-Nagata, J., Martinez Abad, F., García-Bermejo Giner, J., & García-Peñalvo, F. J. (2017). Augmented reality and pedestrian navigation through its implementation in m-learning and e-learning: Evaluation of an educational program in Chile. *Computers & Education, 111*, 1-17. doi:10.1016/j.compedu.2017.04.003

Joseph, S. R., & Uther, M. (2009). Mobile devices for language learning: Multimedia approaches. *Research and Practice in Technology Enhanced Learning*, *4*(01), 7-32.

Juan, C. M., Llop, E., Abad, F., & Lluch, J. (2010). *Learning words using augmented reality*. Paper presented at 2010 10th IEEE International Conference on Advanced Learning Technologies. doi:10.1109/icalt.2010.123

Kaenchan, P. (2018). *Examining Thai students' experiences of augmented reality technology in a university language education classroom* (Doctoral dissertation). Retrieved from https://search.proquest.com/openview/94db5439b5a387654961e08326faf6f5/1?pq-origsite=gscholar&cbl=18750&diss=y

Kamarainen, A. M., Metcalf, S., Grotzer, T., Browne, A., Mazzuca, D., Tutwiler, M. S., & Dede, C. (2013). EcoMOBILE: Integrating augmented reality and

probeware with environmental education field trips. *Computers & Education, 68*, 545-556. http://dx.doi.org/10.1016/j.compedu.2013.02.018

Karakaya, K. (2010). *An investigation of English language teachers' attitudes toward computer technology and their use of technology in language teaching* (Unpublished master's thesis). METU, Ankara, Turkey.

Karal, H., & Abdüsselam, M. S. (2015). Artırılmış gerçeklik [Augmented Reality]. In B. Akkoyunlu, A. İşman, & F. Odabaşı (Eds.), Eğitim Teknolojileri Okumaları 2015 (pp. 149–176). Ankara, Turkey.

Kaufmann, H., & Schmalstieg, D. (2002). Mathematics and geometry education with collaborative augmented reality. ACM SIGGRAPH 2002, New York, USA.

Kaufmann, H., & Dünser, A. (2007). Summary of usability evaluations of an educational augmented reality application. *Virtual Reality*, 660-669. doi:10.1007/978-3-540-73335-5_71

Kay, R. H. (2006). Evaluating strategies used to incorporate technology into pre-service education: A review of the literature. *Journal of Research on Technology in Education*, *38*(4), 383-408.

Kerawalla, L., Luckin, R., Seljeflot, S., & Woolard, A. (2006). "Making it real": exploring the potential of augmented reality for teaching primary school science. *Virtual Reality*, *10*(3-4), 163-174. doi:10.1007/s10055-006-0036-4

Kesim, M., & Özarslan, Y. (2012). Augmented Reality in education: Current Technologies and the potential for education. *Procedia - Social and Behavioral Sciences*, *47*, 297-302. doi:10.1016/j.sbspro.2012.06.654

Kirkgoz, Y. (2007). English language teaching in Turkey: Policy changes and their implementations. *RELC Journal*, *38*(2), 216-228.

Kirkley, S. E., & Kirkley, J. R. (2005). Creating next generation blended learning environments using mixed reality, Video Games and Simulations. *TechTrends*, *49*(3), 42-53. doi:10.1007/bf02763646

Klimova, A., Bilyatdinova, A., & Karsakov, A. (2018). Existing teaching practices in augmented reality. *Procedia Computer Science*, *136*, 5-15.

Klopfer, E., & Squire, K. (2007). Environmental Detectives—the development of an augmented reality platform for environmental simulations. *Educational Technology Research and Development*, *56*(2), 203-228. doi:10.1007/s11423-007-9037-6

Klopfer, E., & Yoon, S. (2005). Developing games and simulations for today and tomorrow's tech savvy youth. *TechTrends*, *49*(3), 33-41. doi:10.1007/bf02763645

Ko, C. H., Chang, T. C., Chen, Y. H., & Hua, L. H. (2011, September). *The application of augmented reality to design education*. Paper presented at International Conference on Technologies for E-Learning and Digital Entertainment (pp. 20-24). Springer, Berlin, Heidelberg.

Koehler, M., & Mishra, P. (2009). What is technological pedagogical content knowledge (TPACK)?. *Contemporary Issues in Technology and Teacher Education*, *9*(1), 60-70.

Kolb, D. A. (2014). *Experiential Learning: Experience as the source of learning and development*. New Jersey: FT Press.

Kraidy, U. (2002). Digital media and education: Cognitive impact of information visualization. *Journal of Educational Media*, *27*(3), 95-106.

Küçük, S. (2014). *Mobil artırılmış gerçeklikle anatomi ogreniminin tip ogrencilerinin akademik başarıları ile bilişsel yüklerine etkisi ve ogrencilerin uygulamaya yönelik görüşleri* [Effects of learning anatomy via mobile augmented reality on medical students' academic achievement, cognitive load, and views toward implementation] (Unpublished Doctoral Dissertation). Ataturk University, Erzurum.

Küçük, S., Yilmaz, R., & Göktaş, Y. (2014). Augmented Reality for learning English: Achievement, attitude and cognitive load levels of students. *TED Eğitim ve Bilim*, *39*(176). doi:10.15390/eb.2014.3595

Kukulska-Hulme, Agnes (2006). Mobile language learning now and in the future. In: Svensson, Patrik ed. Fr˚an vision till praktik: Spr˚akutbildning och Informationsteknik (From vision to practice: language learning and IT), (pp. 295–310) Sweden: Swedish Net University

Lantavou, O., & Fesakis, G. (2018, October). *The effect of an augmented reality board game on English vocabulary development*. Paper presented at ECGBL 2018 12th European Conference on Game-Based Learning. Sophia Antipolis, Greece.

Lee, J., Cerreto, F. A., & Lee, J. (2010). Theory of planned behavior and teachers' decisions regarding use of educational technology. *Journal of Educational Technology & Society*, *13*(1), 152-164.

Lee, K. (2012). Augmented reality in education and training. *TechTrends, 56*(2), 13-21.

Lee, K. W. (2000). English teachers' barriers to the use of computer-assisted language learning. *The Internet TESL Journal, 6*(12), 1-8.

Legault, J., Zhao, J., Chi, Y., Chen, W., Klippel, A., & Li, P. (2019). Immersive virtual reality as an effective tool for second language vocabulary learning. *Languages*, *4*(1), 13, 1-32. doi:10.3390/languages4010013

Legault, L., Green-Demers, I., & Pelletier, L. (2006). Why do high school students lack motivation in the classroom? Toward an understanding of academic motivation and the role of social support. *Journal of Educational Psychology*, *98*(3), 567-582. doi:10.1037/0022-0663.98.3.567

Lei, J. (2009). Digital natives as pre-service teachers: What technology preparation is needed? *Journal of Computing in Teacher Education, 25*(3), 87-97.

Levy, M. (1997). *Computer-assisted language learning: Context and conceptualization*. Oxford University Press.

Levy, M., & Stockwell, G. (2013). *CALL dimensions: Options and issues in computer-assisted language learning*. New York: Routledge.

Li, J. T., & Tong, F. (2019). Multimedia-assisted self-learning materials: the benefits of E-flashcards for vocabulary learning in Chinese as a foreign language. *Reading and Writing*, *32*(5), 1175-1195.

Li, J., Cummins, J., & Deng, Q. (2017). The effectiveness of texting to enhance academic vocabulary learning: English language learners' perspective. *Computer Assisted Language Learning*, *30*(8), 816-843. doi:10.1080/09588221.2017.1366923

Liao, Y.C. (1999). Effects of hypermedia on students' achievement: A meta-analysis. *Journal of Educational Multimedia and Hypermedia*, *8*(3), 255-277

Liaw, S. S. (2008). Investigating students' perceived satisfaction, behavioral intention, and effectiveness of e-learning: A case study of the Blackboard system. *Computers & education*, *51*(2), 864-873.

Lisdahl, K. M., Sher, K. J., Conway, K. P., Gonzalez, R., Ewing, S. W. F., Nixon, S. J., & Heitzeg, M. (2018). Adolescent brain cognitive development (ABCD) study: overview of substance use assessment methods. *Developmental cognitive neuroscience*, *32*, 80-96.

Lin, C. C., Chan, H. J., & Hsiao, H. S. (2011). EFL students' perceptions of learning vocabulary in a computer-supported collaborative environment. *Turkish Online Journal of Educational Technology-TOJET*, *10*(2), 91-99. x

Lin, C., Chai, H., Wang, J., Chen, C., Liu, Y., Chen, C., & Huang, Y. (2016). Augmented reality in educational activities for children with disabilities. *Displays*, *42*, 51-54. doi:10.1016/j.displa.2015.02.004

Lin, T., Duh, H. B., Li, N., Wang, H., & Tsai, C. (2013). An investigation of learners' collaborative knowledge construction performances and behavior patterns in an augmented reality simulation system. *Computers & Education*, *68*, 314-321. doi:10.1016/j.compedu.2013.05.011

Linse, C. T., & Nunan, D. (2005). *Practical English language teaching: Young learners*. New York: McGraw-Hill.

Liou, W., Bhagat, K. K., & Chang, C. (2016). Beyond the flipped classroom: A highly interactive cloud-classroom (HIC) embedded into basic materials science courses. *Journal of Science Education and Technology, 25*(3), 460-473. doi:10.1007/s10956-016-9606-8

Liu, P. H. E., & Tsai, M. K. (2013). Using augmented-reality-based mobile learning material in EFL English composition: An exploratory case study. *British Journal of Educational Technology, 44*(1), E1-E4.

Liu, P. L., & Chen, C. J. (2015). Learning English through actions: A study of mobile-assisted language learning. *Interactive Learning Environments, 23*(2), 158-171.

Liu, T. Y., Tan, T. H., & Chu, Y. L. (2009). Outdoor natural science learning with an RFID-supported immersive ubiquitous learning environment. *Journal of Educational Technology & Society, 12*(4), 161-175.

Liu, T. (2009). A context-aware ubiquitous learning environment for language listening and speaking. *Journal of Computer Assisted Learning, 25*(6), 515-527. doi:10.1111/j.1365-2729.2009.00329.x

Liu, T., & Chu, Y. (2010). Using ubiquitous games in an English listening and speaking course: Impact on learning outcomes and motivation. *Computers & Education, 55*(2), 630-643. doi:10.1016/j.compedu.2010.02.023

Lloyd, A., Rogerson, S., & Stead, G. (2017). Imagining the potential for using virtual reality technologies in language learning. *Digital Language Learning and Teaching*, 222-234. doi:10.4324/9781315523293-19

Long, M. (1996). The role of the linguistic environment in second language acquisition. *Handbook of second language acquisition*.

Luan, W. S., & Teo, T. (2011). Student Teachers' Acceptance of Computer Technology. *Technology Acceptance in Education*, 43-61. doi:10.1007/978-94-6091-487-4_3

Macchiarella, N. D., Liu, D., Gangadharan, S. N., Vincenzi, D. A., & Majoros, A. E. (2005, September). *Augmented reality as training medium for*

aviation/aerospace application. Paper presented at Human Factors and Ergonomics Society Annual Meeting, Los Angeles, USA.

Maftoon, P., Hamidi, H., & Sarem, S. N. (2015). The effects of CALL on vocabulary learning: A case of Iranian intermediate EFL learners. *BRAIN. Broad Research in Artificial Intelligence and Neuroscience*, *3*(4), 19-30.

Mahadzir, N. N. (2013). The use of augmented reality pop-up book to increase motivation in English language learning for national primary school. *IOSR Journal of Research & Method in Education (IOSRJRME), 1*(1), 26-38. doi:10.9790/7388-0112638

Majid, N. A. A., Arshad, H., & Yunus, F. (2018). Children and teacher's interaction for English pre-literacy using mobile augmented reality. *International Journal*, *3*(15), 71-78.

Majid, N. A. A., Yunus, F., Arshad, H., & Johari, M. F. M. (2016). Development framework based on mobile augmented reality for pre-literacy kit. *World Academy of Science, Engineering and Technology, International Journal of Social, Behavioral, Educational, Economic, Business and Industrial Engineering*, *10*(8), 2905-2908.

Makoe, M., & Shandu, T. (2018). Developing a mobile app for learning English vocabulary in an open distance learning context. *The International Review of Research in Open and Distributed Learning*, *19*(4). doi:10.19173/irrodl.v19i4.3746

Martín Gutiérrez, J., & Meneses Fernández, M. D. (2014). Applying augmented reality in engineering education to improve academic performance & student motivation. *International Journal of Engineering Education, 30*(3), 625-635.

Mathieson, K. (1991). Predicting user intentions: Comparing the technology acceptance model with the theory of planned behavior. *Information Systems Research,* 2(3), 173-191. doi:10.1287/isre.2.3.173

Mayer, R. E., & Moreno, R. (2003). Nine ways to reduce cognitive load in multimedia learning. *Educational Psychologist*, *38*(1), 43-52.

McDonough, J., & Shaw, C. (1993). *Materials and methods in ELT: A teacher's guide*. Oxford: Blackwell.

McNair, C. L., & Green, M. (2016). Pre-service teachers' perceptions of augmented reality. *Literacy Summit Yearbook*, 74-81.

Meara, P. (1980). Vocabulary acquisition: A neglected aspect of language learning. *Language Teaching, 13*(3-4), 221-246.

Merchant, Z., Goetz, E. T., Cifuentes, L., Keeney-Kennicutt, W., & Davis, T. J. (2014). Effectiveness of virtual reality-based instruction on students' learning outcomes in K-12 and higher education: A meta-analysis. *Computers & Education, 70,* 29-40. doi:10.1016/j.compedu.2013.07.033

Montoya, M. H., Díaz, C. A., & Moreno, G. A. (2017). Evaluating the effect on user perception and performance of static and dynamic contents deployed in augmented reality based learning application. *Eurasia Journal of Mathematics, Science & Technology Education, 13*(2), 301-317.

Moore, P. (1995). Learning and teaching in virtual worlds: Implications of virtual reality for education. *Australasian Journal of Educational Technology, 11*(2), 91-102. doi:10.14742/ajet.2078

Morrison, A., Oulasvirta, A., Peltonen, P., Lemmela, S., Jacucci, G., Reitmayr, G., & Juustila, A. (2009, April). Like bees around the hive: a comparative study of a mobile augmented reality map. *In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (pp. 1889-1898). ACM.

Morrison, R. (2017). Virtual Reality in the language learning classroom. *The Morning Watch: Educational and Social Analysis, 44*.

Mota, J. M., Ruiz-Rube, I., Dodero, J. M., & Arnedillo-Sánchez, I. (2018). Augmented reality mobile app development for all. *Computers & Electrical Engineering, 65*, 250-260. doi:10.1016/j.compeleceng.2017.08.025

Motallebzadeh, K., Beh-Afarin, R., & Rad, S. D. (2011). The effect of short message service on the retention of collocations among Iranian lower intermediate

EFL learners. *Theory and Practice in Language Studies*, *1*(11). doi:10.4304/tpls.1.11.1514-1520

Muho, A., & Kurani, A. (2014). The role of interaction in second language acquisition. *European Scientific Journal*, *16*, 44-54.

Mumtaz, K., Iqbal, M. M., Khalid, S., Rafiq, T., Owais, S. M., & Al Achhab, M. (2017). An e-assessment framework for blended learning with augmented reality to enhance the student learning. *Eurasia Journal of Mathematics, Science and Technology Education*, *13*(8), 4419-4436. doi:10.12973/eurasia.2017.00938a

Munir, F. (2016). The effectiveness of teaching vocabulary by using cartoon film toward vocabulary mastery of EFL students. *Journal of English Language Teaching and Linguistics*, *1*(1), 13. doi:10.21462/jeltl.v1i1.20

Mutlu, U., Yelken, T. Y., & Atay, C. (2018). Analyzing the views of pre-service teachers on the use of augmented reality applications in education. *European Journal of Educational Research*, *7*(4). doi:10.12973/eu-jer.7.4.849

Nation, I. S. (2001). *Learning Vocabulary in Another Language*. Cambridge, England: Cambridge University Press.

Nergis, A. (2011). Foreign language teacher education in Turkey: A historical overview. *Procedia-Social and Behavioral Sciences*, *15*, 181-185.

Nikoopour, J., & Kazemi, A. (2014). Vocabulary learning through digitized & non-digitized flashcards delivery. *Procedia - Social and Behavioral Sciences*, *98*, 1366-1373. doi:10.1016/j.sbspro.2014.03.554

Nim Park, C., & Son, J. (2009). Implementing computer-assisted language learning in the EFL classroom: teachers' perceptions and perspectives. *International Journal of Pedagogies and Learning*, *5*(2), 80-101. doi:10.5172/ijpl.5.2.80

Nincarean, D., Alia, M. B., Halim, N. D. A., & Rahman, M. H. A. (2013). Mobile augmented reality: The potential for education. *Procedia-Social and Behavioral Sciences*, *103*, 657-664.

Noeparast, N., & Khatami, M. (2014). The effect of using NetSupport School software on Iranian intermediate EFL learners' vocabulary retention and reading comprehension. *International Journal of Educational Investigations*, *1*(1), 305-312.

Nunan, D., & Carter, R. (2001). *The Cambridge Guide to Teaching English to Speakers of Other Languages.* Cambridge, England: Cambridge University Press.

Núñez, M., Quirós, R., Núñez, I., Carda, J. B., Camahort, E., & Mauri, J. L. (2008, July). Collaborative augmented reality for inorganic chemistry education. In *WSEAS International Conference. Proceedings. Mathematics and Computers in Science and Engineering* (Vol. 5, pp. 271-277). WSEAS.

O'Brien, H. L., & Toms, E. G. (2005, November). *Engagement as process in computer-mediated environments.* Poster presented at the Annual Conference of American Society for Information Science and Technology, *Charlotte, NC*.

Oberg, A. (2011). Comparison of the effectiveness of a call-based approach and a card-based approach to vocabulary acquisition and retention. *CALICO Journal, 29*(1), 118-144. doi:10.11139/cj.29.1.118-144

Ogata, H., Misumi, T., Matsuka, T., El-Bishouty, M. M., & Yano, Y. (2008). A Framework for Capturing, Sharing and Comparing Learning Experiences in a Ubiquitous Learning Environment. *Research and Practice in Technology Enhanced Learning,03*(03), 297-312. doi:10.1142/s1793206808000537

Oliveira, T., & Martins, M. F. (2011). Literature review of information technology adoption models at firm level. *Electronic Journal of Information Systems Evaluation*, *14*(1), 110-121.

Onder, R. (2016). *Eğitimde artırılmış gerçeklik uygulamaları: Aurasma ve Color Mix* [Augmented reality in education: Aurasma ve Color Mix]. Paper presented at Academic Informatics Conference, Retrieved at 07.05.2016 from www.ab.org.tr.

Orey, M., Amiel, T., & McClendon, J. (2006, March). The world almanac of educational technologies. Paper presented at Society for Information Technology & Teacher Education International Conference.

Oxford, Rebecca. (1990). *Language learning strategies: What every teacher should know*. Boston. MA: Heinle and Heinle.

Özdemir, Muzaffer. (2017). Artırılmış Gerçeklik Teknolojisi ile Öğrenmeye Yönelik Deneysel Çalışmalar: Sistematik İnceleme [Experimental Studies on Learning with Augmented Reality Technology: A Systematic Review]. *Mersin Üniversitesi Eğitim Fakültesi Dergisi*. 13. 609-632. 10.17860/mersinefd.336746.

Özdemir, M. (2018). Educational augmented reality (AR) applications and development process. *Mobile Technologies and Augmented Reality in Open Education*, 26-53. doi:10.4018/978-1-5225-2110-5.ch002

Palalas, A. (2011). Mobile-assisted language learning: Designing for your students. *Second Language Teaching and Learning with Technology: Views of Emergent Researchers*, 71-94. doi:10.14705/rpnet.2011.000007

Papanastasiou, E. C., & Angeli, C. (2008). Evaluating the use of ICT in education: Psychometric properties of the survey of factors affecting teachers teaching with technology (SFA-T3). *Journal of Educational Technology & Society*, *11*(1).

Park, S. Y. (2009). An analysis of the technology acceptance model in understanding university students' behavioral intention to use e-learning. *Educational Technology & Society*, *12*(3), 150-162.

Park, S. Y., Nam, M. W., & Cha, S. B. (2012). University students' behavioral intention to use mobile learning: Evaluating the technology acceptance model. *British Journal of Educational Technology*, *43*(4), 592-605.

Parkman, S., Litz, D., & Gromik, N. (2017). Examining pre-service teachers' acceptance of technology-rich learning environments: A UAE case study.

Education and Information Technologies, *23*(3), 1253-1275. doi:10.1007/s10639-017-9665-3

Pasaréti, O., Hajdin, H., Matusaka, T., Jámbori, A., Molnár, I., & Tucsányi-Szabó, M. (2011). Augmented Reality in education. Paper presented at *INFODIDACT 2011 Informatika Szakmódszertani Konferencia.*

Peña-Rios, A., Hagras, H., Gardner, M., & Owusu, G. (2017, July). A fuzzy logic based system for geolocated augmented reality field service support. Paper presented at *2017* IEEE International Conference on Fuzzy Systems (FUZZ-IEEE) IEEE, Naples, Italy. doi:10.1109/fuzz-ieee.2017.8015477

Pérez-López, D., & Contero, M. (2013). Delivering educational multimedia contents through an augmented reality application: A case study on its impact on knowledge acquisition and retention. *Turkish Online Journal of Educational Technology-TOJET*, *12*(4), 19-28.

Pilgrim, J., & Martinez, E. (2015). Literacy terminology and technology integration for 21st century teaching: A survey of educators. *Journal of Reading Education*, *40*(3), 9-16.

Polat, M. (2016). *Emerging technologies in language pedagogy: Language learners' perceptions through the lenses of innovation diffusion and user intention theories.* (Doctoral Dissertation). Retrieved from https://repository.arizona.edu/bitstream/handle/10150/612413/azu_etd_14691_sip1_m.pdf?sequence=1

Polly, D., Mims, C., Shepherd, C., & Inan, F. (2010). Evidence of impact: Transforming teacher education with preparing tomorrow's teachers to teach with technology (PT3) grants. *Teaching and Teacher Education*, *26*, 863–870.

Prensky, M. (2001). Digital natives, digital immigrants part 1. *On the horizon*, *9*(5), 1-6.

Qian, M., & Clark, K. R. (2016). Game-based Learning and 21st century skills: A review of recent research. *Computers in Human Behavior*, *63*, 50-58. doi:10.1016/j.chb.2016.05.023

Radu, I. (2014). Augmented reality in education: a meta-review and cross-media analysis. *Personal and Ubiquitous Computing*, *18*(6), 1533-1543. doi:10.1007/s00779-013-0747-y

Rana, P. S. (2013). Education and the use of technology. *Republica The Week, 12*.

Redondo, E., Fonseca, D., Sánchez, A., & Navarro, I. (2017). Educating urban designers using augmented reality and mobile learning technologies. *Revista Iberoamericana de Educación a Distancia*, *20*(2), 142.

Regenbrecht, H., Baratoff, G., & Wilke, W. (2005). Augmented reality projects in the automotive and aerospace industries. *IEEE Computer Graphics and Applications, 25*(6), 48-56. doi:10.1109/mcg.2005.124

Richards, J. C., & Jones, R. H. (2013). Creativity and Language Teaching. *Iranian Journal of Language Teaching Research, 1*(3), 19-43

Ro, Y. K., Brem, A., & Rauschnabel, P. A. (2018). Augmented reality smart glasses: Definition, concepts and impact on firm value creation. In *Augmented Reality and Virtual Reality* (pp. 169-181). Springer, Cham.

Roberge, L., Long, S. B., & Burnham, D. B. (2002). Data warehouses and data mining tools for the legal profession: using information technology to raise the standard of practice. *Syracuse Law Review*, *52*, 1281.

Rogers, E. M. (2003). Diffusion of innovations (5th ed.). New York, NY: The Free Press.

Robert, A. (2002). Learner attitudes towards the use of CALL. *Computer Assisted Language Learning*, *15*(3), 241-249.

Rogers, E. M. (1995). Diffusion of innovations: Modifications of a model for telecommunications. In *Die diffusion von innovationen in der*

telekommunikation (pp. 25-38). Springer, Berlin, Heidelberg.doi:10.1007/978-3-642-79868-9_2

Rose, R. F., & Bhuvaneswari, G. (2016, March). *Word recognition incorporating augmented reality for linguistic E-conversion.* Paper presented at 2016 International Conference on Electrical, Electronics, and Optimization Techniques (ICEEOT). doi:10.1109/iceeot.2016.7755061

Rosell-Aguilar, F. (2018). Autonomous language learning through a mobile application: A user evaluation of the Busuu app. *Computer Assisted Language Learning*, *31*(8), 854-881. doi:10.1080/09588221.2018.1456465

Rosli, H. W., Baharom, F., Harun, H., Daud, A. Y., Mohd, H., & Darus, N. M. (2010). *Using augmented reality for supporting learning human anatomy in science subject for Malaysian primary school.* Paper presented at Regional Conference on Knowledge Integration in ICT.

Saeidi, M., & Mozaheb, M. A. (2012). Comparing vocabulary learning of EFL learners by using two different strategies (mobile learning vs. flashcards). *International Journal of Mobile Learning and Organisation*, *6*(3/4), 303. doi:10.1504/ijmlo.2012.050050

Safar, A. H. (2016). The effectiveness of using augmented reality apps in teaching the English alphabet to kindergarten children: A case study in the state of Kuwait. *EURASIA Journal of Mathematics, Science and Technology Education*, *13*(1). doi:10.12973/eurasia.2017.00624a

Salleh, S. & Albion, P. (2004). Using the theory of planned behaviour to predict Bruneian teachers' intentions to use ICT in teaching. In C. Crawford et al. (Eds.), *Proceedings of Society for Information Technology and Teacher Education International Conference 2004* (pp. 1389-1396). Chesapeake, VA.

Sanna, A., & Manuri, F. (2016). A survey on applications of augmented reality. *Advances in Computer Science: An International Journal*, *5*(1), 18-27.

Santos, M. E., Lübke, A. I., Taketomi, T., Yamamoto, G., Rodrigo, M. M., Sandor, C., & Kato, H. (2016). Augmented reality as multimedia: The case for situated vocabulary learning. *Research and Practice in Technology Enhanced Learning*, *11*(1). doi:10.1186/s41039-016-0028-2

Schmitt, N. (2000). *Vocabulary in Language Teaching*. Cambridge, England: Cambridge University Press.

Schofield, J. W. (1995). *Computers and Classroom Culture*. Cambridge, England: Cambridge University Press.

Schrier, K. (2006, July). *Using augmented reality games to teach 21st century skills.* Paper presented at ACM SIGGRAPH 2006 Educators program.

Schrier, K. (2006, January). Using augmented reality games to teach 21st century skills. Paper presented at ACM SIGGRAPH 2006 Educators program on - SIGGRAPH '06. doi:10.1145/1179295.1179311

Seferoğlu, G. (2004). A study of alternative English teacher certification practices in Turkey. *Journal of Education for Teaching*, *30* (2). 151-159.

Serin, O. (2012). Mobile learning perceptions of the prospective teachers (TPNR Sampling). *Turkish Online Journal of Educational Technology*, *11*(3), 222-233. x

Shea, A. M. (2014). *Student perceptions of a mobile augmented reality game and willingness to communicate in Japanese* (Doctoral dissertation). Available from ProQuest Dissertations and Theses database. (UMI No. 3619866).

Shelton, B. E., & Hedley, N. R. (2004). Exploring a cognitive basis for learning spatial relationships with augmented reality. *Technology, Instruction, Cognition and Learning*, *1*(4), 323-357.

Shen, J., & Eder, L. B. (2009). Intentions to use virtual worlds for education. *Journal of Information Systems Education*, *20*(2), 225-233.

Shi, X. (2017). Application of Multimedia Technology in Vocabulary Learning for Engineering Students. *International Journal of Emerging Technologies in Learning (iJET), 12*(01), 21-31. doi:10.3991/ijet.v12i01.6153

Shuhaiber, J. H. (2004). Augmented reality in surgery. *Archives of surgery, 139*(2), 170-174.

Sila Ahmad, K., Sudweeks, F., & Armarego, J. (2015). Learning English vocabulary in a mobile assisted language learning (MALL) environment: A sociocultural study of migrant women. *Proceedings of the 2015 InSITE Conference*. doi:10.28945/2166

Şimşek, I., & Can, T. (2016, March). *The design and use of educational games in 3D virtual worlds.* Paper presented at Society for Information Technology & Teacher Education International Conference.

Smith, H., Luckin, R., Fraser, D. S., Williams, L., Dünser, A., Hornecker, E., Woolard, A. & Lancaster, B. (2007). *Sun seeking: Interactive story-reading through different media*. Paper presented 2007 Conference on Artificial Intelligence in Education: Building Technology Rich Learning Contexts That Work.

Solak, E., & Cakir, R. (2015). Exploring the effect of materials designed with augmented reality on language learners' vocabulary learning. *The Journal of Educators Online*, *12*(2), 50-72. doi: 10.9743/jeo.2015.2.

Solak, E., & Cakır, R. (2017). Investigating the role of augmented reality technology in the language classroom. *Croatian Journal of Education, 18*(4), 1067-1085. doi:10.15516/cje.v18i4.1729

Sommerauer, P., & Müller, O. (2014). Augmented reality in informal learning environments: A field experiment in a mathematics exhibition. *Computers & Education, 79*, 59-68. doi:10.1016/j.compedu.2014.07.013

Somyürek, S. (2014). Gaining the attention of generation Z in the learning process: Augmented reality. *Educational Technology Theory and Practice, 4*(1), 63-80.

Sotiriou, S., & Bogner, F. X. (2008). Visualizing the invisible: Augmented reality as an innovative science education scheme. *Advanced Science Letters*, *1*(1), 114-122.

Squire, K. D., & Jan, M. (2007). Mad city mystery: developing scientific argumentation skills with a place-based augmented reality game on handheld computers. *Journal of Science Education and Technology*, *16*(1), 5-29. doi:10.1007/s10956-006-9037-z

Squire, K., & Klopfer, E. (2008). Augmented reality simulations on handheld computers. *Journal of the Learning Sciences*, *16*(3), 371-413. doi:10.1080/10508400701413435

Stapleton, C., Smith, E., & Hughes, C. E. (2005, October). *The art of nurturing citizen scientists through mixed reality*. Paper presented at the Fourth IEEE and ACM International Symposium on Mixed and Augmented Reality.

Sugar, W., Crawley, F., & Fine, B. (2004). Examining teachers' decisions to adopt new technology. *Journal of Educational Technology & Society*, *7*(4), 201-213.

Sumadio, D. D., & Rambli, D. R. (2010, March). *Preliminary evaluation on user acceptance of the augmented reality use for education.* Paper presented at 2010 Second International Conference on Computer Engineering and Applications. doi:10.1109/iccea.2010.239

Swales, J. (1980). ESP: The textbook problem. The ESP Journal, 1(1), 11-23.

Sykes, J. M. (2018). Digital games and language teaching and learning. *Foreign Language Annals*, *51*(1), 219-224. doi:10.1111/flan.12325

T. Azuma, Ronald. (1996). A survey of augmented reality. *Presence: Teleoperators and Virtual Environments*. 6. 10.1162/pres.1997.6.4.355.

Tabatabaei, O., & Goojani, A. H. (2012). The impact of text-messaging on vocabulary learning of Iranian EFL learners. *Cross-Cultural Communication*, *8*(2), 47-55.

Tang, A., Owen, C., Biocca, F., & Mou, W. (2003). Comparative effectiveness of augmented reality in object assembly. *Proceedings of the conference on Human factors in computing systems - CHI '03*. doi:10.1145/642625.642626

Tarng, W., & Ou, K. (2012). A study of campus butterfly ecology learning system based on augmented reality and mobile learning. *2012 IEEE Seventh International Conference on Wireless, Mobile and Ubiquitous Technology in Education*. doi:10.1109/wmute.2012.17

Taşkıran, A. (2018, July). *Augmented reality games and motivation in language learning*. Paper presented at EdMedia: World Conference on Educational Media and Technology, Amsterdam, Holland.

Taşkıran, A., Koral, E., & Bozkurt, A. (2015, January). Artırılmış Gerçeklik Uygulamasının Yabancı Dil Öğretiminde Kullanılması [Use of AR application in Foreign Language Teaching]. Paper presented at Akademik Bilişim Konferansı , Eskisehir, Turkey.

Taylor, S., & Todd, P. A. (1995). Understanding information technology usage: A test of competing models. *Information Systems Research, 6*(2), 144-176. doi:10.1287/isre.6.2.144

Teo, T. (2009). Examining the relationship between student teachers' self-efficacy beliefs and their intended use of technology for teaching: A structural equation modeling approach. *The Turkish Online Journal of Educational Technology, 8*(4), 7-15

Teo, T. (2009). Modelling technology acceptance in education: A study of pre-service teachers. *Computers & Education, 52*(2), 302-312.

Teo, T. (2011). Factors influencing teachers' intention to use technology: Model development and test. *Computers & Education, 57*(4), 2432-2440.

Teo, T. (2014). Unpacking teachers' acceptance of technology: Tests of measurement invariance and latent mean differences. *Computers & Education, 75*, 127-135. doi:10.1016/j.compedu.2014.01.014

Teo, T. (2015). Comparing pre-service and in-service teachers' acceptance of technology: Assessment of measurement invariance and latent mean differences. *Computers & Education*, *83*, 22-31. doi:10.1016/j.compedu.2014.11.015

Teo, T., Luan, W. S., & Sing, C. C. (2008). A cross-cultural examination of the intention to use technology between Singaporean and Malaysian pre-service teachers: An application of the Technology Acceptance Model (TAM). *Journal of Educational Technology & Society*, *11*(4), 265-280.

Thomas, B., Piekarski, W., & Gunther, B. (1999). Using augmented reality to visualise architecture designs in an outdoor environment. *International Journal of Design Computing Special Issue on Design Computing on the Net (DCNet)*, *1*.

Thornton, P., & Houser, C. (2005). Using mobile phones in English education in Japan. *Journal of Computer Assisted Learning*, *21*(3), 217-228. doi:10.1111/j.1365-2729.2005.00129.x

Tobar-Muñoz, H., Baldiris, S., & Fabregat, R. (2017). Augmented reality game-based learning: enriching students' experience during reading comprehension activities. *Journal of Educational Computing Research*, *55*(7), 901-936. doi:10.1177/0735633116689789

Tomlinson, B. (2003). Developing materials for language teaching. London: Continuum.

Tomlinson, B. (2009). Principles and procedures of materials development for language learning. *Metodologias e Materiais para o ensino do Português como Língua Não Materna*, 45-54.

Tomlinson, B., & Avila, J. (2007). Seeing and saying for yourself: the roles of audio-visual mental aids in language learning and use. *Language Acquisition and Development: Studies of Learners of First and Other Languages*, 61-81.

Tomlinson, B. (1998). *Materials development in language teaching*. Cambridge: Cambridge University Press.

Tondeur, J., Pareja Roblin, N., van Braak, J., Voogt, J., & Prestridge, S. (2017). Preparing beginning teachers for technology integration in education: ready for take-off?. *Technology, Pedagogy and Education*, *26*(2), 157-177.

Tondeur, J., Roblin, N. P., van Braak, J., Fisser, P., & Voogt, J. (2013). Technological pedagogical content knowledge in teacher education: In search of a new curriculum. *Educational studies*, 39(2), 239-243.

Uzunboylu, H., & Ozdamli, F. (2011). Teacher perception for m-learning: scale development and teachers' perceptions. *Journal of Computer Assisted Learning*, *27*(6), 544-556. doi:10.1111/j.1365-2729.2011.00415.x

Vafa, S., Sappington, K., & Coombs-Richardson, R. (2018). Using augmented reality to increase interaction in online courses. *International Journal of Educational Technology and Learning*, *3*(2), 65-68.

Valimont, R., Vincenzi, D., Gangadharan, S., & Majoros, A. (n.d.). The effectiveness of augmented reality as a facilitator of information acquisition. *Proceedings. The 21st Digital Avionics Systems Conference*. doi:10.1109/dasc.2002.1052926

Van Manen, M. (1995). On the epistemology of reflective practice. *teachers and teaching: Theory and Practice*. *1*(1), 33-50. doi:10.1080/1354060950010104

Vate-U-Lan, P. (2012). An augmented reality 3d pop-up book: the development of a multimedia project for English language teaching. *2012 IEEE International Conference on Multimedia and Expo*. doi:10.1109/icme.2012.79

Vedadi, S., Abdullah, Z. B., Kolivand, H., Cheok, A. D., & Aris, B. B. (2018). Impact of gender on vocabulary acquisition using augmented reality among iranian seventh grades students. *Advanced Science Letters*, *24*(6), 4030-4033. doi:10.1166/asl.2018.11535

Venkatesh, Morris, Davis, & Davis. (2003). user acceptance of information technology: Toward a unified view. *MIS Quarterly*, *27*(3), 425. doi:10.2307/30036540

Venkatesh, V., & Davis, F. D. (1996). A model of the antecedents of perceived ease of use: Development and test. *Decision Sciences*, *27*(3), 451-481.

Venkatesh, V., & Davis, F. D. (2000). A theoretical extension of the technology acceptance model: Four longitudinal field studies. *Management Science*, *46*(2), 186-204.

Veřmiřovský, J. The importance of visualisation in education. *E-learning & Lifelong Learning*, 453-463.

Viberg, O., & Grönlund, Å. (2012). *Mobile assisted language learning: A literature review*. Paper presented at *11th World Conference on Mobile and Contextual Learning*.

Vincenzi, D. A., Valimont, B., Macchiarella, N., Opalenik, C., Gangadharan, S. N., & Majoros, A. E. (2003). The effectiveness of cognitive elaboration using augmented reality as training and learning paradigm. *PsycEXTRA Dataset*. doi:10.1037/e576882012-008

Vlahakis, V., Karigiannis, J., Tsotros, M., Gounaris, M., Almeida, L., Stricker, D., & Ioannidis, N. (2001). Archeoguide: First results of an augmented reality, mobile computing system in cultural heritage sites. *Virtual Reality, Archeology, and Cultural Heritage*, *9*.

Vygotsky, L. S. (1980). *Mind in society: The development of higher psychological processes*. Harvard university press.

Wang, L., Ertmer, P. A., & Newby, T. J. (2004). Increasing pre-service teachers' self-efficacy beliefs for technology integration. *Journal of Research on Technology in Education*, *36*(3), 231-250.

Wang, X., Kim, M., Love, P., & Kang, S. (2013). Augmented Reality in built environment: Classification and implications for future research. *Automation in Construction*, *32*, 1-13. doi: 10.1016/j.autcon.2012.11.021

Wang, Y. H., & Shih, S. K. (2015). Mobile-assisted language learning: effects on EFL vocabulary learning. *International Journal of Mobile Communications*, *13*(4), 358. doi:10.1504/ijmc.2015.070060

Wang, M., Callaghan, V., Bernhardt, J., White, K., & Peña-Rios, A. (2017). Augmented reality in education and training: Pedagogical approaches and illustrative case studies. *Journal of Ambient Intelligence and Humanized Computing*, *9*(5), 1391-1402. doi:10.1007/s12652-017-0547-8

Wang, Y. (2017). Exploring the effectiveness of integrating augmented reality-based materials to support writing activities. *Computers & Education*, *113*, 162-176. doi:10.1016/j.compedu.2017.04.013

Wang, Y., Chen, C., Hong, C., & Tsai, Y. (2013). Interactive augmented reality game for enhancing library instruction in elementary schools. Paper presented at *2013 IEEE 37th Annual Computer Software and Applications Conference Workshops*. doi:10.1109/compsacw.2013.128

Warschauer, M. (1996). *Computer-assisted language learning: An introduction*. In S. Fotos (Ed.), Multimedia language teaching. Tokyo: Logos International.

Warschauer, M., & Healey, D. (1998). Computers and language learning: An overview. *Language Teaching*, *31*(02), 57-71.

Warschauer, M., & Meskill, C. (2000). Technology and second language teaching. *Handbook of undergraduate second language education*, *15*, 303-318.

Warschauer, M.: (1997) Computer-mediated collaborative learning: *Theory and practice, Modern Language Journal*, *81*(4), 470–481.

Watson, G. (2006). Technology professional development: Long-term effects on teacher self-efficacy. *Journal of Technology and Teacher Education*, *14*(1), 151-166.

Webel, S., Bockholt, U., Engelke, T., Gavish, N., Olbrich, M., & Preusche, C. (2013). An augmented reality training platform for assembly and maintenance skills. *Robotics and Autonomous Systems*, *61*(4), 398-403.

Wei, L. S., & Habibah E. (2011). Relationship between students' perception of classroom environment and their motivation in learning English language. *GEMA Online Journal of Language Studies*, *1*(21), 240-250.

Weiner, B. (1985). An attributional theory of achievement motivation and emotion. *Psychological Review*, *92*(4), 548-573. doi:10.1037/0033-295x.92.4.548

West-Knights, I. (2017). Why are schools in China looking west for lessons in creativity? Financial Times.

White, C., & Reinders, H. (2010). The theory and practice of technology in materials development and task design. Cambridge University Press.

Wojciechowski, R., & Cellary, W. (2013). Evaluation of learners' attitude toward learning in ARIES augmented reality environments. *Computers & Education*, *68*, 570-585. doi:10.1016/j.compedu.2013.02.014

Wu, H.-K., Lee, S. W.-Y., Chang, H.-Y. & Liang, J.-C. (2013). Current status, opportunities and challenges of augmented reality in education. *Computers & Education*, *62*, 41–49.

Wu, W., Chang, H. P., & Guo, C. J. (2008). An empirical assessment of science teachers' intentions toward technology integration. *Journal of Computers in Mathematics and Science Teaching*, *27*(4), 499-520.

Wu, Q. (2014). Learning ESL Vocabulary with Smartphones. *Procedia - Social and Behavioral Sciences*, *143*, 302-307. doi:10.1016/j.sbspro.2014.07.409

Wu, Q. (2015). Designing a smartphone app to teach English (L2) vocabulary. *Computers & Education*, *85*, 170-179. doi:10.1016/j.compedu.2015.02.013

Yang, F. O. (2012). *Using personalized VLS on mobile English vocabulary learning*. Paper presented at 2012 IEEE Seventh International Conference on Wireless, Mobile and Ubiquitous Technology in Education. doi:10.1109/wmute.2012.57

Yang, J. (2013). Mobile assisted language learning: review of recent applications of emerging mobile technologies. *English Language Teaching*, *6*(7). doi:10.5539/elt.v6n7p19

Yang, M., Liao, W., & Shih, Y. (2013). VECAR: Virtual English classroom with markerless augmented reality and intuitive gesture interaction. Paper presented at *2013 IEEE 13th International Conference on Advanced Learning Technologies*. doi:10.1109/icalt.2013.134

Ying Li. (2010). Augmented Reality for remote education. Paper presented at *2010 3rd International Conference on Advanced Computer Theory and Engineering (ICACTE)*. doi:10.1109/icacte.2010.5579661

Yoon, S. A., Elinich, K., Wang, J., Steinmeier, C., & Tucker, S. (2012). Using augmented reality and knowledge-building scaffolds to improve learning in a science museum. *International Journal of Computer-Supported Collaborative Learning*, *7*(4), 519-541. doi:10.1007/s11412-012-9156-x

York, T. T., Gibson, C., & Rankin, S. (2015). Defining and measuring academic success. *Practical Assessment, Research & Evaluation*, *20 (5).*

Yuen, A. H., & Ma, W. W. (2008). Exploring teacher acceptance of e-learning technology. *Asia-Pacific Journal of Teacher Education*, *36*(3), 229-243.

Yuen, S. C., Yaoyuneyong, G., & Johnson, E. (2011). Augmented Reality: An overview and five directions for AR in education. *Journal of Educational Technology Development and Exchange*, *4*(1), 119-140. doi:10.18785/jetde.0401.10

Zhang, J., Sung, Y., Hou, H., & Chang, K. (2014). The development and evaluation of an augmented reality-based armillary sphere for astronomical observation instruction. *Computers & Education*, *73,* 178-188. doi:10.1016/j.compedu.2014.01.003

Zhonggen, Y. (2018). Differences in serious game-aided and traditional English vocabulary acquisition. *Computers & Education*, *127,* 214-232. doi:10.1016/j.compedu.2018.07.014

Zhou, Z., Cheok, A. D., Pan, J., & Li, Y. (2004). *Magic Story Cube*. Paper presented at 2004 ACM SIGCHI International Conference on Advances in Computer Entertainment Technology - ACE '04. doi:10.1145/1067343.1067404

Zhou, Z., Cheok, A., & Pan, J. (2004). 3D story cube: an interactive tangible user interface for storytelling with 3D graphics and audio. *Personal and Ubiquitous Computing*, *8*(5). doi:10.1007/s00779-004-0300-0

Zhu, Y., Fung, A. S., & Wang, H. (2012). Memorization effects of pronunciation and stroke order animation in digital flashcards. *CALICO Journal, 29*(3), 563-577. doi:10.11139/cj.29.3.563-577

Zint, M. (2002). Comparing three attitude-behavior theories for predicting science teachers' intentions. *Journal of Research in Science Teaching, 39*(9), 819-844. doi:10.1002/tea.10047

APPENDICES

A. Adapted DTPB Scale

Gender : Female ( ) Male ( )

Age: 18-19 ( ) 20-21 ( ) 22-23 ( ) 24-30 ( )

You have attended Augmented Reality Use and Development in Language Learning and Teaching training and this scale will investigate your intention of use in your future teaching career.

Read the statements below and tick (✓) the option that suits you the best. There are no right or wrong answers.

AU: Actual Use Int: Intention Att: Attitude EU: Ease of use PU: Perceived Usefulness
SN: Subjective Norm PBC: Perceived Behavioral Control PI: Peer Influence SU: Student Influence
SUI: Superior Influence COMP: Compatibility FC: Facilitating Conditions
SE: Self-Efficacy

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
1. AU1 I believe that I could communicate to others the consequences of using AR in my future classroom.					
2. AU2 I would have no difficulty explaining why AR 3. technologies may or may not be beneficial.					
4. INT1 I plan to use AR technologies in my future classroom.					
5. INT2 I intend to use AR technologies as soon as I start teaching.					
6. ATT1 AR will be useful in my teaching.					
7. ATT2 The advantages of using AR outweigh the disadvantages of not using it.					
8. ATT3 Using AR is a good idea.					
9. EU1 I feel that AR will be easy to use.					
10. EU2 I feel that using AR will be easy to incorporate in my future classroom.					
11. PU1 I feel that using AR will help my students learn more about the subject.					
12. PU2 I feel that using AR will improve my students' satisfaction with the course.					
13. PU3 I feel that using AR will improve my students' grades.					
14. PU4 I feel that using AR will improve students' evaluation.					
15. PU5 To help my students better learn the material, I will incorporate AR technologies in my future classroom.					
16. SN1 My peers will be using AR technologies in their 17. classrooms.					

18. SN2 My Instructor/TA(teaching assistant) confirms my ability and knowledge to use AR technologies in my future classroom.					
19. SN3 My peers think I will benefit from using AR technologies in my future classroom.					
20.	**Strongly Agree**	**Agree**	**Neutral**	**Disagree**	**Strongly Disagree**
21. SN4 My superiors will think it is important to use AR technologies in my classroom.					
22. SN5 My students will think it is important to use AR 23. technologies in my classroom.					
24. PBC1 Using the AR technologies is entirely within my control.					
25. PBC2 I have the knowledge and ability to use AR.					
26. PI1 Peers who influence my behavior would think that I should use AR technologies in the classroom.					
27. PI2 Peers who are important to me would think that I should use AR technologies in the classroom.					
28. SUI1 My superior, who influences my behavior would think that I should use AR technologies in the classroom					
29. SUI2 My superior, whom I will report to would think that I should use AR technologies in the classroom					
30. SI1 Students who influence my behavior would think that I should use AR technologies in the classroom					
31. SI2 Students who are important to me think that I should use AR technologies in the classroom					
32. COMP1 Using ARtechnologies are compatible with the way I will teach					
33. COMP2 Using AR technologies fit well with the way I will I teach					
34. FC1 The AR technologies will be compatible with the computer I use in the classroom					
35. FC2 I will be able to use AR technologies using any computer connected to the internet.					
36. SE1 I would feel comfortable using AR technologies					
37. SE2 I could easily use AR technologies on my own					

38. SE3 I know enough to use AR technologies					

B. Ethics Committee Approval Letter

MEDİPOL UNV İSTANBUL MEDİPOL ÜNİVERSİTESİ

T.C.
İSTANBUL MEDİPOL ÜNİVERSİTESİ
Sosyal Bilimler Bilimsel Araştırmalar Etik Kurulu Başkanlığı

E-İmzalıdır

Sayı : 43037191-604.01.01-E.4488 06/02/2019
Konu : Etik Kurulu Kararı

Sayın Cemil Gökhan KARACAN

Üniversitemiz Sosyal Bilimler Bilimsel Araştırmalar Etik Kuruluna yapmış olduğunuz "Hizmet Öncesi İngilizce Öğretmenlerinin Arttırılmış Gerçeklik Teknolojisi Kullanımına ve Geliştirmelerine Dair Gelecekteki Kullanım Yönelimleri ve Tutumları" isimli başvurunuz incelenmiş olup, etik kurulu kararı ekte sunulmuştur.

Bilgilerinize rica ederim.

Prof. Dr. Ali BÜYÜKASLAN
Sosyal Bilimler Bilimsel Araştırmalar
Etik Kurulu Başkanı

EK:
-Karar Formu (2 sayfa)

Bu belge 5070 sayılı e-Imza Kanununa gore Prof. Dr. Ali BUYUKASLAN tarafından 06.02.2019 tarihinde e-imzalanmıştır.
Evrağınızı https://ebys.medipol.edu.tr/e-imza linkinden 6A60FFB3X1 kodu ile dogrulayabilirsiniz.

İstanbul Medipol Üniversitesi
Kavacık Mah. Ekinciler Cad.No:19 Kavacık Kavşağı 34810
Beykoz/İSTANBUL

Tel: 444 85 44
İnternet: www.medipol.edu.tr
Ayrıntılı Bilgi İçin : bilgi@medipol.edu.tr

İSTANBUL MEDİPOL ÜNİVERSİTESİ
SOSYAL BİLİMLER BİLİMSEL ARAŞTIRMALAR ETİK KURULU
ETİK KURULU KARAR FORMU

BAŞVURU BİLGİLERİ					
	ARAŞTIRMANIN AÇIK ADI	Hizmet Öncesi İngilizce Öğretmenlerinin Arttırılmış Gerçeklik Teknolojisi Kullanımına ve Geliştirmelerine Dair Gelecekteki Kullanım Yönelimleri ve Tutumları			
	KOORDİNATÖR/SORUMLU ARAŞTIRMACI UNVANI/ADI/SOYADI	Cemil Gökhan Karacan			
	KOORDİNATÖR/SORUMLU ARAŞTIRMACININ UZMANLIK ALANI	Araş. Gör.			
	KOORDİNATÖR/SORUMLU ARAŞTIRMACININ BULUNDUĞU MERKEZ	İstanbul			
	DESTEKLEYİCİ	-			
	ARAŞTIRMAYA KATILAN MERKEZLER	TEK MERKEZ ☒	ÇOK MERKEZLİ ☐	ULUSAL ☒	ULUSLARARASI ☐

İSTANBUL MEDİPOL ÜNİVERSİTESİ
SOSYAL BİLİMLER BİLİMSEL ARAŞTIRMALAR ETİK KURULU
ETİK KURULU KARAR FORMU

	Belge Adı	Tarihi	Versiyon Numarası	Dili
Değerlendirilen Belgeler	ARAŞTIRMA PROTOKOLÜ/PLANI			Türkçe ☒ İngilizce ☐ Diğer ☐
	BİLGİLENDİRİLMİŞ GÖNÜLLÜ OLUR FORMU			Türkçe ☒ İngilizce ☐ Diğer ☐
Karar Bilgileri	**Karar No: 03**	**Tarih: 04/02/2019**		
	Yukarıda bilgileri verilen Sosyal Bilimler Bilimsel Araştırmalar Etik Kurulu başvuru dosyası ile ilgili belgeler araştırmanın gerekçe, amaç, yaklaşım ve yöntemleri dikkate alınarak incelenmiş ve araştırmanın etik ve bilimsel yönden uygun olduğuna **"oybirliği"** ile karar verilmiştir.			

İSTANBUL MEDİPOL ÜNİVERSİTESİ SOSYAL BİLİMLER BİLİMSEL ARAŞTIRMALAR ETİK KURULU	
BAŞKANIN UNVANI / ADI / SOYADI	Prof. Dr. Ali BÜYÜKASLAN

Unvanı/Adı/Soyadı	Uzmanlık Alanı	Kurumu	Cinsiyet		Araştırma ile ilişki		Katılım *		İmza
Prof. Dr. Ali BÜYÜKASLAN	İletişim Fakültesi	İstanbul Medipol Üniversitesi	E ☒	K ☐	E ☐	H ☒	E ☒	H ☐	
Prof. Dr. Ahmet Hamdi TOPAL	Hukuk Fakültesi	İstanbul Medipol Üniversitesi	E ☒	K ☐	E ☐	H ☒	E ☒	H ☐	
Doç. Dr. Nurullah GÜR	İşletme ve Yönetim Bilimleri Fakültesi	İstanbul Medipol Üniversitesi	E ☒	K ☐	E ☐	H ☒	E ☒	H ☐	
Doç. Dr. Mevlüt TATLIYER	İşletme ve Yönetim Bilimleri Fakültesi	İstanbul Medipol Üniversitesi	E ☒	K ☐	E ☐	H ☒	E ☒	H ☐	
Dr. Öğr. Üyesi Erol YILDIRIM	İnsan ve Toplum Bilimleri Fakültesi	İstanbul Medipol Üniversitesi	E ☒	K ☐	E ☐	H ☒	E ☒	H ☐	

* :Toplantıda Bulunma

C. Consent Form

Gönüllü Katılım Formu

Değerli Katılımcı;

Bu çalışma, Dr.Öğr.Üye Mustafa Polat danışmanlığında, Bahçeşehir Üniversitesi İngiliz Dili Eğitimi Anabilim Dalı Yüksek Lisans Programı öğrencisi Arş.Gör.Cemil Gökhan Karacan tarafından yüksek lisans tezi kapsamında yürütülmektedir. Çalışmanın amacı, Hizmet Öncesi İngilizce Öğretmenlerinin Arttırılmış Gerçeklik Teknolojisi Kullanımına ve Geliştirilmesine Yönelik Gelecekteki Kullanım Yönelimleri ve Tutumları'nı araştırmaktır. Çalışmanın yürütülebilmesi için gerekli etik izinler alınmıştır.

Çalışmaya katılım tamamen gönüllülük esasına dayanmaktadır. Katılım sırasında sorulardan ya da herhangi başka bir nedenden ötürü kendinizi rahatsız hissederseniz cevaplamayı istediğiniz anda bırakabilirsiniz. Çalışmayı yarıda kesmek size hiçbir sorumluluk getirmeyecektir. Verilen anketlerin hiçbirinin üzerine isminizi yazmayınız. Vereceğiniz bilgiler tamamen gizli tutulacak ve yalnızca bilimsel araştırma amacıyla kullanılacaktır.

Tüm soruların yanıtlanması yaklaşık 5 dakika sürmektedir. Soruların doğru ya da yanlış cevabı yoktur. Dikkatlice okuyunuz ve sorulara sizi en iyi şekilde ifade eden cevabı vermeye çalışınız. Çalışmadan elde edilecek sonuçların güvenirliği bakımından tüm soruları içtenlikle ve eksiksiz olarak yanıtlamanız önemlidir.
Bu araştırma hakkında daha fazla bilgi almak isterseniz Arş.Gör.Cemil Gökhan Karacan'a aşağıdaki e-mail adresinden ulaşabilirsiniz.
Katılımınız ve katkılarınız için teşekkür ederiz.
Arş.Gör.Cemil Gökhan Karacan, E-Posta: cgkaracan@medipol.edu.tr

Bu çalışmaya tamamen gönüllü olarak katılıyorum ve istediğim zaman yarıda kesip çıkabileceğimi biliyorum. Verdiğim bilgilerin bilimsel amaçlı yayımlarda kullanılmasını kabul ediyorum. (Formu doldurup imzaladıktan sonra uygulayıcıya geri veriniz).

Tarih İmza

-----/-----/------

D. Semi-Structured Interview Questions

a) Pre-Interview Questions

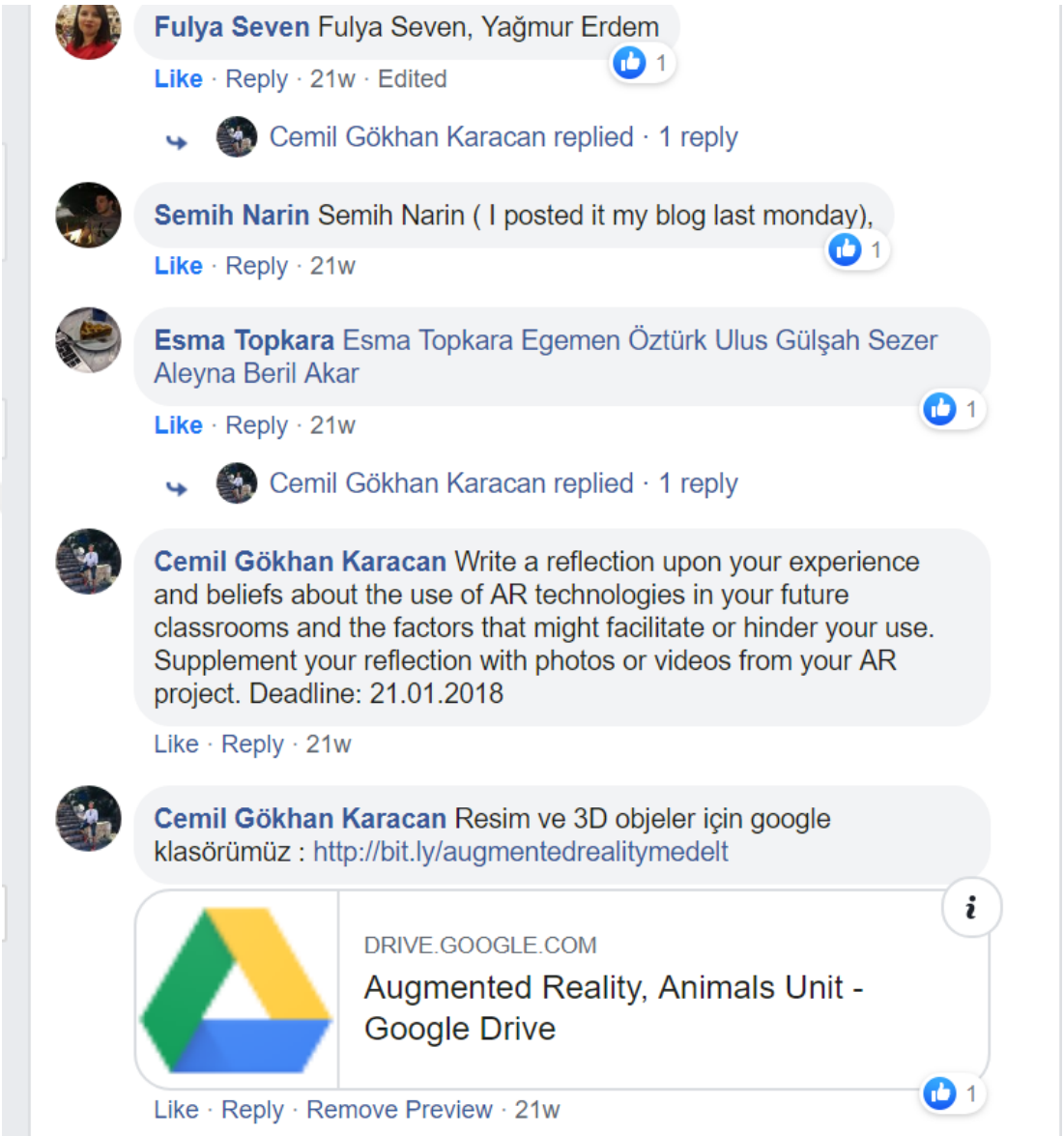
1- Bu teknoloji hakkında ne biliyorsun ? [What do you know about this technology?]
2- Sence eğitimde kullanılır mı ? [Do you think that it can be employed in education?]
3- Sence dil öğretiminde kullanılabilir mi ? [Do you think that it can be employed in language teaching ?]
4- İngilizce öğretmen adaylarını yetiştirmede kullanılması mümkün mü ? [Do you think that AR can be employed in training of English pre-service teachers?]

b) Post- Interview Questions

5- Bu teknolojiyi sana tanıtmadan önce bir bilgin var mıydı ve sonrasında fikirlerin nasıl değişti ? [Did you know about this technology before the training and how did it change your ideas ?]
6- Bu teknolojiyi kullanmada kendine güveniyor musun? [Do you have confidence in using this technology?]
7- Bu teknolojiyi kolaylılık, yararlılık ve kullanışlılık bakımından değerlendirir misiniz ? [How would you assess this technology in terms of easiness, usefulness and usability?]
8- Öğrencilerinin, diğer öğretmenlerin, yönetici/müdürlerinin veya kişisel olarak saygı duyduğun hocalarının bu teknolojiyi kullanmak konusunda seni ne kadar etkiler ? [How would your students, fellow teachers, administrators or professors you respect affect your use of this technology?]
9- Gelecekte bu teknolojiyi kullanmak niyetinde misin ve hangi nedenler dolayısıyla ? [Do you intend to use this technology in future and for what reasons ?]

E. Reflection Papers

Instruction for the reflection papers was as follows:



AUGMENTED REALITY

Augmented reality is used by many companies to sell their products. It works with a device. It is used with this device's object confirmation feature. In order to use this technology you need internet connection and a device such as cellphone, tablet etc. Also you need an augmented reality application in your device. When you supply all these steps, you will be able to observe the process by using the app. For example; let's think you have a picture in your book and when you look at this photo by the camera of theapplication in your cell phone you will see this object in a 3d version.

How can we use augmented reality for language teaching? I think it is a very interesting way to teach especially young learners as they are pretty good with technology. I imagine a classroom where each student has a tablet as a lesson material. They will be able to see the pictures from their books as 3d characters. For example; they learn animals, when they use the augmented reality application with their tablets they will see animals moving on the book as 3d objects which is very impressive way of learning. Books with pictures, reading texts, exercises are pretty boring for young learners. Most of them do not even want to do such kind of activities. But augmented reality apps makes them curious. They want to try and learn themselves. Learning is much more easier when the learner experiences it personally. In that case; i really am looking forward to using augmented reality applications in my english classes as much as possible. As the technology improves, it will be much easier to use these apps.

Augmented Reality (AR)

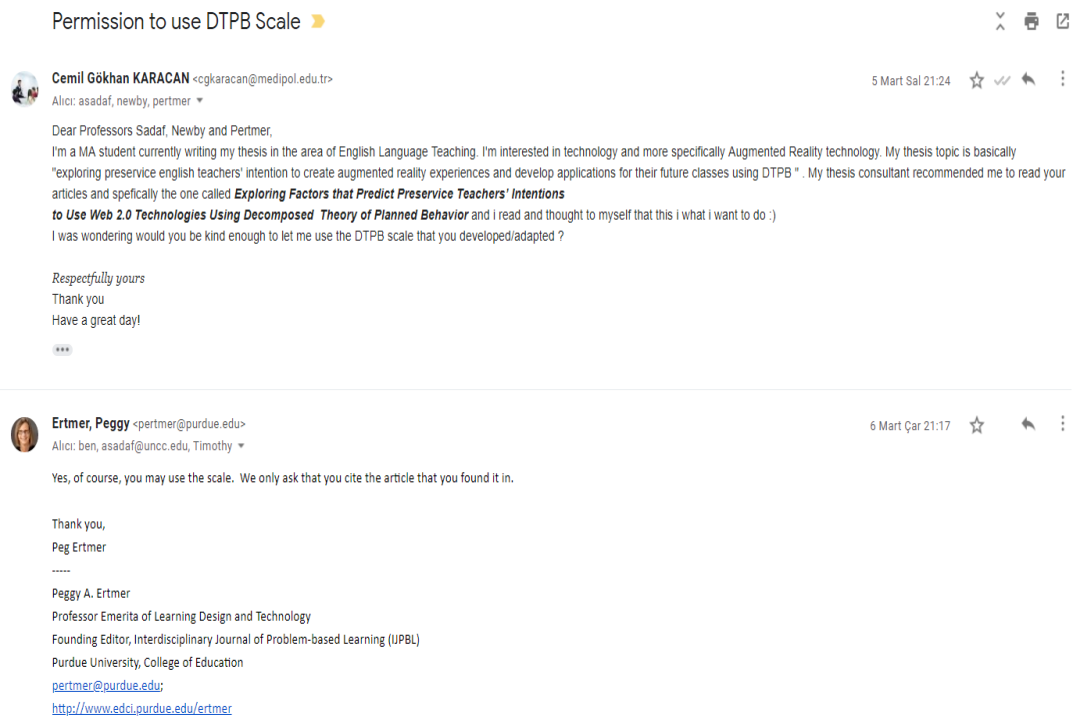
Augmented reality (AR) provides an environment that creates a realistic simulation for users via some visual elements and it enhances or changes the real world via these virtual elements. This technology can be used every part of education, such as biology, chemistry, math, and physics. In addition, it can be used in foreign language education, such as vocabulary and oral communication skills to help learners in a learning process and enhance their creativity. The reason is that it provides an environment for a realistic simulation to activate students' brain which increases their creativity and affects their learning process in a good way. In other words, they will learn more effectively thanks to AR technology compared to the old one. To me, old techniques, such as textbooks, role-plays, videos, and others can enhance learner's interaction with each other but these techniques have limitations in foreign language education. The reason is that these old techniques do not provide effective and meaningful activities or context. Thanks to AR, they can explore and experience the use of language in real-life conversations and activities. Teachers should be aware that language needs more practice to comprehend a language. With AR, they can practice real-life conversation and they can discuss what they have experienced which help them to speak well. There are some apps or websites that can provide AR technology for us, such as Augment, Layar and HP reveal. With these apps, I can create effective and attractive activities or games which will make my students more successful and motivated. As a future teacher, AR technology can be so helpful for teaching a subject. I can integrate AR technology in my classrooms for some reasons, such as motivation and success. In addition, in some areas such as vocabulary and oral communication skills. Briefly, AR technology should be integrated into the classroom to provide efficient learning process.

The first reason is that it can increase learners' motivation because our learners will be digital users that means using AR make them more active and motivated in the classroom. It can be integrated into teaching vocabulary. To make it clear, vocabulary can be learned effectively because while teaching a vocabulary, teachers can use AR technology to show vocabulary via realistic simulation. This makes the vocabulary knowledge more permanent and fun for learners. For example, when I am doing some activities about animals in the primary level classroom, I can use AR to provide an effective learning process. I can use AR with games or activities, such as matching the animals with their pictures. These pictures can be scanned by using some apps that provide realistic simulation to make them activated during the class activities. Another example is that when I am teaching a subject like, animals, I can prepare AR for my students. This AR includes some voices, texts, and funny movements, like dancing. In this way, they will learn animals with fun.

The second reason is that AR technology will make them more successful. They can learn more with AR technology because they have a chance to learn by doing some realistic activities and seeing some realistic simulation. To be more precise, oral communication activities can be more interesting and attractive for learners thanks to AR technology. The reason is that they want to participate more eagerly in the activities because it will be so fun for them. In addition, they can practice real-life experiences with AR. They can be exposed to the real-life conversation and culture of the language which makes the learning process more effective and meaningful. The most important point is that they will not learn a language in an isolated environment. So, they can learn more easily and permanently because they will be exposed to the pragmatics more than they used to be.

I want to share my own experience, as well. I have tried augmented reality to my students. It caught their attention pretty much and they learn a vocabulary so easily. I am using AR technology from this day forth to make the learning process more meaningful and effective for my students. My final thought is that augmented reality is a living tool, we can do things beyond what we think.

F. Permission to use the Scale



Permission to use DTPB Scale

Cemil Gökhan KARACAN <cgkaracan@medipol.edu.tr> 5 Mart Sal 21:24
Alıcı: asadaf, newby, pertmer

Dear Professors Sadaf, Newby and Pertmer,
I'm a MA student currently writing my thesis in the area of English Language Teaching. I'm interested in technology and more specifically Augmented Reality technology. My thesis topic is basically "exploring preservice english teachers' intention to create augmented reality experiences and develop applications for their future classes using DTPB " . My thesis consultant recommended me to read your articles and spefically the one called ***Exploring Factors that Predict Preservice Teachers' Intentions to Use Web 2.0 Technologies Using Decomposed Theory of Planned Behavior*** and i read and thought to myself that this i what i want to do :)
I was wondering would you be kind enough to let me use the DTPB scale that you developed/adapted ?

Respectfully yours
Thank you
Have a great day!

Ertmer, Peggy <pertmer@purdue.edu> 6 Mart Çar 21:17
Alıcı: ben, asadaf@uncc.edu, Timothy

Yes, of course, you may use the scale. We only ask that you cite the article that you found it in.

Thank you,
Peg Ertmer

Peggy A. Ertmer
Professor Emerita of Learning Design and Technology
Founding Editor, Interdisciplinary Journal of Problem-based Learning (IJPBL)
Purdue University, College of Education
pertmer@purdue.edu;
http://www.edci.purdue.edu/ertmer

G. Curriculum Vitae

PERSONAL INFORMATION

Surname, Name: Karacan, Cemil Gökhan

Nationality: Turkish (TC)

Date and Place of Birth: 17 October 1995, Istanbul

Marital Status: Single

E-mail: cgkaracan@medipol.edu.tr

EDUCATION

Degree	Institution	Year of Graduation
MA	Bahcesehir University	2019
BA	Istanbul University	2017
High School	Bahçelievler Cumhuriyet Anatolian	2013

WORK EXPERIENCE

Year	Place	Enrollment
2018-Present	Istanbul Medipol University	Research Assistant
2017-2017	English Time	Teacher
2017-2017	G3D - Global 3D Systems	Translator
2016-2016	ATEN International	Translator
2016-2016	TEGV	Teacher
2015-2015	LÖSEV	Teacher

FOREIGN LANGUAGES

English (fluent)

CERTIFICATES

Certificate of Attendance to Gamfed Gamification Meetup (2019) Istanbul, Turkey

Certificate of Attendance and Contribution to the YouRNI Project- Young Refugees Need Integration. Dissemination Conference (2019) Istanbul, Turkey

Certificate of Training, Future Learning : VII.Uluslararası "Gelecek için Öğrenme Alanında Yenilikler" Konferansı 2018: Eğitimde Dijital Dönüşüm (2018) Istanbul, Turkey

Certificate of Attendance for, IATEFL RESIG Conference (2018) Istanbul, Turkey

Certificate of Attendance for, Gamfed Gamification Conference (2018) Istanbul, Turkey

Certificate of Attendance for, 2nd International Black Sea Conference on Language and Language Education (2018) Sinop, Turkey

PUBLICATIONS
Year

2019 Guest Article (Bringing Dead to Life: Vocabulary Teaching with Augmented Reality) published in “EFLMagazine”

2019 Article (“Self-Efficacy and the Use of Compensatory Strategies: A Study on EFL Learners.”) published in European Journal of Educational Research

2018 Conference paper published in "TEACHERS RESEARCH! IATEFL ReSIG International Conference" ("Reducing 7th Grade Turkish EFL Learners' Speaking Anxiety in Oral Production Through Classroom Debate Technique")

HOBBIES
Poetry-writing, charity works, painting