PRE-SERVICE EFL TEACHERS' PERCEPTIONS AND SELF-EFFICACY OF AUGMENTED REALITY TECHNOLOGY: A MIXED-METHOD STUDY

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ABSTRACT

PRE-SERVICE EFL TEACHERS' PERCEPTIONS AND SELF-EFFICACY OF AUGMENTED REALITY TECHNOLOGY: A MIXED-METHOD STUDY

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The current study sought to investigate the pre-service EFL teachers' perceptions of Augmented Reality technology, their acceptance level for utilising this technology in English language classroom, and their self-efficacy level in employing this technology. In this mixed method study, the quantitative strand was based on one group pre-test-post-test design, and the quantitative data were gathered through pre- and post-surveys, TAM survey, and reflection form from 50 volunteers recruited based on convenience sampling. The qualitative strand composed of semi-structured interviews carried out with 12 voluntary students and open-ended questions posed in the surveys and reflection form. The quantitative data were analysed through paired sample t-test, Friedman test, and Wilcoxon Signed Rank Test whereas constant comparative analysis method was applied to analyse the qualitative data. According to the findings, the prospective EFL teachers' perceptions of AR technology was positive. Although their acceptance level of this technology differed significantly after their experience, no significant difference was identified in their self-efficacy of using AR technology for designing language learning materials. Additionally, the results revealed that vocabulary is the language skill for which AR technology is the most beneficial whilst writing is regarded as the skill for which AR technology is the least

useful. The EFL teacher candidates also expressed the affordances and constraints of AR technology along with their recommendations based on their experience. Taken together, this study can inform teachers, teacher educators, policy makers, curriculum planners, material and course book designers in relation to the employment of AR technology for language teaching.

Keywords: Augmented Reality, Language Learning Material Design, Pre-Service English Teachers' Perceptions and Self-Efficacy, AR Enhanced Materials

ÖZ

İNGİLİZCE ÖĞRETMEN ADAYLARININ ARTIRILMIŞ GERÇEKLİK TEKNOLOJİSİNE İLİŞKİN ALGILARI VE YETKİNLİKLERİ: KARMA YÖNTEM ÇALIŞMASI

OKUMUŞ, Ayşegül
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Bu çalışma, öğretmen adaylarının Artırılmış Gerçeklik teknolojisine yönelik algılarını, bu teknolojiyi İngilizce dersinde kullanmaya yönelik kabul düzeylerini ve bu teknolojiyi kullanmaya yönelik öz-yeterlik düzeylerini araştırmayı amaçlamıştır. Bu karma yöntem çalışmasında, nicel kısım, bir grup ön test-son test tasarımına dayanıyordu ve nicel veriler, ön ve son anketler, TAM anketi ve yansıma formu aracılığıyla kolaylık örneklemesi göre belirlenen 50 gönüllü katılımcıdan toplandı. Nitel veriler ise 12 gönüllü öğrenci ile gerçekleştirilen yarı yapılandırılmış görüşmelerden, anketlerde ve yansıma formunda sorulan açık uçlu sorulardan oluşmaktadır. Nicel veriler, eşleştirilmiş örneklem t-testi, Friedman testi ve Wilcoxon İşaretli Sıralar Testi ile analiz edilirken, nitel verilerin analizinde sabit karşılaştırmalı analiz yöntemi uygulanmıştır. Bulgulara göre, İngilizce öğretmen adaylarının AG teknolojisine yönelik algıları olumluydu. Bu teknolojiyi kabul düzeyleri deneyimlerinden sonra önemli ölçüde farklılık gösterse de dil öğrenme materyallerini tasarlamak için AG teknolojisini kullanma öz yeterliliklerinde önemli bir farklılık gözlenmedi. Ek olarak, bulgular, AG teknolojisinin en faydalı olduğu dil becerisinin kelime bilgisi olduğunu, yazma ise AG teknolojisinin en az yararlı olduğu beceri olarak görüldüğünü ortaya koymuştur. Hizmet öncesi İngilizce öğretmenleri,

deneyimlerine dayalı önerileriyle birlikte AG teknolojisinin imkânlarını ve kısıtlamalarını da ifade ettiler. Sonuç olarak, bu çalışma öğretmenleri, öğretmen eğitimcilerini, politika yapıcıları, müfredat planlamacılarını, materyal ve ders kitabı tasarımcılarını dil öğretimi için AG teknolojisinin kullanımı ile ilgili olarak bilgilendirebilir.

Anahtar Kelimeler: Artırılmış Gerçeklik, Dil Öğrenme Materyali Tasarımı, İngilizce Öğretmen Adaylarının Algıları ve Öz-Yeterlikleri, AG Tabanlı Materyal

To my beloved family

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LIST OF ABBREVIATIONS

AR	Augmented Reality
CALL	Computer Assisted Language Learning
MALL	Mobile Assisted Language Learning
ELT	English Language Teaching
EFL	English as a Foreign Language
ICT	Information and Communication Technologies
TAM	Technology Acceptance Model
MoNE	Ministry of National Education
HEC	Higher Education Council
B.A.	Bachelor of Arts

CHAPTER 1

INTRODUCTION

1.1. Introduction

The current study seeks to unveil Turkish pre-service EFL teachers' perceptions of AR technology including the affordances and constraints of this technology and their suggestions. This study also aims to determine their acceptance level of AR technology and their self-efficacy level in using this emergent technology for the purpose of designing English language learning materials. In this chapter, the background of the study, the problem statement, the purpose of the study along with the research questions, and the significance of the study are provided.

1.2. Background of the Study

The technological instruments such as computers, laptops, and smart phones have become more pervasive than ever during 21st century and have both affected and transformed how the information is conveyed to learners. With the advance of technology into education, Computer Assisted Language Leaning (CALL) has received wide acceptance from language teachers especially during the last two decades (Zhang et al., 2020). Compared to traditional learning, CALL was found to assist language teaching and learning, and enhance learners' academic achievement (Tamim et al., 2011). With the advent of mobile devices, MALL started to be recognised as a new area and what differentiates MALL from CALL is "its personal use and portability" (Çakmak, 2019, p. 37). Regarding the use of MALL, some mixed findings have been identified in the relevant literature because there were some studies which concluded that MALL had positive effect on language learning and some other studies which yielded inconclusive findings (Kamasak et al., 2020).

In recent years, AR Technology has become prevalent as a result of proliferation of mobile technologies like smart phones (Zhang et al., 2020). In the literature, *Augmented Reality* was defined as an emergent technology bridging the gap between the real and the virtual worlds by inserting digital images into real world (Azuma, 1997; Mohn, 2015). The most recent definition of *Augmented Reality* was proposed by Wang et al. (2018, p. 1391) as "a combination of technologies that superimpose computer-generated content over a real world environment". Three kinds of AR include marker-based AR, markerless AR, and location-based AR (Wojciechowski & Cellary, 2013). Among these three types of AR, marker-based AR was found to be frequently used in the field of education in a meta-analysis study (Bacca et al., 2014). The technological hardware used for AR technology to operate consists of head-mounted displays, handheld displays such as tablets and smart-phones, and pinch gloves depending on the AR application employed (Kesim & Özarslan, 2012). The AR applications which are currently used are Blippar, HP Reveal, ARToolkit, Unity, Aurasma, ZooBurst, Augment, Layar, and Daqri.

This historical development of AR technology is presented in Figure 1.1. In 1968, the first head-mounted display called 'The Sword of Damocles' was created by Ivan Sutherland, a Harvard professor and computer scientist. In 1974, a laboratory, called 'Videoplace' that was entirely dedicated to artificial reality, was built by Myron Kruger, a computer researcher and artist, at the University of Connecticut. In 1990, the term 'augmented reality' was coined by Tom Caudell, a Boeing researcher. In 1972, 'Virtual Fixtures', which was one of the first fully functional augmented reality systems, was designed by Louis Rosenburg, a researcher in the USAF Armstrong's Research Lab. In 1994, augmented reality took its place in the entertainment industry for the first time with the theatre production titled Dancing in Cyberspace with the initiative of Julie Martin, a writer and producer. In 1998, the first live NFL game with the virtual 1st & Ten graphic system – aka the yellow yard marker- was broadcasted by Sportsvision. The technology displays a yellow line overlayed on top of the feed to present quickly where the team just advance to get a first down. In 1999, a hybrid synthetic vision system of their X-38 spacecraft was prepared by NASA in order to leverage AR technology to assist in providing better navigation during their test flights.

In 2000, ARToolKit, an open-source software library, was developed by Hirokazu Kato, and this library aids other developers in building augmented reality software programs. In 2003, AR technology was added to sports aerial camera and provided viewers with an aerial shot of the field with graphics overlaid on top of it. In 2009, AR was employed in print media for the first time and used as part of web browsers with the help of ARToolKit. In 2013, the MARTA app (Mobile Augmented Reality Technical Assistance) which primarily gave technicians step-by-step repair instructions within the service manual, was debuted by Volkswagen. In 2014, Google Glass devices, a pair of augmented reality glasses that users could wear for immersive experiences, was produced by Google. In 2016, wearable AR technology called the HoloLens, which is more advanced than the Google Glass, was unveiled by Microsoft. In the same year, Pokémon Go was released and changed the way average consumers thought about the emerging technology. In 2017, IKEA Place, which changed the retail industry forever, was presented by IKEA.

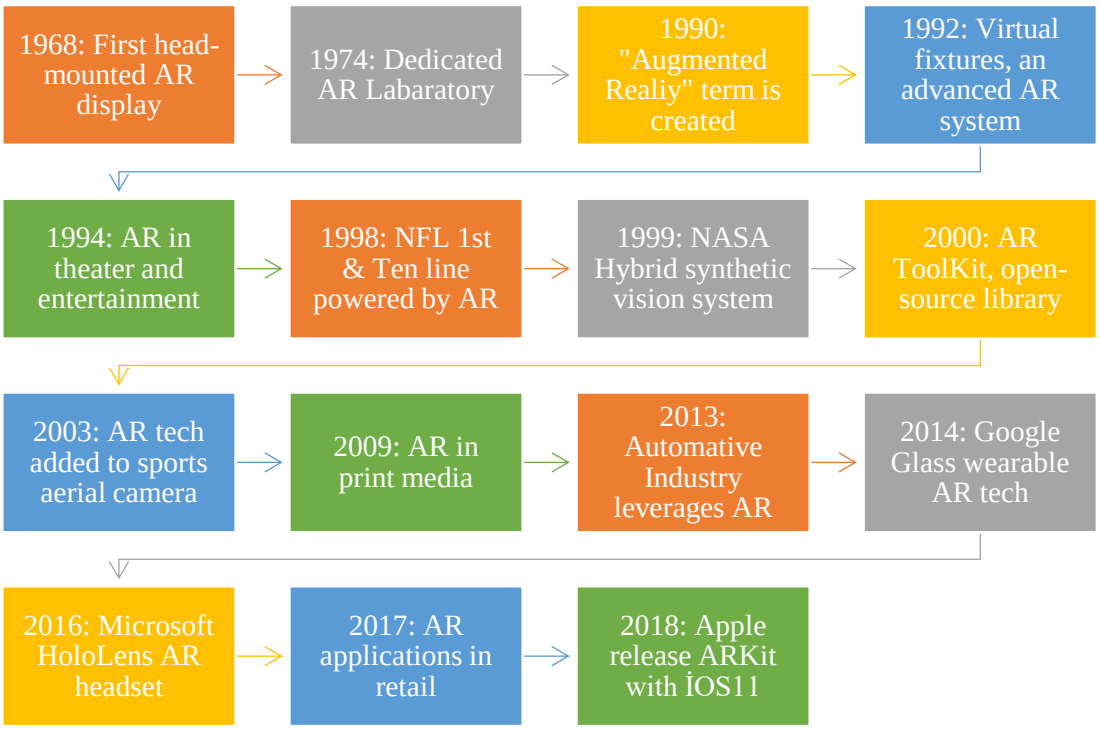

Figure 1.1 Augmented Reality Timeline (Poetker, 2019)

In the last decade, the implementation of AR technology has been widespread, and it has been utilised in the following areas: military; medicine; engineering design; robotic; telerobotic; manufacturing, maintenance, and repair applications; consumer design; psychological treatments since the early 1990s (Azuma et al., 2001). The use of AR technology has also been observed in tourism (Fritz et al., 2005), archaeology (Vlahakis et al., 2001), commerce, advertising, entertainment, design (Alkhamisi et al., 2013), and construction (Vasilevski & Birt, 2020).

The utilisation of AR technology was not limited to these fields because it can be employed for edutainment as well (Kesim & Özarslan, 2012). In NMC Horizon Report for Higher Education (Johnson et al., 2016), it was predicted that AR and VR technology would have become more pervasive within two to three years. As predicted, the implementation of AR technology has been widespread in a variety of areas, but its use has been only recently observed in the field of English Language Teaching (ELT) (Hockly, 2019).

In the literature, it was indicated that the theoretical frameworks on which AR technology depends contained Constructivism and Situated Learning (Bower et al., 2014; Wang et al., 2018). Firstly, AR technology is regarded as "powerful means to constructivist learning" (Robinson & Coltz, 2013, p. 3353) because it allows learners to interact with the tasks, concepts and resources at a deeper level, which helps them to establish permanent connections within their knowledge base (Kerawalla et al., 2006). AR technology is also effective in overcoming the barriers of time and place and thus enables learners to reach the relevant information "for just-in-time learning" (Wang et al., 2018, p.4). Additionally, AR technology can be beneficial for Situated Learning in that it helps creating "authentic and contextualised learning by bringing the real world into the classroom" (Bower et al., 2014, p.7).

Since the employment of AR application for the first time, there have been some empirical investigations into the affordances and constraints of this technology in educational contexts. In systematic review of the literature analysing 68 studies conducted on the use of AR in K-12 education, higher education, and adult training, Akçayır and Akçayır (2017) summarised the benefits as well as the challenges of AR

technology and put these into three major categories: learner outcomes, pedagogical contributions, interactions, and other. The category of learner outcomes included the following benefits: increased academic achievement, increased learning motivation, improved learning, positive attitude, increased satisfaction, low cognitive load, increased confidence, and improved spatial ability. The second category, pedagogical contribution and interactions, consisted of these benefits: increased enjoyment, enhanced learner engagement, improved interest, increased interaction and communication between learners and teacher, and fostered self-learning. The last category contained the followings; helps visualisation of the abstract concepts, easy to use, and cost friendly. As for the disadvantages of AR technology in educational contexts, Akçayır and Akçayır (2017) concluded based on 68 scientific articles that AR technology is difficult to use and design, time consuming, not suitable for crowded classrooms, causes technical difficulties and cognitive load, distracting learners' attention, and inadequate teacher ability to use technology.

AR technology has only recently begun to make inroads into language teaching and learning (Hockly, 2019), and AR technology is believed to be "still on the methodological fringes of language teaching" (Nöhrer, 2020, p.2). Various activities have been suggested for possible implementation of AR technology for educational purposes (Yuen et al., 2011). The first one is discovery-based learning activity which is based on the notion of learning more about places and objects and generally employed in museums, historical or cultural places. As an example, in Mentira Project carried out by Holden and Skyes (2012), Spanish university students at the USA were expected to gather evidence in order to solve an AR-based murder-mystery game by talking to the local people in Spanish. Another type of activity is object modelling, which appeals to students who are trained to be a designer or an architecture since they can benefit from AR technology so as to design objects, spaces or buildings. Additionally, AR pop-up books have been prepared by using triggers such as QR codes or images which lead users to a virtual interface consisting of text, image, audio, or video. Previous studies have dealt with the use AR pop-up books for teaching Turkish and English (Bursalı & Yılmaz, 2019; Mahadzir and Phung, 2013; Vate-U-Lan, 2012). Another use of AR technology is for skills training in vocational education and

training. The last offered activity is AR gaming, and the most recent sample of AR gaming is Pokémon Go. For language learning purposes, MondlyAR was designed. It operates with a virtual language learning assistant and a smartphone and enables users to learn 41 languages through various activities (MondlyAr, n.d). In addition to these, Bonner and Reinders (2018) put forward some practical ideas for AR-enhanced language learning activities which include "creating campus tour, giving and following directions, location-based puzzle treasure hunts, providing instant-access supplementary materials for readings, automatically assigning roles in information gap activities, and backchanneling with the teacher during classwork or homework."

Despite the fact that it has been almost thirty years since the advent of this technology, and there are various affordances reported, AR technology is still considered to be in its infancy (Wu et al., 2013; Yuen et al., 2011). Although there is a growing body of literature that recognises the benefits of AR technology, this technology has not completely made its way into language education at primary, secondary, or university level (Bonner & Reinders, 2018). Even though the number of AR-enhanced language learning materials has lately increased, the instances of application of these materials are quite rare (Hockly, 2019). That is why research conducted on educational use of this technology does not keep up with the rapid improvement of AR technology (Bower et al., 2014). Consequently, not enough evidence can be gathered in relation to the impact of AR technology on teaching and learning process (Wu et al., 2013).

One of the main reasons for the lack of evidence for the implementation of AR technology in the classroom environment is inadequate teacher ability to use technology as it was indicated as the drawback of this technology in the literature (Akçayır & Akçayır, 2017). Therefore, it is of significance to examine the pre-service EFL teachers' perceptions of AR technology, their acceptance and self-efficacy levels in this technology because they are to utilise technology to teach English as foreign language in these times when unexpected events occur. This study is essential because the pre-service EFL teachers are expected to design AR-enhanced language learning materials to teach any language skills for any levels of English language proficiency.

1.3. Statement of the Problem

It has been a very long time since technology and computers have found their place in different fields all over the world. English Language Teaching has been one of these fields as put forward by Hubbard and Levy (2006).

> The growth of the Internet and proliferation of computers in school and home setting has led to a significant expansion of the use of technology in foreign and Second language instruction (p. 10).

Due to recent outbreak of COVID-19 pandemic, the vital importance of technology has been recognised more than ever in every walks of life from business to education and transformed the way the courses are delivered. As a result of this epidemic, Emergency Distance Education (EDE) had to be carried out because it was the ideal solution to maintain educational practices at different levels of education. Although the significance of technology and digital competences which refer to being capable of employing information and communication technology (ICT) have been pointed out in the field of English Language Teaching (ELT) for many years (Vladescu, 2016), teaching practices conducted during EDE indicated that some teachers were not technologically competent enough to adopt to this sudden change and needed training on how to use technology more efficiently for educational purposes (Mishra et al., 2020). Due to Covid-19 pandemic, education is still being done through online education. Hodges et al. (2020) expressed that online education should not be limited only to emergency online practices and the quality of online education should be enhanced with thorough planning and design of instructional processes. Therefore, teachers are required to be more competent than ever, and even newly graduated English Language Teachers have been asked to state their level of competency in using technological instruments for online and distance education. Additionally, both contemporary pre-service EFL teachers and their prospective students will be digital natives and are to become 'tech-savvy' (Prensky, 2001). Nonetheless, a considerable number of them were found to lack knowledge and skills which digital natives are expected to have (Bennett et al., 2008). In order to provide a learning process which is appropriate for these digital natives and embrace the challenges occurring in education

resulting from epidemic or natural disasters, pre-service teachers are expected to be more capable of employing instructional technology tools. That is why, not only in-service teachers but also pre-service teachers should be trained for this purpose as part of their undergraduate education. Consequently, it may not be viable to relive 2020 and make up for educational practices but it is possible to update our knowledge and skills concerning instructional technology tools (Gao & Zhang, 2020). Otherwise, teachers and students who are not adequately proficient in utilising technology are high likely to lag behind online education (Hubbard & Levy, 2006; Adedoyin & Soykan, 2020).

In recent years, Augmented Reality technology, which was defined as augmenting the real world by integrating virtual objects into physical world and as the technology which bridges the gap between real and virtual world (Azuma, 1997), has started to attract attention. Kipper and Rampolla (2012) asserted that AR has been a mainstream since 2009, and its use has been widespread in many fields including advertising, task support, navigation, home and industrial, art, sightseeing, entertainment and games, social networking, education, and translation. In the last decade, this technology has also been utilised as an instructional technology tool in various educational fields. These fields consisted of physics, chemistry, biology, mathematics, and geography.

As for the field of English Language Teaching (ELT), there have been researches on motivation, learning outcomes and the efficiency of AR technology. In terms of language skills, most of the studies in this field have focused on the use of Augmented Reality technology for vocabulary teaching (Akçayır & Akçayır, 2016; Karacan, 2019). Up to now, apart from the master thesis study of Karacan (2019), pre-service EFL teachers have not been provided with a training on this technology, and there is still very little scientific understanding of this emergent technology in ELT field. As Saforrudin et al. indicated (2011), having knowledge about and experience with AR technology is a desirable attribute which most of the language teachers do not possess. That is why, considering the current high demand for technological competency and the studies conducted so far, AR technology is still in its infancy and the

implementation of AR-enhanced language learning materials needs investigation (Kljun et al., 2020).

Within the scope of this study, after the pre-service English teachers had been informed about the Augmented Reality application, they were asked to design five activities using "Blippar", an Augmented Reality application, to teach any English language skill for any level of proficiency. This study attempted to reveal pre-service teachers' opinions about Augmented Reality application, the affordances and constraints of AR technology. Another goal was to determine their acceptance level of this technology and their self-efficacy level in using AR technology to design AR-enhanced language learning materials. The relevant data were gathered with the help of surveys administered before and after the activity design process, reflection forms, and semi-structured interview.

1.4. Purpose of the Study and Research Questions

The current study seeks to examine Turkish pre-service EFL teachers' perceptions and acceptance level of Augmented Reality technology and measure their self-efficacy level in using this emergent technology for the purpose of designing English language learning materials. The main questions addressed in this study are as follows:

1. What are the perceptions of the ELT pre-service teachers, who are informed in the integration of Augmented Reality (AR) technologies to English courses, on the use of Augmented Reality to teach English (listening, speaking, reading, writing, vocabulary, grammar) to EFL learners?

1.a. What are the advantages of using AR technologies to teach English?

1.b. What are the disadvantages of using AR technologies to teach English?

1.c. What are the suggestions of ELT pre-service teachers for the use of AR technologies to teach English?

2. What was ELT preservice teachers' acceptance level of augmented reality technology activities after the experience in designing AR enhanced activities to teach English?

3. After completing the activities, what level of self-efficacy did ELT preservice teachers experience in using augmented reality technology?

1.5. Significance of the Study

This study investigated pre-service English language teachers' perceptions about the employment of Augmented Reality technology for teaching and learning English language, their acceptance level of this technology, and their self-efficacy in employing AR technology for preparing AR-based language learning materials. This study contributes to the ELT field in three ways.

The first one is that it provides an input session to pre-service English teachers on the use of AR, and they are expected to create AR enhanced activities to teach any language skills (speaking, listening, reading, writing, grammar, and vocabulary) to students at any level of English. The previous studies have mostly focused on how to teach vocabulary with the help of activities developed with Augmented Reality. Therefore, this study can generate new insights into the utilisation of AR technology for language teaching and learning.

The second contribution is that it unearths prospective English teachers' views on the affordances and constraints of utilising AR technology in language learning and teaching. Although there have been a few studies unveiling pre-service teachers' perceptions of AR technology, what makes this study unique is that all language skills are taken into consideration, and the pre-service EFL teachers gained hands-on experience with AR technology. Therefore, these views can inform language teachers, material and course book designers about how to benefit from AR technology in English language classes.

In the third place, the self-efficacy of prospective English language teachers in using Augmented Reality technology can support policy makers regarding curriculum redesign and guide curriculum planners to embody courses related to ICT and digital literacy. Additionally, the findings of the present study can encourage teacher educators to integrate technology more into their courses so as to equip pre-service EFL teachers with the necessary knowledge and skills of digital literacy. As Goldman

Sachs (2016) estimated that AR technology will have been employed by 15 million users working in educational fields by 2025, immediate actions can be taken regarding the update of pre-service teacher education curriculum so as to provide prospective teachers with the education they will need to employ such innovative technologies appropriately.

Considering these contributions, the present study can inform teachers, teacher trainers, teacher educators, policy makers, curriculum planners, material and course book designers in relation to the employment of Augmented Reality technology for language teaching and can fill the niches in the field of ELT.

1.6. Definitions

Augmented Reality: It was defined as an emergent technology bridging the gap between the real and the virtual worlds by inserting digital images into real world (Azuma, 1997; Mohn, 2015). The most recent definition of Augmented Reality was proposed by Wang et al. (2018, p. 1391) as "a combination of technologies that superimposes computer-generated content over a real-world environment".

Technology Acceptance Model (TAM): This model is about users' willingness to employ a specific technology in their life to accomplish their goals of completing certain tasks and activities (Teo, 2011).

Computer self-efficacy: It refers to "the degree to which an individual believes that he or she has the ability to perform a specific task/job using the computer" (Compeau & Higgins, 1995, p.190).

CHAPTER 2

LITERATURE REVIEW

2.1. Introduction

This chapter presents the definition of Augmented Reality, the studies previously carried out on the use of AR technologies, the affordances and constraints of AR technologies, the practices of AR technologies on language skills, teachers' and learners' perceptions of AR technologies in language classrooms, and pre-service language teacher education.

2.2. Language Teaching and Technology

Technology integration was defined as the use of technological instruments in an efficient way in order to accomplish the learning outcomes (Davies, 2011). The employment of technology in the educational fields including ELT dates back to 1960s when movies and tape recorders were utilised for teaching English, and its use became more common in 1970s especially in European schools (Davies, 2011). During these years, slide show technology enabled the courses to be audio and video recorded. In 1980s, language laboratories including computers, tape recorders, and projectors were designed (Coley et al., 1997). During the millennial age, how languages are learned and taught have been under the impact of multimedia technologies ranging from pictures and videos to computer games and social networking sites (Ahmad, 2012; Şimşek & Can, 2016). With the common use of these technological tools which offer limitless opportunities to learners, language learning has become more enjoyable and productive (Ahmad, 2012). In time, the field of ELT have been significantly affected

by several organizations and journals including EUROCALL, ReCALL, CALICO Journal, and Language Learning and Technology (Karacan, 2019). Recently, emergent technologies such as VR and AR have made their ways into the field of ELT (Godwin-Jones, 2015; Johnson et al., 2014).

2.2.1. Information and Communication Technology (ICT)

Information and Communication Technology refers to the combination of telecommunications and computers which allows the information to be ready for storing, conveying, and dissemination (Ratheeswari, 2018). Thanks to ICT, users can work on any project no matter where they are and when (Ghasemi & Hashemi, 2011). The affordances of ICT are not limited to this, and it also fosters active learning (Dori & Belcher, 2005) and enables cooperative learning (Warschauer, 1997).

As for the implementation of ICT in ELT field, it provides language learners with many benefits (Akpabio & Ogiriki, 2017; Azmi, 2017). First, ICT makes information easily accessible and enables learners to work on their project (Ghasemi & Hashemi, 2011). In addition to this, ICT has the potential to cater for various learning styles. Thus, it can promote learner autonomy because they can work individually at their own pace to improve their language skills. Second, making use of technology in language classes increases learners' motivation and interest in the lesson (Dedja, 2015). Third, learners have the chance to communicate with native speakers through the networks provided with technological instruments, which was also supported by Reeves and Nass (1996, p.5) who stated that "the interactivity of people with computers, television, the Internet and other media are the foundations of natural and social interactions of everyday life". Hence, ICT found its place in educational fields and the curriculum (Papanastasiou & Angeli, 2008).

2.2.2. Computer Assisted Language Learning (CALL)

With the advent of computers, they have become an integral part of language teaching and learning process (Goh et al., 2010). Computer Assisted Language Learning, also known as CALL, was defined as "the search for and study of an application on the computer in language teaching and learning" by Levy (1997, p. 1).

CALL has gone through three main phases, namely structural CALL, communicative CALL and integrative CALL, as categorised by Warschauer (1996). The first phase, behaviouristic CALL, took place during the 1970s and 1980s when Grammar-Translation and Audio-Lingual methods were the mainstream in language teaching. Therefore, language tasks were mainly based on drill and focused on accuracy. The communicative CALL refers the phase between 1980s and 1990s during which Communicative Language Teaching was the paradigm in ELT field. Therefore, fluency and intelligibility were at the forefront. The programs included mostly skill-based activities with the help of games, reading text construction, and word processors. After 1990s when the Internet and multimedia infiltrated our life, the third phase, Interactive CALL, started. The main paradigms in ELT were task-based, project-based, and content-based approaches, and language skills were to be integrated instead of being taught in isolation. The use of multimedia technology was of significance because it can promote learner motivation and autonomy, and lead to decrease in level of anxiety (Warschauer, 1997).

The affordances of CALL were summarised as the followings: it contributes to active participation; learners can set their own pace for learning and study at any place and any time they want; it can facilitate classroom instruction and increase the teacher-learner interaction; it can be an incentive for language learning (Wang, 2008; Yanpar & Yıldırım, 1999). On the other hand, the constraints of CALL were as follows: lack of technical and theoretical knowledge, limited access to necessary hardware and software, and financial problems (Lee, 2000; Wang, 2008). When the studies on teachers' and learners' perception of CALL were analysed, it was found that both parties held positive opinions about the implementation of CALL (Almekhlafi, 2006; Aydın, 2013; Ayres, 2002; Escalada & Zollman, 1997; Robert, 2002). After computers, the second most important instrument has become mobile phones which have brought about a gradual shift from CALL to mobile assisted language learning (MALL).

2.2.3. Mobile Assisted Language Learning (MALL)

As mobile phones have become “a familiar part of the lives of the most teachers and students” (Facer, 2004, p. 1), its implementation in language teaching and learning has been inevitable. Mobile-Assisted Language Learning, also known as MALL, is concerned with the employment of mobile phones or handheld devices for the purpose of teaching and learning languages (Bezircilioğlu, 2016; Mcconatha et al., 2008; Miangah & Nezarat, 2012; Wagner et al., 2016). What makes MALL different from CALL is “its use of personal, portable devices that enable new ways of learning, emphasizing continuity or spontaneity of access and interaction across different contexts of use” (Kukulska-Hulme & Shield, 2008).

The benefits of MALL make mobile devices more popular, and these benefits include providing ‘anytime’ and ‘anywhere’ learning (Bayyurt et al., 2014), allowing lifelong language learning by extending the boundaries of the classroom (Kukulska-Hulme, 2006; Mehta, 2012), transforming language classroom into an entertaining learning environment (Mehta, 2012), and increasing learners’ motivation (Palalas, 2011). On the other hand, the limitations of MALL should be taken into consideration as well, and these consist of small screen size, low computing power, limited data storage, and high cost of internet access (Czerska-Andrzejewska, 2016; Thornton & Houser, 2005).

Up to now, a number of studies have investigated the effectiveness of MALL and learners’ perceptions (Bezircioğlu, 2016; Biçen, 2015; Li et al., 2017; Liu & Chen, 2015; Nino, 2015) whereas a few studies asserted the opposite stand (Dashtestani, 2016). The pre-service and in-service EFL teachers’ opinions about the applications of MALL in educational context were also found to be positive (Öz, 2014; Savaş, 2014; Serin, 2012; Tafazoli & Golshan, 2014; Uzunboylu & Özdamlı, 2011). Şad and Göktaş (2014) found out that pre-service EFL teachers preferred using computers to mobile phones in learning environments. However, Dashtestani (2013) pointed out that EFL teachers’ perceptions of MALL practices were moderately positive. In addition, a few studies provided comparisons between learners’ and teachers’ views on the use of MALL in the classroom. Saidouni & Bahloul (2016) concluded that perceived effectiveness of MALL led teachers and learners to have positive opinions

about MALL practises in language learning context. Nevertheless, Park and Slater (2015) stated that teachers were not willing to integrate mobile devices into their courses despite learners' enthusiasm.

In relation to mobile learning, a great deal of previous research has focused on teaching and learning language (Viberg & Grünlund, 2012). This may stem from the fact that mobile phones play the role of facilitator in language classes (Demouy & Kukulska-Hulme, 2010). When the studies related to MALL were reviewed, MALL was found be effective in teaching and learning grammar (Khodabandeh, 2017; Moghari & Marandi, 2017). Even though most of the studies pointed out that MALL has been beneficial for learning vocabulary (Hayati et al., 2013; Wu, 2014; Wu & Huang; 2017; Kurt & Bensen, 2017; Rahimi & Miri, 2014; Sarıçoban & Özturan, 2013), no significant contribution to vocabulary was identified on the part of MALL in a few studies (Sato et al., 2015; Lai, 2016). As one of the receptive skills, reading skills have been improved with the help of MALL (Gheytasi et al., 2015; Hsu et al., 2013; Lin, 2014; Wang, 2017b). Listening is another receptive skill to which activities carried out with MALL made significant contributions (Azar & Nasiri, 2014; Hwang & Chen, 2013), whereas Hwang et al. (2016) reached the conclusion that the use of mobile-based activities did not cause any significant difference on learners' listening comprehension skills. As for the productive language skills, major impact of MALL on writing skills was observed in several studies (Khodi, 2015; Andujar 2016). Lastly, it was concluded that it was efficient to benefit from MALL for improving oral communication skills in terms of fluency (Ahn & Lee, 2016) and pronunciation (Saran et al., 2009).

2.4. Defining Augmented Reality

Recently, growing interest has been observed in different types of reality, namely virtual, augmented, and mixed, in various fields (Altınpulluk, 2019). From these three kinds of realities, Augmented Reality has grown popular in the last decade. Augmented Reality is defined as the integration of virtual objects into physical world and as the technology which bridges the gap between real and virtual world (Azuma, 1997). In other words, "Augmented Reality is taking digital or computer-generated information,

whether it be images, audio, video, and touch or haptic sensations and overlaying them over in a real-time environment." (Kipper & Rampolla, 2012, p.18). The distinctive features which distinguish AR from Virtual reality are stated by Azuma (1997) as "AR combines real and virtual; AR is interactive in real time; AR is registered in 3D". The fundamental difference between AR and VR lies behind the fact that "virtual reality aims to replace the real world while augmented reality respectfully supplements it." (Kesim & Ozarslan, 2012, p. 2). In reality-virtuality continuum proposed by Milgram and Kishino (1994) (see Figure 2.1), AR resides on the left side of the spectrum since AR creates an environment where information is inserted into real world through a computer (Wang & Dunston, 2011).

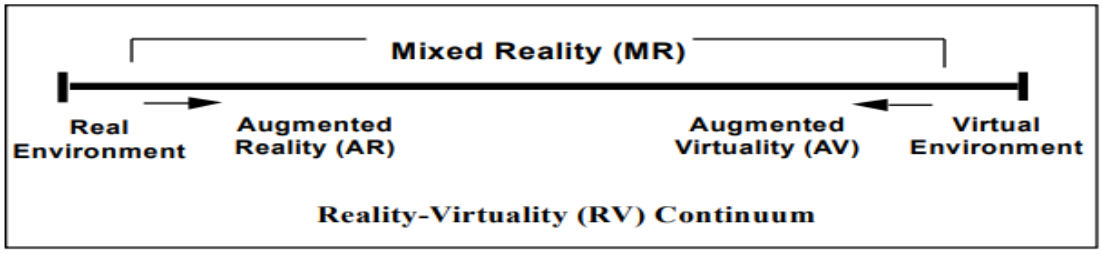

Figure 2.1 Reality-Virtuality Continuum (Milgram & Kishino, 1994)

As for AR to operate, there are various technological hardware which includes head-mounted displays (Video-see through system and Optic-see through system), handheld displays (smart phones and tablets), and pinch gloves as displayed in Figure 2.2 (Kesim & Ozarslan, 2012).

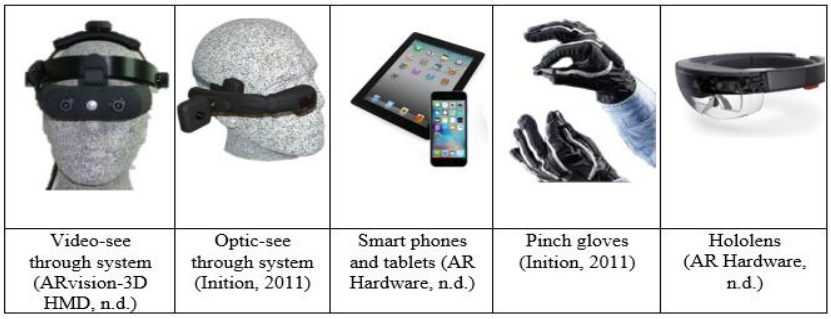

Figure 2.2 Technological Hardware for Augmented Reality

There are three types of AR technology which include marker-based AR, markerless AR, and location-based AR as presented in Figure 2.3. Within this context, the marker

refers to a trigger which can be an image or location depending on the types of AR. To start with marker-based AR, “the digital world is anchored to the real world” (Blippar, 2018). For instance, the trigger can be a page of the book or a picture to present an educational animation. In this case, the device, a tablet or smart phone, must first recognise the page or the picture you are looking at from the live camera view. When the picture is recognised by the camera, the animation or video can start playing immediately, tracked to the appropriate place on the page.

		
Marker-based AR	Markerless AR	Location-based AR

Figure 2.3 Types of Augmented Reality (Blippar, 2018)

In markerless AR, there is no trigger, and the user moves the virtual objects. As illustrated in Figure 2.3, user can place virtual furniture inside your living room. The only point user needs to decide is where to place the virtual object. This virtual object can be furniture as well as a virtual video-game character. With this type of AR, virtual objects “float” in mid-air. In Location-based AR, the virtual world is in a physical space. This kind of AR ties augmented reality content to a specific location. To exemplify, user can both walk in a city street and see a virtual road sign displaying the street name through their phone’s camera, which is location-based AR. Another common example is Pokémon Go which is a location-based AR game.

2.4.1. Theoretical Framework

Dunleavy and Dede (2014) related Augmented Reality technology mainly with two theoretical foundations which are namely Situated Learning Theory and Constructivist Learning Theory by stating that:

> ...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).

According to Situated Learning Theory, put forward by Brown et al. (1989) and based on the principles of Sociocultural Theory of Vygotsky (1980), it has been claimed that there is a specific context in which learning and language acquisition occur, and the relationship among learners, objects, and cultural aspects can foster learners' performance in learning. This theory also asserts that learning occurs as a result of the integration of previous knowledge and contextual learning that is considered to be informal, authentic, and accidental (Stein, 1998). As AR paves the way for a learning environment in which the users experience, interact, complete the learning task, solve the problem, and put what they have gained as knowledge into other simulations.

Constructivist Learning Theory states that learners go through some processes which lead them to construct their own mental structures by interacting with their environment (Richard, 2015; Illeris, 2009). During this process, learners also rely on their previous knowledge and sociocultural background to build knowledge as much as they do on the context and the environment. As pointed out by Dunleavy and Dede (2014), learners get the opportunity both to make their own interpretations of the immersive interfaces of AR based on their own lived experiences and to interact with virtual and real-life individuals so as to form their own understanding of the multimedia displays and construct their new context-based comprehension. Additionally, AR technology creates an environment where Situated learning theory and Constructivist learning theory merge in that learners understand the real world and put their knowledge into practice in AR learning environment. During this learning process, multimedia plays the roles of scaffolder, previous knowledge activator, motivator, and facilitator.

2.4.2. Technology Acceptance Model (TAM)

Technology Acceptance Model (TAM) was first put forward by Davis et al. (1989) and aimed at finding out users' acceptance of a certain technology. This model is about users' willingness to employ a specific technology in their daily life tasks and activities

to accomplish their goals (Teo, 2011). Over the years, TAM has been re-constructed and extended with some determinants such as self-efficacy (Igbaria & Iivari, 1995; Cho, 2015; Chen, 2014) and enjoyment (van der Heijden, 2003; Venkatesh, 2000; Mun & Hwang, 2003; Yusoff, et al., 2011; Wojciechowski & Cellary, 2013) so as to measure these aspects more accurately especially in emerging technologies like Mixed Reality, Virtual Reality, and Augmented Reality. The next extension to TAM was TAM3 which was developed by Venkatesh and Bala (2008) by pointing out the importance of understanding behavioural intentions of the users and actual usage of technologies with a major focus on certain determinants which affect Perceived Usefulness and Perceived Ease of Use, original components from the original TAM (Davis et al., 1989).

TAM3 was considered to differ from its previous versions in terms of several aspects. First, as Venkatesh and Bala (2008) indicated, TAM3 "presents a complete nomological network of the determinants of individuals' IT [information technology] adoption and use" (p. 279) as it is illustrated in Figure 2.4. As this extended version of TAM combined all the constructs proposed so far since the introduction of the original TAM, it enables the researcher to describe the full picture and delve into further details of users' acceptance of a specific technology at the initial stages of their experience.

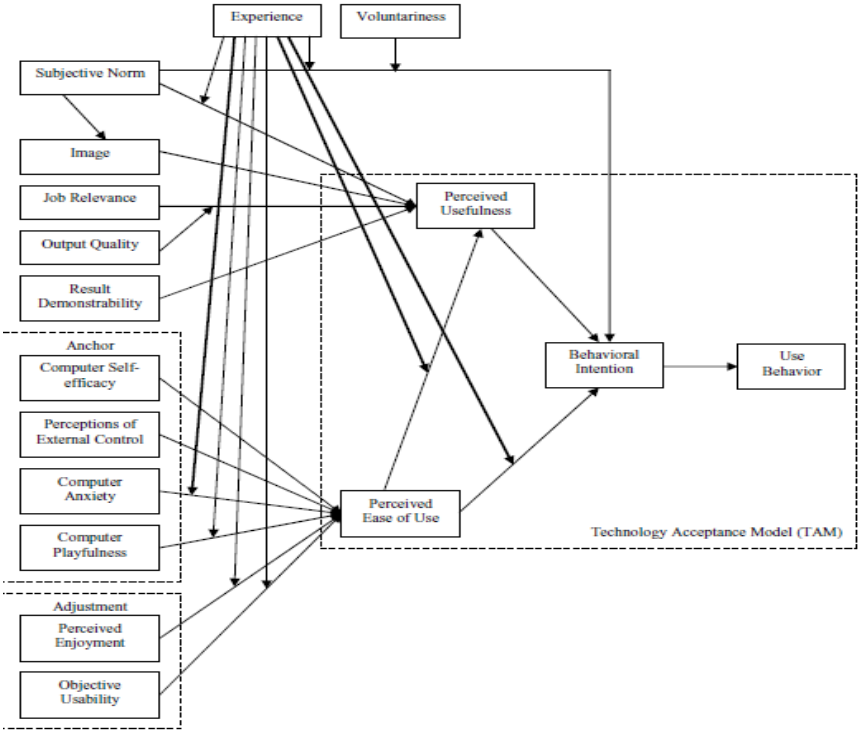

Figure 2.4 Technology acceptance model 3 (TAM3) by Venkatesh and Bala (2008)

In TAM3, perceived usefulness and perceived ease of use are two main determinants of users' intention to adopt any technological instrument. Within this context, experience and voluntariness play the role of moderator. One of the main determinants, "perceived ease of use", contains "computer self-efficacy, perception of external control, computer anxiety, computer playfulness, perceived enjoyment, and objective usability" as the determinants as it is presented in Table 2.1. Based on Social Cognitive Theory, self-efficacy refers to "judgments of how well one can execute courses of action required to deal with prospective situations" (Bandura, 1982, p. 122). In relation with this, computer self-efficacy stands for the degree to which the user considers he or she has the competence to execute particular task/job by using computer (Compeau & Higgins, 1995). Perception of external control connotes the extent to which a person thinks that there are operational and technological tools to help utilization of the technological instrument (Venkatesh et al., 2003). As for computer anxiety, it entails the degree of the discomfort or even anxiety a person feels when using computers (Venkatesh, 2000). Another determinant of perceived ease of use, computer playfulness, aims to explore "the degree of cognitive spontaneity in microcomputer

interactions" (Webster & Martocchio, 1992, p. 204). Additionally, perceived enjoyment refers to the level of enjoyment users derive from employing the technological system in focus (Venkatesh, 2000). The last determinant, objective usability, means the comparison of the programs used according to the effort needed to finish particular tasks (Venkatesh, 2000).

Table 2.1. Determinants of Perceived Ease of Use and Perceived Usefulness (Venkatesh & Bala, 2008)

Determinants	Definitions
Perceived Ease of Use	
Computer Self-Efficacy	The degree to which an individual believes that he or she has the ability to perform a specific task/job using the computer (Compeau & Higgins, 1995).
Perception of External Control	The degree to which an individual believes that organizational and technical resources exist to support the use of the system (Venkatesh et al., 2003).
Computer Anxiety	The degree of "an individual's apprehension, or even fear, when she/he is faced with the possibility of using computers" (Venkatesh, 2000, p. 349).
Computer Playfulness	"...the degree of cognitive spontaneity in microcomputer interactions" (Webster & Martocchio, 1992, p. 204).
Perceived Enjoyment	The extent to which "the activity of using a specific system is perceived to be enjoyable in its own right, aside from any performance consequences resulting from system use" (Venkatesh, 2000, p. 351)
Objective Usability	A "comparison of systems based on the actual level (rather than perceptions) of effort required to completing specific tasks" (Venkatesh, 2000, pp. 350–351).
Perceived Usefulness	
Subjective Norm	The degree to which an individual perceives that most people who are important to him think he should or should not use the system (Fishbein & Ajzen, 1975; Venkatesh & Davis, 2000).
Image	The degree to which an individual perceives that use of an innovation will enhance his or her status in his or her social system (Moore & Benbasat, 1991).
Job Relevance	The degree to which an individual believes that the target system is applicable to his or her job (Venkatesh & Davis, 2000).
Output Quality	The degree to which an individual believes that the system performs his or her job tasks well (Venkatesh & Davis, 2000).
Result Demonstrability	The degree to which an individual believes that the results of using a system are tangible, observable, and communicable (Moore & Benbasat, 1991).

Under the main determinant of perceived usefulness, the following determining factors exist: "subjective norm, image, job relevance, output quality, result demonstrability" as it is displayed in Table 2.1. Subjective norm refers to the perceptions of other people about whether a person should make use of the system or not (Fishbein & Ajzen, 1975). Image connotes the status a user gains after using a certain technological instrument (Moore & Benbasat, 1991). As for job relevance, it is about whether the technological

tool in focus can be considered as beneficial or not (Venkatesh & Davis, 2000). Additionally, output quality connotes the users' belief in the system to conduct his or her assigned duties well (Venkatesh & Davis, 2000). The last factor, result demonstrability, means the extent to which users think that the findings obtained from the system can be noticeable and measurable (Moore & Benbasat, 1991).

2.5. Affordances and Constraints of Augmented Reality

Up to now, previous studies have reported the benefits and drawbacks of AR technology, and the following two sections provide these studies conducted in this regard.

2.5.1. Affordances of Augmented Reality

The systematic reviews carried out revealed that AR technology provides the following educational advantages: academic achievement, performance, motivation, perception, satisfaction, interaction, retention, collaboration, positive attitude, evaluation, usability, attention, behaviour change, engagement, communication, enjoyment, skill, visualization, improving user experience, treatment, low cost, (Altınpulluk, 2019; Bacca et al., 2014)

In a meta-review analysis with the studies on AR in the field of education, Radu (2014) stated the benefits of AR for learning as "increased content understanding, learning spatial structure and function, learning language associations, long-term memory retention, improved physical task performance, improved collaboration, and increased student motivation".

In the same vein, a systematic review of literature was undertaken by Akçayır and Akçayır (2017) on the advantages and disadvantages of using AR technology for educational purposes. The benefits of this technology were divided into four major categories which were learner outcomes, pedagogical contributions, interaction, and other. The category of learner outcomes included the followings: increasing learner achievement, satisfaction, and motivation, facilitating learners' understanding, providing positive attitude, decreasing the cognitive load, raising learners' confidence

and spatial ability. In the second category, pedagogical contributions, the affordances were as follows: promoting enjoyment, interest, and learners' engagement, enhancing collaboration and interaction among learners and instructor, fostering self-learning and learning by doing, providing learner-centred technology, applicable for multi-sensory learning, and getting access to information in an instant. The interaction category referred to the provision of interaction between learner and learner, between learner and material, and between learner and instructor. The last category contained the following benefits: helping visualisation of abstract concepts, easy to use, and cost effective.

Similarly, Khoshnevisan and Le (2018) carried out a systematic literature review with the aim of explaining AR, revealing the advantages and disadvantages of AR in language education, recommending some ideas for implications and future studies. The advantages of AR were sort into two categories, affective and learning outcomes. In affective outcome, learner attitude and motivation were the two main themes, while the learning outcomes contained cognition load, language performance and higher order thinking skills such as creativity and inquiry learning, cultural understanding, and cooperative skills. Low cognitive load was also presented as an affordance of AR technology (Cheng, 2017; Küçük et al., 2016).

2.5.1.1. Memory Retention

"In language teaching, retention of what has been taught (e.g., grammar rules and vocabulary) may depend on the quality of teaching, the use of different strategies, the interest of the learners, or the meaningfulness of the materials" (Richards & Schmitt, 2002, p. 457). In this sense, AR technologies can play a role as a different way of teaching the content as AR can transform the learning environment which ultimately facilitates comprehension and awareness (Çetinkaya & Akçay, 2013) and create an authentic and meaningful context for learning (Clarke & Dede, 2007; Dunleavy et al., 2009; Elford, 2013). Sayımer and Küçüksaraç (2015) asserted that as various multimedia can be inserted into the real world, AR can foster bridging the gap between theory and practice. Additionally, Radu (2014) stated that the content learned via AR technologies can be kept in memory longer and can be easily remembered compared

to the traditional way of learning. In some studies, conducted in educational fields, it was indicated that the use of AR resulted in better retention of information and better comprehension (Adedokun-Shittu et al., 2020; Cascales et al., 2013; Huang et al., 2019; Ivanova & Ivanov, 2011; Sommerauer & Müller, 2014; Valimont, 2002). In addition to these, some studies in the field of English Language Teaching (ELT) revealed that when the content is taught through AR integrated materials, learners had better retention and comprehension of this content (Barreira et al., 2012; Doğan, 2016; Santos et al., 2016; Safar et al., 2017; Solak & Çakır, 2015).

2.5.1.2. Learning Outcomes

It was found out that AR has also contributed to learning outcomes in various fields and learning environments (Bower et al., 2014; Lee, 2012; Merchant et al., 2014). In their systematic reviews on the advantages and challenges of AR technology, Akçayır and Akçayır (2017) summarized that AR has improved learning outcomes, facilitated learners' understanding. Nonetheless, it was also reported that there is still need for further research on whether emergent technologies like AR fulfil the potential to enhance learning outcomes of learners (Bacca et al., 2014).

2.5.1.3. Academic Success

In the systematic review and meta-analysis studies carried out in the last decade, it has been reported that academic achievement was one of the mostly indicated benefit of AR in education and training (Akçayır & Akçayır, 2017; Altınpulluk, 2019). It was also found out that AR applications contributed to academic success in various educational context across different levels of education ranging from pre-school to higher education (Batdı & Talan, 2019; Özdemir et al., 2018; Yilmaz & Batdı, 2016; Yılmaz, 2018). Of all the studies on the effect of AR applications on academic success, the learners in the experimental group performed significantly better than the ones in the control group when their academic success was considered in science education (Karagözlü, 2018; Şahin & Yılmaz, 2020), in engineering (Gutiérrez & Fernández, 2014), in physics (Fidan & Tuncel, 2019), in geometry (Ibáñez et al., 2020; İbili & Şahin, 2015), in Ottoman Turkish education (Özcan et al., 2017), in vocational

education and training (Sirakaya, & Kilic-Cakmak, 2018a). Nevertheless, there were also some studies which did not result in a statistical significance in terms of the academic success of two groups in a biology course (Erbaş & Demirer, 2019), in geometry course (Gün & Atasoy, 2017), in physics course (Cai et al., 2013; Yen et al., 2013), in social studies course (Azi & Gündüz, 2020), and in science course (Cai et al., 2017; Chiang et al., 2014).

2.5.1.4. Interaction

Interaction is defined as facilitator in language acquisition process since "it connects input (what learners hear and read); internal learner capacities, particularly selective attention; and output (what learners produce) in productive ways" (Long, 1985, pp. 451-452). Like various instructional technological tools, AR also provides the advantage of promoting and facilitating the interaction among input, output, and learner (Bacca et al., 2014; Hsiao et al.,2016; Dunleavy et al., 2009; Yuen et al., 2011). As AR can shape and foster the way learners interact with the information or the content, this benefit can be invested in planning effective learning materials and environments (Radu, 2014; Santos et al., 2013). AR paves the way for not only the real-time interaction but also the interaction between the learner and the content with the help of coursebooks designed in a proactive format through AR (Kesim, & Özarslan, 2012; Sanna & Manuri, 2016).

2.5.1.5. Motivation

To date, a great deal of previous research has focused on the impact of motivation on Second Language Acquisition (SLA), and it was found out that motivation directly affects the learner performance (Norris-Holt, 2001; Dörnyei, 1994; Gardner & Lambert, 1959; Di Serio et al., 2013). It has been also asserted that AR has the potential to attract learners' attention and improve participation and motivation thanks to the use of 3D visuals (Azuma, 1997; Billinghurst, 2001; Çetinkaya & Akçay, 2013; Jerry & Aaron, 2010; Klopfer, 2008). Although users of AR technology expressed that they had difficulty in using this technology compared to non-AR alternatives, their level of motivation was significantly higher at all conditions (Kaufmann & Dünser, 2007).

A number of studies have examined the effect of AR technology on learner motivation and indicated that AR applications exert positive influence on learner motivation in language classrooms (Boonbrahm et al., 2015; Chen et al., 2020; Liu & Chu, 2010; Li et al., 2015; Mahadzir & Phung, 2013; Redondo et al., 2020; Solak & Çakır, 2015).

Liu and Chu (2010) conducted a quasi-experimental study in order to find out whether there was any significant difference in the learning outcomes between the experimental and control group and also to measure learner motivation. The platform used was named HELLO (Handheld English Language Learning Organization) which consisted of learning activities, ubiquitous games, designed based on the principles of ARCS motivation theory. The participants were 64 seventh grade students, and three high school teachers. The quantitative data was gathered through test score and survey while qualitative data was collected through in-depth interviews. The data analysis revealed that ubiquitous games enhanced the learning outcomes and motivation levels of learners. Another finding was that the higher the motivation is, the better the learning outcomes are.

Another research study based on ARCS motivational model was carried out by Mahadzir and Phung (2013) on the impact of AR pop-up books on motivation of national primary school students in English class. Five primary school students were chosen based on convenience sampling. The observation checklist and semi-structured interview were employed to gather data. The results of the data analysis showed that the first graders found AR pop-up books motivating.

In the similar vein, a pilot study based on ARCS model of motivation was done by Li et al. (2015) to investigate the effect of AR on learners' motivation to learn English vocabulary items. The participants included five Chinese graduate students, and except one of them, they had no previous experience with AR. To teach vocabulary in English, *Aurasma*, a mobile based AR application, was utilized. After the intervention, one-on-one semi-structured interview was conducted with the participants. The findings from thematic analysis indicated that learners had a high level of motivation due to the novelty of AR technology at first, however the limited learning materials and technological issues lessened the effect of AR on their motivation.

Similarly, Boonbrahm et al. (2015) worked with elementary level students by doing 3 AR experiments which aimed to motivate learners to learn English. These experiments focused on writing, reading, and conversation in this respective order. In each experiment, different AR techniques such as marker-marker interaction and user-defined target were utilised. Even though no significant difference was identified between AR and non-AR versions of the activities, learners who experienced AR based activities were observed to demonstrate high level of motivation.

Additionally, Solak and Çakır (2015) attempted to evaluate learners' motivation level during an AR enhanced vocabulary learning experience. Within this scope, it was also aimed to explore the relationship between academic achievement and learner motivation. To this end, data were obtained from 130 undergraduate students studying at a state university in Turkey. Material Motivational Survey was administered as the data collection tool. The findings based on independent sample t-test, ANOVA and correlational analysis showed that AR technology affected learners' motivation in a positive manner, and the correlation between academic achievement and learner motivation was positive and significant.

In another study, Redondo et al. (2020) worked with 102 students in early childhood education in order to find out whether AR can contribute to English language learning in early childhood education, lead to any increase in learners' motivation, and facilitate learners' ability to build socio-affective relationships. In this quasi-experimental study, there were 52 and 50 students in the experimental and control groups, respectively. The pre- and post-surveys were carried out to measure pupils' motivation, enjoyment, and socio-affective relationship among peers, and whether learners achieved the learning outcomes were assessed with the help of a specific tool both before and after the implementation. The findings suggested that the experimental group, who were exposed to AR integrated instruction, exhibited improvement in their motivation, language learning, and socio-affective relationship when compared to the control group.

In a recent study, Chen et al. (2020) studied the influence of captions and English proficiency level on language learning, learner motivation, and attitude in an AR

integrated EFL course which was carried out with "theme-based contextualised learning" approach. The aim of this study, which adopted a 2x3 factorial research design, was to scrutinise the impact of captions and the proficiency level in English on language learning efficiency, motivation, and attitude. There were two levels of language proficiency (higher proficient and less proficient) and three levels of captions (no caption, English caption and Chinese caption). As the target group, six classes of ninth grade students from a high school in Taiwan took part in the research. As data collection instruments, a language achievement test, a motivation questionnaire, and an attitude questionnaire were employed. The impact of captions and language proficiency on learning effectiveness were analysed through two-way MANCOVA while their influence on learner motivation and attitude were checked with two-way MANOVA. The results revealed that although captions did not cause any significant difference in learning effectiveness among different groups, the English language proficiency had an important role to play in it. In general, learners were observed to demonstrate positive motivation and attitude toward the use of AR integrated contextualised learning approach.

2.5.1.6. Multimedia

As Augmented Reality allows for integrating multimedia content such as text, audio, and video with the help of a digital layer into real world (Azuma, 1997; Yılmaz & Batdı, 2016), it is feasible to address multiple senses, increase learners' participation, make learning more permanent (Dunleavy et al., 2009; Wojciechowski & Cellary, 2013; Wu et al., 2013). Therefore, Sırakaya and Kılıç-Çakmak (2018b) asserted that pupils at primary and secondary school can take advantage of this benefit, as they have difficulty in understanding abstract topics due to their cognitive state in those ages (Piaget, 1976). Additionally, integrating virtual data into real world can assist in transforming the learning environment with "rich and meaningful multimedia content that is contextually relevant" (Billinghurst et al., 2001; Bower et al., 2014; Dunleavy & Dede, 2014). In this sense, multimedia acts as "scaffolding, background knowledge activator, motivator, and facilitator" (Khoshnevisan & Le, 2018, p.61). Pérez-López and Contero (2013) made use of AR in order to present the educational content about

digestive and circulatory systems via multimedia, and the findings indicated that the experimental group who received the multimedia content treatment had better retention of information. In the field of engineering, Liarokapis et al. (2002) developed a "Multimedia Augmented Reality Interface for E-Learning (MARIE)" so as to enrich the content and improve the methods of teaching and learning. In the similar vein, Lara-Prieto et al. (2015) carried out a case study and employed AR to produce tutorials for how to administrate 3D printing intended for engineering and design students. With the help of this innovative approach, it was concluded that self-learning method can be promoted, and technological tools can be utilized in an effective way. Additionally, "Multimedia Interactive Book (*miBook*)" including an AR interface was prepared by Dias (2009) with the aim of fostering learning efficiency because this *miBook* can provide various sensory stimuli and interaction with the content, which ultimately contributes to the learning outcomes. Lastly, AR technology was compared with multimedia tools in science lesson designed according to inquiry learning (Hsiao et al., 2016). AR was found to be a contributing factor in learners' academic success and motivation in favour of the experimental group. Several studies reported the effectiveness of AR as multimedia tool in promoting learners' performance (Cadavieco et al., 2012; Liu & Tsai, 2013; Santos et al., 2016).

2.5.1.7. Creativity

One of the fundamental skills which 21st century learners are expected to attain is creativity and innovation (Trilling & Fadel, 2009). Among various technological instruments, AR has the potential to enhance learners' imagination and creativity (Kerawalla et al., 2006; Persefoni & Tsinakos, 2015; Yuen et al., 2011). This conclusion was found out by a number of researchers in previous studies on AR technologies (Ivanova & Ivanov, 2011; Klopfer & Yoon, 2005; Rosli et al., 2010). Applying such methods which boost creativity can facilitate the process of engaging learners in school environment (Richards, 2013). Yılmaz and Göktaş (2017) conducted a correlational study to explore whether there is any significant difference among narrative skill, length of stories, and creativity in stories at elementary level. The experimental group who utilised AR technology in narrative writing performed

significantly better than the control group, the correlation among all variables were positive. This implication indicated that AR technology contributed significantly to learners' creativity.

2.5.1.8. Visualisation

Visualising the topic or the concepts has become more important than before in education and training starting from kindergarten to higher education including distance learning (Veřmiřovský, 2013). As AR technology provides a "stimulating multi-sensory experience" (Kidd & Crompton, 2016, p.100), it is deemed as the best technology in visualizing the concepts with the help of 3D models, graphics, and text (Wang et al., 2018). Özdemir (2017) claimed that visualising the concept via AR makes teaching and learning process easier. In a review of literature which focused on the use of AR in K-12 education, visualisation of content was indicated as the benefit of AR technology (Clemens et al., 2016). This aspect of AR is considered to be valuable in the field of science (Wu et al., 2013) since it enables the abstract concepts to be visualised (Arvanitis et al., 2007; Dunleavy et al., 2009) and also offers opportunities for simulations, and integration of virtual objects into real life without being exposed to virtual life (Diggins, 2005). Several studies have supported this aspect of AR technology by indicating that abstract concepts can be visualised through text, picture, video, and 3D models (Cabero & Barroso, 2016; Dori & Belcher, 2005; Wang et al., 2018). That is why this visualisation makes understanding and comprehension easier (Kaufmann & Schmalstieg, 2003; Shelton, & Hedley, 2002).

2.5.1.8. Learning Environment

According to Maslow's hierarchy of needs, when the physical needs of learners such as food and water are met, a safe learning environment needs to be provided in relation to the second level of this hierarchy, safety needs, so that learning process can begin (Lutz, 2014). In this sense, AR technology is claimed to provide a safe learning environment (Schrier, 2006). AR technology can cater for a real-like environment since it embeds virtual objects which are simulated versions of the ones in real life into a real environment (Chen et al., 2015; Dunleavy & Dede, 2014; Hsiao & Rashvand,

2011). Thus, AR technology facilitates learning process by providing "supplementary and contextual information" (Martín-Gutiérrez et al., 2010; Liu et al., 2007). Additionally, AR technology offers a lifelike environment to learners for learning and studying, and therefore this AR enhanced environment is regarded as authentic as the learning environment in the real life (Chen et al., 2012; Klopfer et al., 2005; Li, 2010). In relation to this aspect of AR technology, it is also stated that AR technology can turn learning process into a natural experience (O'Brien & Toms, 2005). There have been a few studies carried on the AR embedded learning environment. Alkhattabi (2017) surveyed primary school teachers about their acceptance of AR technology and the acceptance rate of utilisation of AR tools within an e-learning environment was found to be high (79%). Similarly, Singh et al. (2019) studied the effect of AR enhanced learning environment on the electronics laboratory skills of engineering students. The findings indicated that the impact of AR application on laboratory skills of learners was positive, and it also prevented learners in the experimental group from being afraid of damaging the equipment in real life as they had already experienced this with the help of AR applications. At this point, it should be pointed out that AR allows for designing cases and experiments which are hard to experience in real life (Kerawalla et al., 2006; Shelton & Hedley, 2002; Wojciechowski & Cellary, 2013; Yuen et al., 2011). In another study conducted by Petrov and Atanasova (2020) in the field of science, the influence of AR learning environment on students' learning performance was examined in STEM education, and the results revealed a statistically significant difference among three groups of learners in favour of the experimental group who benefitted from AR technology. Concerning language teaching and learning, AR enhanced learning environment was preferable for learning words (Juan et al., 2010). As there is a positive correlation between learners' perception of learning environment and their motivation in English language learning (Wei & Elias, 2011), emergent technologies like AR can be exploited for creating such learning environments. Li et al. (2015) designed an immersive learning environment for English classes with AR technology by using flow theory and reported that an authentic learning environment for English language learning can be prepared without spending too much money, and different instructors can contribute to this AR-enhanced environment by changing or remodifying the content.

2.5.1.9. Effectiveness and Attractiveness

The employment of AR applications in various fields have been investigated by many researchers, and it was claimed that AR technology can make the lessons more attractive and effective (Batdı & Talan, 2019; Chang et al., 2010; Kesim & Özarslan, 2012). Martín-Gutiérrez et al. (2010) noted that it is feasible to present the content in an attractive way to the learners with cost-effective AR technology. Additionally, AR technology is effective in conveying information and acquiring knowledge in learning environments outside the classroom (Facer et al., 2004; Williams et al.,2005). The use of AR technology as part of remote education was also examined by Li (2010), and it was concluded that "it yields superior quality compared to the traditional form of remote education" (p.1). As learners of generation Z, also known as "digital natives", are born into a world surrounded by technology (Prensky, 2001), they are considered to be easily bored when traditional methods of teaching and learning are applied (Oblinger et al., 2005). Therefore, it is proposed that AR technology can be employed to draw learners' attention to the lessons at various levels (O'Brien & Toms, 2005; Somyürek, 2014) because learners immerse in a specific and an engaging situation through AR-enhanced activities (Kirkley & Kirkley, 2005). Several studies have examined the effectiveness and attractiveness of AR applications in a variety of fields. Wojciechowski and Cellary (2013) concluded that "image-based AR environments" are considered to be attractive for younger learners in a chemistry lesson at secondary school. In addition, AR technology has been frequently employed in storytelling activities. Dünser and Hornecker (2007) found out that it was effective to use AR-based storybook since learning process became more attractive for young learners with the help of AR. Similarly, Zhou et al. (2004) confirmed the finding that learning became more attractive and effective when 3D graphics and audio features of AR applications were utilized in storytelling. The effective role of AR based picture books in facilitating learning and motivating learners was also supported with the findings of the studies conducted by Cheng and Tsai (2014, 2016).

2.5.1.10. Fun

Some studies conducted on the employment of AR technology in various fields of education reached the conclusion that lessons become more fun and enjoyable (Altinpulluk, 2019; Bacca et al., 2014; Bressler & Bodzin, 2013; Chiang et al., 2014; Ibáñez et al., 2014; Mohd Yusof et al., 2014; Onal et al., 2017; Yılmaz, 2016; Yoon et al., 2012). It was also stated that learners feel comfortable and ready for the lesson thanks to the enjoyable learning environment created by AR applications (Batdı & Talan, 2019). Juan et al. (2010) found out that learners preferred AR-based games to non-AR version of the game since they had more fun with AR-based games. Tobar-Muñoz et al. (2017) revealed that learners enjoy learning with AR-based activities in a reading lesson and they have higher motivation and interest towards the lesson.

2.5.2. Constraints of Augmented Reality

Like any instructional technology instrument, educators have come across with challenging aspects of AR applications when they employed these for educational purposes (Dunleavy & Dede, 2014; Sırakaya & Alsancak-Sirakaya, 2018). The constraints of AR technology are handled in terms of three perspectives which are technical limitations, teachers' and learners' perspective. Firstly, technical limitations are the biggest challenge for educators using AR technology (Lu & Li, 2015). In marker-based AR, some markers are hard to detect for some AR applications (Chang et al., 2014), therefore the choice of the markers is of significance in order for the activity to go smoothly. As for location-based AR, problems related to GPS can occur (Cheng & Tsai, 2013; Chiang et al., 2014; Crandall et al., 2015). Several studies indicated that head-mounted AR systems are comparatively harder to use than its counterparts (Billinghurst et al., 2003; Juan et al., 2010; Kaufmann & Dünser, 2007). Several studies pointed out the complicated interface of AR applications in that students found these applications complicated to use (Lin et al., 2011; Morrison et al., 2009; Munoz-Cristobal et al., 2015; Squire & Jan, 2007). From the perspective of teachers, it was also reported that it is difficult to design (Chiang et al., 2014). Additionally, problems with tracking and calibration are indicated as limitations of this technology (Chang et al., 2014; Van Krevelen & Poelman, 2010). Another limitation

is about the lack of technological hardware or the high costs of such technologies (Billinghurst & Dunser, 2012; Furió et al., 2013; Özarslan, 2013). Secondly, the drawbacks of AR technology are evaluated from the perspectives of teachers and students by some researchers. Munoz-Cristobal et al. (2015) and Gavish et al. (2015) stated that the course hours may not be enough to apply AR enhanced activities in an efficient way. Teachers or students may lack knowledge about the device or application or training on how to design AR integrated learning materials (Akkuş, 2016; Altinpulluk, 2019; Dunleavy et al., 2009; Lin et al., 2011; Lu & Li, 2015; Karadayı-Taşkıran et al., 2015). This lack of training or knowledge may result in ineffective classroom integration in that teachers may dominate the lesson and learners may not engage in the activity (Kerawalla et al., 2006). This technology is regarded as not suitable for teaching to a large group of learners (Yoon et al., 2012). Another common downside of AR application according to findings of several studies (Altinpulluk, 2019; Cheng & Tsai, 2013; Dunleavy & Dede, 2014; Kaenchan, 2018) is that these applications may cause a rise in cognitive load when they are utilized for complicated tasks. Regarding learner differences, Freitas and Campos (2008) found out that low achievers benefitted from AR learning experience the most, whereas the same experience did not lead to the same learning gains for high achievers. On the other hand, Hornecker and Dünser (2007) reached the opposite conclusion that low-ability readers did not reap the benefits of textual content displayed through AR tool. These findings indicate that activities including AR tools should be tailored to suit the needs of the learners (Radu, 2014). In addition, some educators and learners may not have direct access to these applications or even certain digital learning environments like computer laboratories (Azuma, 1997; Chang et al., 2015; Cuban, 2001; Küçük, 2015). Nevertheless, this challenge can be overcome with the help of smartphones which allow for using AR applications (Burston, 2017). In a few studies (Chiang et al., 2014), it was stated that AR technology can distract learners' attention. In relation with this, another liability for learners would be attention tunnelling which refers to the condition that learners' focus is more on the visuals and the technology itself rather than on the content (Billinghurst et a., 2003; Morrison et al., 2009 Tang et al.,2013). That is why learners should pay attention more when doing AR-enhanced activities (Morrison et al., 2009). Last but least, AR technology may not be suitable instrument

to teach some topics and content (Azuma, 1997; Küçük, 2015; Peña-Rios et al., 2017). Considering all the drawbacks of AR technology in educational context, teachers and students may prefer not to utilize this technology for teaching or learning purposes (Yuen et al., 2011). Therefore, it is of importance to discern and eliminate these limitations so that learning process and activities proceed smoothly (Batdı & Talan, 2019).

2.6. Material Design for Language Learning

Designing materials have become a common concern in ELT field for a very long time because language learning materials compose a fundamental aspect of language learning process. Tomlinson (1998) defined materials as any artefact exploited by either teachers or learners with the aim of facilitating language learning process. A set of principles describing how to design effective learning materials were established by Tomlinson (1998). According to these principles, materials should have an impact on learners with the help of 'novelty, variety, attractive presentation, appealing content, achievable challenge'; learners should be comfortable with the materials; learners should be able improve their confidence through materials; materials should include relevant and useful content; materials should enable learners to self-discover; learners should be ready to learn both physically and mentally; materials provide learners with authentic and comprehensible language use; materials should attract learners' attention to linguistic features of the input; materials should give opportunities to learners to use language for communicative purposes; learners should not be anticipated to produce immediately; materials should appeal to different learning styles; materials should be designed in accordance with learners' different affective attitude; materials should provide sufficient input till learners gain confidence to produce the target language; materials should be stimulating for both right and left brains; materials should be limited to controlled practice; materials should allocate enough time and space for providing feedback on the output (Tomlinson, 1998, 2010). In this Information Age, technological instruments enable teachers to design and develop their own materials (Howard & Major, 2004). Tomlinson (2012) also pointed out this marked shift in language learning and teaching materials by listing the affordances of technology for

language learning. According to Tomlinson (as cited in Richards, & Burns, 2012), technology motivates learners, provides them with proficient language users' communication, allows for revision and personalised learning, enables them to communicate with other people at a distance, appeals to learners of this era, also known as "digital natives" (Prensky, 2001). Additionally, it was stated that CALL aids in employment of authentic materials with a real-life context in language classrooms depending on "how the technology is implemented" (Reinders & White, 2010, p. 68).

2.6.1. Designing Learning Materials with Augmented Reality

With the rapid improvements in the technological world, a need for change in educational process like replacing the traditional methods of teaching with the contemporary ones arises as well since it is getting harder to keep up with this revolution (Almousa, 2005; as cited in Safar et al., 2017). In addition, the fact that learners of this era are known for their interest in and flair for technology calls for technologically-component teachers who can keep pace with the requirements of this century. Recently, AR technology have become one of the emergent technologies which prevails in the educational context. Even though this technology started to be employed as an instructional tool allowing for designing interactive, authentic, and engaging learning environment and materials (Duh & Klopfer, 2013; Wang et al., 2018), its use in language learning is not as widespread as it is in other fields of education (Manuri & Sanna, 2016). Considering all the principles of designing effective learning materials and the affordances of AR application for language learning, AR can meet some of these principles and therefore, it can be exploited for designing effective language learning materials (Kaenchan, 2018; Karacan, 2019; Safar et al., 2017).

In the last decade, there have been attempts of designing AR-enhanced materials for language teaching and learning purposes in some studies. The AR-based materials were found to be significantly contributing to learners' motivation and interest (Hung et al., 2017). As a sample study, Taşkıran (2018) conducted a study based on descriptive survey model so as to explore the learners' perceptions of the AR-enhanced language learning materials employed with a game-based approach. The participants

were 83 Turkish students enrolled in the intensive language program and were selected through convenience sampling. Intrinsic Motivation Inventory was administered, and the data gathered were analysed descriptively. It was concluded that the implementation of AR for designing language learning materials for English classes were perceived to be highly motivating and enjoyable. Another study by Hsieh et al. (2014), who examined he impact of AR integrated language learning materials on learners' motivation and acceptance, reached the similar conclusions. The use of AR in vocabulary was found to boost learners' motivation and academic achievement (Solak & Çakır, 2015). In recent years, coursebooks have been transformed into interactive and practical instruments through multimedia integrated with AR technology (Huang et al., 2016; Önder, 2016). Chen (2013) pointed out that AR-based English coursebooks played a major role in learners' academic success in comparison to traditional coursebooks. This may stem from the fact that learners' information retention was facilitated by AR-enhanced books (Dünser et al., 2012). In another study, low anxiety and high user intention to benefit from AR technology in the future were observed when AR-enhanced learning materials were implemented (Küçük et al., 2014). In the similar vein, using AR technology for learning English led learners to have high level motivation and positive perceptions of this technology (Mahadzir & Phung, 2013; Vate-U-Lan, 2012; Wei & Elias, 2011). In a flipped learning environment, the content was found be easily and quickly delivered via AR-based materials (Liou et al., 2016). In a recent systematic review of literature on the utilisation of AR technology for early language learning, Fan et al. (2020) reviewed 53 scientific articles published during the period from 2010 to 2019. According to quantitative and qualitative analysis of these articles, five design principles used for preparing AR-based materials and activities for early language learning have been identified. The first principle is utilisation of 3D models, letters, animations with sound effects for visualising concrete vocabulary items. The second principle is about providing hands-on interaction with learning materials such as flashcards and coursebooks. Another principle was gamification, it was reported that most of the games were spelling games, matching games, collecting games, and puzzle games. Additionally, "congruent spatial mappings between physical representations and digital representations" (Fan et al., 2020, p. 15) was another design principle which

was used as basis for spelling games and teaching prepositions. Lastly, a small number of studies benefitted from location-based features of AR applications. There were instances of both indoor and outdoor activities. In this review, three kinds of early language learning activities have also been determined, and these consisted of "word spelling games, paper-based word knowledge visualisation activity, location-based word knowledge visualization activity and/or spelling games" (Fan et al., 2020, p. 12)

2.7. Impact of Augmented Reality on Language Skills

This section provides the previous studies carried out on the effect of AR technology on language skills. AR-enhanced activities were found to offer some opportunities for language learning, engage language learners, and affect their academic achievement significantly (Akçayır & Akçayır, 2016; Küçük et al., 2014; Richardson, 2016).

2.7.1. Reading

In the last decade, the use of AR application for reading comprehension skills has been investigated through some studies (Bursalı & Yılmaz, 2019; Castillo & Vásconez, 2020; ChanLin, 2018; Tobar-Muñoz et al., 2017; Vate-U-Lan, 2012; Yeh & Tseng, 2020; Yılmaz et al., 2016).

ChanLin (2018) examined how AR enhanced 228 story books, which are created by secondary school students, were employed for children's reading and how they reacted to this type of reading activity. The relevant data were obtained through observation and questionnaire. Based on observations, it was revealed that classrooms and the library were set up by adults. They also scaffolded learners while they were reading stories through their tablets or mobile devices. Thus, they could keep the learners on task. It was also found out that children had a positive perception about the integration of AR into story books and had fun during the reading activity thanks to "rich and vivid reading experience with the visual interface and interactive mode" of AR application (p. 226).

In a similar vein, Vate-U-Lan (2012) designed an AR 3D pop-up book for 3rd grade learners in Thailand and evaluated this AR 3D pop-up book integrated into storytelling

activity in an English course. In this quasi-experimental research, out of 484 third grade students, 99 students were chosen based on purposive sampling. To collect qualitative data, the pop-up book was assessed by five educational technologists before it was used in class. As for quantitative data, pre- and post-achievement tests were carried out. The difference between pre- and post-achievement tests reached statistical significance, which indicated that AR 3D pop-up book led to an increase in learners' achievement.

The use of AR pop-up books and integration of AR technology into storytelling were not limited to only English language. Bursalı and Yılmaz (2019) analysed the impact of AR applications on fifth grade students' Turkish reading comprehension and learning permanency. Eighty-nine pupils were selected based on convenience sampling for this mixed method study. The data gathering instruments were as follows: a reading comprehension pre-test, reading comprehension success test, permanency test and an attitude scale for AR applications. The findings according to the independent sample t-test and content analysis revealed statistical significance between the experimental and control group, which showed that the students in the experimental group performed better in terms of reading comprehension skills and learning permanency than the ones in the control group. They also stated that they had an enjoyable reading experience with AR application. The decrease in anxiety level was also indicated as another finding. It was suggested that AR technology can be utilized in reading courses.

Another study on the use of AR technology for reading comprehension in Turkish was carried out by Yılmaz et al. (2016). This explanatory research aimed to identify the relationship between learners' perception of AR picture books and their comprehension performance in these stories. The sample included 92 five- and six-year-old pre-school students. As data collection tools, an attitude form, story comprehension test, and interview were administered. Descriptive and correlational analysed were employed for quantitative data while content analysis was done on qualitative data. AR enhanced story books were found to be interesting and fun by these learners. Although a positive correlation was identified between their happiness

and reading comprehension, no statistical correlation was found between their enjoyment and reading comprehension.

Additionally, Yeh and Tseng (2020) investigated how EFL learners benefit from multimodal modes (audio and visual modes) to express themselves with AR technology. The sample of this study consisted of 52 Taiwanese EFL students who were expected to introduce the local culture by creating content on an AR application as part of their must course, Multimedia English. Pre- and post-multimodal literacy survey, the modes used by the students, and learners' reflection essays formed the data collection tools. The quantitative data were analysed through paired-sample t-test, while the content analysis was done to analyse the qualitative data. It was reported that learners' experience with AR technology contributed significantly to their multimodal literacy.

In another recent study done by Castillo and Vásconez (2020), how AR technology affects reading comprehension skills of English learners doing their B.A. at a public university in Ecuador. In total, 90 learners were randomly selected and split into two groups. The experimental group completed three reading lessons including image-based AR by using an AR application developed by the researchers. The audio recordings of reading texts and phonetics exercises were also integrated. Pre- and post-tests and semi structured survey were administered to gather data. The findings showed that utilisation of AR contributed significantly to learners' reading skills but there was no significant improvement in their listening comprehension skills. It was also reported that learners felt motivated to maintain studying English outside the class by employing AR application.

Tobar-Muñoz (2017) prepared an AR game with a design-based research approach for enhancing reading comprehension experience of students from Columbia. Fifty-one students from 3rd to 6th grade levels partook in this study. Both quantitative and qualitative data were obtained through Reading Comprehension Questionnaire, Intrinsic Motivation Inventory, and video recording of learners' experience with AR-based game and book. The independent sample t-test was conducted on the quantitative data while the data from the transcription of the videos were analysed

based on the principles of Grounded Theory. In contrast with the previously mentioned studies, there was no significant difference between the experimental and the control groups in terms of reading comprehension level. However, the learners in the experimental group showed greater motivation and interest during the activity as learners' skills of problem solving, exploration and socialisation were facilitated with the help of AR-based game.

To sum up, a number of studies have been carried out concerning learners' reading skills, and almost all studies, except the study of Tobar-Muñoz (2017), reported that AR technology had the potential to make contribution to reading comprehension skills of learners.

2.7.2. Listening

Up to now, several attempts have been made to explore the impact of AR technology on learners' listening comprehension skills (del Río Guerra et al., 2020; Liu, 2009; Suwancharas, 2016).

Liu (2009) prepared "Handheld English Language Learning Organization (HELLO)" which included AR integrated ubiquitous learning environment and intended to facilitate English language learning. This case study, which adopted a quasi-experimental research design, aimed to determine the impact of this learning platform on learners' performance. To this end, data from 64 students at a high school was collected. As instruments, pre-test, three tests, post-test, and interviews were used. The aim of three tests was to assess listening and speaking skills of learners. Analysis of covariance (ANCOVA) was done to check if there is significant difference between the two groups. Except the pre-test, all the test reached a statistical significance, which indicated that the experimental group performed better in listening and speaking tasks than the control group, and this AR based platform contributed at a significant level to their learning.

Suwancharas (2016) designed a multimedia tool with AR so as to improve undergraduate learners' listening skills. In this experimental research, 30 junior students voluntarily participated, and they were separated into three groups based on

their English language proficiency. The data were obtained through pre- and post-listening tests and satisfaction questionnaire. Descriptive statistics and t-test were employed for analysing the data. The findings showed that learners improved their listening comprehension skills in English at a significant level as a result of their multimedia learning experience with AR technology, and the learners were satisfied with the integration of AR into their courses.

In a recent research conducted (del Río Guerra et al., 2020), the efficiency of AR and video for listening comprehension tasks was compared. The study was carried out with the 32 elementary school students who had different levels of reading comprehension (high versus low). The participants were selected based on criterion sampling. A nationwide reading test was taken as the basis, and students who scored 17 or 18 on this examination were considered to have high reading comprehension whereas those whose score is 15 or less were regarded as having low reading comprehension. The leaners in AR group completed the activities by using the AR-enhanced version of a story while the learners in video group performed the activity by watching the video of the same story. Once the activities were finished, the participants completed a listening comprehension test. The findings based on ANOVA indicated that the difference between the lesson format and learners' performance was not significant, which meant that the way the students completed the activity did not make a significant difference on their listening comprehension. Nevertheless, the learners with high reading comprehension level in AR group performed significantly better than the ones with the low reading comprehension level. According to results of Welch's t-test, reading comprehension level led to a significant difference on the time spent on the exam, but lesson format did not cause a significant difference.

To conclude, AR-based listening activities have improved learners listening comprehension skills at a significant level whereas the recent study by del Río Guerra et al. (2020) reached the opposite conclusions in this context.

2.7.3. Speaking

There have been a few scientific investigations into the utility of AR technology for oral communication skills in the last decade (Dalim et al., 2020; Shea, 2014).

Dalim et al. (2020) designed TeachAR which combines AR technology with speech recognition technology in order to teach topics such as colours, 3D shapes, and spatial relationships to young learners. The main goal of this study was to evaluate if this design was efficient regarding these four aspects "learning gain, task completion time, enjoyment and perceived ease of use." One hundred and twenty Malaysian pre-school children took part in this research. As data gathering tools, pre and post-test, task completion time, Intrinsic Motivation Inventory were employed. For both quantitative and qualitative data analysis, Kruskal-Wallis H Test was run and if this test revealed any significant difference, Dunn-Bonferroni post hoc test was done. The results indicated that as AR technology significantly contributed to learners' engagement and learning gains, it was found to be an efficient instrument for young learners. The learners had high level of motivation and showed inclination towards AR application as well.

Shea (2014) carried out a case study on learners' perceptions of the integration of an AR mobile game into Japanese learning process and its impact on learners' "willingness to communicate". Nine students studying Japanese at a university located in California joined into this dissertation study and played this AR game for three weeks. To gather data, demographic survey, observations during gameplay, and semi-structured interviews were utilised. The qualitative data were analysed according the steps suggested by Creswell (2009). The researcher concluded that AR mobile games had a positive impact on learners' willingness to communicate, and these games also decreased learners' L2 anxiety, fostered "personalised learning", and facilitated out-of-class learning.

In conclusion, it was indicated that AR technology play a significant role in learners' speaking skill and decreasing their L2 anxiety, but there is not enough study to make generalisation, and there is still need for further research.

2.7.4. Writing

Several studies investigating the employment of AR technology for teaching and learning writing skills have been carried out (Helwa, 2019; Liu & Tsai, 2013; Wang, 2017a; Yılmaz & Göktaş, 2017).

Liu and Tsai (2013) conducted an exploratory case study in order to design an AR-enhanced learning material which provided learners with scenic spots so that they can get information about the buildings, places and views they found interesting. Another aim of this research was to explore whether learners' writing compositions in English could be facilitated with these AR-based materials. Five undergraduate students taking an English composition course formed the sample group of this study. As data gathering instruments, researchers benefit from learners' essays and reflections about their experience with AR technology. The quantitative data were based on the number of words in students' essays while the reflections were analysed qualitatively. As a result of this research, AR-based learning materials were found to support learners' linguistic and content knowledge, and thus, they could write meaningful compositions.

Yılmaz and Göktaş (2017) made an attempt to examine the impact of AR application on elementary learners' story writing skills. The stories were analysed in terms of narrative skill, length of the story and creativity. Post-test-only design with a non-equivalent group model was adopted. One hundred pupils at fifth grade level were selected as the sample with purposive and convenience sampling. A narrative scale and creative story form were utilised for collecting data. To analyse data, one-way MANOVA and multiple correlation tests were conducted. The difference between the experimental and control groups was statistically significant in terms of their narrative skills, story length, and creativity. The learners who used AR application performed better in their story writing activity. Additionally, all these variables had a positive correlation between them.

Helwa (2019) evaluated if mobile AR applications are efficient in developing pre-service teachers' descriptive writing skills and motivation for English language. This study adopted a mixed method research methodology. The sample included 35

students studying at faculty of education in Egypt. The data collection tools consisted of descriptive writing skills test, motivation questionnaire, and semi-structured interview questions. The findings showed that mobile AR technology had significant contributions to learners' EFL writing skills as they performed statistically better in the post test compared to pre-test. Their motivation towards English language also increased.

Wang (2017a) studied the use of AR-based materials for teaching Chinese writing to high-school students who were 30 students at twelfth grade. Within the scope of this experimental study, questionnaires and interviews were employed to reveal learners and teachers' perceptions of AR-enhanced materials. The learners in the experimental group performed better in their writing tasks in terms of content control, article structure, and wording.

All in all, the impact of AR-based writing task was found to be significant based on these studies although there is a need for further research.

2.7.5. Vocabulary

During the last decade, there has been a growing body of research investigating the implementation of AR application for teaching and learning vocabulary, and this area has been the most studied language sub-skill regarding the integration of AR into ELT field (Akçayır & Akçayır, 2016; Barreira et al., 2012; Chen & Chan, 2019; Chen & Wang, 2015; Çakır et al., 2015; Çevik et al., 2017; He et al., 2014; Jalaluddin et al., 2020; Juan et al., 2010; Safar et al., 2017; Santos et al., 2016; Solak & Çakır, 2016; Tandoğan, 2019; Tsai, 2020; Yaacob et al., 2019).

Some of the studies were carried out at tertiary level (Akçayır & Akçayır, 2016; Çakır et al., 2015; Doğan, 2016; Tandoğan, 2019). Akçayır and Akçayır (2016) did a research to examine whether AR technology affects learners' vocabulary learning and retention. In this study based on a quasi-experimental pre-test and post-test control group design, there were 91 freshmen who were divided into two groups, experimental and control groups. A multiple-choice test was administered before and after the experiment, and the data were analysed through an independent sample t-test and ANCOVA. The findings revealed statistical significance between the two groups,

which showed that vocabulary learning through AR technology contributed to students' vocabulary learning and retention skills at a significant level.

As part of master thesis study, Tandoğan (2019) probed if learners' vocabulary learning and motivations were fostered through instructional materials designed based on the principles of ARCS motivation model. The sample group of this quasi-experimental study included 67 engineering students who had upper-intermediate level of English. As a data collection tool, a vocabulary achievement test and motivation survey were carried out both before and after the experiment. Ten of the students were interviewed about their experience with AR. Independent sample t-test was run to check if there was a significance between the two groups whereas content analysis was done on qualitative data. Both vocabulary achievement test and motivation survey revealed statistical significance between two groups. The students who were exposed to the AR experience had high level of motivation and were more successful in vocabulary achievement test. The data from the semi-structured interview demonstrated that the students had positive views about the AR technology.

In another master thesis study conducted by Doğan (2016) at higher education level, the effect of AR enhanced materials on vocabulary learning retention was investigated. In this research which adopted a mixed-method research design, the data were collected from 40 elementary level students studying at a university in Turkey. Vocabulary knowledge test and semi-structured interviews were employed as data gathering instruments. The data analysis based on independent sample t-test and ANCOVA indicated that AR enhanced materials significantly affected not only vocabulary learning but also retention. The learners also expressed that they had positive opinions about the integration of AR technology into vocabulary learning process.

In the similar vein, Çakır et al. (2015) studied the impact of AR applications on learners' academic achievement and motivation. This quasi-experimental research was carried out with 60 undergraduate students. The relevant data were gathered through achievement test and "Instructional Materials Motivation Survey". An independent sample t-test was run to analyse the data. In the achievement test, the experimental

group performed better than the control group and had higher level of motivation according to the findings of motivation survey.

A few studies have been conducted at pre-school level of education (Çevik et al., 2017; He et al., 2014; Safar et al., 2017). Çevik et al. (2017) examined whether mobile-based AR technology affects students' vocabulary learning in English. This experimental study was done with the participation of 31 students at pre-school level. A vocabulary checklist was utilised to check how many word students learned. An independent sample t-test showed that the difference between the groups were statistically significant in favour of the experimental group.

He et al. (2014) scrutinised the application of a mobile-based software including AR technology which was developed with the purpose of English language learning. In this experimental research, English words were taught with their pronunciation and virtual images to 40 pre-school pupils who were equally divided into experimental and control groups. The findings from the pre- and post-tests were analysed with an independent sample t-test which showed that learning achievement was significantly higher in favour of the experimental group learners who experienced AR enhanced mobile assisted language learning. Therefore, the interviews with the teachers indicated their positive perceptions of this immersive technology.

Similarly, Safar et al. (2017) worked with pre-school children in order to examine the use of AR in teaching English alphabet in the state of Kuwait. To this end, this empirical research employed 42 pre-school children who were randomly assigned to experimental and control groups. An observation card and an achievement test were used to gather data. The analysis based on the Mann-Whitney test indicated that learners in the experimental group were more successful than the ones in the control group in the achievement test, and they had higher level of interaction with the English alphabet through AR technology. The analysis of the Spearman test demonstrated that the relationship between learners' interaction with the English alphabet and their achievement test scores was strong and linear.

Primary school had been the learning environment used as the study context in some studies (Barreira et al., 2012; Jalaluddin et al., 2020; Juan et al., 2010; Chen & Wang,

2015; Solak & Çakır, 2016; Tsai, 2020; Yaacob et al., 2019). Juan et al. (2010) worked on the impact of AR based spelling game on primary school students' vocabulary learning. Thirty-two children were equally divided into experimental and control group. The experimental group played five AR based spelling game while the control group played five real equivalents of the game. After each game, learners were asked to complete a post-game questionnaire with 7-point Likert scale. When two games were compared with paired sample t-test, only significant item in the questionnaire was that they enjoyed using the AR game for learning English vocabulary. Nevertheless, the independent sample t-test revealed no statistical significance between the two groups regarding their learning outcome.

In another study, Barreira et al. (2012) designated Matching Objects and Words (MOW), an AR based game for vocabulary learning. In this case study, the participants were 26 Portuguese pupils who were studying at third grade. Before the implementation, diagnostics test was administered to ensure that the level of both groups was equal. During the implementation, learners were provided with visual and auditory clues so that they can learn pronunciation and spelling of the animal names. After the experiment, formative test was conducted to measure the learners' progress in English language learning. According to comparison of the results of two groups, it was reported that the experimental group who played AR game made a significant progress in learning English vocabulary.

Similarly, Chen and Wang (2015) investigated if the difference in learning styles and English language proficiency level affect learners' vocabulary learning which was assisted with mobile AR technology. The learning styles in focus were field independence and dependence, and the difference between these two learning styles lies behind whether learners can study any subject on their own or not. This quasi-experimental study was conducted with the participation of 52 third grade students from Taiwan. Pre- and post-tests were administered to check learners' vocabulary knowledge. After the experiment, questionnaire about their learner motivation was given, and semi-structured interview were held with the students as well. The data analysis based on ANCOVA and independent sample t-test indicated that although

there was a statistical difference between two groups in favour of the experimental one in terms of their vocabulary learning outcomes, the two groups did not significantly differ with regard to their learning motivation and proficiency level in English.

In 2019, an action research was undertaken by Yaacob et al. with the aim of exploring whether AR enhanced flashcards are efficient for improving low ability level learners' vocabulary. Ten students at grade one level were selected based on convenience sampling. Pre- and post-tests were employed to gather quantitative data which were descriptively analysed. For collecting qualitative data, observations and interviews were conducted, and the data were coded and categorised under certain themes. The findings demonstrated that AR-based flashcards facilitated all ten students' vocabulary knowledge, and these flashcards enhanced learners' motivation and engagement.

In a longitudinal study by Jalaluddin et al. (2020), the impact of mobile AR application on ESL low achievers' vocabulary knowledge was examined. To this end, this experimental research with one group pre-test- and post-test design was done with 45 second grade students registered to LINUS program which is conducted to facilitate low achievers' learning process at school situated in Malaysia. The application in focus was also evaluated according to the framework of the ADDIE Instructional Design method. As a data collection instrument, British Picture Vocabulary Scale III was administered before and after the six months of treatment. Additionally, the spelling test was done to investigate accuracy in writing the target words. A paired sample t-test was done to analyse the quantitative data, and the spelling test was descriptively analysed. The results revealed that mobile AR application contributed significantly to the learners' vocabulary knowledge. However, they still had difficulty in writing the target words.

In a recent study conducted by Tsai (2020) at primary school located in Taiwan, traditional vocabulary teaching method was compared with the AR-based vocabulary teaching method. Forty-two pupils at fifth grade level took part in this study which was based on unequal pre-test and post-test design experimental research design. The quantitative data were collected with English vocabulary tests and an instructional materials motivation questionnaire while the qualitative data were obtained via

structured interviews. The findings of the independent samples t-test showed that the experimental group who experienced AR-based vocabulary teaching performed significantly better than the control group in English vocabulary test. The data from instructional materials motivation questionnaire were also analysed via independent samples t-tests. All the sub-dimensions of this questionnaire including attention, confidence, satisfaction, and relevance were significant in favour of the experimental group, which indicated that AR-based vocabulary teaching affected learners' motivation in a positive way in comparison to traditional vocabulary teaching method. Lastly, the thematic analysis of the qualitative data revealed the benefits and drawbacks of AR technology in that this technology is exciting, interesting, and motivating whereas it was distracting, harmful for their eyes, not preferable for learning words.

At the secondary school level, Solak and Çakır (2016) carried out a quasi-experimental study with the aim of discovering the role of AR technology in learning vocabulary. The sample consisted of 61 fifth grade students studying at a state elementary school. Pre-tests and post-tests were administered to both experimental and control groups. Independent sample t-tests analysis revealed that the learners who were exposed to AR enhanced vocabulary learning had significantly better vocabulary retention.

In the similar vein, Santos et al. (2016) developed a handheld AR system based on the principles of multimedia learning and attempted to teach German and Filipino by making use of situated vocabulary learning. For learning Filipino words, 31 students took part in the study and completed tests about the words they learned and the usability of the system. As for learning German words, 14 students partook in the study by filling in a word-recognition test and "Instructional Materials Motivational Survey". The conducted tests were analysed through independent samples t-test, paired sample t-test, and ANCOVA. The findings showed that AR technology significantly fostered vocabulary retention and facilitated learners' attention. However, vocabulary learning outcomes were similar for each group.

In contrast with the studies referred related to the use of AR in vocabulary learning, Chen and Chan (2019) found no statistical significance between the AR-based and

traditional flashcards in their study which investigated the integration of AR flashcards into vocabulary teaching to kindergarten learners. In this quasi-experimental research, the participants included 98 pupils who were five and six years old and four teachers from China. Pre- and post-vocabulary achievement test were conducted for students while the interviews were held with the teachers. Paired-sample t-test and independent sample t-tests were done for quantitative data analysis while qualitative data were coded. The findings revealed that although no statistical significance was found between learning with AR flashcards and traditional flashcards, each method contributed significantly to learners' vocabulary knowledge. The teachers pointed out the challenges of using AR flashcards.

Until now, a great body of research has been carried out, and most of these studies pointed out the utility of AR technology on vocabulary learning whereas only two studies reached the opposite conclusions.

2.7.6. Grammar

As one of the language sub-skills, grammatical structures were included in the studies although the use of AR technology for teaching and learning grammar was not directly examined (Mahadzir & Phung, 2013; Scrivner et al., 2016; da Silva at al., 2015). However, several suggestions have been offered in the literature.

First, AR application can be integrated into the textbook to provide further information about grammatical structure (Zhang, 2018). Secondly, Bonner and Reinders (2018) put forward a suggestion that a narrative can be broken down into several pieces, and each piece can be illustrated through a separate AR target. Then, learners can be asked to complete this jigsaw activity by putting together these pieces so as to comprehend the full content of the story. Thirdly, marker-based AR projects can be prepared by learners, these projects can be employed for teaching words and grammar (Godwin-Jones, 2016). Moreover, a few studies offered suggestions for further studies on the use of AR technology for teaching and learning grammar. Bursalı and Yılmaz (2019) suggested that its implementation can be examined in relation to grammatical structure along with other language skills. Additionally, Solak and Çakır (2016) recommended

that a course syllabus for adult learners can be designed with the integration of AR technology, and this course design can be scrutinised in a longitudinal study.

Even though several practical ideas have been recommended for employing AR technology for teaching and learning grammatical structures, there is a need for further investigation into this area due to the scarcity of research studies.

2.8. Pre-service Language Teacher Education

The world has been in an ever-changing process since the beginning of the time, which requires countries to have 'high quality human resources' to adapt to these changes in every walks of life including education (Seferoğlu, 2004). In order to adjust to the changes in language education, a need for revision of pre-service language teacher education curriculum may emerge.

2.8.1. Pre-service Language Teacher Education in Turkey

Language teacher education programs in Turkey have gone through various regulations. Even though the roots of first English language education program trace back to the foundation of Robert college in 1863 (Kırkgöz, 2011), it was only after the foundation of Turkish Republic has English become one of teacher education programs (Aygün, 2008). Starting from 1982, all teacher education programs have been governed by Higher Education Council (Seferoğlu, 2004). With the reform implemented in 1990s, uniformity in terms of curriculum was aimed in teacher education programs of all subject areas. The latest change in the language teacher education curriculum occurred in May 2018 in line with the decision of Higher Education Council. Thus, the same curriculum has been followed by all English Language Teaching Departments in Turkey. In this curriculum, there were language skills courses in the first year of the program, followed by theoretical courses on ELT, Linguistics, and English Literature courses in the second year. In the third year, the curriculum included methodological courses which require pre-service language teachers to prepare lesson plans and conduct micro-teachings. In the last year of the program, teacher candidates visit practicum schools so as to make observations and complete teaching tasks under the supervision of their instructors and mentor teachers.

In addition to the field related courses, pedagogical courses including educational psychology and philosophy, classroom management, material design, and Turkish Education system exist in the curriculum. Although a uniformity can be anticipated with this change in the curriculum, the teaching style and opinions of the course instructors will lead to some variation due to selection of different materials and resources (Karacan, 2019). When pre-service language teachers graduate from this 4-year long undergraduate program, they become eligible to be appointed as in-service language teachers to state schools by taking KPSS, a public personnel selection examination (Seferoğlu, 2004). Some graduates may prefer to work in private schools at different levels ranging from pre-school to high school as English language teachers.

2.8.2. Integration of Technology in Pre-service Language Teacher Education in Turkey

Richards (2014) stated that "The use of technology in teaching becomes more important in present times, because teachers also have to be able to keep up with the technological knowledge of their students" (p. 2). Therefore, not only pre-service teachers but also teacher educators are expected to gain the necessary knowledge of technology (Aslan & Zhou, 2015; Barzaq, 2007; Koçoğlu, 2009; Moradkhani et al., 2013; Prensky, 2001). As providing the essential hardware and software to the schools does not guarantee effective integration of technology into instruction (Gülbahar & Güven, 2008), teacher education programs have started to incorporate technology into curriculum in order to prepare teachers to be technology proficient (Braul, 2006; Rosaen et al., 2003; Tondeur et al., 2013; Yüksel & Kavanoz, 2011).

In Turkey, the curriculum of pre-service language teacher education included three ICT courses, Computer I, Computer II, Instructional Technology and Material Development, in 2006 while there were two ICT courses which are Information Technologies and Instructional Technologies in the latest curriculum designed for pre-service teacher education programs by Higher Education Council (HEC). Information technologies courses description contains the following topics "Information technologies and computational thinking; problem solving concepts and approaches; algorithm and flow charts; computer systems; basic concepts of software and

hardware; operating fundamentals of systems, current operating systems; file management; utilities (third party software); word processing programs; calculation/ table/graphic programs; presentation programs; desktop publishing; database management systems; Web designing; internet use in education; communication and collaboration technologies; safe internet use; information ethics and copyright; computer and effects of the internet on children / young people" (HEC, 2018). As for Instructional Technologies course, the suggested topics are as follow: "Information technologies in education; classification of teaching process and instructional technologies; theoretical approaches to instructional technologies; new directions in learning approaches; current literacy; instructional technologies as tools and materials; design of teaching materials; thematic designing teaching material; creating area-specific object warehouse, teaching material evaluation criteria." (HEC, 2018). According to these course descriptions, it was concluded that pre-service teachers are to acquire how to integrate technological tools into their instruction via Instructional Technologies course (Gündüz & Odabaşı, 2004). Despite these ICT courses in the curriculum, teacher candidates' knowledge and skills in terms of technology integration lagged behind their students (Göktaş, 2006). That is why it was put forward that courses throughout the curriculum are supported with instructional technology tools so as to increase learners' exposure to technology use (Anger & Mathcers, 2005; Göktaş & Aybat, 2006). Even though it was stated that pre-service teachers' gains from these courses (Aslan & Zhu, 2017) and higher exposure to technology (Agyei & Voogt, 2011; Watson, 2006) are significant predictors of pre-service teachers' intention of technology integration, whether pre-service teachers taking only two ICT courses will be technology-proficient when they graduate is still open to question. Regarding the scope of this study, AR technology has had problems in taking its place in educational context because Manuri and Sanna (2016) claimed that teachers could not "develop deployable content" (p.25). Therefore, the necessity of training pre-service and in-service teacher on how to use AR application in instruction and designing materials have been emphasized (Kaenchan, 2018; Karacan, 2019; Kesim & Özarslan, 2012).

2.9. Perceptions of Augmented Reality

To better understand the effectiveness of AR technology for language teaching and learning purposes, many studies have reported the perceptions pre-service teachers, in-service teachers, and learners about AR-enhanced learning materials. In the following two sections, the studies on the learners' and teachers' perceptions of AR technology are presented, respectively.

2.9.1. Learners' Perception of Augmented Reality

In the recent decade, with the fast spread of AR technology, learners' perception of AR technology and its implementation in certain classes have been one of the most common studied field (Abd Majid et al., 2015; Alizadeh et al., 2017; Cheng, 2017; Chen & Wang, 2018; Gündoğmuş et al., 2016; Han et al., 2015; Ibáñez et al., 2016; Küçük et al., 2014; Liu et al., 2018; Majid & Yunus, 2018; Wojciechowski & Cellary, 2013; Yang & Mei, 2018)

At pre-school level, two research studies the learners' perceptions of AR technology have been identified (Han et al., 2015; Majid & Yunus, 2018). An exploratory study was carried out by Han et al. (2015) so as to scrutinise learners' perception of computer- and robot-mediated AR technology which was employed to prepare interactive and participatory dramatic play activities for pre-school level. To this end, 81 children took part in this study by filling in a survey which aimed to measure learners' perceptions of AR facilitated dramatic play activities with regard to their satisfaction, sensory immersion, and media recognition. Based on the findings of independent sample t-test, it was concluded that the learners in the robot-mediated condition demonstrated significantly higher perceptions than the ones in the computer-mediated condition in terms of three aspects, "interest in dramatic play, interactive engagement, empathy with media". Another finding was that younger learners and girls had more positive views about AR-based dramatic play activities compared to older learners and boys. In addition to this, Majid and Yunus (2018) prepared an AR-based mobile application for letter recognition and examined the opinions of both teacher and learners about this instrument. The researchers developed two versions of

this application and the second version included more multimedia widgets with the aim of increasing learners' engagement with the letters. For this case study, a teacher and six pre-school students were observed during their use of the AR letter kit. The analysis of the observations suggested that both the teacher and learners held positive perceptions of AR letter kit, especially the second version of the application. It was also found out that the students interacted more with the letters via the second version of the application by pointing, responding, and inspecting while doing the activity.

At primary school level, Liu et al. (2018) designed a 45-minute English lesson by making use of an AR application in a primary school in China. The goal of this study was to determine how AR applications affect an English language lesson and learners' perception of AR technology in English classes. For this purpose, 45 students and teachers were interviewed after the implementation process. The students stated that they had positive views about the use of AR in English language courses. The teachers pointed out the advantages of this technology by expressing that it helps creating "a realistic language context in the classroom environment" (p.5).

As for the secondary school level, Küçük et al. (2014) examined if achievement levels of students affect their cognitive load and attitude and if there is any correlation between these variables. For this purpose, this study adopted causal-comparative and correlational methods. The participants consisted of 122 fifth grade students who completed three data collection instruments, AR applications attitude scale, cognitive load scale, and achievement test. The attitude scale was based on 5-point Likert scale while the cognitive load scale was designed with 9-point Likert scale. Descriptive analysis, one-way MANOVA, and Pearson's multiple correlation test were conducted. The analysis revealed that there was a statistically significance difference in terms of learners' attitude in favour of the successful students. It was concluded that the learners were happy to benefit from AR technology to learn English and their anxiety level was low. They also stated that they intended to use this technology in their future classes.

Additionally, Gündoğmuş et al. (2016) examined learners' attitude towards AR technology which can increase their motivation toward listening tasks and improve their listening comprehension skills. Within the scope of this descriptive study, the

listening tasks were enhanced through AR technology. An attitude scale was administered to gather data from 60 sixth grade level students. The results of descriptive analysis indicated that learners had a positive perception of AR applications in English language learning and also had fun during these lessons. They also expressed their intention to use this technology in the future as it is an attractive instructional tool which also fosters their motivation.

In another study, the relationship between the learner presence and learners' perception, learning achievement and learner presence in AR-enhanced learning environment was examined by Chen and Wang (2018). The study was conducted with a one-group pre-test-post-test method. The data from 60 secondary school students were collected through three instruments, an achievement test, a learners' presence inventory, a questionnaire about learners' perception. According to independent sample t-test and partial correlation analysis, the results indicated that there was a significant correlation between learners' presence and academic achievement in AR-based learning environment. The multiple correlation analysis showed that presence was a significant factor in learners' achievement and perception in an immersive learning environment. In order for AR-based activities to be efficient, it was suggested that the lessons should be well-planned which would lead to positive perception and high level of presence, which ultimately affects the learners' academic achievement.

Similarly, Wojciechowski and Cellary (2013) conducted an empirical study in a chemistry course to investigate learners' perception of AR-based learning environment through ARIES, an "e-learning system that allows teachers to be part of authoring process of interactive educational scenarios.". The subjects consisted of 42 secondary school students who were registered to a chemistry course. The data were obtained via a TAM questionnaire. The relationship between the components of TAM was checked through regression analysis. It was concluded that two constructs, perceived usefulness, and perceived enjoyment, played a significant role in learners' attitude towards AR-enhanced leaning environments. Perceived enjoyment was more determining factor in learners' plan to make use of AR applications in the future compared to perceived usefulness.

At the tertiary level, there have been several attempts to explore learners' perceptions of AR technology in a variety of fields. In computer science field, Abd Majid et al. (2015) scrutinised learners' opinions about the implementation of AR technology for learning microprocessor. To this end, a mobile application was designated for the purpose of teaching and learning this subject. This study adopted the ADDIE model which is composed of five stages: Analysis, Design, Development, Implementation, and Evaluation. The data were collected through questionnaire with 5-point Likert scale from 24 sophomores registered in a computer organisation and operating system course. The descriptive analysis of the data indicated their motivation to benefit from AR technology in learning and their satisfaction for making use of this technology.

In a correlational study carried out by Cheng (2017), the aim was to unveil the relationship among learners' cognitive load, motivation, and attitude when they were engaged with AR based reading activity. To this end, 153 university students partook in this study by completing three different surveys. The data were analysed with paired-sample t-test and within-subject ANOVA. The results indicated low cognitive load, high level of motivation, and positive views about their experience with AR based book. When the learners had high level of motivation, they thought positively about the usefulness of AR technology and intend to use AR technology in the future.

Another study on learners' attitude towards AR-facilitated activity was done by Ibáñez et al. (2016). The sample of the study included 122 engineering students who were expected to solve an electromagnetic problem. TAM survey was administered to gather data which were analysed through regression analysis. The results showed that perceived ease of use played a significant role in perceived enjoyment but not in perceived usefulness, and perceived enjoyment affects learners' perception of AR-based activity and intention to benefit from AR technology.

In relation to foreign language education, Yang and Mei (2018) carried out a case study to explore learners' experience and perception of the integration of AR technology into language learning classes. The participants were seven university students who were to learn Japanese orthography. Semi-structured interviews and observations were

utilised for data collection. The findings based on the thematic analysis indicated that learners' perception of immersive language learning with AR technology was positive.

In the field of ELT, Alizadeh et al. (2017) examined the effectiveness of an AR tool in preparing poster carousels as part of an exploratory case study. The data were collected from 71 undergraduate students who were registered to a blended course of English for General Academic Purposes. These students were expected to prepare posters by using an AR application. During the presentations, learners were observed to understand their attitude towards AR technology. After the poster presentation, the students completed a user experience questionnaire and an open-ended feedback form. The findings revealed that although the students had positive perceptions of their AR experience and many opportunities to be exposed the target language, they also stated that using AR may not directly contribute to English language learning.

Overall, these studies indicated that learners expressed positive views on the implementation of AR technology in classroom environment.

2.9.2. Pre-Service and In-Service Teachers' Perceptions of Augmented Reality Technology

It is of significance to determine whether teachers are ready to adopt and implement these immersive technologies like AR technology as part of their courses (Dalim et al., 2017). This is because teachers play the key role in deciding if any technological tool is integrated into the courses or not. Depending on the teachers' acceptance of the technological tools and their level of readiness, these technological tools can be utilised with the aim of teaching and learning. If teachers have negative perceptions of the instructional technology instruments, then it is less likely to observe the employment of these instruments in learning environments (Jamrus & Razali, 2019). Nevertheless, if their attitude towards the implementation of these technologies is too positive, then it is probable that the attention of both teachers and learners would be on the technology itself instead of the lesson (Yoon et al., 2012). With regard to teachers' technology acceptance and perceptions of the immersive technology, some studies have been carried out in recent years (Cabero-Almenara et al., 2019; Delello,

2014; Kaenchan,2018; Karacan, 2019; Mundy et al., 2019; Nöhrer, 2020; Pasalidou & Fachantidis, 2021; Putiorn et al., 2018; Sural, 2018; Uygur et al., 2018).

Putiorn et al. (2018) designed an AR application and investigated teachers' opinions about this application and its effectiveness in an Astronomy course. In total, 38 pre-service teachers from different departments were asked to reflect on their experience with this technology. Their opinions were obtained through a questionnaire which included four main constructs, "perceived interest and enjoyment, perceived competence, perceived effort/importance, and the level of pressure/tension." The data were analysed with independent sample t-test. The findings revealed that learners' engagement and enjoyment were fostered with the help of AR-based lesson. The female pre-service teachers expressed that learners enjoyed the lesson whereas the male pre-service teachers stated that students felt pressured during the AR-based activity. Additionally, female candidate teachers were more eager to benefit from AR technology compared to male candidate teachers. When schools in rural and urban areas were compared in terms of the use of AR technology, teachers considered that it would be challenging to implement AR technology in the schools located in rural areas.

In an exploratory case study conducted, Delello (2014) investigated the pre-service teachers' views about implementation of an AR application in a science course. The participants were 31 pre-service teachers who were registered to a science methodology course at undergraduate level. After the intervention, reflection papers were used as data collection instrument for retrospective evaluation of pre-service teachers' experience. It was found out that AR technology affected candidate teachers' learning in a positive way by increasing their motivation, engagement, and enthusiasm, and easing the teaching practice. The weaknesses of this technology were stated as "time consuming, teachers' lack of knowledge or skills, and lack of infrastructure."

Another study on pre-service teachers' opinions about the use of AR technology in education was carried out by Uygur et al. (2018). The study based on survey model included 220 pre-service teachers who were studying at faculty of education as the sample group. As the data collection tool, a questionnaire composed of 2 items and an

open-ended question was administered. The qualitative data were analysed descriptively while content analysis was done on the qualitative data. The results showed that the pre-service teachers were not much aware of AR technology, and this technology was evaluated as "entertaining, motivating and facilitating learning" by the ones who knew about this technology. They also stated that this technology should be widely employed in educational fields.

Additionally, Sural (2018) investigated pre-service teachers' views about the integration of AR technology. A marker-based AR application was designed, and pre-service teachers were asked to use this application and reflect on their experience. As data collection tools, cross-sectional survey and open-ended questions were utilised to gather data from 82 pre-service teachers who were chosen based on convenience sampling from Department of Computer Education and Instructional Technology. The descriptive analysis was run on the quantitative data while the content analysis was performed on the qualitative data. The teacher candidates stated that they felt quite excited about the use of AR technology as part of their lesson and that AR application would be useful to teach and learn other topics as well.

In an experimental study, Cabero-Almenara et al. (2019) investigated learners' acceptance of AR technology and if gender plays any role in their knowledge acquisition. In order to conduct this experimental research based on a single pre-test post-test group, three data gathering tools which were a multiple-choice test, TAM survey, and an "ad hoc" for evaluating course notes were employed. The sample group included 396 university students from faculty of education. Paired sample t-test and Pearson's correlation were applied to analyse the data. No significant difference was identified between gender and learners' acceptance of AR technology. Additionally, class notes which were enhanced with AR technology were regarded as easy to use. The learners expressed that they had a good degree of acceptance and plan to use this technology in the future. Lastly, the learners' perceived enjoyment and plan to use AR applications played a significant role in learners' academic achievement.

There have been a few attempts into exploring the pre-service language teachers' view about AR technology (Kaenchan, 2018; Karacan, 2019). Kaenchan (2018) carried out

a mixed-methods study to explore EFL Thai students' experiences with AR technology in their reading course. Firstly, demographic data were gathered from 48 EFL pre-service teachers. Next, they participated a three-phase treatment which included "teacher showcase, AR computer tutorial, and students showcase". During the treatment, observational field notes were taken, and the participants completed TAM survey after each phase of the treatment. At the end of the treatment, semi-structured interviews were held with 24 students. While ANOVA and Pearson's correlation coefficient were used to analyse the quantitative data, the qualitative data were coded and categorised as themes. The students who were not aware of AR technology stated the strengths of this technology as engaging, motivating, and fostering memory and memorisation. Their self-efficacy level in using AR was reported to be relatively high and was affected by various factors, "self-satisfaction, creativity, enthusiasm, peer and teacher assistance, training in technology and infrastructure." As long as they had the time and resources, they would be willing to benefit from AR technology in the future. It was also suggested that the curriculum of English language be rearranged so that AR technology can be integrated to cater for learners' needs and learning styles. Another recommendation was that training in the employment of AR technology for language education should be planned for both teachers and students.

As part of master thesis study, Karacan (2019) investigated the constructs which project pre-service English teachers' plan to employ AR technology in the future by making use of Decomposed Theory of Planned Behaviour. This study adopted a mixed-method research design during which EFL teacher candidates were expected to design AR-based activities for teaching vocabulary items. The quantitative data were obtained from 141 pre-service English language teachers via a survey designed with 5-point Likert scale after they had experienced AR technology. The qualitative data collection instruments were reflection papers written by 55 pre-service teachers and semi-structured interviews conducted with 15 pre-service teachers. In order to unveil the factors impacting pre-service teachers' intention to use AR technology, path analysis was conducted on the quantitative data. On the other hand, the qualitative data were analysed through content and descriptive analyses. The most significant factor of the planned behaviour in this context was perceived usefulness. It was also concluded

that the prospective EFL teachers had positive perceptions of AR applications which were considered to be “attention grabbing and motivation-providing”.

Recently, the perspectives of in-service teachers on the utility of AR technology have been gathered through a few studies (Mundy et al., 2019; Nöhrer, 2020; Pasalidou & Fachantidis, 2021). Mundy et al. (2019) carried out a study on the evaluation of the implementation of AR technology from the teachers’ and administrators’ point of view. The sample group contained 35 teachers and administrators. To this end, the data were collected with the help of a survey which consisted of Likert-scale items and open-ended questions and were analysed through ANOVA in order to find out whether there are any significant differences between groups. Although no significant differences were identified between the groups, AR applications were found to be engaging and enjoyable.

The opinions of the primary school teachers about using AR technology for educational purposes were scrutinised by Pasalidou and Fachantidis (2021). Within the scope of this research, a mobile AR application was designed. After the teachers made use of this application during their courses, they were asked to reflect on their experience with this application by completing TAM survey. The correlational analysis of the data revealed significant relationships between some variables. Perceived usefulness and perceived ease of use were two significant factors in teachers’ intention to use the AR application. The application was regarded as easy to use and enjoyable by the teachers.

As for the secondary school level, Nöhrer (2020) examined Austrian secondary school language teachers’ perceptions of and experiences with digital instruments, specifically augmented and virtual reality, in language teaching. An online survey was administered to gather data from 118 language teachers. The descriptive analysis of the data demonstrated that many teachers were familiar with these emergent technologies, and even a small number of teachers had employed these in language teaching. Even though more than half of the teachers did not have too much hands-on experience and did not know how to utilise this technology for language teaching purposes, they expressed that they held positive perceptions towards using the

immersive technologies. On the other hand, a minority of participants sated their doubts in relation to rapid spread of implementation of this technology in language teaching in the future.

The studies reviewed supported that both pre-service and in-service voiced their positive opinions about the employment of AR technology during teaching and learning process. Nonetheless, they also stated that it would be challenging to benefit from this immersive technology as they lack the necessary knowledge on and experience with this technology. There were also some teachers who believed that the use of AR technology in educational context will not be as widespread as predicted.

2.10 The Implementation of Augmented Reality Technology in Turkish Context

This section provides a broad overview of the implementation of AR technology in Turkish context.

To start with the studies exploring the impact of AR technology language skills, the employment of AR pop-up books for Turkish reading comprehension skills was investigated by Bursalı and Yılmaz (2019) and Yılmaz et al. (2016). For writing skills, Yılmaz and Göktaş (2017) examined the impact of AR application on elementary learners' story writing skills by analysing the stories in terms of narrative skill, length of the story and creativity. As for the effect of AR technology on vocabulary in English, some studies were carried out at tertiary level (Akçayır & Akçayır, 2016; Çakır et al., 2015; Doğan, 2016; Tandoğan, 2019). Akçayır and Akçayır (2016) did a research to examine whether AR technology affects learners' vocabulary learning and retention. Tandoğan (2019) probed if learners' vocabulary learning and motivations were fostered through instructional materials designed based on the principles of ARCS motivation model. Doğan (2016) investigated the effect of AR enhanced materials on vocabulary learning retention. In the similar vein, Çakır et al. (2015) studied the impact of AR applications on learners' academic achievement and motivation. At pre-school level, Çevik et al. (2017) examined whether mobile-based AR technology affects students' vocabulary learning in English. At the secondary school level, Solak and Çakır (2016) carried out a quasi-experimental study with the

aim of discovering the role of AR technology in learning vocabulary. Moreover, the learners' and pre-service teachers' perceptions of AR technology were explored. Gündoğmuş et al. (2016) examined learners' attitude towards AR technology which can increase their motivation toward listening tasks. The pre-service teachers' opinions about the use of AR technology in education was carried out by Uygur et al. (2018) and Sural (2018). Karacan (2019) investigated the constructs which project pre-service English teachers' plan to employ AR technology in the future by making use of Decomposed Theory of Planned Behaviour.

As it can be concluded from this overview, the number of studies conducted in Turkey is limited, and there is a need for further research on the use of AR technology for language skills and the perceptions of pre-service and in-service teachers and learners.

CHAPTER 3

METHODOLOGY

3.1. Introduction

This chapter aims to present the research questions, research design, the context and participants, data collection instrument, the procedure for data collection and analysis, assumptions of the study.

3.2. Research Questions

Within the framework of the current study, the main research questions were as follows:

1. What are the perceptions of the ELT pre-service teachers, who are informed about the integration of Augmented Reality (AR) technologies to English courses, on the use of Augmented Reality to teach English (listening, speaking, reading, writing, vocabulary, grammar) to EFL learners?

1.a. What are the advantages of using AR technologies to teach English?

1.b. What are the disadvantages of using AR technologies to teach English?

1.c. What are the suggestions of ELT pre-service teachers for the use of AR technologies to teach English?

2. What was ELT preservice teachers' acceptance level of augmented reality technology activities after the experience in designing AR enhanced activities to teach English?

3. After completing the activities, what level of self-efficacy did ELT preservice teachers experience in using augmented reality technology?

3.3. Research Design

In the current study, mixed method research design was adopted so as to obtain further in-depth information on EFL teacher candidates' perception of integration of Augmented Reality technologies into English language courses and determine their acceptance and self-efficacy level of AR technology. Mixed-method research design is defined by Creswell (2014) as:

> Mixed methods research is an approach to inquiry involving collecting both quantitative and qualitative data, integrating the two forms of data, and using distinct designs that may involve philosophical assumptions and theoretical frameworks. The core assumption of this form of inquiry is that the combination of qualitative and quantitative approaches provides a more complete understanding of a research problem than either approach alone (p. 32).

As it can be inferred from the definition, the rationale behind the choice of mixed-method research design can be explained in four main aspects according to the typology put forward by Bryman (2006). First, quantitative and qualitative research designs have both some strengths and weaknesses. Therefore, carrying out a mixed-method research can aid researchers in drawing the strengths from these research designs and minimising their weaknesses (Creswell, 2014). Second, making use of both research designs can increase the credibility of the findings. Third, this approach offers an effective way of providing a thorough understanding of the research questions because the findings of the quantitative data can be explained further with the help of the qualitative data gathered at the second phase of the data collection procedure. Additionally, pursuing qualitative approach can help the researcher gain profound insights into the participants' perspective or "put meats on the bones of dry" quantitative data as Bryman (2006) described. Thus, both quantitative and qualitative research designs were employed in this study in order comprehend fully the pre-service EFL teachers' perceptions of the integration of Augmented Reality technologies into English language courses. While the quantitative data described the bigger picture, the qualitative data helped in providing rounded, detailed illustrations with the details regarding prospective EFL teachers' perceptions of Augmented Reality technologies

in English language classrooms. Lastly, conducting a mixed methods research design assisted the researcher in eliminating the limitations of each design.

There are six types of mixed methods research designs classified by Creswell (2014); "convergent parallel design", "explanatory sequential design" "exploratory sequential design", embedded design", "transformative design", and "multiphase design". Mixed methods studies include components or strands which refer to the major steps of carrying out quantitative or qualitative research: research question, gathering data, analysing data, and making interpretations based on the data (Tashakkori & Teddlie, 2009). In order to determine appropriate mixed methods research design, these strands need to be examined in terms of four aspects which are "the level of interaction between strands, the priority of two strands, the timing between two components, where and how to mix strands". The level of interaction between the quantitative and qualitative data depends on whether these two components are independent from each other or interact with each other during any phase of the research. If their relationship is independent, then two types of data are collected and analysed separately but are combined while reaching conclusions. However, if these two strands are mixed at any phase of study such as data collection or analysis, then the relationship between quantitative and qualitative strands is considered to be interactive. The second aspect to take into consideration is to determine which strand has the priority in answering the research questions. In this context, either quantitative or qualitative can be given the priority depending on the importance attached to them in the study. Or they can take equal priority if both have a significant role to play in addressing the research inquiry. The next aspect is about in which order the quantitative and qualitative data are gathered. The timing of data collection can be concurrent, sequential or in multiple phases of the study. Lastly, there are various procedures for how to mix the quantitative and qualitative strands. These procedures include a) combining two data sets, b) determining the data collection for the second phase based on the analysis of the data gathered in the first phase, c) integrating one type of data into a larger design, d) merging two kinds of data with the help of a theoretical framework. As for when to bind two data sets, data can be mixed during data interpretation, data analysis, or data

collection. Another way is to combine two strands at the larger design level by mixing within a theoretical framework or a program-objective framework.

The present study fell into the category of "explanatory sequential design" which is defined by (Creswell, Plano Clark, et al., 2003) as "two-phase mixed methods design" during which qualitative data collection and analysis is preceded by quantitative data collection and analysis, and qualitative data aids in explaining the quantitative data further. Figure 3.1. displays the procedure for gathering and analysing data in sequential explanatory mixed-methods design.

In the current study, the quantitative strand took the priority because pre-survey and post-survey were first administered and marked the initial stage of the data gathering process. Then, the qualitative data were obtained through reflection forms and semi-structured interviews. During this process, the quantitative and qualitative data were gathered separately; therefore, timing was sequential as well. Once the quantitative data were obtained and analysed, these findings guided the collection of the qualitative data. When the analysis was conducted on the qualitative data, the findings coming from qualitative strand were merged with the findings based on the quantitative data during the data interpretation process.

According to this procedure, the quantitative strand adopted one group pre-test-post-test design which requires observing and measuring the group both before and after the treatment (Fraenkel et al., 2012). The independent variable is the employment of AR technologies while the dependent variables are the means obtained through pre-survey and post-survey. The pre-service EFL teachers were first given pre-survey in order to establish their views about the integration of AR applications into English language courses before they gained first-hand experience with AR technology. After they had been informed about how to utilise and operate AR technology, they were asked to fill in the TAM survey so that their acceptance and self-efficacy level in AR technology could be gauged at the initial stages of the study. During the implementation process, the prospective EFL teachers were to design one AR-enhanced language learning material every two weeks to teach any English language skill to any proficiency level of their choice. When they submitted their AR-based language learning material to the researcher, they were expected to complete the

reflection form which enabled the researcher to keep track of the shifts occurring in their views regarding AR technology.

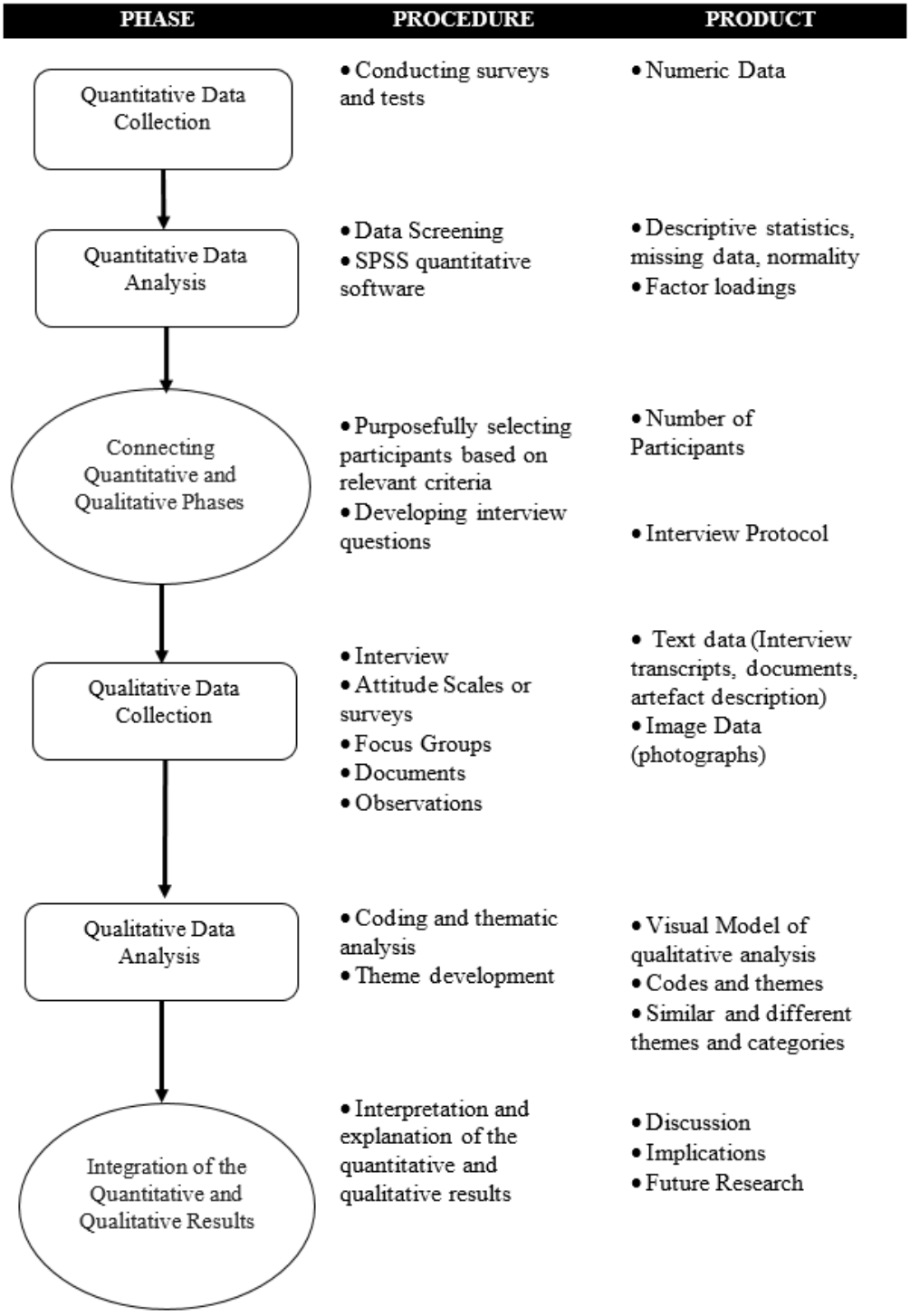

Figure 3.1 Visual Model for Mixed-Methods Sequential Explanatory Design [Adapted and revised from Ivankova et al. (2006)]

In the implementation process, the pre-service EFL teachers could work either in pairs or groups of three. Following the ten-week implementation process, the post-survey and TAM survey were administered so as to investigate whether they have been any changes in their points of view in relation to the utility of AR technology for teaching and learning English and to measure their level of acceptance and self-efficacy in AR.

As for the second phase of the present study, three major data gathering tools, which are namely surveys, reflection forms, and interviews, were employed to obtain the qualitative data. In order to delve further into the perceptions of pre-service EFL teachers on the use of AR technology, they were asked to express their opinions in relation to strengths and weaknesses of AR technology, and their suggestions in written format via reflection forms during the implementation process. Once the implementation period was over, the prospective EFL teachers provided responses to the open-ended questions about the benefits and constraints of AR technology, their intention to use AR technology in the future, comments, and suggestions through the post-survey. Lastly, one-on-one semi-structured interviews were held with twelve participants in order to gain further insights into their first-hand experience. During these interviews, the interviewees were posed the open-ended questions which were prepared beforehand by the researcher. Along with the data obtained through the surveys, reflection forms, and interviews, data triangulation method was utilised to ascertain the reliability and validity of the findings.

Overall, the current study was carried out in the procedure as it is demonstrated in Figure 3.2. to explore pre-service EFL teachers' perceptions of the integration of AR technologies into English language courses, determine their acceptance and self-efficacy level in employing AR technology. First, quantitative data collection instruments, surveys, and reflection form, were prepared and administered, and then qualitative strand was designed and carried out with the help of interviews, reflection forms, and surveys so as to support the results based on the quantitative data by providing further explanations.

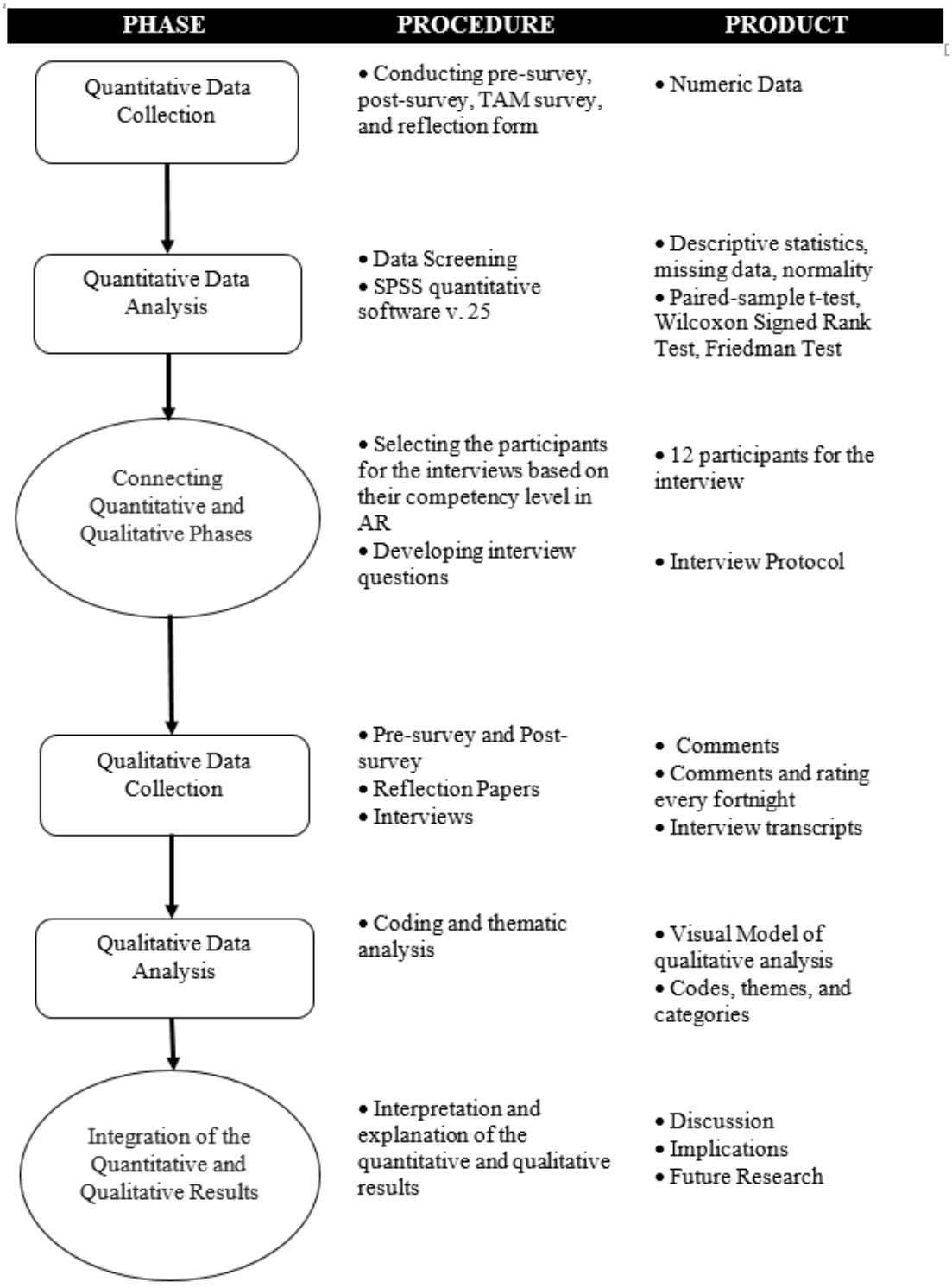

Figure 3.2 Visual Model for the current study [Adapted and revised from Ivankova et al. (2006)]

3.4. The Context and Participants

The population of this study is the pre-service EFL teachers in Turkey. There are 68 public, private, and foundation universities providing B.A. programs in ELT in 2020 in Turkey. However, as reaching all these pre-service EFL teachers was not efficient in terms of time and cost, researcher determined a sample group by applying convenience sampling method. In this non-random sampling method, the participants who are conveniently available and willing to make contributions are recruited for the purpose of research (Fraenkel et al., 2012). Therefore, the researcher, a member of a foundation university offering B.A. program in ELT in Turkey, conducted the study with the voluntary participation of these pre-service EFL teachers who were studying at English Language Teaching Program of this foundation university located in Ankara. Out of the initial cohort of 220 students, 50 students who were registered to Teaching Practice course partook in this study.

3.4.1. Demographics of Participants of the Quantitative Phase

The quantitative phase of the present study was carried out during the spring semester of the 2019-2020 academic year with the participation of 50 pre-service EFL teachers studying at English Language Teaching Program of a foundation university in Ankara. Forty-six percent of them (*N*=23) were 20-22 years old. While 44% of the pre-service EFL teachers (*N*=22) were 23-25 years old, only 10% of them (*N*=5) were 26 and above. Mostly, their age ranged between 20 and 25. The frequencies and percentages of the pre-service EFL teachers' ages are presented in Table 3.1. and Figure 3.3.

Table 3.1 Pre-service EFL Teachers' Age in Quantitative Phase

Age Range	Number	Percentage
20-22	23	46%
23-25	22	44%
26 and above	5	10%
Total	50	100%

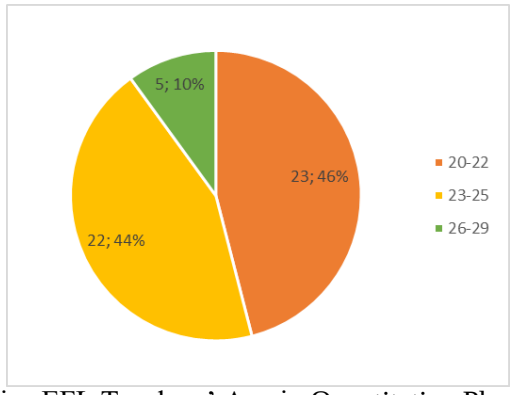

Figure 3.3 Pre-service EFL Teachers' Age in Quantitative Phase

Figure 3.4. illustrates the gender distribution of the pre-service EFL teachers who took part in the quantitative phase of the study, and it was observed that 80% of them (*N*=40) were female while 20% (*N*= 10) were male. Female students who were studying in ELT formed the majority of the participants. The frequencies and percentages of the gender distribution of EFL teacher candidates are demonstrated in Table 3.2. and Figure 3.4.

Table 3.2 Gender Distribution of Pre-service EFL Teachers in Quantitative Phase

Gender	Number	Percentage
Female	40	80%
Male	10	20%
Total	50	100%

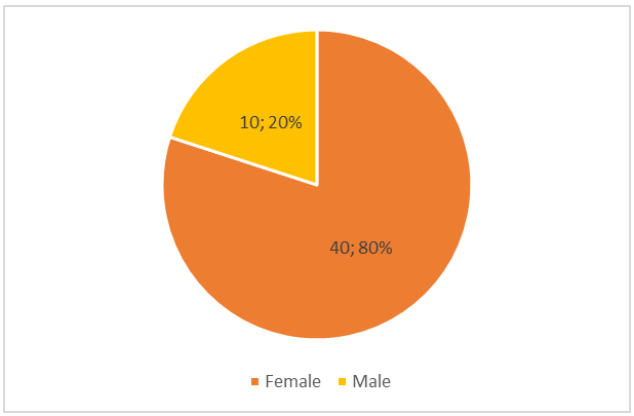

Figure 3.4 Gender Distribution of Pre-service EFL Teachers in Quantitative Phase

As Table 3.3. and Figure 3.5. indicate, 80% of the pre-service EFL teachers who contributed to this study were seniors (*N*=40), whereas 20% of them (*N*=10) were juniors who were also irregular students. Majority of the pre-service teachers were about to graduate from their B.A. in ELT.

Table 3.3 The Class Status of Pre-service EFL Teachers in Quantitative Phase

Class Status	Number	Percentage
Junior	10	20%
Senior	40	80%
Total	50	100%

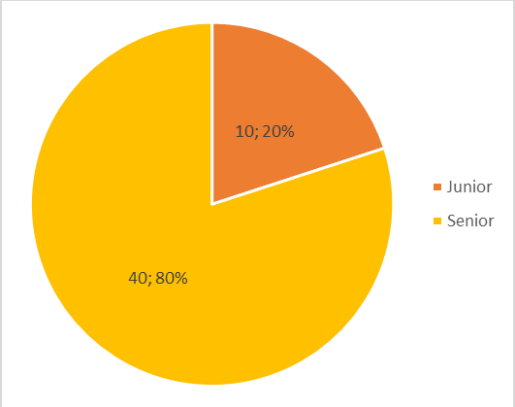

Figure 3.5 The Class Status of Pre-service EFL Teachers in Quantitative Phase

The Table 3.4. and Figure 3.6. indicate that all pre-service EFL teachers have been making use of computers, smartphones, and internet technologies for a long time. More than half of the participants (*N*= 34, 68%) have been using computer and internet technologies for more than 11 years while some of them (N=16, 32%) stated that they have been using these for at least 6 years.

Table 3.4 Pre-service EFL Teachers' Use of Computer, Smart Phone, and Internet Technologies on a Year Basis in Quantitative Phase

Year Range	Number	Percentage
1-5 years	0	0%
6-10 Years	16	32%
11 and above	34	68%
Total	50	100%

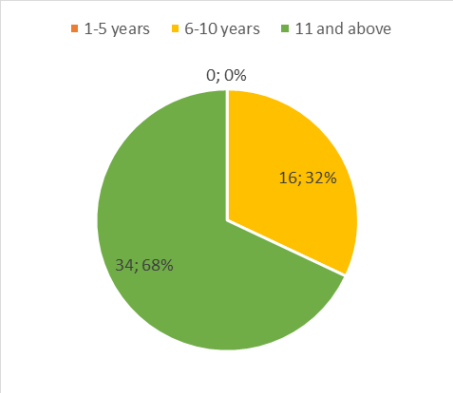

Figure 3.6 Pre-service EFL Teachers' Use of Computer, Smart Phone, and Internet Technologies on a Year Basis in Quantitative Phase

The Table 3.5. and Figure 3.7. summarize the frequencies and percentages for the pre-service EFL teachers' use of computer and smartphone on a daily basis. The number of participants who are using their computer and smartphones for 2 to 4 hours in a day (*N*=23; 46%) were almost equal to the number of participants who are using their computer and smartphones for more than 5 hours a day.

Table 3.5 Pre-service EFL Teachers' Use of Computer and Smart Phone on a Daily Basis in Quantitative Phase

	Number	**Percentage**
Less than an hour	0	0%
2-4 hours	23	46%
More than 5 hours	27	54%
Total	50	100%

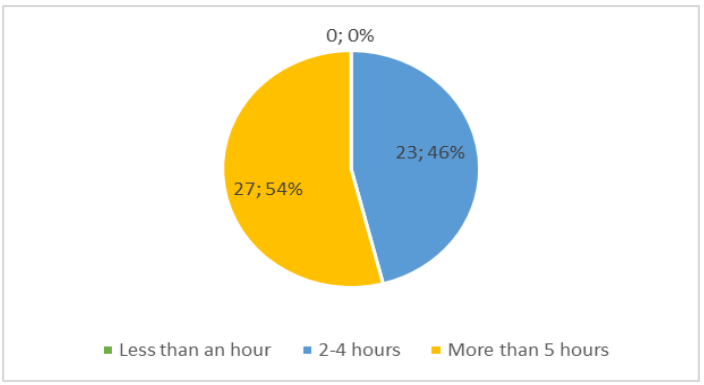

Figure 3.7 Pre-service EFL Teachers' Use of Computer and Smart Phone on a Daily Basis in Quantitative Phase

As it is demonstrated in Figure 3.8. that the participants make use of various means to access to the internet. While all students (N=50, 100%) utilised smartphones as a way of accessing to the internet, 78% of them (N=39) chose computers or laptops for this purpose. Twenty-six percent of them had the opportunity to use tablets as the tool to access to the internet while only one student (2%) indicated smart TV as a means of access to the internet.

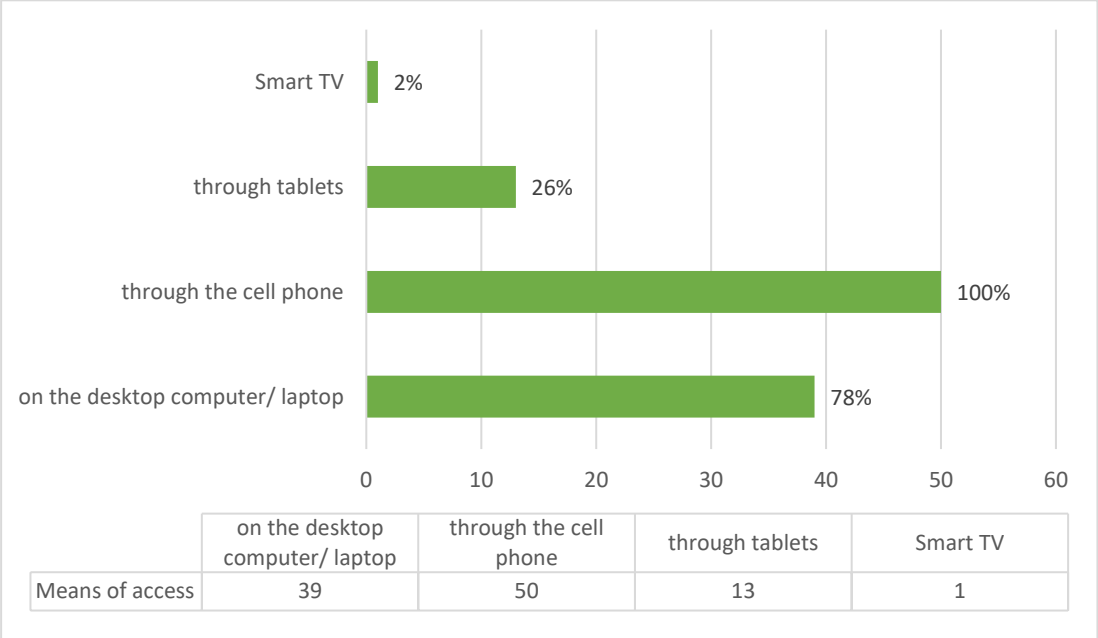

Figure 3.8 The Pre-service EFL Teachers' means of access to the internet

Regarding the pre-service EFL teachers' experience with instructional technologies, all the participants (N=50, 100%) took four compulsory courses which are Computer Literacy, Computer I, Computer II, and Instructional Technologies and Material Design as part of their B.A. program. Additionally, only two participants (4%) stated that they have participated in some formal training on computer and internet technologies which included programming, and web design courses. Majority of the participants (N=48, 96%) have not attended a workshop or a formal training on computer and internet technologies apart from their undergraduate studies.

As it is displayed in Figure 3.9., most of the participants (N=32, 64%) expressed that they are intermediate internet user. Some participants (N=12, 24%) considered

themselves as advanced internet users whereas only six of them (12%) defined themselves as basic internet users.

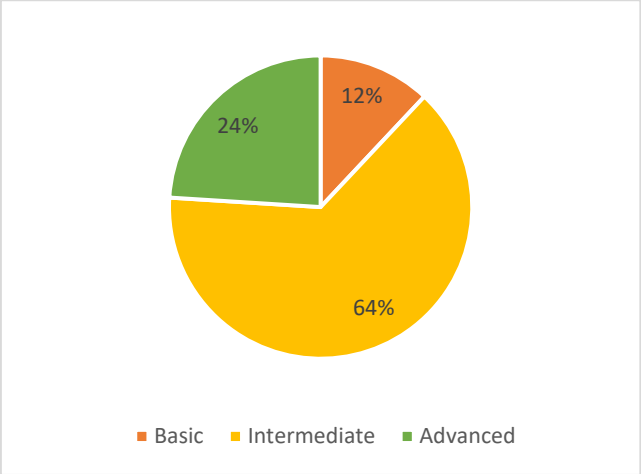

Figure 3.9 The Pre-service EFL Teachers' Proficiency Level as Internet User

As indicated in Figure 3.10., almost all pre-service EFL teachers (N=44, 88%) preferred to utilize computer to study for their courses. Seventy-six percent of the participants (N=38) used computer to have fun. The number of the participants who used computer to communicate with other people (N=33, 66%) were almost equal to the number of participants who benefitted from computer to learn new things (N=34, 68%).

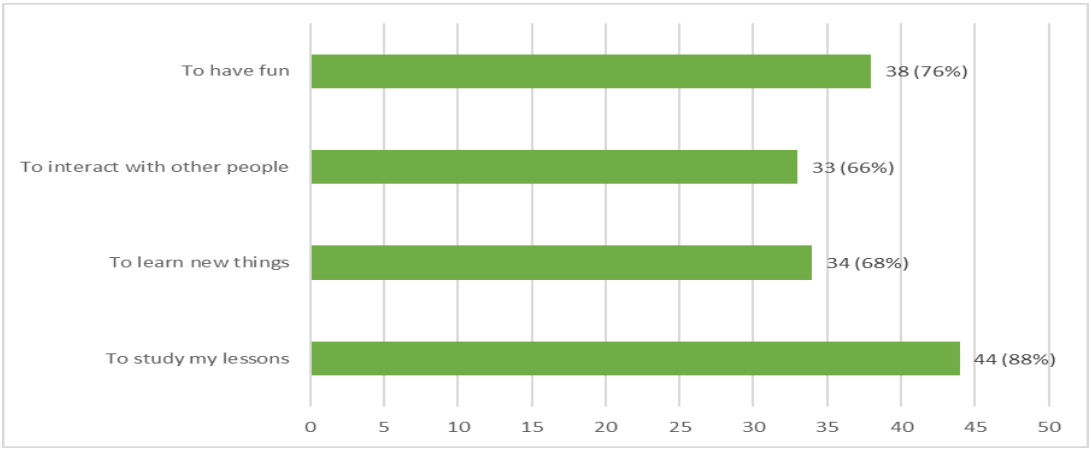

Figure 3.10 The Pre-service EFL Teachers' Purposes of Computer Use

With the aim of illustrating the EFL teacher candidates' background in relation to AR technology, they were required to answer four questions both in pre-survey and post survey. The first question was about whether they know what Augmented Reality is, and if they know, they were to answer the second and the third questions. If not, they were to skip to the fourth question. Out of 50 respondents, more than half of the participants (N=29, 58 %) reported that they know AR technology whereas 42 percent of the participants (N=21) have not heard about this technology beforehand as it is displayed in Figure 3.11. In post-survey, all the participants (N=50, 100%) provided "Yes" as an answer to the first question in part C. As it can be inferred from their responses, this was the first experience with AR technology for most of the participants.

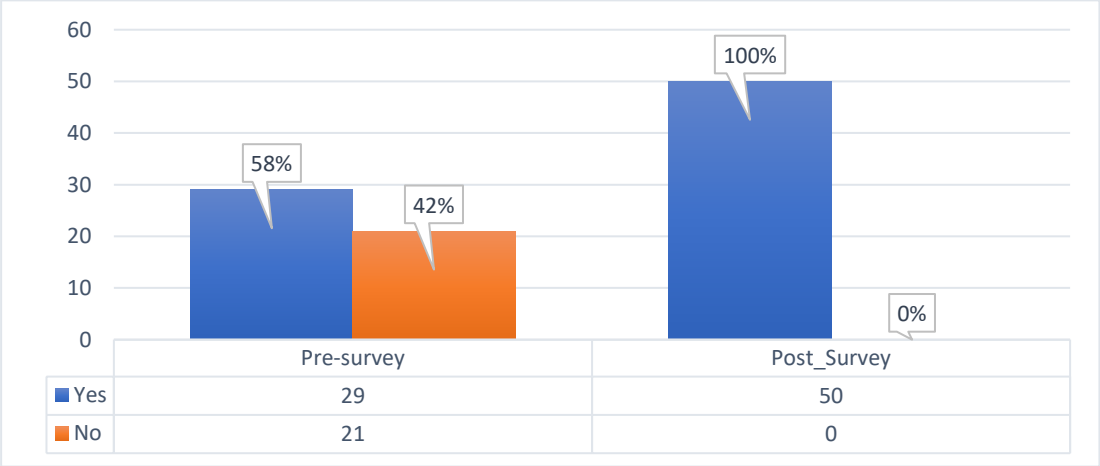

Figure 3.11 The Pre-service EFL Teachers' Knowledge in AR Technology

The second question was to be answered on the condition that the participants said "Yes" to the first question. The second question aimed to find out whether the prospective EFL teacher have had any experience with AR technology beforehand. Out of 42 pre-service EFL teachers who responded "Yes" to the first question, there were only six participants (14%) who had the opportunity to experience AR technology while the majority of the participants (N=36, 86%) indicated that they have not gained any experience with AR technology as it is demonstrated in Figure 3.12. In the post survey, all the respondents (N=50, 100%) reported that they have experienced AR technology.

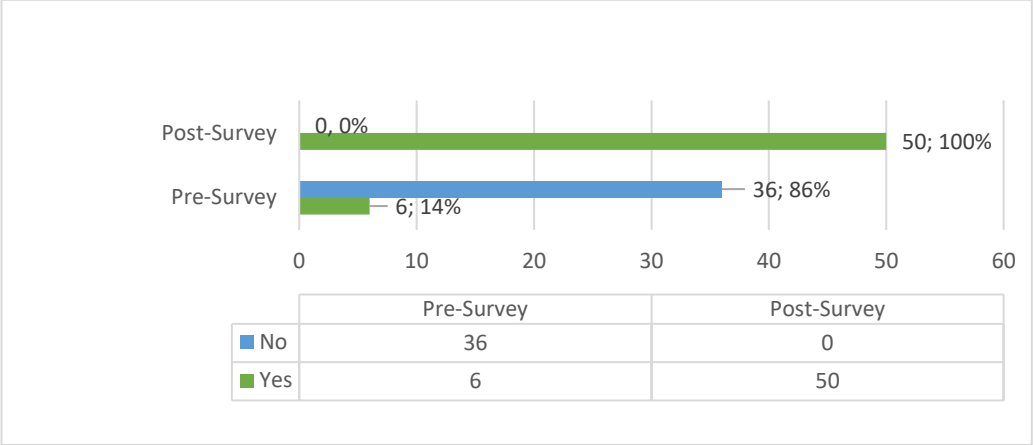

Figure 3.12 The Pre-service EFL Teachers' Experience with AR Technology

As for the third question, the participants were asked to indicate how many times they have tried Augmented Reality before and were provided four options which are namely once, twice, three times, and more than three times. Out of six participants, five of them (83%) experienced AR technology only once while one of them (17%) had experience with AR technology more than three times. In the post-survey, all the participants (N=50; 100%) expressed that they tried AR technology more than three times as they prepared five AR-enhanced language learning materials (Figure 3.13).

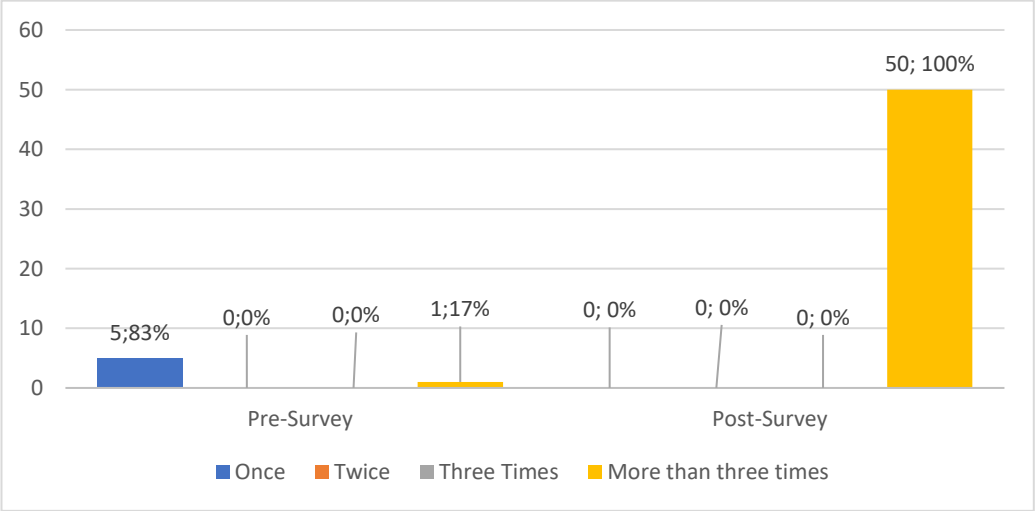

Figure 3.13 The Pre-service EFL Teachers' Experience with AR Technology in numbers

The fourth question required the pre-service EFL teachers to state which Augmented Reality tools with which they have experience and were offered the following five

options: Blippar, HP Reveal, Augment, Unified AR, and Other. The findings for both pre-survey and post-survey are provided in Figure 3.14. In pre-test, except Augment, each tool was used by only one participant: Blippar (N=1, 20%), HP Reveal (N=1, 20%), and Unified AR (N=1, 20%). For other option, one of the participants (20%) indicated that he developed his own AR applications and used them. As for the post-survey, all the participants utilised Blippar (N=50, 82%) because it was the instrument employed for the purpose of this study. There were four participants (8%) who used Augment while two participants (4%) mentioned Pokémon Go. The rest of the tools was used by only one participant: HP Reveal (N=1, 2%) and Unified AR (N=1, 2%). For other option, one of the participants (2%) indicated that he used the AR application he developed.

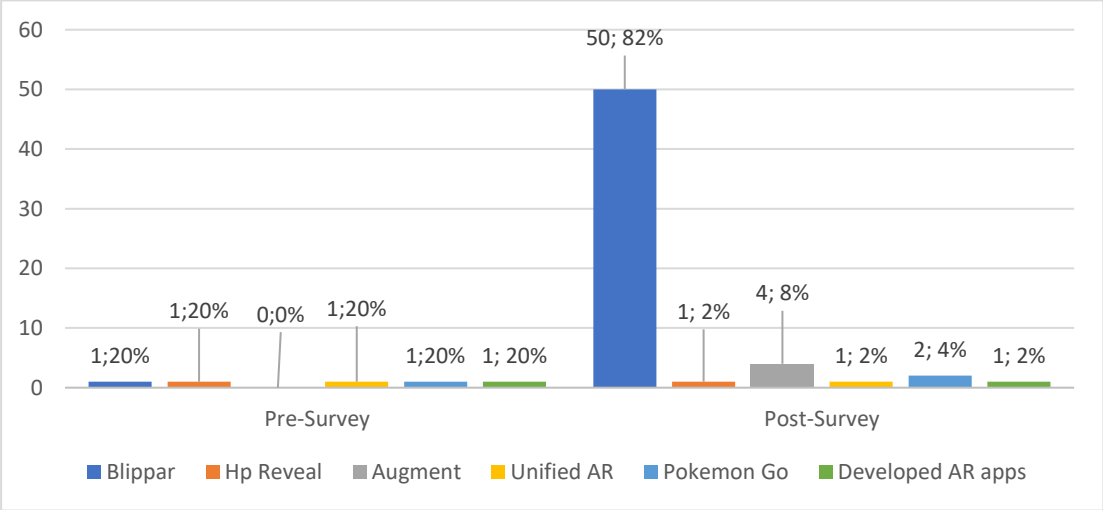

Figure 3.14 The AR Technology Tools Used by Pre-service EFL Teachers

In the post-survey, the prospective EFL teachers were also asked to self-report their level of competency in using AR technologies by choosing one of the levels which are namely basic, intermediate, and advanced. This question was regarded as a criterion for determining the interviewees in that four volunteer participants from each competency level were selected for the interview schedule. Fourteen EFL teacher candidates (28%) stated that they were basic users of AR technology are presented in Figure 3.15. While approximately half of the respondents (N=24; 48%) rated

themselves as intermediate users of AR technology, twelve of them (24%) reported their competency level in AR technology as advanced.

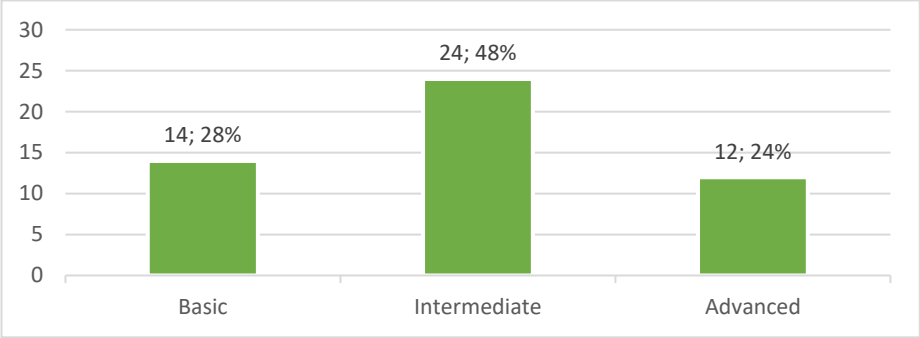

Figure 3.15 The Competency Level of Pre-service EFL Teachers in AR Technology

3.4.2. Demographics of Participants of the Qualitative Phase

The qualitative phase of the current study was carried out in the spring semester of the 2019-2020 academic year with the participation of 12 pre-service EFL teachers studying at English Language Teaching Program of a foundation university in Ankara. Their ages ranged between 21 and 28. Out of 12 participants, eleven of them were female while one of them was male. The interviewees were mostly seniors but only one of them was junior year student who was also an irregular student. In post-survey, the participants were asked to self-report their competency level in AR technology. According to this criterion, there were three categories, basic, intermediate, and advanced, and from each category four interviewees who were willing to contribute to the study by providing further information about their experience took part in the qualitative phase of the current study. The information regarding the pre-service EFL teachers' age, gender, class status, and competency level in AR technology are presented in Table 3.6.

Table 3.6 Pre-service EFL Teachers' Age, Gender, Class Status, and Competency Level in AR in Qualitative Phase

	Age	Gender	Class Status	Competency Level in AR
Participant 1	28	Female	Senior	Basic
Participant 2	24	Female	Senior	Basic
Participant 3	21	Female	Junior	Basic
Participant 4	25	Female	Senior	Basic
Participant 5	23	Female	Senior	Intermediate
Participant 6	21	Female	Senior	Intermediate
Participant 7	23	Female	Senior	Intermediate
Participant 8	24	Female	Senior	Intermediate
Participant 9	24	Female	Senior	Advanced
Participant 10	22	Male	Senior	Advanced
Participant 11	22	Female	Senior	Advanced
Participant 12	21	Female	Senior	Advanced

3.5. Data Collection Instrument

In the current study, both quantitative and qualitative data were obtained with the help of surveys and interview. The details of each data gathering tool are summarised in the following four parts.

3.5.1. Survey

The main aim of utilising surveys in research studies is to "describe the characteristics of a population by examining a sample of that group" (Dörnyei, 2007, p. 96). Employing surveys to gather data provides various advantages to the researchers. These advantages consist of "gathering a large amount of information quickly in a form that is readily processible" (Dörnyei, 2007, p. 101), "relatively inexpensive data collection, and access to a wide range of participants" (Mathiyazhagan & Nandan, 2010, p.44). That is why surveys were conducted before and after the intervention to explore pre-service EFL teachers' perceptions of the integration of AR technologies into English language classrooms.

3.5.1.1. Pre-Survey

The pre-survey was designed for collecting demographic data and data on their experience in technology, their attitude toward technology, their previous experience in Augmented Reality, their opinions about Augmented Reality, and its use in English courses at the beginning of the study. The pre-survey contained five main parts;

Demographic data and experience in technology (Part A), Perceptions of technology (Part B), Experience in Augmented Reality (Part C), Opinions about the use of Augmented Reality technologies in English courses (Part D) respectively (See appendix C). The pre- and post-surveys were adapted from a previous thesis study conducted by Cirit (2014) on the perceptions of the ELT pre-service teachers on the integration of web 2.0 tools to the courses for alternative assessment.

In the demographic data and experience in technology part (Part A), the subjects were expected to fill in the parts asking for their age, gender, class status, their experience in internet technologies, their proficiency in computer use, how long they have been using computer, how they access the internet, and the purpose of their computer use. Additionally, they were also asked whether they have received any formal training or attended a workshop on computer and internet technologies, and whether they have taken any courses on instructional technologies before.

The second part of the survey, perceptions of technology (Part B), was designed on a four-point Likert scale with values ranging from 1 to 4. One stands for "Totally Disagree" while 4 stands for "Totally Agree". In total, there were 10 statements in part B. The subjects were posed questions about their perceptions of the integration of technology to English lessons. In order to evaluate the internal consistency of the perceptions of technology scale, Cronbach's Alpha Coefficient Model was utilised, and Cronbach's Alpha coefficient was found to be .659. Eight of the items would lead to a decrease if deleted. The exceptions to this were items 5 and 9, and if these items were deleted from the scale, the reliability would increase the alpha to $\alpha = .872$. Therefore, these items were removed from the scale so as to ensure the reliability of the scale.

In Part C, there were 4 questions about experience in AR. Whether the participants know what AR is, whether they have experienced it beforehand. Additionally, on the condition that they have used AR before, how many times they experienced it and which tools they have used were the questions to be answered in this part as well.

In the last part, namely "Opinions about the use of Augmented Reality technologies in English courses", the purpose was to explore participants' opinions about the

integration of AR technologies to English courses. This part had two sections with different types of questions. The first section included 6 statements with 4-point Likert scale and values ranging from 1 to 4, and they were about whether Augmented Reality will be useful for language skills, grammar, and vocabulary. The internal consistency of this scale was found to be .764, which indicated that the scale was reliable. The second section posed two open-ended questions about the language skill for which the Augmented Reality tool is the most useful and the least useful along with their reasons.

Table 3.7 Research Questions, Data Collection Instruments, Methods, and Data Analyses Procedures

Research Questions	**Instrument**	**Method**	**Analysis**
1. What are the perceptions of the ELT pre-service teachers, who are informed about the integration of Augmented Reality (AR) technologies to English courses, on the use of Augmented Reality to teach English (listening, speaking, reading, writing, vocabulary, grammar) to EFL learners?	Pre-survey Post-survey Refection Form The Interview Schedule	Quantitative Qualitative	Descriptive Statistics Wilcoxon Signed Rank Test Friedman Test Constant Comparative Analysis
1.a. What are the advantages of using AR technologies to teach English?	Post-survey Reflection Form The Interview Schedule	Quantitative Qualitative	Descriptive Statistics Constant Comparative Analysis
1.b. What are the disadvantages of using AR technologies to teach English?	Post-survey Reflection Form The Interview Schedule	Quantitative Qualitative	Descriptive Statistics Constant Comparative Analysis
1.c. What are the suggestions of ELT pre-service teachers for the use of AR technologies to teach English?	Post-survey Reflection Form The Interview Schedule	Quantitative Qualitative	Descriptive Statistics Constant Comparative Analysis
2. What was ELT preservice teachers' acceptance level of augmented reality technology activities after the experience in designing AR enhanced activities to teach English?	TAM Survey Post-survey The Interview Schedule	Quantitative Qualitative	Descriptive Statistics Paired Sample T-test Constant Comparative Analysis
3. After completing the activities, what level of self-efficacy did ELT preservice teachers experience in using augmented reality technology?	TAM Survey Post-survey The Interview Schedule	Quantitative Qualitative	Descriptive Statistics Paired Sample T-test Constant Comparative Analysis

3.5.1.2. Post-Survey

The post-survey included six main parts; Demographic data and experience in technology (Part A), Perceptions of technology (Part B), Experience in Augmented Reality (Part C), Opinions about the use of Augmented Reality technologies in English courses (Part D), and Open-ended Questions and Suggestions (Part E) respectively (See appendix D). Four of these parts (Parts A, B, C, and D) were adapted from a previous research conducted by Cirit (2014) on the perceptions of the ELT pre-service teachers on the integration of web 2.0 tools to the courses for alternative assessment. The questions in the last part (Part E) were written by the researcher and checked by the advisor of the researcher.

In the demographic data and experience in technology part (Part A), the participants were asked to answer some questions about their age, gender, class status, their experience in internet technologies, their proficiency in computer use, how long they have been using computer, how they access to the internet, and the purpose of their computer use. Whether they have received any formal training or attended a workshop on computer and internet technologies, and whether they have taken any courses on instructional technologies before were posed to the participants as well.

The second part of the survey, perceptions of technology (Part B), consisted of 10 statements designed on a four-point Likert scale with values ranging from 1 to 4, and this part aimed at exploring their perceptions of the integration of technology to English lessons. In order to evaluate the internal consistency of the perceptions of technology scale, Cronbach's Alpha Coefficient Model was utilised, and Cronbach's Alpha coefficient was found to be .632. Eight of the items would lead to a decrease if deleted. The exceptions to this were items 5 and 9, and if these items were deleted from the scale, the reliability would increase the alpha to $\alpha = .850$. Therefore, these items were removed from the scale so as to ensure the reliability of the scale.

The next part of the survey, Experience in Augmented Reality (Part C), contained 4 questions as the pre-survey did. The participants revealed what they have experienced during the implementation process in this part. They provided responses to the following questions; whether they know what AR is, whether they have experienced

it beforehand, how many times they experienced it and with which AR tools they have experienced. The participants were also asked to self-report their level of competency in using AR technologies by choosing one of the levels which are namely basic, intermediate, and advanced.

In Part D, "Opinions about the use of Augmented Reality technologies in English courses", this part aimed at investigating whether any changes occurred in their opinions about the integration of AR technologies to English courses after their experience with AR technology. There were 6 statements based on 4-point Likert scale in the first section of this part. In order to evaluate the internal consistency of this scale, Cronbach's Alpha coefficient was calculated and was found to be .705, which indicated that the instrument was reliable. In this part, there were also 2 open-ended questions about which the language skill for which the Augmented Reality tool is the most useful and the least useful along with their reasons.

As for the last part of Open-ended Questions and Suggestions (Part E), it intended to delve into pre-service EFL teachers' opinions about the use of AR technology in English language classrooms after their own experience with it. The participants were asked to respond to 5 open-ended questions which were about which aspects of AR activities they liked, the challenges they faced, whether they would like to employ AR in their future English classes, their suggestions for the type of activities which AR can be integrated, and if they have any further comments or questions about AR.

3.5.2. Reflection Form

The reflection form was introduced to the participants once they filled in the pre-survey, and it was ensured that they understood the rationale behind the use of reflection form during the implementation process. The reflection paper was filled by each participant right after they completed each task. The participants were expected to submit their tasks and the reflection paper in this respective order to the researcher. The goal of gathering data during task implementation process was to discover the participants' opinions before they forget about the tasks they designed. The fact that the same reflection paper was employed for each 5 tasks enabled the researcher to observe the changes occurred in the participants' perceptions over the task

implementation process. The reflection paper was composed of two sections; there were 8 statements designed on a 4-point Likert scale with values from 1 to 4 in the first part, whereas the second section included questions asking participants to indicate 3 advantages, 3 disadvantages they came across with during task implementation process, and 3 suggestions for improving their task or the AR tool (See appendix E). A reliability analysis was carried out on the quantitative part of the reflection form which consisted of eight items. The Cronbach's alpha values for 5 reflection forms were .761, .715, .824, .794, .791 respectively, indicating that the reflection form was reliable.

3.5.3. Technology Acceptance Model (TAM) Survey

There are several reasons for the choice of TAM3 reconstructed by Venkatesh and Bala (2008) for exploring the participants' acceptance of AR technology and measuring their self-efficacy in using this technology. First, as Venkatesh and Bala (2008) indicated, TAM3 "presents a complete nomological network of the determinants of individuals' IT [information technology] adoption and use" (p. 279). As this extended version of TAM combined all the constructs proposed so far since the introduction of the original TAM, it enables the researcher to describe the full picture and delve into further details of users' acceptance of a specific technology at the initial stages of their experience.

In the current study, TAM survey designed as part of doctoral dissertation study by Kaenchan (2018) was adopted and was composed of two parts. The first part included 24 items about the acceptance of Augmented Reality Technology, and six constructs from TAM3 (Venkatesh & Bala, 2008) which were as follows; "1) Perceived Ease of Use, 2) Perceived Usefulness, 3) Perceptions of External Control, 4) Computer Anxiety, 5) Perceived Enjoyment, and 6) Behavioural Intention." There were 4 statements for each construct and twenty-four items in total (See Appendix F). The survey questions utilised 4-point Likert scale coded as 4: Strongly Agree; 3: Agree; 2: Disagree; 1: Strongly Disagree. A reliability analysis was conducted on the technology acceptance level scale comprising 24 items. Cronbach's alpha was found to be .847 in

pre-TAM survey and .901 in post-TAM survey, which showed that the instrument was reliable.

In the second part of TAM3 survey, the aim was to assess the participants' assumed levels of self-efficacy, which is another construct from TAM3 (Venkatesh & Bala, 2008). This tool was originally developed by Compeau and Higgins (1995) and adapted for the current study from the doctoral thesis study of Kaenchan (2018). The survey contained 10 items which referred to self-reported level of self-efficacy in using the AR technology, was designed on 4-point Likert scale coded as: 4: Totally confident; 3: Moderately Confident; 2: Slightly Confident; 1: Not at all confident. The participants were asked to read each statement and self-rate their confidence for each situation on a scale from 1 to 4. Internal consistency of the self-efficacy scale was evaluated by carrying out reliability test. Cronbach's Alpha coefficient was found to be .882 in pre-TAM survey and .822 in post-TAM survey, indicating that the instrument was reliable.

3.5.4. Interview

Interview is a beneficial way of gathering data which may not be accessible through surveys or observations (Blaxter et al., 2010). The main purpose of interviews is to elicit the intended meaning of what the interviewees express (McNamara, 1999) and to further explore individual's responses (McNamara, 1999). There are three types of interviews which are structured, semi-structured, and unstructured. Out of these three types, semi-structured interview was determined as the data gathering instrument since it "gives the interviewer the space to seek clarity as to what the interviewee actually means and why they gave a particular answer." (Morris, 2015, p.10). Thus, on the basis of the relevant literature and research questions of the present study, an interview protocol was developed by the researcher (See Appendix G). The research questions were adapted and formed based on the interview protocol developed by Kaenchan (2018) to unearth Thai students' experiences of AR technology in a university language education classroom.

With the aim of describing pre-service EFL teachers' experience in AR technology thoroughly, semi-structured interviews were carried out with twelve participants. The

interviews were held one week after the pot-survey was administered. According to responses of the participants in relation to their self-efficacy level in employing AR technologies in post-survey, four participants who were willing to partake in the semi-structured interviews were selected from each competency level, namely basic, intermediate, and advanced. At the beginning of the interview, it was explicitly indicated that participating into the interview is on voluntary basis and they can withdraw from the interview at any point without any reasons if they feel uncomfortable. It was also stated that their voice will be recorded, and they provided oral consent at the beginning of each interview. The interviews were conducted in English.

The semi-structured interview schedule consisted of three parts and 20 questions in total. The first part aimed to examine interviewee's experience towards the use of AR by posing ten questions about their acceptance and perception about AR technology, and their self-efficacy in this technology. The second part included questions about the AR enhanced activities design process so as to delve further into the EFL teacher candidates' experience with AR technology. The third part contained 4 questions with the aim of finding out what they think about the future of AR technology in the field of education and whether the prospective EFL teachers plan to use AR technology in the future. With the last question in the fourth part, the participants were asked if they have any further questions, comments, and suggestions related to the research.

3.6. Data Collection Procedures

Prior to commencing the study, the surveys, reflection form, and interview protocol were designed by the researcher and checked by the supervisor of the researcher. Following this, the ethical approval was obtained in February 2020 from Applied Ethics Research Centre located at Middle East Technical University (See appendix A).

The data for the current study was gathered online because of COVID-19 pandemic during the spring semester of 2019-2020 academic year. This was an explanatory sequential mixed method study, and both quantitative and qualitative data were gathered to carry out the research. While qualitative data were collected with the help of open-ended questions in pre- and post-surveys, reflection forms, and semi structured

interviews, the quantitative data were obtained through pre- and post-surveys, TAM survey, and reflection forms.

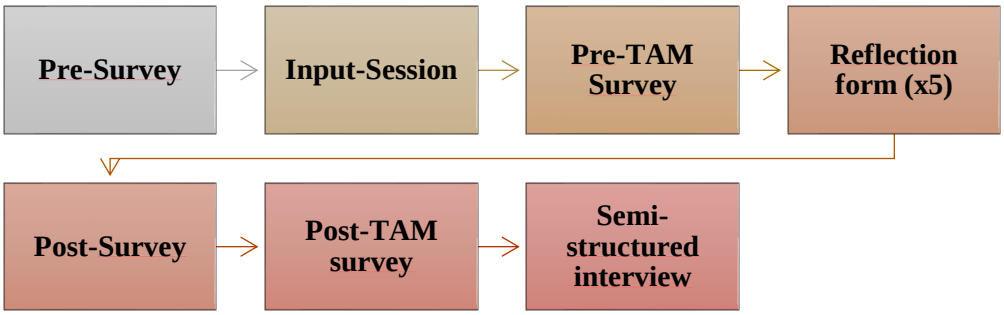

Figure 3.16 The Data Collection Process

As demonstrated in Figure 3.16, there were six steps to follow in data collection process. The process started by informing the participants about the research and what they are expected to do if they were to participate in the study. The pre-service EFL teachers were ensured that the data gathered from them would be used for the thesis study that the researcher carried out. They were also told that participating to the research was on voluntary basis and they may leave the survey undone without stating any reason. Thus, it was made sure that they do not have to participate to the research. Then, the consent form was sent to the voluntary pre-service EFL teachers via Google Forms (See Appendix B).

3.6.1. Conducting Survey

On obtaining the informed consent form from the participants, pre-survey was introduced to the students and the instructions for how they were supposed to fill in the surveys and what is expected from them were explained. If they had any questions about the research or the surveys, they were encouraged to ask beforehand. In total, 50 pre-service EFL teachers accepted to take part in the study. The pre-survey was administered via Google-Forms, and five days were allocated to them to fill in the pre-survey.

After the pre-survey, the researcher introduced the AR tool, Blippar, to be used during the study. The pre-service EFL teachers were provided with a step-by-step instruction on how to use and navigate on Blippar so that they learn how to use it. In case they need any assistance about a problem, the researcher would be there to solve any problem. The input session on AR technology was first planned in the face-to-face format. However, due to COVID-19 pandemic, both the input session and the data collection had to be conducted online.

The procedure for the online input session is illustrated in the Figure 3.17. First, AR technology was defined, and its types were explained. The basics of the AR tool, Blippar, were provided along with step-by-step instructions which were supported with screenshots. After the video tutorials were presented, the websites that provide samples and support to use the software were demonstrated, respectively. Sample activities were shared with the participants, and then the input session was finalised with hands-on activity session during which the participants tried out the software and asked their questions. During the task design process, the participants were able to pose their questions through WhatsApp group or via e-mail.

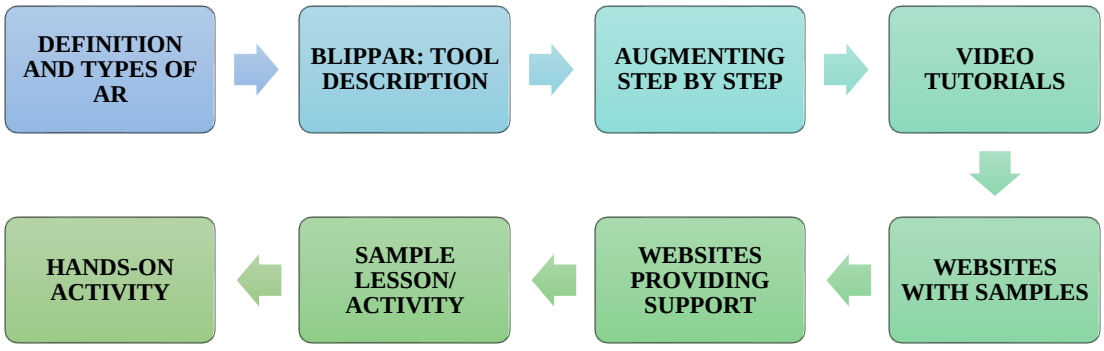

Figure 3.17 The steps of Online Input Session on AR Technology

After the input session, the students were asked to form pairs or groups of three to work together during the task implementation process. They submitted their tasks through Google Classroom. Next, TAM survey was conducted to explore the prospective EFL teachers' acceptance of AR technology and their self-efficacy in

using AR before their experience with AR. The rationale behind the implementation of TAM survey after the introduction of the tool was to ensure that they know what AR is and how it operates. Thus, they can provide more accurate information regarding their acceptance of and self-efficacy of AR technology.

During the implementation process, two weeks were allotted to the participants to design each task and fill in the activity template. Two sample AR enhanced activities designed by the pre-service EFL teachers were provided in Appendix H. In the first activity, the aim is to practise the prepositions of places. There is a map in the scene. The girl in the map moves from one place to another. When the girl stops at a place, students will click on the writing (next to the place) and will answer the question. They need to form a full sentence by stating where the girl is (E.g She is at the market). If they answer it correctly, they will click on "next" and go to the next place. If they answer it wrong, they will click on "go back" and go back to the same question until they find the correct answer. This activity was designed as a practice after students learned about the preposition of places. In the second activity, the aim is to provide information about the planets. When learners scan the picture, they will see planets on the screen. Students need to click on each of them and read the information provided on the screen which will help them to learn more about the planets that they have been taught in the class. This activity can be employed as a warm-up activity before a reading or listening lesson. In a grammar lesson, teachers can make use this activity to practise comparatives as well.

When they submitted their AR-enhanced activity, they were asked to complete the Reflection Form by considering the activity they prepared. Once they had designed five AR enhanced activities to teach English in ten-week long process, post-survey and TAM survey were conducted to find out if there were any significant changes in their perceptions of AR in English courses, their acceptance of and self-efficacy of AR technology.

3.6.2. Conducting the Interviews

In order to determine the interviewees for semi-structured interviews, the pre-service EFL teachers were asked to self-report their competency level in AR technologies as

part of post-survey. There were three categories as competency levels which are basic, intermediate, and advanced. From each category, 4 participants volunteered to take part in the interview. At the beginning of each interview, it was ensured that the participation in the interviews was on voluntary basis, and their data would be used only for scientific purposes. As the participants were not able to attend to interviews face to face at the time, the interviews were carried out via Zoom meetings.

Table 3.8 Pre-service EFL Teachers' Class Status, Competency Level in AR, and Interview Durations

	Class Status	**Competency Level in AR**	**Interview Duration**
Participant 1	Senior	Basic	21.26
Participant 2	Senior	Basic	20.53
Participant 3	Junior	Basic	17.11
Participant 4	Senior	Basic	25.08
Participant 5	Senior	Intermediate	27.52
Participant 6	Senior	Intermediate	15.56
Participant 7	Senior	Intermediate	19.52
Participant 8	Senior	Intermediate	23.11
Participant 9	Senior	Advanced	24.19
Participant 10	Senior	Advanced	19.31
Participant 11	Senior	Advanced	28.56
Participant 12	Senior	Advanced	15.36

At this point, they were also informed that the interviews would be carried out in English, and only audio recordings of the interviews would be kept. It was also ascertained that the cameras of the interviewees were off during the interview so as not to reveal their identity. In Table 3.8, the details regarding the interview schedule are presented. The interviews were carried out on one-on-one basis. In order to eliminate any ethical concerns, the participants were provided pseudonyms to address them during the interviews. The date and time for each interview were determined by the participants. As the interviews were done via Zoom meetings, the participants were asked to arrange a quiet room for the interview process. All the interviews were transcribed and then coded for the data analysis.

3.7. Data Analysis

As the current study was based on explanatory sequential mixed method design, both quantitative and qualitative data were collected to reveal the perceptions of pre-service EFL teachers regarding the integration of AR technologies into English lessons and determine their acceptance of and self-efficacy level in AR technology.

The quantitative data were gathered with the help of pre-and post-surveys, TAM survey, and reflection form. First, descriptive statistics were completed, and the normality of the data distribution was checked through Kolmogorov-Smirnov's test for all the data gathered through each instrument. In order to find out whether there was any significant shift in the perceptions of pre-service EFL teachers about the use of educational technologies in English classes, Wilcoxon Signed Rank Test was run on the data collected through pre-and post-surveys because the same participants took part in both of these surveys.

In order to unveil pre-service EFL teachers' views on the use of AR for language skills, the data from pre- and post-survey (Part E) were analysed with Wilcoxon Signed Rank Test, nonparametric equivalent of paired sample t-test.

As for the data of TAM survey, following the descriptive statistics, whether the data were normally distributed was checked through Kolmogorov-Smirnov's test. The data for each part of TAM survey were analysed with paired-sample t-test so as to investigate if the participants changed their point of view in terms of acceptance of AR technology and if there was any significant difference between their self-efficacy level in AR technology at the beginning of the study and their self-efficacy level after the experience with AR.

Once the data from the reflection form was descriptively analysed, the normality was calculated with Kolmogorov-Smirnov's test. As reflection form was administered five times during the implementation process, a Friedman test, which is the nonparametric equivalent of repeated measures ANOVA, was performed to check if there had been any statistically significant changes in their views of AR technology in English classes over the implementation process.

As for analysis of qualitative data collected through pre-and post-surveys, reflection form, and semi-structured interviews, constant comparative method, which is “the data-analytic process whereby each interpretation and finding are compared with existing findings as it emerges from the data analysis.” (Lewis-Beck et al, 2004, p. 181), was employed.

In this analysis method, the coding procedures, open, axial, and selective coding, as suggested by Strauss and Corbin (1990) were followed. Straus and Corbin (1990) describe these steps of coding as follows:

- Open Coding: "The process of breaking down, examining, comparing, conceptualizing, and categorizing data" (p. 61).
- Axial Coding: "A set of procedures whereby data are put back together in new ways after open coding, by making connections between categories. This is done by utilizing a coding paradigm involving conditions, context, action/ interactional strategies, and consequences" (p. 96).
- Selective Coding: "The process of selecting the core category, systematically relating it to other categories, validating those relationships, and filling in categories that need further refinement and development" (p. 116).

In the current study, the researcher conducted open and axial coding on the qualitative data gathered through pre- and post-surveys, reflection form, and semi-structured interviews. Within this scope, each finding was constantly compared in order to form relevant categories till the data reached the state of saturation which refers to the point where “no new information or themes are observed in the data” (Guest et al., 2006). Next, the categories were constructed from these codes in open coding by making use of axial coding. Then, the researcher chose the main categories by relating these categories to each other in the selective coding stage. Lastly, the frequency analysis was conducted for each code.

In order to increase the research quality and credibility, inter-coder reliability analysis was carried out with the help of one expert who is a graduate of English Language Teaching Program and has a Ph.D. in the field of Computer Education and Instructional Technology. He has also conducted research on AR technology and its

use in educational fields. First, a coding book was formed, and then 20% of the qualitative data gathered from pre-service EFL teachers through interviews and reflection forms were coded by both the expert and the researcher. The codes of the researcher were compared with the codes of the expert, and the coding was finalised with the negotiation of both coders. The reliability was computed based on the formula offered by Miles and Huberman (1994). The number of agreements were divided by total codes (the number of agreements + the number of disagreements). The inter-coder reliability was found to be .086, which is considered to be sufficient for agreement among multiple coders (Miles & Huberman, 1994). The themes and codes were also checked by another peer who has B.A. in ELT and Master of Arts degree on Educational Technologies. She also carried out her master thesis study on AR technology. Additionally, employing three kinds of data gathering instruments enabled the researcher to conduct data triangulation, which enhances the validity and reliability of the findings (Strauss & Corbin, 1998; Yin, 1994; Denzin, 1978).

3.8. Assumptions of the Study

The assumptions of the present study are as follows:

- In order to ensure the validity and reliability, both survey and interviews were conducted to gather quantitative and qualitative data.
- The pre-service EFL teachers who partook in the quantitative part of the study rated the items in the survey sincerely while the interviewees provided answers to the interview questions in a genuine manner.
- The pre-service EFL teachers sufficiently represented the population.

3.9. The Role of The Researcher

The researcher is the key factor in gathering and analysing the data in qualitative research (Merriam & Tisdell, 2015; Patton, 2015). The qualitative researcher should provide an environment within which people can respond in a manner that adequately reflects their points of view (Patton, 2015) and express their beliefs, biases, values, feelings, and point of views in an honest way (Miles et al., 2014).

The researcher of this study being the conductor and language teacher carried out the input session on how to use AR technology and how they can design AR enhanced language learning materials. When four different positions, put forward by Gold (1958) for researcher's stance: "Complete participant", "Participant as observer", "Observer as participant", and "Complete observer", are considered, the researcher was observer as participant and did not interfere with the course of the task design process, but responsible for supporting the pre-service EFL teachers about technical help and problems. The researcher had a balanced relationship with them and answered their questions, respectively.

Moreover, Patton (2015) indicated that "the credibility of qualitative methods, therefore, hinges to a great extent on the skill, competence, and rigor of the person doing the fieldwork—as well as the things going on in a person's life that might prove to be a distraction" (p.67). The background of the researcher is presented below:

The researcher had a B.A. in English Language Teaching at Middle East Technical University and started her master's degree in ELT. During both undergraduate and master's degrees, she took courses on the integration of ICT into ELT. She had one and a half year teaching experience with young learners. Additionally, she was working as a research assistant at the Department of Foreign Language Education at Başkent University. She learned how to design AR-based materials as part of her undergraduate courses and attended workshop about the AR embedded materials conducted at THE conference in 2019. Her research interests include teacher education, technology integrated language learning material, and the integration of ICT into ELT.

CHAPTER 4

RESULTS

4.1. Introduction

In this chapter, the findings of the current study are presented under three main sections. The first section contains three subsections which provide the results for the first research question regarding the pre-service EFL teachers' perceptions on the use of Augmented Reality to teach English (listening, speaking, reading, writing, vocabulary, grammar) to EFL learners. The affordances and constraints of AR technology, and pre-service teachers' recommendation are included in this section as well. The second section consists of findings for the second research question about prospective EFL teachers' acceptance level of augmented reality technology activities after the experience in designing AR enhanced activities to teach English. In the last section, results for the third research question in relation to EFL teacher candidates' self-efficacy level in AR technology are presented.

4.2. Results in Relation to Pre-Service EFL Teachers' Perceptions of AR Technology

The first research question of this mixed method research scrutinised ELT pre-service teachers' perceptions of the use of AR technology to teach English (listening, speaking, reading, writing, vocabulary, grammar) to EFL learners. Under this main research question, three sub questions including affordances and constraints of AR technology in ELT classroom, and EFL pre-service teachers' recommendations were also investigated. Both quantitative and qualitative data were gathered through pre-survey, reflection forms, post-survey, and semi-structured interview in this respective order, and the results of data analysis are presented below.

4.2.1. Quantitative Results in Relation to Research Question 1

The quantitative data providing answers to the first research question were obtained through pre-survey, post-survey, and reflection form. The findings based on the analysis are presented for each instrument, respectively.

4.2.1.1. Pre-survey and Post-survey

In order to understand pre-service EFL teachers' perception of the implementation educational technology in English classes, the quantitative data were collected through second part of the pre- and post-surveys including eight items on 4-point Likert scale. Table 4.1. reveals that the descriptive statistics for attitude toward technology in pre-survey were N=50, M= 27.80, SD= 3.85 while the descriptive statistics of the post survey for the same part were N=50, M= 28.82, SD= 3.07.

Table 4.1 Descriptive Statistics (Mean and Standard Deviations) for Attitude toward Technology

		Attitude Toward Technology Pre-survey		**Attitude Toward Technology Post-survey**	
	n	**Mean**	**Sd**	**Mean**	**Sd**
Exp. 1	50	27.80	3.85	28.82	3.07

The Kolmogorov-Smirnov's test ($p<.05$) showed that data gathered in part B of pre- and post-surveys were not normally distributed (Table 4.2.), which was also supported with the visual inspection of their histograms and boxplots.

Table 4.2. Kolmogorov-Smirnov Test for Pre-survey and Post-survey Part B

	df	**Statistics**	**Assumption Sig. (2-tailed)**
Pre-survey Part B	50	.197	.000
Post-survey Part B	50	.181	.000

That is why, Wilcoxon Signed Rank Test, non-parametric version of paired-sample t-test, was found appropriate to be conducted so as to find out if there was any significant difference in terms of pre-service EFL teachers' perceptions of technology integration into English classes. According to Wilcoxon Signed Rank Test (see Table 4.3.), the

difference in the EFL teacher candidates' perceptions of technology integration in English classes between pre-survey (M= 27.80, SD= 3.85) and post-survey means was statistically significant (M= 28.82, SD= 3.07), Z = -2,090, p < 0.05. This indicated that the ten-week long AR-based activity design process made a significant change on their views of technology.

Table 4.3 Wilcoxon Signed Rank Test for Technology Integration into English Classroom

		N	Mean Rank	Sum of Ranks	z	p
Postsurvey-Presurvey	**Negative Ranks**	26	19.77	514.00	-2.090	.037
	Positive Ranks	12	18.92	227.00		
	Ties	12				

Whether the data from part D, the use of AR for language skills, in pre- and post-surveys showed normal distribution was checked with the Kolmogorov-Smirnov's test, and Table 4.4. demonstrate that the data were not normally distributed (p<.05), which was also supported with the visual inspection of their histograms and boxplots.

Table 4.4. Kolmogorov-Smirnov Test for Pre-survey and Post-survey Part D

	df	Statistics	Assumption Sig. (2-tailed)
Pre-survey Part D	50	.157	.004
Post-survey Part D	50	.160	.003

In order to reveal pre-service EFL teachers' views on the use of AR for language skills, the data from pre- and post-survey (Part D) were analysed with Wilcoxon Signed Rank Test, nonparametric equivalent of paired sample t-test, as the data were not normally distributed based on visual inspection and Kolmogorov-Smirnov's test (p < .05). The results of Wilcoxon Signed Ranks test were demonstrated in Table 4.5. The only statistical significance was observed in the mean scores between pre-survey and post-survey for vocabulary (Z = -2.449, p = .014). Nevertheless, no significant difference was detected in the means between pre-survey and post-survey for listening skill (Z = -.435, p = .663), speaking skill (Z =-1.590, p = .112), reading skill (Z = -.498, p = .619), writing skill (Z = -.124, p = .901), and for grammar (Z =-1.945, p = .052).

Table 4.5 The Results of Wilcoxon Signed Ranks Test on the use AR for Language Skills

Skills	Postsurvey-Presurvey	N	Mean Rank	Sum of Ranks	z	p
Listening	Negative Ranks	10	14.75	147.50	-.435	.663
	Positive Ranks	15	11.83	177.50		
	Ties	25	-			
Speaking	Negative Ranks	14	13.43	188.00	-1.590	.112
	Positive Ranks	9	9.78	88.00		
	Ties	27	-			
Reading	Negative Ranks	16	13.06	209.00	-.498	.619
	Positive Ranks	11	15.36	169.00		
	Ties	23	-			
Writing	Negative Ranks	16	15.88	254.00	-.124	.901
	Positive Ranks	15	16.13	242.00		
	Ties	19	-			
Grammar	Negative Ranks	9	13.50	121.50	-1.945	.052
	Positive Ranks	19	14.97	284.50		
	Ties	22	-			
Vocabulary	Negative Ranks	5	10.50	52.50	-2.449	.014*
	Positive Ranks	16	11.16	178.50		
	Ties	29	-			

4.2.1.2. Reflection Forms

In order to check if there were any statistically significant changes in their views on the use of AR technology in English classes over the implementation process, the reflection form was administered five times after each AR-enhanced activity had been prepared. The data distribution was found to be not normal based on Kolmogorov-Smirnov's test ($p<.05$) and visual inspection as it is presented in Table 4.6.

Table 4.6. Kolmogorov-Smirnov Test for Refection Forms

	df	Statistics	Assumption Sig. (2-tailed)
Reflection Form 1	50	.160	.003
Reflection Form 2	50	.136	.022
Reflection Form 3	50	.135	.024
Reflection Form 4	50	.153	.005
Reflection Form 5	50	.165	.002

Therefore, Friedman test, nonparametric version of repeated measures ANOVA, was conducted on the data so as to find out if there were any statistical differences among the means of reflection forms. As it is summarised in Table 4.7., there was a statistically significant difference in pre-service EFL teachers' opinion about the use AR technology in English classes over time, $\chi^2(4) = 22.231$, $p < 0.001$.

Table 4.7 The Results of Friedman Test Based on Reflection Forms

	Mean Ranks						Test Statistics		
	n	**R1**	**R2**	**R3**	**R4**	**R5**	**Chi-Square**	**df**	**Asymp. Sig.**
Exp. 1	50	2.48	2.76	2.95	3.09	3.72	22,231	4	,000

Post hoc analysis with Wilcoxon Signed Rank Test was carried out on different combinations of reflection forms so as to find out where the differences actually occurred. The findings of the test were displayed in Table 4.8. There were no significant differences between reflection 1 and 2 (Z = -.956, p = .339), between reflection 1 and 3 (Z = -1,692, p = .091), between reflection 2 and 3 (Z = -1.236, p = .216), between reflection 2 and 4 (Z = -1,497, p = .134), between reflection 3 and 4 (Z = -,545, p = .586), and between reflection 1 and 4 (Z = -1.777, p =.076) despite an overall increase in their perceptions of AR-based English language learning materials. However, there were statistically significant differences between reflection 1 and 5 (Z = -3,477, p < .0001), between reflection 2 and 5 (Z = -3,174, p= .002), between reflection 3 and 5 (Z = -2,416, p = .016), and between reflection 4 and 5 (Z = -3.115, p = .002). These significant differences meant that their experience in designing five AR-based language learning materials in ten-week long process led to significant changes on their perspectives of AR technology throughout this process.

Table 4.8 Wilcoxon Signed Rank Test for differences between Reflection Forms

Reflection Forms		**N**	**Mean Rank**	**Sum of Ranks**	**z**	**p**
R4-R1	**Negative Ranks**	15	19,63	294,50	-1.777	.076
	Positive Ranks	26	21,79	566,50		
	Ties	9				
R5-R1	**Negative Ranks**	6	20,33	122,00	-3,477	,001*
	Positive Ranks	31	18.74	581,00		
	Ties	13				

Table 4.8 Wilcoxon Signed Rank Test for differences between Reflection Forms (Continued)

Reflection Forms		N	Mean Rank	Sum of Ranks	z	p
	Negative Ranks	9	15,83	142.50	-3,174	,002*
R5-R2	**Positive Ranks**	28	20.02	560.50		
	Ties	13				
	Negative Ranks	10	13,55	135,50	-2,416	,016*
R5-R3	**Positive Ranks**	22	17.84	392,50		
	Ties	18				
	Negative Ranks	6	11,25	67.50	-3.115	,002*
R5-R4	**Positive Ranks**	22	15.39	338,50		
	Ties	12				
	Negative Ranks	16	20,13	322,00	-.956	,339
R2-R1	**Positive Ranks**	23	19,91	458,00		
	Ties	11				
	Negative Ranks	15	17.97	269,50	-1,692	,091
R3-R1	**Positive Ranks**	24	21,27	510,50		
	Ties	11				
	Negative Ranks	14	13,25	185.50	-1.236	,216
R3-R2	**Positive Ranks**	17	18.26	310,50		
	Ties	19				
	Negative Ranks	12	16,46	197,50	-1,497	,134
R4-R2	**Positive Ranks**	21	17.31	363,50		
	Ties	17				
	Negative Ranks	12	16.04	192.50	-,545	,586
R4-R3	**Positive Ranks**	17	14.26	242.50		
	Ties	21				

4.2.2. Qualitative Data Analysis Results in Relation to Research Question 1

The qualitative data providing answers to the first research question were obtained through pre-survey, post-survey, reflection form, and the interview schedule. The findings based on the qualitative analysis are presented in the following three sections.

4.2.2.1. Integration of AR Technology into English Language Courses

The qualitative data on the pre-service EFL teachers' perceptions of the integration of AR technology into English courses were collected with the help of open-ended questions in pre- and post-surveys, reflection forms, and semi-structured interview. In surveys, EFL teacher candidates were required to indicate for which language skill AR technology is the most and least useful, respectively. The data were analysed

descriptively, and frequencies were calculated for each language skills as it is set out in Table 4.9.

Table 4.9 Descriptive Analysis (Frequencies) Results for Language Skills

	Skills	Pre-Survey *f*	Post-Survey *f*	Reflection *f*	Interview *f*	Total Frequency
AR is most useful for…	Reading	9	22	16	7	54
	Listening	16	46	18	18	98
	Speaking	22	40	20	13	95
	Writing	3	14	15	8	40
	Grammar	2	20	16	8	46
	Vocabulary	13	69	18	8	103
AR is least useful for…	Reading	10	13	5	0	28
	Listening	2	9	3	0	14
	Speaking	7	13	4	0	24
	Writing	24	30	5	2	61
	Grammar	12	10	4	0	26
	Vocabulary	0	0	0	0	0

In pre-survey, prospective EFL teachers indicated that AR based English learning materials are beneficial most for speaking skill (*f*=22), followed by listening skill (*f* = 16), vocabulary (*f* =13), reading skill (*f* =9), writing skill (*f* = 3), and grammar (*f* =2). As for skills for which AR technology is least useful, writing skill was the most mentioned one (*f* =24), followed by grammar (*f* =12), reading skill (*f* = 10), speaking skill (*f* = 7), and listening skill (*f* = 2). Vocabulary was not stated even once as an answer to this question.

In reflection forms, according to the EFL teacher candidates, the language skills to which AR technology contributes were as follows: speaking skill (*f* = 20), listening skill (*f* = 18), vocabulary (*f* =18), reading skill (*f* =16), grammar (*f* =16), and writing (*f* =18). In these reflection forms, AR technology was stated to be the least useful for language skills in the following order: reading skill (*f* =5), writing (*f* =5), speaking skill (*f* = 4), grammar (*f* =4), and listening skill (*f* =3). As it is in the pre-survey, prospective EFL teachers did not believe that AR technology is not useful for vocabulary knowledge.

After the pre-service EFL teachers had designed five AR-enhanced activities, they stated in post-survey that AR technology is the most useful for learning vocabulary (*f*

=69), followed by listening comprehension skill (*f* = 46), oral communication skill (*f* = 40), reading skill (*f* = 22), learning grammar (*f* = 20), and writing (*f* =14). The skill for which AR is the least beneficial were stated in the following order: writing (*f* =30), speaking skill (*f* =13), reading skill (*f* =13), grammar (*f* = 10), and listening (*f* = 9). In the post-survey, vocabulary was not expressed as one of the skills for which AR is not helpful.

Based on the data gathered through semi-structured interviews, AR technology is the most useful for listening skill (*f* =18), followed by speaking skill (*f* =13), writing skill (*f* = 8), grammar (*f* =8), vocabulary (*f* =8), and reading (*f* =7). Writing skill (*f* =2) was stated as the only language skill for which AR technology is least useful. According to data collected, vocabulary was not mentioned as a skill which cannot be facilitated through AR technology.

Almost all the pre-service EFL teachers indicated that AR-enhanced language learning activities would foster learners' vocabulary knowledge thanks to the visualisation features of AR applications which are regarded as "fresh perspectives" for teaching and revising vocabulary.

> It could be easily stated that Augmented Reality tool is most useful for listening and vocabulary purposes. The reasons for that is because the prospective students can very easily see the object or the goal of the vocabulary section using the Augmented Reality application. It should also be stated that the students can, through this app, can listen to the different pronunciations of some different words. This not also lets them learn the word but also makes them listen and understand the vastly different versions of the English language. [Participant 5, post-survey]

> Vocabulary is often one of the trickier points of language to teach students in a fun and engaging way. Rote memorization of lengthy, paper-based lists seems to be the default method of learning for many students, which does not guarantee that learners will have a functional understanding of the target language in the longer term. Thus, fresh perspectives to teaching and learning vocabulary need to be adopted for the classroom. [Participant 30, post-survey]

For teaching the target words, the benefits of 3D models were pointed out by prospective EFL teachers in that these models can aid in demonstrating the actual representations of concrete items in the real world.

> I think it would be vocabulary. Because it is so easy to relate objects to words with AR. Let's say you want to teach kids about apple, you can just show them the 3d object of an apple and they will learn better because they can almost physically see what the word actually is in real life. [Participant 33, post-survey]

> I think it can be useful for vocabulary because they will see the actions and pictures of the vocabulary and they can remember more easily. When they see them in 3D and use them while learning vocabulary learning will be more memorable and fun. It will break up the monotony of a lesson and they won't try to memorize them. [Participant 36, post-survey]

According to prospective EFL teachers' opinions, AR-based activities enhance listening comprehension skill because it enables integration of multimedia such as audio and videos and also practising pronunciation of the words.

> I believe it could be useful for listening most because we can listen people who are native speakers and we can do it in anywhere anytime. The people that we listen could be more authentic. Also students might choose different listening topics that includes same objectives, so the lessons would be more personalized and technology of the 21st century would be used more efficiently. [Participant 19, pre-survey]

> Listening. Students can learn true pronunciation of words and facilitate learning. First, students can hear pronunciation and repeat words. Maybe, in storytelling stories. Teacher can highlight these words and attract students' interests. Maybe, can be added songs, cartoons, videos and etc. So, the students can improve their listening skills and almost pronunciation and using of words in sentences. [Participant 2, post-survey]

Many pre-service EFL teachers reported that AR-based activities would be beneficial for oral communication skills because it provides an authentic like environment for the speaking activities.

> The Augmented Reality tool is most useful in speaking skill because it creates a fun, lively environment where students can improve their speaking skill and express themselves comfortably.

> They can use the applications comfortably to practice. It gives the opportunity to speak more. [Participant 3, pre-survey]
>
> Augmented Reality is a useful tool for speaking skills. Because it provides a speaking environment for students. And it can practice students' speaking skills. Students become more active in the lesson with the exercises in this application and improve their speaking skills with fun games. [Participant 6, post-survey]

One of the respondents suggested that it can be utilised for speaking skill by having learners record their review for a book they finished reading and attach this recording to the book digitally. Thus, they can have instant access to the review.

> Students can record themselves giving a brief review of a novel that they just finished, and then attach digital information to a book. Afterward, anyone can scan the cover of the book and instantly access the review. [Participant 23, post-survey]

Additionally, the pre-service EFL teachers articulated that AR technology can facilitate learners' expressions with the help of visual aids.

> With AR tools, students are exposed to some context and contents which facilitates their speaking. For instance, they can create more interesting and interactive videos while they make role play. The students can create what they imagine and be a character what they want. It will be more economic by considering time and money because they don't need to find concrete items. [Participant 25, pre-survey]
>
> I think it could enhance speaking skill with the aid of visual aids, students will have more things to talk about. The visual aids would facilitate learners and help them form more sentences about the topic of the lesson. Also, learners can practice their listening skills because audios and videos can be integrated to AR enhanced activities. [Participant 13, post-survey]

In addition, reading was mentioned as one of the language skills which can be fostered with the help of AR technology because visuals designed through AR applications can facilitate learners' reading comprehension.

> I think AR is the most useful tool for reading. Reading can be made more meaningful with the use of different visuals and multimedia. It helps students improve their reading. This app raises students' motivation. The images will help students

> understand even they don't know all the words. [Participant 12, post-survey]
>
> Reading books with this technology is quite enjoyable. Moreover, AR helps us on the book. Although it is slower than reading a concrete book or text, it is very useful because it is more fun. [Participant 33, pre-survey]

As one of the sub-skills, grammar was regarded to be supported with the use of AR technology by some pre-service EFL teachers since this emergent technology can increase learner motivation and help teachers design effective activities for teaching grammar.

> I think Augmented Reality tool is very useful for all of the English language skills. If I have to choose some of them, maybe grammar can be useful because normally, teaching grammar is not that easy. With the help of guided technology and augmented reality, etc., students may feel more motivated and eager to learn English and some grammatical structures best by it. But like I said, I think for all of the skills (mostly), it is useful. [Participant 17, post-survey]
>
> Grammar because it helps teacher to teach grammar deductively. Sometimes teacher cannot use effective methods or find appropriate examples for grammar teaching. So they prefer traditional ways for teaching grammar. But with AR tool, it will be clearer for creating effective activities. [Participant 27, post-survey]

Although a few pre-service EFL teachers indicated, AR-based language learning materials can foster learners' descriptive writing skills with the aid of visuals provided to them via AR technology.

> The possible benefits involve the reference to multiple intelligence and the possibility of learning the language by observing and exploring. It also enhances language performance and achievement, the interaction among teacher, learners and peers, self-learning and motivation. Firstly, games created with AR enable learning language outside the classroom and increase participants' willingness to communicate. Secondly, focusing on writing development in EFL, we can use AR to help learners improve their descriptive essay writing. [Jane, Interview]
>
> As I said before, the student may be asked to write an article about a picture shown, that is, it can be used for writing skill. [Participant 3, post-survey]

Both pre-survey and post-survey required the pre-service EFL teachers to name one language skill for which AR technology would be the least beneficial along with their reasons, and the most mentioned language skill was writing skill because it was reported that AR technology helps learners with their receptive skills, and the design of AR technology does not allow its users to practise productive skills like writing.

> I think it is not very useful for writing part. The augmented reality is perfect for visual learning but when it comes to writing there are not too many options. Writing is a productive skill and this tools mostly helps students with receptive skills. To be able to produce an outcome students need to use their own higher order thinking skills with using other tools such as blog pages etc. [Participant 21, post-survey]
>
> I think it is least useful for writing skills because there isn't an area in the application, they can improve their writing. They will mostly see listen and use the language because of the tools in the application. The only thing a teacher can do is ask them to write somewhere else what they have learned or saw but it wouldn't be something that the application provides. [Participant 37, post-survey]

Some prospective EFL teachers believed that AR technology is not necessary for practising reading comprehension skills since it does not contribute to the practice process apart from helping visualisation of the reading text which would be only possible for descriptive texts and stories.

> I think it is less useful in reading because we already practice reading with actual reading, we can only use it to illustrate what have we read in the text but animations and videos are more capable in doing so. [Participant 13, post-survey]
>
> Reading skill is the Augmented Reality tool least useful for because it is enough for students to be provided a reading text in order them to improve their reading skill although it may be useful to make them understand what the text is about. But I think it is better if students imagine what the text is about. Thus, in terms of reading, Augmented Reality is not essential. [Participant 30, pre-survey]

Some prospective EFL teachers reported that AR technology would be employed if grammar is taught in an implicit way. Otherwise, AR technology is not appropriate for teaching grammar explicitly.

> It may not be very useful for improving grammar, I believe students learn better abstract grammar rules with traditional face to face system. Still, Augment Reality would be useful for it anyway but not as much as it could be useful for other language skills. [Participant 19, pre-survey]
>
> I think AR the least useful tool for grammar. Teaching grammar can become difficult by using AR. It can be useful if implicit teaching is applied. However, in general the grammar is explicitly taught, which can lead to misunderstandings. In fact, if a good planning is made, very good results can be obtained. [Participant 12, post-survey]

As one of productive language skills, the prospective EFL teachers claimed that AR-based language learning materials do not contribute to learners' oral communication skills because the AR applications do not enable voice recording, and there is not much interaction between the user and the application.

> Another skill which would be hard to practice with this AR application is speaking skill because learners cannot record their voice although they can get a feedback from the system. [Participant 13, post-survey]
>
> I think speaking skill is least useful one because of the same reason there is less interaction between the user and the program which you use when it is compared with other skills. [Participant 41, pre-survey]

In relation to the interaction, it was indicated that even though it is possible to design situations and context for speaking activities, it would not be efficient for speaking because it is not as viable as talking to people in person.

> I believe Augmented Reality will be least useful for speaking and writing skills. Students cannot learn how to speak from tool because speaking requires real people, discussion and situations. You can create situation and place with AR tool but you cannot make them speak just using AR tool. [Participant 47, post-survey]

A small number of pre-service EFL teachers expressed that AR technology is not necessary for practising listening comprehension skill because the audio and video files upload to AR system are already available on the website, and the number of listening activities which can be prepared with AR applications would be limited.

> In my opinion, the AR tools are least useful in listening skill because current technology is enough for listening activities. There are many listening audio and video for students and the AR tools will not make any difference. Sometimes authentic materials like documentaries, radio broadcast or TV shows are preferred. Also students should realize that language is useful in their daily life. If we have to use non-authentic materials as a teacher, there are many audios in every course book, so the teachers don't need to use the AR tools. Material developers may use the AR tools of course, but the things that they create are limited. [Participant 25, pre-survey]

> I think listening skill is the least useful for AR in that in AR videos and audios are uploaded from the websites which are already in that websites. The students would not use any extra effort. They only listen to the audio or watch the video. In short, listening is not a skill that requires seeing the objects, animals, etc. We can do listening practice from any website or any audio records. [Participant 14, post-survey]

Moreover, the topics of the AR-enhanced language learning materials designed by the pre-service EFL teachers were analysed and the frequencies for each topic is demonstrated in Table 4.10. In total, 110 AR-based language learning activities were prepared by 22 groups of the pre-service EFL teachers. Most of the activities were about food (f= 17), animals (f=8), seasons and weather conditions (f=8), jobs (f=7), colours (f=7), clothes (f=5), abilities (f=5), and space (f=5). There were some activities whose topics were special days and events (f=4), countries and nationalities (f=4), telling time (f=3), daily routines (f=3), environment (f=3), movies (f=3), prepositions of place (f= 3), feelings (f=3), and house (f=3).

As for grammar topics, the activities focused on like/dislike (f= 2), tenses (present continuous, past simple) (f=2), and giving directions (f= 1). There were activities designed about body parts (f= 2), shapes (f= 2), classroom objects (f= 2), and numbers (f= 2). Lastly, the prospective EFL teachers designed one activity for each following topic vacation (f= 1), designing menu (f= 1), family members (f= 1), transportation (f=1), greetings (f=1), and continents (f= 1).

Table 4.10 Frequencies for Topics of AR-based Materials Designed by Pre-service EFL Teachers

Topics	Frequency	Topics	Frequency
Food	17	House	3
Animals	11	Body Parts	2
Seasons and Weather Conditions	8	Shapes	2
Free time activities and Hobbies	8	Tenses (Present Continuous, Past Simple)	2
Jobs	7	Classroom Objects	2
Colours	7	Numbers	2
Clothes	5	Like/Dislike	2
Abilities	5	Social Media	1
Space	5	Vacation	1
Special Days and Events	4	Giving Directions	1
Countries and Nationalities	4	Designing menu	1
Telling Time	3	Family members	1
Daily Routines	3	Environment	1
Environment	3	Transportation	1
Movies	3	Greetings	1
Prepositions of Place	3	Continents	1
Feelings	3		

In addition, the EFL teacher candidates were asked to express their suggestions about the ways AR technology can be utilised in English lessons by referring to topics and how often it can be employed in post-survey. They recommended that AR technology can be used mostly for topics which are visually rich. These visual topics included the followings as it is presented in Table 4.11; animals (f= 4), colours (f=4), numbers (f= 4), seasons and weather conditions (f= 3). A few of respondents suggested the following topics for AR-based lessons; food and drinks (f=2), free time activities and hobbies (f= 2), festivals (f= 2), environment (f=2), daily life (f=2), planets (f=2), jobs (f=2), and clothes (f=2). Even though they were recommended only once as a topic, the followings were also mentioned; the body parts (f=1), family members (f=1), social media (f=1), designing menu (f=1), movies (f=1), and nationalities (f=1). As grammar topics, prepositions (f=1), like/dislike (f=1), and telling time (f=1) were also proposed as possible topics for AR-enhanced lessons.

Table 4.11 Frequencies for Topics Suggested for AR Technology Based English Lesson

Topics	Frequency	Topics	Frequency
Animals	4	Clothes	2
Colours	4	Body Parts	1
Numbers	4	Family members	1
Seasons and Weather Conditions	3	Social Media	1
Food and Drinks	2	Designing menu	1
Free time and Hobbies	3	Prepositions	1
Festivals	2	Like/Dislike	1
Environment	2	Movies	1
Daily Life	2	Telling Time	1
Planets	2	Nationalities	1
Jobs	2		

Furthermore, some EFL teacher candidates suggested activity types which AR technology can be used to design. They proposed the followings: quizzes (N=1, 6%), games (N=3, 19%), revision activities (N=5, 31%), warm-up activities for a new topic (N= 4, 25%), and homework (N=3, 19%) (See Figure 4.1).

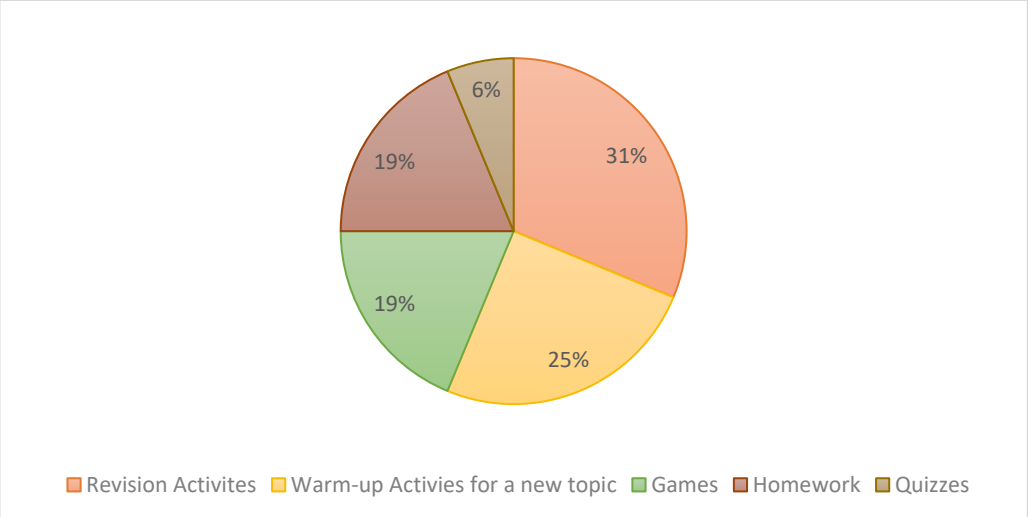

Figure 4.1 Frequencies for Activity Types AR Technology Can Be Used to Design

Most of the pre-service EFL teachers suggested that AR-based activities can be implemented for the purpose of revising the topics and introducing a new topic.

> It will be enough to use it 2 or 3 times a month. I also use it the topics that I have described as inadequate and complete the missing topics. I do once in a while to repeat. Or I can do it in

> preparation for the next topic. I make a preliminary preparation. I also do it as a separate activity for students with disabilities. [Participant 4, post-survey]

Some of the prospective EFL teachers proposed that teachers can prepare quizzes and games by using AR technology.

> I believe, preparing quizzes and games can be useful. Because Augmented Reality offers many options. We can add videos, songs and links. Students enjoy Augmented Reality tools while learning and practising. Quizzes can be useful. Students will complete a quiz on a platform which they like. [Participant 10, post-survey]

As another type of activity, integration of AR technology into homework was suggested by some EFL teacher candidates so as to scaffold learners when they have difficulty at any point of the homework.

> Students can scan homework to reveal information to help them solve a problem. [Participant 23, post-survey]
>
> It can't be used in classrooms very well. So, I think it should be given as homework. But the student's parents should be informed about the given homework and their responsibilities about it. [Participant 50, post-survey]

In relation to how often AR technology can be integrated into English lessons (See Figure 4.2), the prospective EFL teachers put forward that it can be used once a week (N=4, 23%) while some supported its use twice a week (N=6, 35%) and even three times a week (N=1, 6%). There were a few respondents suggested AR technology to be employed twice a month (N=3; 18), and a few of them thought that it can frequently integrated into the lesson (N=3; 18%).

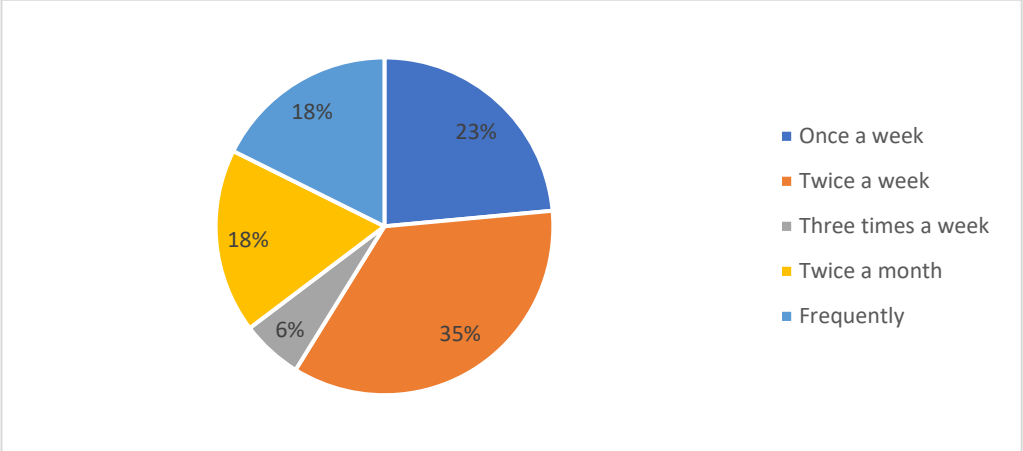

Figure 4.2 Frequencies for How Often AR Technology Should Be Integrated into English Lessons

Most of the respondents put forward that AR technology can be integrated into courses either once a week or twice a week because they believed that frequent integration of this immersive technology can be time-consuming.

> I think Augmented Reality is especially more useful for post activities and reviewing the previous lessons. However, It can be also time-consuming to use it all the time. That's why it can be used once, maybe twice a week. I think more elementary level topics can be more enjoyable for the students like, weather conditions and clothes. [Participant 24, post-survey]

For the same reason, time-consuming, some recommended that teachers can benefit from AR technology every two weeks in their courses.

> Augmented Reality can be used almost in every topic. So I suggest it to be used for the topics we cannot bring authentic materials to the classroom. It can be time consuming for teachers if it is used too often. It can be used once in two weeks. Or teachers can prepare shorter AR activities each week. [Participant 33, post-survey]

Nonetheless, there were a few prospective EFL teachers who were in support of the frequent use of AR technology in language classes in order to attract learners' attention and facilitate learning process.

> It can be used usually. If the topic is so boring for the students, Augmented Reality can be used in order not to students get bored.

> Or the topic may be hard. If you use Augmented Reality, the students may learn much easier. [Participant 44, post-survey]

Overall, all the pre-service EFL teachers argued that AR technology is beneficial for vocabulary as one of the language subskills. Nevertheless, they claimed that AR technology cannot be effectively employed for writing, grammar, and reading. Some also deemed AR technology as inefficient for practising speaking and listening. Additionally, they put forward a variety of topics into which AR technology can be integrated. They also proposed the following AR based activity types: quizzes, games, revision activities, warm-up activities for a new topic, and homework. As for how often AR applications can be utilised in English lessons, various suggestions were made and these included once a week, twice a week, three times a week, and twice a month. There were also a few participants who recommended its frequent use.

4.2.2.2. Qualitative Data Analysis Results in Relation to Subquestions for Research Question 1

The following three sections provide the qualitative analysis findings for the sub-questions of the first research questions. The visual model for the emerging themes and codes according to the data obtained through surveys, reflection forms, and interviews is demonstrated in Figure 4.3.

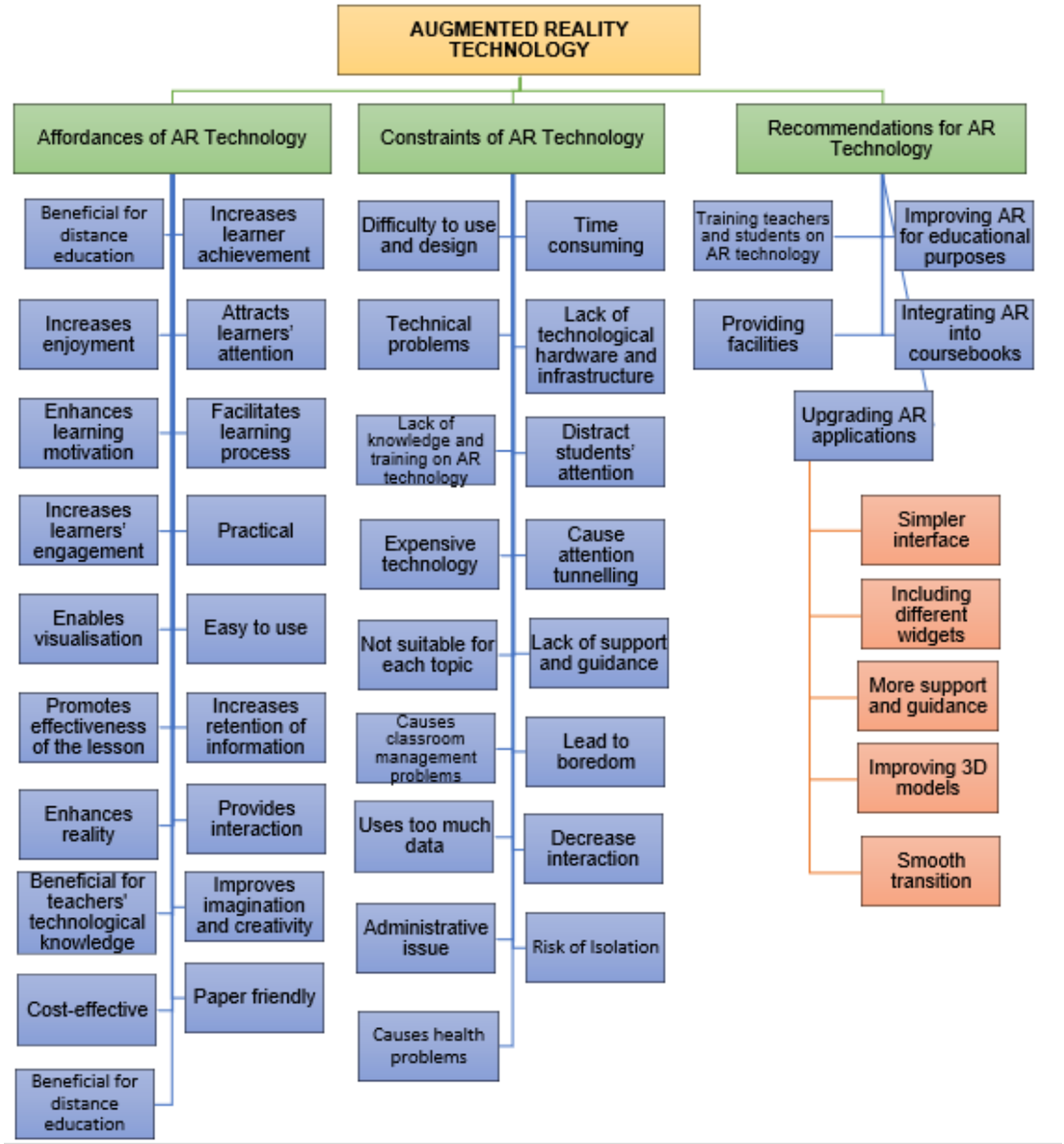

Figure 4.3 Emerging Themes and Codes for Affordances and Constraints of AR Technology along with the Recommendations

4.2.2.2.1 Affordances of Augmented Reality Technology

The first sub-question in relation to the pre-service EFL teachers' perceptions of AR technology was about the benefits of AR technology for teaching English. Their responses were elicited through open-ended questions in post-survey, reflection forms, and semi-structured interview. After the qualitative data were analysed, eighteen codes emerged as they are presented in Table 4.12. The majority reported that AR technology can increase enjoyment (*f*=145), attract learners' attention (*f*=103), and enhance learning motivation (*f*=74). They also stated that AR technology can facilitate learning process (*f*=64) and increase learners' engagement (*f*=53). In addition to that AR technology enables visualisation (*f*=45), AR applications were regarded as practical (*f*= 48), easy to use (*f*=35). They expressed that AR technology can aid in promoting effectiveness of the lesson (*f*=22), increasing retention of information (*f*= 18), and enhancing reality (*f*= 14). Additionally, AR technology was believed to provide interaction (*f*= 14). A minority indicated that having knowledge on and experience with AR technology can be beneficial for their technological knowledge (*f*= 8). They articulated that it could improve imagination and creativity (*f*=7), and it is paper friendly (*f*= 4) and cost-effective (*f*=4). Lastly, AR technology was considered to be useful for distance education (*f*=3) and can increase learner achievement (*f*= 3).

Table 4.12 Frequencies for Affordances of Augmented Reality Technology

Categories	Codes	Frequency
Affordances of AR technology	Increases Enjoyment	145
	Attracts learners' attention	103
	Enhances Learning Motivation	74
	Facilitates Learning Process	64
	Increases learners' engagement	53
	Practical	48
	Enables Visualisation	45
	Easy To use	35
	Promotes Effectiveness of the lesson	22
	Increases Retention of Information	18
	Enhances reality	14
	Provides Interaction	14
	Beneficial for teachers' technological knowledge	8
	Improves imagination and creativity	7
	Paper Friendly	4
	Cost-Effective	4
	Increases Learner Achievement	3
	Beneficial for distance education	3

Most of the prospective EFL teachers pointed out that AR-enhanced activities enhance enjoyment and make lessons fun with the help of the visuals created through AR applications.

> Well, I definitely think it is more fun and enjoyable than regular classes because it puts rare and difficult sights into picture to our real world with the help of, of course, hardware but that just puts a whole different level to teaching. To be able to literally bring stuff right in front of your students and you as well, that just makes the lesson more fun and enjoyable. [Cade, interview]

> I liked how objects act as if they existed in real life. I think they will attract the attention of these students to a lot of lessons, and the students will both enjoy and learn from the lesson so that they will be successful in their lessons and look forward to the next lesson. [Participant 29, post-survey]

As utilising technology for educational purposes is the trend in this era, AR technology can contribute to learners by attracting their attention to lessons.

> First of all, these activities are a great way of getting sts' attention because nowadays technology is the trend. [Participant 8, post-survey]

> Yes, exactly. It will be very beneficial, especially with the younger kids. They will probably be very interested in using the AR technology in the classroom and they will be more into the class. They will pay attention even more. [Emily, interview]

They also believed that making use of AR technology can appeal to learners of this era as they were born into technology and therefore named as “digital natives”.

> Of course, it helped my career as an English language teacher because, you know, children in these days are called digital natives and they are into technology. Also it is because I also got to see two different worlds in one, you know, computer page, virtual world and the real world around us and we can combine them and make use of it while we teach English to the students all around the world. [Sally, interview]

Additionally, it was noted by the pre-service EFL teachers that English language learners would be more motivated because doing AR-based activities is something they have never experienced before.

> Yes. So, as I said, I would, obviously, because it's because it's really fun and enjoyable for students. It's something unique that they didn't see before. So, it is really interesting, and it will really motivate them towards the lesson more. [Erinore, interview]

> This app increases the motivation of the students towards English more. [Participant 7, reflection form 3]

It was also stated that AR technology facilitates learning process because it cannot only make abstract concepts easier to understand but also consolidate what they have learned through AR-based activities.

> Before my experience, I would say I do not have any ideas but after my experience I do have some ideas and I can say it is very important in our learning and teaching because we can give our students 3D objects and we can give them sound. So it will make it more clear for them and make it easier to understand some abstract things. So it's very important. [Emily, interview]

> In my opinion, augmented reality is an actually innovative approach for the time that we live in and it has or will have great importance in many areas such as education, which is our field, and even though I have an old school approach to my own learning, I believe that it is pretty useful for learning. And I think it would be useful to help the students consolidate and practice the new knowledge through visuals in language learning classrooms. [Sara, interview]

As AR technology is considered to be appealing to 21st century learners who are also known as digital natives, the EFL teacher candidates believed that this would enhance learners' engagement. Thus, learners would actively take part in English lessons.

> I would use it in my classrooms. The most useful way to use AR personally is to reach our smaller students who are more difficult to reach because a teacher can't have one hundred percent energy all the time. So, I believe my usage of AR is to reach those students and make them more involved into our lessons to help them success even more. [Cade, interview]

> Yes, it is important because I tried it for the first time. It can make the lesson more active and effective. The students may be more active because nowadays we call students as 21st century learners. That's why technology is suitable and effective for them because they learn in different ways not only in the traditional way. [Rose, interview]

In addition, practicality of AR technology was emphasized by the pre-service EFL teachers since AR technology enables them to design various activities and games throughout different scenes or keep the same activity go on through ten scenes.

> It is indeed, because it provides the classrooms with various activities that would help with language improvement and the students might have the opportunity to have a different perspective about the subjects they learn, like. We are not limited to do certain activities. We can add variety and we can use different activities through augmented reality to have some actually spice in the activities. [Sara, interview]

In relation to practicality, it also allows users to integrate different sources and media into one material, which makes preparing language learning materials less time consuming.

> It helps us to use variable sources easily. …We don't have to use many websites and applications separately. [Participant 33, reflection form 1]

> It was less time-consuming because I could put a lot of activities in one page without having to spend a lot of minutes on it and I had more time on focusing on students, etc. It was also very practical. [Participant 17, post-survey]

Another aspect of AR technology which was regarded as an advantage by the prospective EFL teachers was that this technology enables visualising the content with a variety of visuals, 3D models, and videos.

> It is, yes, actually. It is so new area for me, but for the beginner level of language learners, especially in the vocabulary teaching part, it would be so useful because we can just visualize anything. And it is really good to see an animal in front of me just sitting next to me. Then just see the picture of the animal that's in that terms. The 3D reality in the classroom would be very helpful to teach some new words. And as also if we can integrate the videos of yours or some other tools with the augmented reality. And in that way, it would be so useful to use with all language skills. So, yes, it is useful for learners. [Janet, interview]

> An attractive and visually rich application in terms of three-dimensional pictures and sounds. It is compatible with today's technology. [Participant 40, reflection form 1]

Over half of the participants expressed that AR instruments are easy to use as long as users have intermediate level of computer knowledge.

> I think it is easy to use. Every people who have intermediate level computer knowledge can easily create an AR. [Participant 28, post-survey]

Considering that AR technology can help visualisation and provides a real-like learning environment, some pre-service EFL teachers stated that this technology can promote the effectiveness of language learning activities.

> Learning is more effective with real-time visuals and sounds. [Participant 8, reflection form 2]
>
> I think using and integrating Augmented Reality into the classroom is useful and effective for students and teachers as well in and out of the learning environment. Students love using technology to improve their language learning skills, etc. With this, it will be more real for them to engage in the activities, etc. and they will feel more motivated. [Participant 17, post-survey]

Some prospective EFL teachers argued that as AR technology can appeal to different senses, it can make learning more permanent and increase retention of information as well.

> And also, if we can just, you know, integrate all the skills, link visuals, that could be more permanent knowledge for students. Because they can see. They can hear. They can even sometimes try to touch the visuals. That would be helpful for language learners. [Janet, interview]
>
> The teacher makes the lesson more attractive using this app. This app enables the students to make the information more permanent in the memory with the visuals presented to the students. With this app, students participate more actively in the lesson. [Participant 7, reflection form 5]

Some EFL teacher candidates expressed that AR technology enhances reality and provides real-like environment for language learning activities, which makes learners get familiar with what they will come across in real life.

> Well, for example if we are going to teach our students about what to say and what to do in a restaurant or in a shopping centre, we can use that AR technology to create an environment that is

> similar to what they are going to encounter in the real world. [Cade, interview]
>
> I think it is very important to learn about Augmented Reality because we cannot deny the technology in our lives now, and with Augmented Reality we can make students feel like they are in a natural environment where they can see things they would see in a real life environment. [Sally, interview]

Some pre-service EFL teachers commented that AR technology can facilitate the language learning process by increasing the interaction among teacher, learner, and language learning material.

> Yes, I think it can be because augmented reality designs have three types of interaction in learning context, interaction with the material, interaction among students and interaction between teacher and student. So, because of that the lessons can be more fun and useful. [Jennifer, interview]
>
> There are lots of things I like about Augmented Reality activities …, improves physical task performance of the student, they can improve their interaction with each other I mean they improve collaboration. The class is more interactive with AR. [Participant 44, post-survey]

As an answer to the interview questions about the utility of AR technology for their teaching career, most of the interviewees stated that having learned and experienced AR technology before they graduate will be helpful for their technological knowledge as an EFL teacher because most of the teachers do not benefit from instructional technology tools and most likely are not aware of this technology either.

> I think it helped because I have already seen some schools. They all asked about if I know about the technology, if I am good at technology, if I had to teach online. They just want to know if the teachers know about technology. So, we want to have a good place in education, we need to know such technologies and it helped me in my teaching career and find a good school. Also, it would be really good in our CVs as well. When they ask about our technological background, we also say Microsoft Office but now we can say Augmented Reality and Blippar. They are more things to say on our CV. [Janet, interview]
>
> As many teachers don't know what Augmented Reality is or don't know how to use it. That's why it will be helpful for me and my career. [Rose, interview]

As AR technology aids in visualising the content, it was also suggested that it can contribute to learners' imagination and creativity.

> It fosters students' creativity and imagination. [Participant 41, reflection form 2]
>
> Augmented Reality is also helpful for the students' imagination. [Participant 48, post-survey]

A few pre-service EFL teachers added that AR technology is paper friendly since a piece of paper including an image or a picture is enough to design an AR-based language learning material.

> It helps to prepare materials without wasting paper. [Participant 21, reflection form 4]
>
> Augmented Reality is a good teaching aid and especially in the future it will be used very often because every generation uses technology more and more. Instead of preparing materials with paper, scissors, glue, etc. augmented is an easy and motivating choice for language classrooms. [Participant 33, post-survey]

In addition to being paper-friendly, very few participants commented that AR technology is cost-effective with widespread use of smart phones and internet access.

> AR is evolving to become more cost-friendly, accessible, effective, and essential – including in grounding schoolchildren with the competencies and knowledge required to collaborate with others and get ahead in careers of the future. [Participant 4, reflection form 5]
>
> It is interesting and easy to use. Only internet connection and a smart phone are enough to use it in any part of Turkey. [Mary, interview]

In reflection form, when the participants were asked about the advantages of AR technology, very few participants remarked that ultimately it can contribute to learners' academic achievement.

> It can improve the learning curve even more by offering students practical knowledge as well. [Participant 43, reflection form 1]

A minority of the respondents indicated that AR technology can be useful for distance education as well because learners can do revision or redo the activities on their own whenever they want.

> It is appropriate for distance learning. [Participant 21, Reflection form 1]
>
> Students can repeat while they are watching the AR. Also they can replay the project if they want it. I think using AR technology is very effective for times like this (for online teaching). [Participant 27, Reflection form 1]

All in all, the pre-service EFL teachers expressed that AR technology can offer many affordances for English language teaching and learning process. It helps visualising the content through audios, videos and 3D models, which draws learners' attention to lessons. It facilitates learning process with the help of various media, which makes learning more permanent and promotes effectiveness of the lesson. Thus, AR technology was believed to contribute to learning outcome and learners' academic achievement. AR-based activities were regarded as engaging and motivating. Therefore, students can both have fun and learn at the same time. Additionally, the prospective EFL teachers found AR application practical and paper friendly because the system enables users to design various activities and games only with a picture or an image. Another advantage was that AR technology can be useful for distance education. Lastly, the EFL teacher candidates stated that having gained knowledge about and experience with AR technology before they graduated would improve their technological knowledge and help their teaching career as an EFL teacher as well.

4.2.2.2.2 Constraints of Augmented Technology

The second sub-question in relation to the pre-service EFL teachers' perceptions of AR technology aimed to reveal the limitations of AR technology for teaching English. The relevant data were gathered with the help of open-ended questions in post-survey, reflection forms, and semi-structured interview. When the qualitative data were analysed, seventeen codes were created as they are demonstrated in Table 4.13. Within this scope, the most highlighted aspect of AR technology was its complicated interface which makes it difficult to use and design (*f*= 96). Concerning this, the majority of pre-

service EFL teachers deemed AR as time consuming (*f*= 67). They also frequently pointed out technical problems (*f*= 64) and lack of technological hardware and infrastructure (*f*= 61). Additionally, they expressed that there is a lack of knowledge and training on AR technology (*f*= 59). The necessary technological hardware for AR applications to operate was considered to be expensive (*f*= 26). Some prospective EFL teachers reported that AR technology might distract students' attention (*f*= 25) and cause attention tunnelling (*f*= 17). A small number of respondents said that it might not be suitable for each topic (*f*= 13). A few respondents indicated that the support and guidance provided might not be enough (*f*= 8). A few EFL teacher candidates believed that it could lead to boredom (*f*= 7) and cause classroom management problems (*f*= 7). Additionally, they indicated the risk of isolation (*f*=6) and the health problems possibly caused by AR technology (*f*=6) as disadvantages. The other constraints referred were that it can decrease interaction (*f*= 3), it uses too much data (*f*= 4). Lastly, an administrative issue was stated by one participant as a disadvantage, which was using mobile phones are not allowed at schools (*f*= 1).

Table 4.13 Frequencies for Constraints of Augmented Reality Technology

Categories	Codes	*Frequency*
Constraints of AR technology	Difficulty to use and design	96
	Time consuming	67
	Technical Problems	64
	Lack of technological hardware and infrastructure	61
	Lack of Knowledge and Training on AR Technology	59
	Expensive Technology	26
	Distract Students' attention	25
	Cause Attention Tunnelling	17
	Not suitable for each topic	13
	Lack of support and guidance	8
	Causes classroom management problems	7
	Lead to boredom	7
	Causes health problems	6
	Risk of isolation	6
	Uses too much data	4
	Decrease interaction	3
	Administrative Issue	1

One of the main limitations of AR technology remarked by pre-service EFL teachers was that AR technology is difficult to use and some participants had also difficulty in

activity design process. They associated this difficulty with the complicated interface of AR applications.

> I had some difficulty understanding the features of the application while doing the first application. It took a while to learn what and how to use when designing my activity. Afterwards, I found it a bit difficult how to open my activity in Blippar application. However, as I progressed, I discovered more features and started using them in my other activities. [Participant 15, post-survey]
>
> Augmented reality is a little bit hard to use that's why I had some challenges while using it and putting the items into the application and when I renew the pages some items are become bigger or smaller or even slide to another place. That's why I had to arrange them again and again. [Participant 24, post-survey]

Concerning the difficulty in designing AR based materials, some prospective EFL teachers stated that they had problems with finding 3D objects which are compatible with the AR application.

> I believe while creating an activity, Blippar or Augmented Reality tool in general, the most difficult part is finding 3D objects and materials. Even if you find these objects, they are in a different file format. I think augmented reality programmes and applications should find a way to implement 3d object or files that work well with Blippar or any other Augmented Reality. There should be a way to work well with those files and with their applications. So, they can easily use other 3D objects on different websites or programmes. [Cade, interview]

While adding different scenes were complex process for some participants, some participants found adding transition between the scenes basic because the audio on the first scene does not keep playing through different scenes.

> I believe, adding new pages was difficult. I would like to add pages, but it was hard to find. So, my activities are limited with one page only. If there are more specific information at the site, preparing an activity could be easier and fun to me. [Participant 10, post-survey]
>
> Transition between scenes is not developed. Music is not transferring when you changed the scene and you have to click the button to start the music. It is not possible to add a background music. It is the biggest problem for AR program. Because it is important for young learners. [Participant 49, post-survey]

According to the pre-service EFL teachers, another disadvantage of AR technology was that designing language learning activities takes too much time. Therefore, preparing such activities for each lesson can be exhaustive.

> The disadvantages of this technology are that it takes too much time to prepare the material. For example, for one task, it took two hours to prepare it, which is too much. With technology, we cannot always do the things we want to. These are the disadvantages for me. [Rose, interview]
>
> Unfortunately, it takes a lot of time to prepare and I can say that this is quite tiring. [Participant 36, post-survey]
>
> It is hard and time consuming to prepare an activity for whole class. Instead, handout activities can be prepared. [Participant 47, reflection form 1]

Another common constraint mentioned by the respondents were related to technical problems which possibly occur either during activity design process or during implementation process in the classroom. It was pointed out that AR application depends on technology and technological hardware working properly.

> Yes, actually it can be. You know, it's still a developing feature that is taking up most of the education phase for the term that we're in right now. But sometimes technology could fail us, and things might not go as planned. So that might be the disadvantage of it. But in addition to that, I believe that in time, the people who are running these augmented reality tools will improve it in order to have more variety for further studies. [Sara, interview]
>
> Sometimes technology could disappoint its users by not working properly when it is needed. [Participant 35, reflection form 1]

One technical problem voiced by the respondents was that AR application might not work properly due to low performance of the application and the website from time to time.

> Sometimes the performance of the website or the application can be low which can affect the teaching and learning environment. Sometimes lack of privacy can be an issue. It just didn’t happen to me, but it may happen because it is technology at the end of the day. [Sally, interview]

> I also found that even if I upload the pictures / objects properly, it doesn't open on the phone. In addition, I had a hard time adjusting the size of the objects. [Participant 36, post-survey]

Another common technical problem indicated by the prospective EFL teachers was about the bad internet connection which could influence both activity design and implementation process in a bad way.

> Sometimes the internet connection may go off and this may affect the learning environment in a bad way. [Participant 17, reflection form 2]
>
> My internet connection was weak so the Blippar always freezes during the work and that gave me some hard time. [Participant 21, post-survey]

The majority of respondents highlighted that lack of technological hardware and infrastructure such as lack of smartphones or internet connection was another concern of the participants because they need this hardware in order for AR technology to function correctly, and some schools located in certain parts may not be able to provide these facilities.

> Yes, probably because it's very new technology that we are using in our classes. So maybe the school wouldn't have the technological stuff that I need so I can have problems with that or maybe my computer won't work properly. [Emily, interview]
>
> Yeah, it is not only for language teaching, but as general, it is hard to use, I mean, not to use technology, but there is a lot of disadvantages of this technology because we need to have some devices. We need to have Internet connection and these all need some…How can I say? Some areas maybe don't have these connections. Not all schools have this kind of chance. So, it might be this advantage for this type of schools. [Janet, interview]

Some participants noted that they did not have any challenges because they are born into this technological era whereas it can be hard for teachers who lack knowledge and training on how to use computers and AR technology.

> It is not really hard to use AR tool to design activities for the lesson, but I'm only saying it because I was born into this era of technology, so it is easy for me. It can be challenging for older teachers to create helpful activities for their lessons. [Participant 8, post-survey]

> Actually, I'm not so good at computer it always so hard and time-taking for me to prepare a thing. This is a new platform for me so it's hard to get used to AR. But it's easy to learn so I adjust to that platform and I enjoyed when I create something. [Participant 11, post-survey]

From the prospective EFL teachers' perspectives, some features of AR applications can be expensive when the lack of technological hardware at certain schools are taken into consideration. As an example, some participants pointed out that users are required to pay some fee so as to share their AR-based activities through the website.

> The first thing that came to my mind is that some versions are expensive because we can create some activities and useful visuals but to make it further by sharing our activity with others, we need to pay some money. [Sally, interview]

In the case that the necessary permissions are given, the pre-service EFL teachers expressed their concern that if AR-based activities are not well planned and organised, it can distract students' attention during the implementation process.

> If we don't create an appropriate AR, it can distract students' attention. So, also students' attention span is very short, and we should design the task for it. [Mary, interview]
>
> I cannot use Augmented Reality every day. When I prepare my lessons, I can see if I can teach students by creating an activity by using Augmented Reality technology. Also depend on class wealth, students abuse the technology and can be distracted if they struggle using technology. [Participant 47, post-survey]

As some respondents commented, another drawback could be related to the fact that some learners may pay more attention to various aspects of AR application and neglect the core of the activity, which is named as "attention-tunnelling".

> Also, it is colourful, there is sound. The students' aim can be changed. They may want to play game instead of learning. [Mary, interview]
>
> Because of colourful setting students can only focus on watching AR instead of participating the lesson. [Participant 27, reflection form 3]

It was noted by some prospective EFL teachers that it is not possible to teach each topic with the help of AR technology because the system was not eligible for designing certain activities and therefore not appropriate for teaching some topics.

> AR may not be appropriate for each lesson. [Participant 12, reflection form 2]
>
> The app is not so good to do anything you want or teach. [Participant 50, reflection form 3]

A small number of pre-service EFL teachers found the support provided barely enough and indicated that they need more guidance and support from the website and the application.

> I found the common function weak because when I started using the Program there was no introducer or information about how we could do it. I understood the program myself and learned how to do it. When I first signed in, I would like it to guide me. Or it could be the confirmation key in the selections and additions I made. [Rose, interview]

Only a small number of respondents indicated that implementing AR-based activities can cause classroom management problems because some learners may consider AR-based activities only as a game or fun activity.

> When students think it as a game, there may be some management problems in the classroom. [Participant 24, reflection form 1]
>
> There will be students who can disrupt the order of the lesson and not take this activity seriously. [Participant 3, reflection form 5]

Some prospective EFL teachers pointed out that AR application should be employed for preparing a variety of activities, otherwise it may lead learners to get bored after some time.

> I think whenever there is a visually satisfying topic there should be a well-designed AR activity. Even if a student is an audial learner, an on point visual activity always creates a better learning environment. Students might get bored from using AR if it is used in the same boring way all the time. [Participant 8, post-survey]

A small number of the respondents stated that AR technology can lead to some health problems like addiction to virtual world when users spend too much time employing AR technology.

> Students may spend a lot of their times using technology which can be unhealthy both mentally and physically as well. [Participant 17, reflection form 1]
>
> Addiction to the virtual world. [Participant 41, reflection form 5]

Another disadvantage reported by the prospective EFL teachers was the risk of isolation which can result from the immersive nature of AR technology.

> I think the disadvantages are about its usability and practicality, technical problems and lack of training, and risk of isolation. [Jane, interview]

Concerning the internet connection, a few participants expressed that another liability of AR application is using too much data, which increases expenses spent by schools or teachers employing AR technology.

> Unfortunately, AR applications require internet and they use the data in excess. The price of mobile internet is higher in our country compared to many countries. This is a minor problem for college students, but it is very difficult to use in public schools. If an application that does not require internet needs is made, its use becomes widespread in our country. [Participant 37, post-survey]

According to a few pre-service EFL teachers' opinions, AR technology has the potential to lead to decrease in the amount of interaction between pairs.

> Students can lose the interaction between their peer if they focus on the AR tool too much. [Participant 28, reflection form 3]

Although only one participant mentioned this administrative issue, students are not allowed to use their mobile phones under normal conditions during the school hours, which is a major drawback as smart phones are essential to conduct AR-enhanced activities.

> As a support and through sources, mobile phone or Internet connection are important. But we cannot use mobile phone in our classrooms. [Jane, interview]

All in all, the pre-service EFL teachers expressed that designing and implementing AR-enhanced activities in English language classroom poses some challenges. In terms of activity design process, it was considered to be difficult to use due to complicated interface of AR applications and therefore time-consuming. It was noted that the interface of AR applications does not enable users to prepare activities for each topic. In addition to several technical problems which are likely to occur, lack of technology hardware poses a major difficulty. Providing these facilities to the school can be costly when excessive data consumption of AR applications is taken into consideration. Some participants believed that there was not enough guidance given by the applications and the website. Some respondents mentioned that many teachers would not be competent enough to employ AR technology and prepare AR-based activities. Another drawback was about an administrative issue which is learners are not permitted to use their smart phones during the course hours. Additionally, there might be some classroom management problems; AR technology may be distracting for students and cause attention tunnelling. There might be a decrease in interaction among pupils. Additionally, if the same types of activities are carried out, then learners might lose interest in AR technology. Lastly, spending too much time using AR technology can lead to some health problems and isolate users from their environment due to its immersive nature.

4.2.2.2.3 Recommendations for Using Augmented Reality Technology

The goal of the last sub-question in relation to the pre-service EFL teachers' perceptions of AR technology was to elicit their recommendations on employing AR technology to teach English. The open-ended questions were asked to the participants in post-survey, reflection forms, and semi-structured interview. Based on the qualitative data analysis, five main codes were formed as they are displayed in Table 4.14. The prospective EFL teachers suggested AR applications to be upgraded by simplifying their interface (*f*=38), including different widgets (*f*=35), providing more support and guidance through website and the application (*f*=30), improving 3D models (*f*=9), and making transition between the scenes smoother (*f*=4). Another suggestion was training teachers and learners on how to use AR technology (*f= 29*).

Approximately one fourth of the respondents proposed that AR applications should be improved for educational purposes (*f*=12). Additionally, they put forward that certain facilities should be provided by the school administration (*f*=10). Lastly, a few EFL teacher candidates made a suggestion that AR technology should be integrated into EFL coursebooks (*f*=3).

Table 4.14 Frequencies for Recommendations for the Use of Augmented Reality Technology

Codes	Codes	Frequency
Upgrading AR applications	Simpler Interface	38
	Including different widgets	35
	More support and Guidance	30
	Improving 3D models	9
	Smooth Transition	4
Training teachers and students on AR technology		29
Improving AR for Educational Purposes		12
Providing facilities		10
Integrating AR into Coursebooks		3

Most of the pre-service EFL teachers recommended that the interface of AR application can be simplified for educators.

> The website should be more understandable and more basic for anyone to use it. It is just too complicated. [Participant 1, reflection form]
>
> Maybe they can make it easier to understand for us. The interface can be designed simpler. I wouldn't change too many things. Only some things could be easier to understand. Well, the 3D the objects were one of them. [Janet, interview]

If it is viable, they even suggested that different interfaces for different users can be developed so as to tailor the AR applications according to users' aims because they do not need the features which are more useful for the field of architecture.

> I recommend them that they can divide the Blippar into categories like students, teachers, or interior designers. A teacher does not need to use a function which an architecture will be using. A student can use simpler things. So, categories can make the work easier. Also, they can add some images for us, teachers. [Mary, interview]

> Specific categories according to purpose of use can be created. There should be some specific categories like education, business, gaming etc. So, it is will be easier to use according to people's aim. [Participant 27, reflection form 5]

Over half of the respondents put forward that the variety of widgets included in AR applications can be expanded, which would enable users to prepare various kinds of materials and activities.

> Maybe different objects, and different types of materials and real-world connection can be improved by adding different things, materials, etc. to Blippar. Other than that, it is a very useful tool for teachers and students all around the world. [Participant 19, reflection form 2]

A small number of participants indicated that AR applications supply more options for 3D models and ensure the compatibility of visuals with 3D models.

> I don't know, actually. Maybe they can improve the 3D versions. I mean, I tried to use this world map and some 3D objects, but these pictures didn't really fit inside of the 3D objects. There were some complications and we couldn't use everything we wanted to use. [Janet, interview]
>
> Definitely to work on more compatibility with different files or 3D objects. [Cade, interview]

According to the prospective EFL teachers, another aspect of AR application which needs improving was the transition between the scenes. A few participants offered that there should be a smooth transition between the scenes and there should be a way to keep playing the music even if the scenes change.

> Switching between scenes are not good. Music should continue through scenes. [Participant 49, reflection form]

In relation to upgrading of AR application, it was also recommended that these applications should provide more guidance and step by step instructions. These instructions should serve in every language not only in English.

> There should be a guide that will help you step by step to make a simple activity when you sign up. [Participant 8, reflection form 2]

> A user guide should be created for every language. [Participant 12, reflection form 2]

More than half of the pre-service EFL teachers put forward a suggestion that both teachers and students should be given training on how to use AR technology. As a response to the question about self-efficacy in AR, one of the interviewees mentioned that technology-based courses they have taken during their undergraduate degree were devoted to basic technological knowledge. Therefore, a separate course on emergent technologies like AR technology would be more beneficial for them during their pre-service education so that they can address to learners of this generation.

> I think I'm six. I'm not really bad. I know a lot of things related to technology, but I know that I can improve so much better. I mean, it would be better if we have a separate course for such technologies. I know we had some computer courses in the university, but it wasn't enough for implementing augmented reality. I mean, teachers and such technologies, we need to have some separate courses for that so that my knowledge is not enough to go outside and use all the tools related to augmented reality. I know how to use Blippar because I practiced it more than once. But there are a lot of tools and we actually it would be better if we learn some other tools as well. And that's why I am six now. What I can improve myself and I can get closer to ten. [Janet, interview]

> I think lessons about Augmented Reality should be essential for all faculty of education students. New generation students do not like the classical teaching methods. In my opinion, each generation requires new teaching methods and as teachers we should update ourselves always. [Participant 21, post-survey]

Like pre-service education, training on how to use AR technology and design language learning materials should be provided to teachers as part of their in-service teacher training. This training should not be limited to only teachers and should involve students as well in order for AR-enhanced activities to proceed smoothly in the classroom.

> Also students as well as teachers should get necessary knowledge about how to use AR. [Participant 20, reflection form 2]

> In order to use the augmented reality, I think a good education should be provided. And the teachers who will give this training should be well trained on this subject, because if the teachers are

> well trained on this subject, the topics will be transferred to the classrooms and students well. [Participant 16, post-survey]

In relation to updating the AR tools, the prospective EFL teachers also made recommendations for improving these tools for educational purposes by including options for pictures or even a picture archive for educator because it was difficult to select an appropriate picture for the activities.

> Also, they can add some images for us, teachers. [Mary, interview]
>
> The image option should definitely be improved because it is difficult to find a picture. [Participant 39, reflection form 1]

Another recommendation for improving AR technology for educational purposes was that a network or platform can be designed for sharing AR-based activities with other educators. Thus, a pool of AR-based activities can be formed. Teachers would save time by working on these readymade activities to tailor according to lessons objectives and learners' needs.

> Maybe teachers can share the topics and create an AR then share it with other teachers therefore, it will be easier for all of the teachers. [Participant 27, reflection form 1]
>
> There should be more website which contains AR materials and teachers can share their materials with each other. [Participant 28, reflection form 1]
>
> I would tell them to provide users with some samples and enable the users to make changes on those samples. Like readymade ones that could be edited later by other users, which can be timesaving and more efficient in terms of variety I believe. [Sara, interview]

Some EFL teacher candidates suggested that the technological hardware should be provided either by the government or the school administration.

> Needed areas can be support by government. [Participant 21, reflection form 5]
>
> Government can provide devices and tools for educators and students as well. [Participant 20, reflection form 3]
>
> In order to prevent technical problems, schools should be enriched with necessary devices. [Participant 21, reflection form 2]

As the respondents put forward, for AR applications to work smoothly, internet connection should be strong, which is another facility to be supplied by the schools.

> Scanning picture sometimes may be a problem about connection. So, this part should be improved. [Participant 2, reflection form 1]

Concerning the future adoption of AR technology in educational fields, as students are not allowed to use their smart phones during school hours, special rooms should be designated for conducting lessons including AR-based activities according to pre-service EFL teachers.

> We could have some AR labs, like vocabulary labs and listening laps in schools. So, I don't think it will be very easy to use it every class in the school. But if we make it into a lab or something like that, it will be very easy to use, very easy to access and very helpful for the students. We can adapt it like that. [Emily, interview]

> All right. For individual classrooms. It may not seem possible right now, you know, a different classroom at a time, but at schools. I believe that they can be special classrooms like tiny rooms, maybe especially for augmented reality applications like laboratories. And the students can be taken to those classes once in a while to have different lessons there, which might be fun, which might cause add to excitement and the need for education and love for learning. [Sara, interview]

Some pre-service EFL teachers suggested that AR technology should be integrated into curriculum and EFL coursebooks in the near future.

> I think Augmented Reality should definitely be included in lessons. In fact, I think it should be included in the curriculum and the MEB should prepare suitable AR activities for the lessons. [Participant 8, post-survey]

> Also, for English language teachers, the course books will be prepared integrated with AR technology. For example, there will be some barcodes or QR code, we will just scan the code and there will be visuals and sounds in front of us. So, course books will also be beneficial in that term. For me, I will use AR technology in my classroom to teach vocabulary as a start, also develop listening skills. Also, I believe not only in language courses but also other lessons like history and geography will benefit from AR as well. [Janet, interview]

All in all, the pre-service EFL teachers put forward their suggestions concerning the AR technology and its use in English language learning. Their recommendation consisted of the followings: upgrading AR applications by simplifying the applications; including more options 3D models; providing more support and guidance; making transition between the scenes smoother; training pre-service and in-service teachers, and students on using AR technology; improving AR for educational purposes; providing facilities such technological hardware and internet connection; integrating AR into EFL coursebooks and English language curriculum.

4.3. Results in Relation to Pre-Service EFL Teachers' Acceptance of AR Technology

TAM survey was employed to scrutinise the prospective EFL teachers' acceptance level of AR technology for the purpose of teaching and learning English. TAM survey was administered both before and after the activity design process to gather quantitative data while interview and post-survey was the main tool for collecting qualitative data.

4.3.1. Quantitative Data Analysis Results in Relation Research Question 2

In order to understand the pre-service EFL teachers' acceptance of AR technology in ELT, the quantitative data were obtained through TAM survey including 24 items on 4-point Likert scale. Table 4.15. presents that the descriptive statistics for their acceptance of AR technology in pre-TAM survey were N=50, M= 71.08, SD= 9.043 while the descriptive statistics of the post survey for the same part were N=50, M= 75.12, SD= 10.217.

Table 4.15 Descriptive Statistics for TAM Survey Part A (Mean and Standard Deviation)

		TAM Pre-Survey Part A		TAM Post-Survey Part A	
	n	**Mean**	**Sd**	**Mean**	**Sd**
Exp. 1	50	71,08	9,043	75,12	10,217

The next step was to run normality tests to find out whether the assumptions were met for paired-sample t-test. For this purpose, "Kolmogorov-Smirnov normality test" was carried out, and the histograms and boxplots were checked for visual inspection of

normality. Kolmogorov-Smirnov's test (p>.05) showed that data were normally distributed for the first part of TAM survey (See Table 4.16).

Table 4.16. Kolmogorov-Smirnov Test for TAM Survey Part A

	df	Statistics	Assumption Sig. (2-tailed)
Pre-TAM survey Part A	50	.054	.200
Post-TAM survey Part A	50	.072	.200

Therefore, paired sample t-test, a "parametric test", was conducted to find out whether there was any significant difference in acceptance level of the prospective EFL teachers in terms of AR technology between pre-TAM survey (M=71.08, SD=9.04) and post-TAM survey (M=75.12, SD=10.21). As it is displayed in Table 4.17., the paired sample t-test reached statistical significance, t (49) = 3.38, p =.001, which indicated that the EFL teacher candidates' experience with this technology for 10 weeks led to a significant difference in the level of acceptance of AR technology in English courses.

Table 4.17 Paired Sample T-Test for TAM Survey Part A

	Mean	Sd	t	df	Sig. (2-tailed)
Post TAM-Pre TAM	4,04	1.192	3.38	49	.001

4.3.2. Qualitative Data Analysis Results in Relation Research Question 2

In order to unveil the pre-service EFL teachers' acceptance level of AR technology, some open-ended questions were posed to them through semi-structured interview and post-survey. During the interview, the question of whether there have been any changes in their thoughts in terms of integrating AR tools to English courses was directed to the prospective EFL teachers (See Table 4.18). There were one neutral and eleven negative views before the experience, and all the views were positive after their experience.

Table 4.18 The interviewees' acceptance of AR technology before and after the experience

Perception	Before the experience	After the experience
Positive	0	12
Neutral	1	0
Negative	11	0

Before they experienced AR technology, almost all respondents noted that there was no potential in AR technology for teaching English. After the implementation, they decided to make use of this emergent technology in their future classes.

> Oh one hundred percent. I mean before I started, I saw no potential in AR because it was difficult to implement when I knew about it. I did not know we could use AR with our phones, through websites and we can use our phones and project the visuals there. It changed my idea because basically I learned how it was to use, how it became a lot easier to use. [Cade, interview]
>
> Yes. Before that, I will probably never think about it to use it in my class. But now. I'm more open to it. I can actually try. If I have the tools to use it, I will definitely try to use it in my class. [Emily, interview]
>
> So at first I really thought that this AR website will not work especially in English classes. But after I study on it, I realized that it's really helpful actually and it's something unusual for students and for teachers. [Erinore, interview]

After the implementation process, AR technology, which enables teachers to prepare various activities for language teaching and learning, was regarded as "a new language learning strategy", therefore, all the pre-service EFL teachers had positive views about the employment of AR-based activities in English classes.

> Yes, of course. And I think that a new option, which is a big option, actually has been added to the pool of activities that take place in a language learning classroom. Like, it adds different tasks, and it has a way to catch up with the era that we're in right now and apply recent developments in the classroom. [Sara, interview]
>
> I think Augmented Reality technology can be used as a new language learning strategy. It can be used for improving learning in general and particularly in language learning. It will be good and brilliant idea to mix reality with technological tools, which might enhance language learning. At the beginning, I was

> neutral because I haven't heard about it before. Now, I have positive thought about it. [Jennifer, interview]

It was noted that two of the interviewees were not familiar with AR technologies before the implementation process. After the implementation process, they thought that AR technology can be utilised for teaching English as well.

> Before that, I didn't have any idea about augmented reality. We have been exposed to augmented reality with games, instagram or snapchat filters. But, I did not know its name. after that, I know its name, augmented reality, it is not only used for games or instagram filters. It can be also used for educational purposes, architecture industry. I didn't know that it is that beneficial. [Mary, interview]

> I heard the word augmented reality for the first time in this project. When I researched, I realized that it is really a very different tool and used in different fields. I was excited to use it in the language class and to design tasks. I saw it as a useful tool to contribute to the learning of the students. That's why I liked it when doing the tasks. When I finished the last task, I decided that it was an enjoyable AR for all students to participate in the learning of concrete subjects. [Rose, interview]

Although some prospective EFL teachers have heard about this emergent technology, they stated that they felt hesitant to use this technology at first since they have not had experience in using this technology for educational purposes.

> At first, I felt hesitant to start this kind of activity because it was new for me. Of course, I have used technology before, but this kind of activity was different for me. After the task implementation process, I felt totally comfortable and confident in using the app, using Blippar and providing students with this kind of activity and materials based on this technology. These kinds of thoughts came to my mind. I had some difficulty at first. But after that, I tried to solve this, and I was very happy about it. [Sally, interview]

In relation to the pre-service EFL teachers' acceptance of AR technology, they were posed the question of whether they would benefit from AR tools in their future classes both in post-survey and interview, and the frequencies were calculated and displayed in Table 4.19. According to data from post-survey, 38 of them stated that they intend to use AR technologies in their English classes in the future whereas four of them were

against employing AR-based language learning materials in the future. There were eight participants who were indecisive about implementing AR-enhanced activities in their future English classes due to several reasons. Out of 12 pre-service EFL teachers interviewed, nine of them expressed their intention to benefit from AR technology in the future while three of them were indecisive about using this technology.

Table 4.19 Frequency for Intention to Employ Augmented Reality Technology

Question	Answers	Post-Survey Frequency	Interview Frequency
Would you like to use Augmented Reality tools in your future English lessons?	**Yes**	38	9
	No	4	0
	Both yes and no	8	3

In relation to their intention to utilise AR technology, the prospective EFL teachers were also asked to provide their reasons. Most of the pre-service EFL teachers were in favour of integrating AR technology into English courses due to several reasons such as fun, motivating, and engaging.

> I would like to use Augmented Reality tools in my future English lessons. First of all, it is fun for both teachers and students because there are a lot of activities that can be shown to students in a colourful, engaging way. In that sense, it is motivating as well. It is practical because teachers won't have to deal with different worksheets, papers, etc. It is less time consuming and this will help both teachers and students within the learning environment. All in all, I would like to use it in my future English lessons. [Participant 17, post-survey]

> I would love to use it because it was very fascinating because I can imagine when the students see the AR technology and they use it, it will make them very excited. I would like to see that in the future. [Emily, interview]

Another reason indicating their intention to benefit from AR technology for teaching English in the future was that they can either design different activities on different scenes or keep an activity going on throughout the scenes.

> I would use Augmented Reality in my future classes because it is fun, enjoyable and informative and also students can see all the

> things at once. We can give different activities on different scenes. [Sally, interview]
>
> Of course, I would like to use Augmented Reality tools in my future English lessons. Because it's useful for the students' learning. They have fun while they are learning. There are different types of activities and these activities take attention of the students. [Participant 44, post-survey]

Some EFL teacher candidates expressed that they would design AR-based activities from time to time because AR-based activity design process takes too much time.

> Of course, I will. Although I won't be able to use it in each lesson. I would use it for teaching vocabulary, but it does not have a purpose in the writing lessons. [Hannah, interview]
>
> I can use it will be more effective. students can have a lot of fun. but I do not use in every lesson. because it takes a lot of time to prepare. sometime students should learn with real world. the same things always bore them. It will be enough to use it 2 or 3 times a month. [Participant 4, post-survey]

Additionally, some pre-service EFL teachers mentioned that the use of AR technology would be more common in educational fields in the future, therefore they would try to make use of this immersive technology as well.

> I would because Augmented reality has the potential to replace paper textbooks, physical models, posters, printed manuals, etc. It offers portable and less expensive learning materials. As a result, education becomes more accessible and mobile. Also, interactive, gamified AR learning can have a significant positive impact on students. It keeps them engaged throughout the lesson and makes learning fun and effortless. [Participant 23, post-survey]

There were some respondents who were indecisive about whether they would implement AR-enhanced language learning materials in their future classes because this technology may not be accessible in their school due to its location, and pupils are not allowed to use their smart phones during the class hours.

> Both yes and no. Preparing activities with AR program is really difficult and using it in classroom won't be possible if I go to the east of Turkey as a teacher. But I want to use it because it can be a very good fun activity for young learners, and it is a good

> supplement for teaching a foreign language. [Participant 49, post-survey]
>
> Yes, I would like to use it because it is proper for children and it is nice for learning and English teaching. I wouldn't use it because it takes lots of time for us to prepare an activity. Also, kids cannot bring smart phones to the classroom for using the app. It should be something like homework. [Participant 50, post-survey]

A few of them stated that their hesitation resulted from the conditions of the school they will be working at, and these conditions can include the load of the language curriculum and the managers' perceptions of AR technology integration into English language classes.

> I am not sure because it depends on my manager. If she or he is open to it, then why not? [Evelyn, interview]
>
> Almost all private schools have their own systems and programs. If I have extra time between classes, then I can use Blippar to teach vocabulary. [Jennifer, interview]

On the other hand, there were some prospective EFL teachers who were not in favour of using AR technology in English courses because they do not consider AR technology as an appropriate tool for teaching and learning English, and they would prefer using realia to utilising visuals provided by AR applications.

> I do not think I will use it when I become a teacher because it is very tiring to prepare and takes time. I can also teach my students this with a real object rather than an abstract picture such as car toy. I am against especially young students learning by looking at a screen. [Participant 36, post-survey]
>
> I do not think of using AR in my lessons in the future because I do not think it is very suitable for English lesson. I think AR could not convey the content of the course adequately in other skills except vocabulary. For all these reasons, I do not intend to use AR. [Participant 38, post-survey]

Overall, approximately all the EFL teacher candidates interviewed reported that they were not quite familiar with AR technology before their experience with this technology as part of this study. After the implementation, the participants demonstrated a positive inclination towards the use of AR technology in English lessons, and all the interviewees expressed their acceptance of this technology.

4.4. Results in Relation to Pre-Service EFL Teachers' Self-Efficacy in Using AR Technology

The last research question of this mixed method study aimed to investigate the pre-service EFL teachers' self-efficacy level in using AR technology. To this end, the quantitative data were obtained through TAM survey, and interview questions were utilised to gather the qualitative data.

4.4.1. Quantitative Data Analysis Results in Relation Research Question 3

To measure the self-efficacy level of the pre-service EFL teachers in utilising AR technology for designing language learning materials, the quantitative data were collected through TAM survey. Table 4.20 reveals that the descriptive statistics for attitude to their self-efficacy level in using AR technology in pre-TAM survey were N=50, M= 29.92, SD= 6.163 while the descriptive statistics of the post-TAM survey for the same part were N=50, M= 30.30, SD= 5.643.

Table 4.20 Descriptive Statistics for TAM Survey Part B

		TAM Pre-Survey Part B		TAM Post-Survey Part B	
	n	**Mean**	**Sd**	**Mean**	**Sd**
Exp. 1	50	29,92	6,163	30,30	5,643

The normality of the data was checked by conducting Kolmogorov-Smirnov normality test. The data distribution was found to be normal based on the visual inspection of boxplot and Kolmogorov-Smirnov's test (p>.05) (See Table 4.21).

Table 4.21 Kolmogorov-Smirnov Test for TAM survey Part B

	df	**Statistics**	**Assumption Sig. (2-tailed)**
Pre-TAM survey Part B	50	.115	.097
Post-TAM survey Part B	50	.118	.078

Therefore, paired-sample t-test, a parametric test, was appropriate to be conducted so as to explore whether the pre-service EFL teachers' self-efficacy level in AR technology before implementation process significantly differed from their self-efficacy level after this process. The difference between pre-TAM survey and post-

TAM survey was not statistically significant, t (49) = .430, p=.669 as it is presented in Table 4.22, which indicated that the experience with AR technology for ten weeks did not lead to a significant change on their self-efficacy level in using AR technology.

Table 4.22 Paired Sample T-Test for the self-efficacy level in AR technology

	Mean	Sd	t	df	Sig. (2-tailed)
Post-TAM survey-Pre-TAM survey	.380	6.25	.430	49	.669

4.4.2. Qualitative Data Analysis Results in Relation to Research Question 3

During the semi-structured interview, the responses related to the pre-service EFL teachers' self-efficacy level in employing AR technology were gathered and then analysed in a qualitative manner. As it was reported beforehand, four prospective EFL teachers from each competency level, namely basic, intermediate, and advanced, were interviewed. The interviewees were asked to identify their self-efficacy level in using AR on a scale from one to ten, where one indicated the lowest confidence and ten meant the highest. Their self-perceived levels of self-efficacy in using AR technology are displayed in Table 4.23. The mean score of the self-efficacy level of employing AR technology among all 12 interviewees during the semi-structured interview was 6 which was moderately high, which implied that the pre-service EFL teachers considered themselves as proficient users of AR technology.

Table 4.23 A report of self-perceived level of efficacy level in using AR technology

Interview Participants	Reported level (1-10) of self-efficacy	Interview Participants	Reported level (1-10) of self-efficacy
Jane	3	Jennifer	7
Emily	4	Janet	6
Evelyn	3	Hannah	8
Mary	4	Cade	8
Rose	6	Erinore	8
Sara	7	Sally	8
			Mean 6

Concerning their self-efficacy level in using AR technology, the interviewees also highlighted several factors which affected their self-efficacy level in using AR technology either in a positive or negative way. The emerging themes based on the qualitative analysis are displayed along with their frequencies in Table 4.24. The major categories were the followings: Intrapersonal factors, Interpersonal factors, and Technological and Technical factors. The category of intrapersonal factors included computer anxiety (*f*=12) and low computer self-efficacy (*f*=12). The second category, interpersonal factors, consisted of peer assistance (*f*=11) and peer pressure (*f*=1). As for the last category, technological and technical factors comprised training on AR (*f*=3), technological facilities (*f*=4), and complex interface of AR technology (*f*=5).

Table 4.24 Emerging Themes for Self-Efficacy Level in using AR Technology

Categories	Codes	Frequencies
Interpersonal factors	Peer Assistance	11
	Peer Pressure	1
Intrapersonal Factors	Low Computer Self-Efficacy	4
	Computer Anxiety	3
Technological and Technical Factors	Complicated Interface of AR technology	5
	Technological Facilities	4
	Training on AR	3

4.4.2.1. Interpersonal Factors

The interpersonal factors were highlighted as a significant factor arising from the relationship among peers or between the instructor and the learner. In this category, peer assistance and peer pressure were mentioned.

Firstly, when the interviewees were asked about whether they would work on their own, in pairs or in groups if they had a chance to choose, they referred to their own experiences and the majority of the respondents indicated that they would work in pairs because they could get help from their peers as well as help others during AR-based activity design process.

> I think both of them are ok for me. For this process, working in pairs really helped me in terms of using this activity because I asked my friend, a classmate, about the things that I make, I had difficulty and she asked me as well. So, we feel good on that. And we always, you know, interacted with each other. We always communicated with one another. And that helped in terms of using the app and making the design more as enjoyable as we could. As you know as well, because, you know, like I said, communication and collaboration is very important as well, especially in teaching English. We can exchange our ideas, and yeah, we tried to create a useful design in terms of providing students with this kind of materials and design. I mean. [Sara, interview]

There were also two interviewees who normally do not prefer to work in groups or in pairs. However, they felt positive about designing AR-based materials with their peers because they could support each other by finding pictures and helping each other at the points they had had difficulty.

> Normally I prefer individual tasks. But for this specific task, I like to work with up because my pair is really good at technology. And I'm also good at technology. And we just understand each other. We help each other. And that was good for me to just have some support in these parts that I don't understand. My pair helped me and parts that she didn't understand. And she doesn't understand. I helped her. So, it was good to work with a pair. [Janet, interview]

> Actually, I'm not really good at working in groups or pairs, but in this activity with Blippar especially, I would choose to work in a group or in pair because as I said, it's not that easy to find things that we searched that we want to find. [Erinore, interview]

In spite of the benefits of pair work mentioned by some interviewees, there was only one interviewee who preferred to work on her own because she would like to complete the tasks on her own.

> On my own because I like doing things by myself. [Evelyn, interview]

In addition to these, one of the interviewees commented that she suffered from peer pressure because her pair was not open to her ideas and collaboration. Therefore, she would prefer to work on the AR-based activity on her own as well.

> I prefer doing on my own, because when I create something in my mind, I want to…I want to create it. But sometimes my pair doesn't like that idea or doesn't understand my idea and change something that I don't like. I prefer doing on my own and also when I do on my own, it does not take a long time. But, when I do with my pair, it takes time because making decisions especially. That kind of thing can be a problem sometimes. [Mary, interview]

4.4.2.2. Intrapersonal Factors

To start with first intrapersonal factor, a considerable number of interviewees (N=9) stated that they have not felt any anxiety while using AR technology since AR technology was easy to use and enjoyable for them. Therefore, their self-confidence in designing AR-based activities was quite high.

> No, I don't feel any anxiety or frustration about using AR because I think it's really like easy to use and create something. [Erinore, interview]
> No, of course, it is very enjoyable, and I used it very comfortably. There was no situation where I felt nervous. [Hannah, interview]

When one interviewee was asked about whether he had anxiety while using AR technology, he commented on his experience by stating that his anxiety resulted from the lack of necessary hardware and difficulty in accessing this hardware not from the software itself. Apart from this, he remarked that he did not have any anxiety in utilising AR technology.

> I think the only way to not to be able to use it effectively is to use it wrong because my honest opinion is that the only limitation of AR is hardware stuff for example our phones, or different glasses. I think they only need to improve the hardware part not the software part because it was easy to use, easy to understand, easy to create stuff on it. But like I said the only difficult part that I had anxiety and frustration is about the way we use not create but use AR. [Cade, interview]

On the other hand, one fourth of the interviewees stated that designing AR-enhanced activities provoked their anxiety because the systems looked complicated for one of them.

> No, I don't feel like that. At the beginning, I felt nervous because understanding how it works was challenging for me. Now, I feel less nervous. [Evelyn, interview]

The other interviewee believed that she is not good at using computer and technology. Therefore, she felt frustrated while she was operating AR technology to prepare language learning activities.

> Of course, I feel frustration and anxiety while using augmented reality technology because when I use computer, I don't think I'm very good at technology. [Jane, interview]

Another interviewee suffered from anxiety at first because she was not familiar with this kind of technology. She noted that she got over her anxiety by making lots of practice.

> At first I did, because I was very new to this. But, you know, in time, you know, I tried I tried a lot of times. So it gets easier when you practice. But no, I didn't feel any anxiety because, you know, like I said, the app is very, you know, clear. So, I can just, you know, check other videos and see how they do it. So I didn't. [Emily, interview]

According to one interviewee, she did not feel any anxiety although there were times when activity design process got complicated.

> When I created AR enhanced activities, it was a bit difficult for me. I know you showed us how to create it. But when we applied it, it got complicated. After that, I realized that it is easy to do things. So, I didn't have any fear or feel any anxiety after the first implementation. [Mary, interview]

As for the second intrapersonal factor, low computer self-efficacy, several reasons were expressed. The pre-service EFL teachers who considered themselves as basic users of AR technology (Scale 1-4) because they stated that they were not good at using technology for educational purposes. They remarked that as they were not much familiar with AR technology, they had difficulty in designing AR-based activities for teaching English.

> I will probably argue four tops because like I said, I'm not very good with technology and I'm very new to this and I'm not I mean,

> I won't say I'm bad at it, but I'm not very good at it as well. So, I will say four. [Emily, interview]
>
> I think I am not quite successful in using AR technology in my classrooms because I don't believe that I can apply actively this platform. I would rate myself as a user of such technology in general three points from a scale of one to 10 points. [Jane, interview]

The intermediate users of AR technology (Scale 5-7) indicated that they were keeping up with the technological developments and were able to improve themselves as they completed designing their AR-enhanced activities. However, they also believe that they have lots of aspects to develop, and this depends on them from now on.

> When I started to use this program, I had really difficult time. But now I like it. I learned the program. If I gave a score to myself, I would give 6 to myself. [Rose, interview]
>
> I think that I might need some more practice. But the instructions given to us were clear and effective enough. But as I've said from now on, it depends on me actually to improve myself. And on a scale of one to ten, I would give myself a six or seven. [Sara, interview]
>
> I think I'm six. I'm not really bad. I know a lot of things related to technology, but I know that I can improve so much better. … But there are a lot of tools and we actually it would be better if we learn some other tools as well. And that's why I am six now. What I can improve myself and I can get closer to ten. [Janet, interview]

As for the prospective EFL teachers who regarded themselves as advanced users of this emergent technology (Scale 8-10), they indicated they felt quite confident in operating this application and improved themselves a lot during the activity design process.

> Well, I believe as of now I would rate it as 8 because AR has moved a long way, it improved so much. It is super easy for people like me to use. Before we started this Blippar activity, it seemed quite complicated. But, after having seen some videos on the internet about it, it became so much clear and easy to use. Basically, the more we use it and work on it, that rate can improve. [Cade, interview]
>
> Yeah, I think I'm successful with our AR activity then when we were doing AR activity. Since I have followed the technology,

> everything we do just seems simple to me. So I rate myself and I gave myself 8 points on this scale. [Hannah, interview]
>
> From a scale of one to ten point, I can rate myself eight about it because I felt very comfortable and confident about using it as time went by. I didn't have that many difficulties when designing my activities for the classroom. [Sally, interview]

In relation to their self-efficacy in using this technology, especially intermediate and advanced users expressed that they could get the support they need by watching videos and reading the support page of the tool and they were capable of coping with the difficulties they faced.

> I think videos are really important in that case because I cannot understand anything when I'm reading something about my problem and when I see it, I can solve the problem really fast. So, videos are really good. And in that case, I saw some videos on the website. So, I watched them, and I sold my problem and my problem was that I couldn't add movement to my objects, and it was really hard. I just want to take something from A to B, but there were two dots and it was really hard to figure out. And I watched the videos on the website, and I solved the problem. [Erinore, interview]
>
> And I have enough support and resources because before this process began, we already explained what we need to do. And also, I have some I have watched some YouTube videos as well. So, it was enough support for me. [Janet, interview]

4.4.2.3. Technological and Technical Factors

Technological and technical factors are composed of training on AR, facilities, and complex interface od AR technology.

When the interviewees were asked to state the constraints they came across, a considerable number of respondents indicated the complicated interface of AR technology, especially adding movement and finding appropriate pictures for 3D models to integrate into their activity.

> My biggest problem when I am using AR technology is, I couldn't find the proper images for my AR. When I create something, I couldn't find 3-D pictures or when I find 3-D pictures. They are not PNG. So, it was a big problem for me. So, I couldn't find any

> help about that. I only try to look at some TNG Web sites. That's so. I couldn't find anything in the Blippar page. I want that. It gives us some useful information. How to use Blippar, but not about images. Well, they can provide us some pictures, some basic pictures, at least for everyone. [Mary, interview]

Additionally, four interviewees pointed out that lack of necessary technological hardware can make not only the activity design process but also implementation process more difficult to handle.

> Yes, probably because it's very new technology that we are using in our classes. So maybe the school wouldn't have the technological stuff that I need so I can have problems with that. Or maybe my computer won't work properly. [Janet, interview]

Concerning the relationship between the self-efficacy level in using AR technology and the facilities, one of the interviewees commented that she would not feel any anxiety or bad about employing AR technology due to the problems which might occur as a result of technology as a response to the question about computer anxiety.

> And no, actually, I don't feel any frustration or anxiety. I think I'm pretty confident with using AR. because now I am more familiar with the AR. technology and I think. And the problem, if there is any problem occur, that wouldn't be because of me. It could be because of technology, but not because of me. I'm pretty confident using it. [Janet, interview]

In relation to information session conducted to teach how to use Blippar which is AR application employed in this study, three interviewees stated that this session and the resources provided helped them throughout the activity design process. These implied that orientation session on using AR technology prior to the implementation is essential for the product of activity design process to be successful.

> But in terms of support and resources, I can confidently say that we were provided with detailed explanations about what we were supposed to do through videos and voice recordings and the kind of support I think that are important are the ones that include the application process beforehand of something that is expected to be done. It's like a representation of what is going to be done or what is asked to be done. [Sara, interview]
> Generally speaking, technology must be followed, and it is an important resource in this sense. But, in this case, our teacher was

> the most important resource because she guided us on how to use it at the beginning. [Hannah, interview]

To conclude, there were various factors which had both positive and negative impacts on the self-efficacy level of the pre-service EFL teachers in using AR technology. These factors included intrapersonal factors such as computer anxiety and low computer self-efficacy, interpersonal factors like peer assistance and peer pressure, and technological and technical factors consisting of training on AR technology, technological facilities, and complicated interface of AR technology.

CHAPTER 5

DISCUSSION AND CONCLUSION

5.1. Introduction

In this chapter, the findings of the current study are discussed with reference to previous studies along with the implications for practice in the following two sections. After the limitations and recommendations for further research are provided in the third section, this chapter will be finalised with the conclusion section.

5.2. Discussion of the Results

The findings of the present study were taken under discussion under three main headings. These are The Pre-service EFL Teachers' Perceptions about the Use of AR Technology for Teaching English, The Pre-service EFL Teachers' Acceptance of AR Technology, and The Pre-service EFL Teachers' Self-Efficacy Level in Using AR Technology. The first section, The Pre-service EFL Teachers' Perceptions about the Use of AR Technology for Teaching English, included the following three subheadings: The Pre-service EFL Teachers' Perceptions about the Affordances of AR Technology, The Pre-service EFL Teachers' Perceptions about the Constraints of AR Technology, The Pre-service EFL Teachers' Recommendations for Using AR Technology.

5.2.1. The Pre-service EFL Teachers' Perceptions about the Use of AR Technology for Teaching English

The first research question of the current study sought to determine the pre-service EFL teachers' perceptions of the use of AR technology for teaching English language to students at any level of proficiency. In order to explore their views about the use of

AR technology in English language classroom, it was also aimed to discover their general perceptions of educational technology.

It was found out that the pre-service EFL teachers held positive views about the integration of instructional technology into language courses in general. This can be explained by the fact that the majority of the pre-service EFL teachers who contributed to this study are digital natives. That is why they frequently make use of technology in their daily life and enjoy the technology integrated lessons (Prensky, 2001). This finding is consistent with the previous studies carried out by Almekhlafi (2006), Aydın (2013), Ayres (2002), Escalada and Zollman (1997), and Robert (2002) who examined both teachers' and learners' perceptions of CALL and concluded that both groups were in support of the implementation of CALL. This finding was also reported in the literature that the pre-service EFL teachers along with the in-service EFL teachers held positive views about the integration of MALL into educational context (Öz, 2014; Savaş, 2014; Serin, 2012; Tafazoli & Golshan, 2014; Uzunboylu & Özdamlı, 2011). Nevertheless, what Dashtestani (2013) found out does not confirm this finding because it was indicated that EFL teachers' perceptions of MALL practices were moderately positive. This result does not seem to be consistent with the study of Park and Slater (2015) who stated that teachers were not willing to integrate mobile devices into their courses despite learners' enthusiasm.

When it comes to the prospective EFL teachers' perceptions of the integration of AR technology into language courses, the findings showed that their experience in designing five AR-based language learning materials in ten-week long process led to significant changes on their perspectives of AR technology throughout this process. This indicated that even though they demonstrated either negative or neutral attitude toward AR technology before their experience in designing AR-based language learning materials, they voiced their positive opinions after ten-week activity design process. This result is in accord with the previous studies conducted by Kaenchan (2018) and Karacan (2019) who also explored the pre-service EFL teachers' opinions about the use of AR technology in teaching and learning English as part of their post-graduate thesis studies. Additionally, this finding is in line with those of the previous

studies done with the participation of students at the faculty of education (Delello, 2014; Putiorn et al., 2018; Sural, 2018; Uygur et al., 2018). This finding is contrary to previous study which suggested that although the students had positive perceptions of their AR experience and many opportunities to be exposed the target language, they also stated that using AR may not directly contribute to English language learning (Alizadeh et al., 2017). This finding can be explained by the fact that the prospective EFL teachers started to believe that AR technology can be exploited for teaching and learning English as they also articulated during the interviews. Even though there were some EFL teacher candidates who were familiar with the AR technology through games and social media filter, they stated that they have not had the opportunity to design AR-based language learning materials and activities beforehand. Therefore, although they know what AR technology represents, they did not know how to benefit from this immersive technology within the scope of their field.

In addition, another goal of the first research question was to explore the perceptions of prospective EFL teachers about for which English language skills AR technology can be beneficial the most and the least. The findings based on the qualitative and quantitative data were discussed for each language skill including vocabulary and grammar one by one. The analysis of both quantitative and qualitative data indicated that the only significant shift in the EFL teacher candidates' opinions occurred in favour of the implementation of AR technology for vocabulary teaching and learning. It was found that AR technology can be utilised for teaching and learning vocabulary because the visualisation features of AR applications can be employed as "fresh perspectives" for teaching and revising vocabulary, which also makes vocabulary learnt more permanent. The finding that AR technology can be utilised for teaching vocabulary in English courses explained the considerable number of studies carried out on the utility of AR application for teaching and learning vocabulary so far. This result matched those observed in earlier studies which analysed whether AR technology affects learners' vocabulary learning and retention. Two master thesis studies done at tertiary level drew similar conclusions that AR technology contributed significantly to learners' vocabulary knowledge in English and their vocabulary retention although they were conducted with two groups with different proficiency

levels in English: one with the participation of engineering students with upper-intermediate level of English (Tandoğan, 2019) and the other with the elementary level students (Doğan, 2016). This result also corroborated the finding of Çakır et al. (2015) who concluded that the use of AR technology had significant impacts on undergraduate learners' vocabulary learning. Additionally, the earlier studies conducted at pre-school level of education supported the outcome that AR technology can significantly facilitate learners' vocabulary knowledge (Çevik et al., 2017; He et al., 2014). The study carried out at pre-school located in Kuwait also supported this finding as Safar et al. (2017) reached the conclusion that learners who experienced AR-based vocabulary learning were more successful in vocabulary achievement test. In addition to these, the previous studies done at primary school level confirmed the significant impact of AR technology on vocabulary learning (Barreira et al., 2012; Chen & Wang, 2015; Yaacob et al. 2019). Barreira et al. (2012) reached the similar conclusions by employing Matching Objects and Words (MOW), an AR-based game designed for vocabulary learning. With the participation of 52 third grade students from Taiwan, Chen and Wang (2015) investigated if the difference in learning styles and English language proficiency level affect learners' vocabulary learning which was assisted with mobile AR technology and concluded that there was a statistical difference between two groups in favour of the experimental one in terms of their vocabulary learning outcomes. In an action research undertaken by Yaacob et al. (2019), the finding of the current study was also supported that AR-based flashcards contributed the students' vocabulary knowledge. The result of a recent longitudinal study by Jalaluddin et al. (2020) was in agreement with the finding of the present study in that AR technology can be utilised for fostering learners' vocabulary knowledge. At the secondary school level, Solak and Çakır (2016) supported the similar conclusion that the learners who were exposed to AR enhanced vocabulary learning had significantly better vocabulary retention. On the other hand, there were several studies which were partially consistent with this finding of the current study that AR technology can be employed for teaching and vocabulary learning (Chen and Wang, 2015; Santos et al., 2016; Tsai, 2020). In a recent study conducted by Tsai (2020) at primary school located in Taiwan, even though the students who were exposed to the AR-based vocabulary teaching method performed significantly better than the control

group in English vocabulary test, the findings of the qualitative data indicated that AR technology was not preferable for learning words. Santos et al. (2016) who developed a handheld AR system based on the principles of multimedia learning concluded that although AR technology significantly contributed to learners' vocabulary retention, vocabulary learning outcomes were similar for each group, the group learning Filipino words and the group learning German words. On the other hand, this finding is contrary to previous studies which suggested that AR technology does not lead to a significant difference on learning vocabulary (Juan et al., 2010; Chen & Chan, 2019). Juan et al. (2010) examined impact of AR-based spelling game on primary school students' vocabulary learning in an experimental study, no statistical significance between the two groups regarding their learning outcome was identified. Additionally, Chen and Chan (2019) found no statistical significance between the AR-based and traditional flashcards in their study which investigated the integration of AR flashcards into vocabulary teaching to kindergarten learners.

For the use of AR technology for listening comprehension skills, no significant change was observed in the views of the pre-service EFL teachers even though the majority also reported that AR-based activities enhance listening comprehension skill because it enables integration of multimedia such as audio and videos and practising pronunciation of the words. Up to now, several attempts have been made to explore the impact of AR technology on learners' listening comprehension skills (del Río Guerra et al., 2020; Liu, 2009; Suwancharas, 2016). In Liu's study (2009), the impact of an AR-enhanced instrument, "Handheld English Language Learning Organization (HELLO)", on high school students' English language learning was investigated, and it was concluded that the experimental group performed better in listening and speaking tasks than the control group, and this AR based platform contributed at a significant level to their learning, which does not support the finding of the current study that AR technology can be employed for facilitating learners' listening comprehension skills. Additionally, Suwancharas (2016) who designed a multimedia tool with AR analysed its effect on undergraduate learners' listening skills. The findings do not confirm the outcome that the multimedia learning experience with AR technology can make significant contributions to learners' listening skills. In addition,

a small number of the prospective EFL teachers expressed that AR technology is not necessary for practising listening comprehension skill because the audio and video files upload to AR system are already available on the website, and the number of listening activities which can be prepared with AR applications would be limited. This finding is confirmed with a recent research conducted by del Río Guerra et al. (2020) who compared the efficiency of AR and video for listening comprehension tasks. The findings indicated that the difference between the lesson format and learners' performance was not significant, which meant that the way the elementary school students completed the activity did not cause a significant difference on their listening comprehension.

When it comes to the utility of AR technology for learners' oral communication skills, no significant shift occurred in their views after the AR-based activity design process. This finding can be explained by that the prospective EFL teachers claimed the AR applications do not enable voice recording. This finding is not in accord with the literature in that this finding can be refuted with a recent study conducted by Dalim et al. (2020) who designed TeachAR which combines AR technology with speech recognition technology. Additionally, they reported that there is not much interaction between the user and the application, and even though it is possible to design situations and context for speaking activities, it would not be efficient for speaking because it is not the same as talking to people in person. On the other hand, many pre-service EFL teacher reported that AR-based activities would be beneficial for oral communication skills. The views were backed up with the following reasons: AR technology provides an authentic like environment for the speaking activities; it enables integration of multimedia such as audio and videos and practising pronunciation of the words; AR technology can facilitate learners' expressions with the help of visual aids. This finding is in corroboration with a recent study conducted by Dalim et al. (2020) who designed TeachAR in order to teach topics such as colours, 3D shapes, and spatial relationships to young learners studying at pre-school located in Malaysia. The results revealed that as AR technology significantly contributed to learners' engagement and learning gains, it was found to be an efficient instrument for young learners. However, limited number of studies conducted would not be enough to make generalisation about the

efficiency or inefficiency of AR technology for practising speaking skill, and there is still need for further research.

As for the employment of AR technology for grammar, their views did not significantly differ after having gained experience in designing AR-based language learning materials. However, they expressed that grammar teaching can be facilitated with the use of AR technology since this emergent technology can help teachers design effective activities for teaching grammar and increase learner motivation more compared to traditional way of teaching grammar. With that being said, there have not been many attempts to investigate the use of AR technology for teaching and learning grammar. Even though grammatical structures were included in the studies, the use of AR technology for teaching and grammar was not directly examined (Mahadzir & Phung, 2013; Scrivener et al., 2016; da Silva at al., 2015). According to some pre-service EFL teachers, the use of AR technology for teaching grammar is only viable as long as it is employed to teach grammar in an implicit way instead of explicit way. Due to the scarcity of research studies, there is not enough evidence which either supports or contradicts this finding.

Furthermore, no significant change was observed in the pre-service EFL teachers' opinions regarding the use of AR technology for reading skill. This finding can be explained by that some took the view that it does not contribute to the practice process apart from helping visualisation of the reading text which would be only possible for descriptive texts and stories. This finding is in accordance with the study done by Tobar-Muñoz (2017) who prepared an AR game for enhancing reading comprehension experience of students from Columbia and identified no significant difference between the experimental and the control groups in terms of reading comprehension level. Although there were some who believed that visuals designed through AR applications can ease learners' reading comprehension process, there was no significant change in their views overall. This finding is not consistent with the findings of the earlier studies conducted (Bursalı & Yılmaz, 2019; Castillo & Vásconez, 2020; ChanLin, 2018; Vate-U-Lan, 2012; Yeh & Tseng, 2020; Yılmaz et al., 2016). In one of the earlier studies, Vate-U-Lan (2012) designed an AR 3D pop-up book for 3rd grade learners in Thailand

and AR 3D pop-up book can facilitate learners' reading skills, which does not support the finding of the present study. In 2020, Castillo and Vásconez carried out a study with English learners doing their B.A. at a public university in Ecuador, which does not corroborate this result by concluding that utilisation of AR contributed significantly to learners' reading skills. Additionally, the impacts of AR pop-up books were examined on Turkish reading comprehension as well (Bursalı & Yılmaz, 2019; Yılmaz et al., 2016), and it was reported that AR technology led to significant improvement of learners' reading comprehension, which is not in line with the finding of the present study either.

Although a few pre-service EFL teachers indicated that AR-based language learning materials can foster learners' descriptive writing skills with the aid of visuals provided via AR technology, no significant change was observed in their opinions. This point of with can be explained by that the computational and operational interface of AR technology does not enable users to practise their writing skills as stated by the pre-service EFL teachers. This finding is not in consistence with the studies conducted previously (Helwa, 2019; Liu & Tsai, 2013; Wang, 2017a; Yılmaz & Göktaş, 2017). In an exploratory case study carried out by Liu and Tsai (2013), the AR-based learning materials were found to support learners' linguistic and content knowledge, and thus, they could write meaningful compositions, which does not confirm the finding of the current study. Another research which does not corroborate this finding was conducted by Yılmaz and Göktaş (2017) who found out that the elementary level learners who used AR application performed significantly better in their story writing activity in terms of their narrative skills, story length, and creativity. Additionally, in a study done at faculty of education in Egypt, Helwa (2019) evaluated if mobile AR applications are efficient in developing pre-service teachers' descriptive writing skills and revealed the significant contributions of AR technology to EFL learners' writing skills, which is not in consistent with the finding of this study. Nevertheless, it is important to bear in mind that the employment of AR technology for teaching and learning writing skills is one of the under-researched areas as it can be deduced from the few number of studies conducted so far.

Concerning the use of AR technology with the purpose of teaching and learning English, the topics of the AR-enhanced language learning materials designed by the pre-service EFL teachers were analysed. Most of the activities were about food, animals, seasons and weather conditions, jobs, colours, clothes, abilities, and space. There were some activities whose topics were special days and events, countries, and nationalities, telling time, daily routines, environment, movies, prepositions of place, feelings, and house. As for grammar topics, the activities focused on like/dislike, tenses (present continuous, past simple), and giving directions. There were activities designed about body parts, shapes, classroom objects, and numbers. Lastly, the EFL teacher candidates designed one activity for each following topic: vacation, designing menu, family members, transportation, greetings, and continents. Additionally, the prospective EFL teachers was asked to express their suggestions about the ways AR technology can be utilised in English lessons by referring to topics and how often it can be employed in post-survey. These topics included the followings; animals, colours, numbers, seasons and weather conditions, food and drinks, free time activities and hobbies, festivals, environment, daily life, planets, jobs, clothes, body parts, family members, social media, designing menu, like/dislike, movies, telling time, nationalities, prepositions. As it can be inferred from the topics suggested and the topics of the AR enhanced activities designed by the pre-service EFL teachers, AR technology is considered to be suitable for teaching and learning visually rich topics, which is also in line with the previous study which deemed AR technology as the best technology in visualizing the concepts with the help of 3D models, graphics, and text (Wang et al., 2018). They also indicated during the interviews that AR technology enables teachers to design an environment which students may rarely see or experience. Therefore, another possible explanation for suggested topics is that they prefer to benefit from AR technology when the real environment or the context is difficult to bring into the classroom environment.

Moreover, the pre-service EFL teachers also proposed the following activity types which AR technology can be employed to design quizzes, games, revision activities, warm-up activities for a new topic, and homework. The fact that revision and warm-up activities to introduce a new topic were suggested can be explained by the

recommendation made on how often AR can be used because such activities can generally occur every two weeks. In the case of games and quizzes, they may want to enhance enjoyment and have students learn, revise, and have some fun at the same time. Games can also decrease learners' anxiety; hence they can focus on the topic more. As for the homework, the possible explanation can be that teachers, without being physically near learners, can scaffold learners when they have difficulty at any point of the homework. This finding also corroborates the study of Wang et al. (2018) as it was indicated that AR technology aids in overcoming the barriers of time and place and thus enables learners to reach the relevant information "for just-in-time learning" (p.4). In a similar vein, AR technology facilitates learning process by providing "supplementary and contextual information" (Martín-Gutiérrez et al., 2010; Liu et al., 2007); therefore, its integration into homework can be beneficial. Another explanation made by one of respondents is that using AR technology may not be feasible in the classroom environment; therefore, integrating it into homework can be sensible, which also support the practical ideas for AR-enhanced language learning activities suggested by Bonner and Reinders (2018).

As for how often AR applications can be utilised in English lessons, various suggestions were made, and these included once a week, twice a week, three times a week, and twice a month. There were also a few participants who recommended its frequent use. These suggestions can be explained by the fact that designing AR-based activities can take a lot of time; therefore, using it from time to time can be practical when the load of the curriculum and few hours of English language classes are taken into account. Another reason can be related to the fact that it is not viable to prepare AR-Enhanced learning material for every topic, which is also in line with the studies reporting that AR technology may not be suitable instrument to teach some topics and content (Azuma, 1997; Küçük, 2015; Peña-Rios et al., 2017).

According to both quantitative and qualitative findings, it was concluded that the perceptions of the pre-service EFL teachers about the implementation of both educational technologies and AR technology in English courses were positive, which also bears similarities with the previous studies. As for the employment of AR

technology for teaching and learning language skills, whilst their opinions significantly altered about the use of AR technology for teaching vocabulary, their views about using this technology for four language skills and grammar did not show significant changes after their hands-on experience. Additionally, they proposed a variety of visually rich topics which can be selected by teachers for integrating AR technology. There were also recommendations for activity types which can be designed through this technology. They also suggested that AR technology can be utilised from time to time since there may not be enough time to prepare or implement such activities in classroom environment.

5.2.1.1. The Pre-service EFL Teachers' Perceptions about the Affordances of AR Technology

In the current study, the sub-questions of the first research question sought to investigate the benefits of AR technology from the perspectives of pre-service EFL teachers. The analysis of data revealed a variety of advantages of AR technology, which are presented in Figure 5.1.

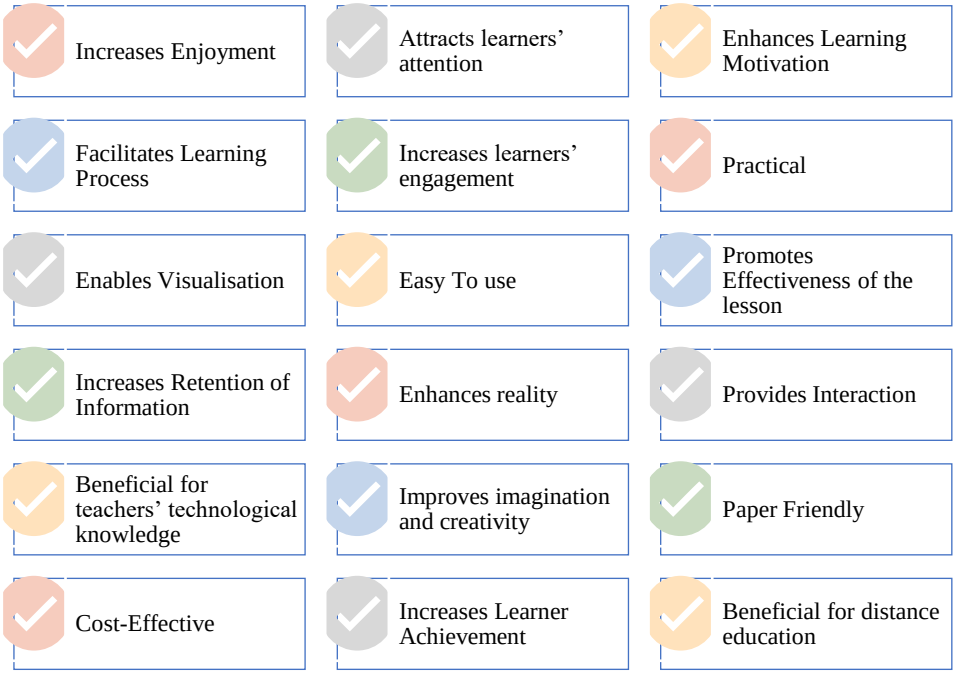

Figure 5.1. Affordances of AR Technology According to Pre-service EFL Teachers

Firstly, the prospective EFL teachers pointed out that AR-enhanced activities enhance enjoyment and make lessons fun with the help of the visuals created through AR applications. This finding matches those observed in the previous studies which concluded that AR technology plays a role in transforming learning environment into a fun and an enjoyable one (Altinpulluk, 2019; Bacca et al., 2014; Bressler & Bodzin, 2013; Chiang et al., 2014; Ibáñez et al., 2014; Mohd Yusof et al., 2014; Onal et al., 2017; Yılmaz, 2016; Yoon et al., 2012). In another study on vocabulary learning by Juan et al. (2010), it was concluded that the learners preferred AR-based games to non-AR version of the game since they had more fun with AR-based games. This finding is also in accord with the study of Tobar-Muñoz et al. (2017) who revealed that learners enjoy learning with AR-based activities in a reading lesson and they have higher motivation and interest towards the lesson. This outcome is contrary to that of Yılmaz et al. (2016) who found no statistical correlation between pre-school learners' enjoyment and reading comprehension after their experience with AR picture books.

Another advantage according to the pre-service EFL teachers was that AR technology can attract learners' attention to lessons, which is accordance with the study of Karacan (2019) who concluded that AR technology is considered to be "attention-grabbing" by the pre-service EFL teachers. Their point of view can be explained by the fact that their prospective students will be from generation Z, also known as "digital natives" (Prensky, 2001), and they are considered to be easily bored when traditional methods of teaching and learning are applied (Oblinger et al., 2005). That is why AR technology can play a key role in drawing learners' attention to the lessons at various levels (O'Brien & Toms, 2005; Somyürek, 2014) because learners immerse in a specific and an engaging situation through AR-enhanced activities (Kirkley & Kirkley, 2005). In addition, this finding can also be related to the various visuals provided by AR technology, which is also in consistent with those of Dünser and Hornecker (2007) and Zhou et al. (2004) who indicated that learning became more attractive and effective when 3D graphics and audio features of AR applications were utilized in storytelling. Additionally, Santos et al. (2016) attempted to teach German and Filipino with a handheld AR system and found out that AR technology facilitated learners' attention, which supports the finding of the present study as well. Concerning this

finding, the prospective EFL teachers also believed that AR technology make lessons more attractive, which seems to be consistent with the earlier studies who asserted that AR technology can make the lessons more attractive and effective (Batdı & Talan, 2019; Chang et al., 2010; Kesim & Özarslan, 2012). Hence, some EFL teacher candidates stated that this technology can promote the effectiveness of language learning activities. However, this finding needs further investigation.

Additionally, it was noted by the pre-service EFL teachers that English language learners would be more motivated, which is in line with the findings of Karacan (2019) and Uygur et al. (2018) who concluded that AR technology is regarded as "motivation-providing" and "motivating" by EFL teacher candidates and pre-service teachers, respectively. This finding also seems to be consistent with other research which found that AR applications exert positive influence on learner motivation in language classrooms (Boonbrahm et al., 2015; Chen et al., 2020; Liu & Chu, 2010; Li et al., 2015; Mahadzir & Phung, 2013; Redondo et al., 2020; Solak & Çakır, 2015). This potential increase in learners' motivation can be explained by the novelty effect because doing AR-based activities is something they have never experienced before and the impact of visuals. This finding can be corroborated by the previous studies which asserted that AR has the potential to improve participation and motivation thanks to the use of 3D visuals (Azuma, 1997; Billinghurst, 2001; Çetinkaya & Akçay, 2013; Jerry & Aaron, 2010; Klopfer, 2008). In the literature, there have studies confirming this finding that AR technology can increase learners' motivation in the context of reading lesson (Castillo & Vásconez, 2020; Cheng, 2017; Cheng & Tsai 2014; Cheng & Tsai 2016; Tobar-Muñoz, 2017), in vocabulary lesson (Tandoğan, 2019; Tsai, 2020; Yaacob et al., 2019), in listening lesson (Gündoğmuş et al., 2016), in speaking lesson (Dalim et al., 2020), and in writing lesson (Helwa, 2019). A master thesis study completed by Tandoğan (2019), who scrutinised whether learners' vocabulary learning, and motivations were fostered through AR-enhanced instructional materials designed based on the principles of ARCS motivation model, reached the conclusion that the engineering students exposed to the AR experience had high level of motivation. This finding seems to be consistent with what Tsai (2020) found out because AR-based vocabulary teaching was found to be significantly more

motivating for fifth graders compared to traditional vocabulary teaching method. Another recent study corroborating this finding was carried out by Dalim et al. (2020) whose study using AR technology in combination with speech recognition technology showed that the young learners had high level of motivation. In a study done in Egypt, Helwa (2019) investigated if mobile AR applications are efficient in developing pre-service teachers' descriptive writing skills and motivation for English language and concluded that motivation towards English language also increased, which is in line with the finding of the present study. Although it is in a different context, the current study's finding is accord with the finding of Bursalı and Yılmaz (2019) who analysed the impact of AR applications on fifth grade students' Turkish reading comprehension and found out that the learners had an enjoyable reading experience with AR application. The finding of the present study is also consistent with the study of Çakır et al. (2015) who investigated the impact of AR applications on learners' academic achievement and motivation and indicated that the experimental group had higher level of motivation according to the findings of motivation survey. On the other hand, this result differs from the study of Chen and Wang (2015) because in the study which investigated if the difference in learning styles and English language proficiency level affect learners' vocabulary learning assisted with mobile AR technology, no significant difference was found in vocabulary learning in regard to students' learning motivation.

In addition, it was stated by the pre-service EFL teachers that AR technology facilitates learning process, which is in line with the study of Uygur et al. (2018) who concluded that AR technology is viewed as "facilitating learning" by pre-service teachers. Another study corroborating this find was conducted by Liu (2009) who scrutinised the impact of "Handheld English Language Learning Organization (HELLO)" on English language learning and found that this AR based platform contributed at a significant level to their learning. This finding may be explained by that AR technology can not only make abstract concepts easier to understand but also consolidate what they have learned with the help of visuals, which is also supported by Sırakaya and Kılıç-Çakmak (2018b) who asserted that pupils at primary and secondary school can take advantage of visuals of AR technology, as they have

difficulty in understanding abstract topics due to their cognitive state in those ages (Piaget, 1976). In this sense, multimedia integrated through AR technology interface acts as "scaffolding, background knowledge activator, motivator, and facilitator" (Khoshnevisan & Le, 2018).

The EFL teacher candidates also believed that AR technology would enhance learners' engagement, which is in line with two studies conducted by Dalim et al. (2020) and Yaacob et al. (2019) respectively. Dalim et al. (2020) indicated that AR technology significantly contributed to learners' engagement and learning gains. Yaacob et al. (2019) found that AR-enhanced flashcards enhanced learners' motivation and engagement. This finding can be explained by the fact that technology can be appealing to 21st century learners who are also known as "digital natives" (Prensky, 2001). Therefore, AR technology is believed to increase learners' engagement by making them take part actively in English lessons.

Moreover, practicality of AR technology was emphasized by the pre-service EFL teachers since AR technology enables them to design various activities and games throughout different scenes or keep the same activity go on through ten scenes. According to the prospective EFL teachers, in relation to practicality, it also allows users to integrate different sources and media into one material, which is in accord with the previous studies (Azuma, 1997; Yılmaz & Batdı, 2016). This aspect of AR technology makes preparing language learning materials less time consuming. Another advantage of AR technology as expressed by the EFL teacher candidates is that AR instruments are easy to use as long as computer knowledge is at intermediate level, which is in line with the previous studies (Ibáñez et al., 2016; Pasalidou & Fachantidis, 2021). Additionally, a few pre-service EFL teachers added that AR technology is paper friendly since there is not much need for lots of papers for designing an AR-based language learning material. Very few participants commented that AR technology is cost-effective as the use of smart phones and internet access was widespread, which seems to be consisted with the study of Martín-Gutiérrez et al. (2010) who noted that it is feasible to present the content in an attractive way to the

learners with cost-effective AR technology. Nevertheless, there are still under privileged areas in terms of access to internet and the necessary hardware.

Another aspect of AR technology regarded as an advantage by the prospective EFL teachers was that this technology enables visualising the content with a variety of visuals, 3D models, and videos. This finding can be supported by what Wang et al. (2018) and Clemens et al. (2016) indicated as they stated that visualisation of content was the benefit of AR technology. This facet of AR technology is of vital importance because visualising the concept via AR makes teaching and learning process easier (Özdemir, 2017), and visualisation makes understanding and comprehension easier (Kaufmann & Schmalstieg, 2003; Shelton, & Hedley, 2002). Thanks to the visuals and multimedia provided through AR applications, it is feasible to address multiple senses, increase learners' participation, make learning more permanent (Dunleavy et al., 2009; Wojciechowski & Cellary, 2013; Wu et al., 2013). Several studies reported the effectiveness of AR as multimedia tool in promoting learners' performance as well (Cadavieco et al., 2012; Liu & Tsai, 2013; Santos et al., 2016). As AR technology aids in visualising the content, it was also suggested by the EFL teacher candidates that it can contribute to learners' imagination and creativity, which can be supported by the earlier propositions (Kerawalla et al., 2006; Persefoni & Tsinakos, 2015; Yuen et al., 2011). This conclusion was also found out by a number of researchers in previous studies on AR technologies (Ivanova & Ivanov, 2011; Klopfer & Yoon, 2005; Rosli et al., 2010). Additionally, this finding is in line with the study of Yılmaz and Göktaş (2017) who confirmed the relationship between AR technology and creativity in narrative writing. As creativity is one of essential skills which digital natives are expected to gain (Trilling & Fadel, 2009), AR technology can be utilised for this purpose in English language classroom as well.

Moreover, the pre-service EFL teachers expressed that enhancing the reality and providing real-like environment for language learning activities is another affordance of AR technology. This finding seems to be consistent with the earlier studies claiming that AR technology can cater for a real-like environment since it embeds virtual objects which are simulated versions of the ones in real life into a real environment (Chen et

al., 2015; Dunleavy & Dede, 2014; Hsiao & Rashvand, 2011). As AR technology enables teachers to design real-like environment by enhancing the reality, learners can get familiar with what they will come across in real life. That is why AR enhanced environment is regarded as an authentic learning environment (Chen et al., 2012; Klopfer et al., 2005; Li, 2010). Another study supporting this finding was carried out by Li et al. (2015) who designed an immersive learning environment for English classes with AR technology by using flow theory and reported that an authentic learning environment for English language learning can be prepared without spending too much money. It was also indicated that this output can be improved by different instructors by changing or remodifying the content. The real-like environment provided by AR technology is also confirmed by the study of Liu et al. (2018) who aimed to determine how AR applications affect an English language lesson and concluded that the teachers pointed out that it helps creating "a realistic language context in the classroom environment" (p.5). Hence, it can be also asserted that AR technology can turn learning process into a natural experience (O'Brien & Toms, 2005). Additionally, as the relationship between learners' perception of learning environment and their motivation in English language learning is of significance (Wei & Elias, 2011), emergent technologies like AR can be exploited for creating such learning environments. This point of view is also confirmed with the study of Juan et al. (2010) who found that AR enhanced learning environment was preferable for learning words. In addition, in the literature it was indicated that AR allows for designing cases and experiments which are hard to experience in real life (Kerawalla et al., 2006; Shelton & Hedley, 2002; Wojciechowski & Cellary, 2013; Yuen et al., 2011). In relation to this, teachers can also make use of AR technology for creating an environment which learners might rarely see or visit.

Some prospective EFL teachers argued that AR-based activities can make learning more permanent and increase retention of information as well, which can be confirmed with the findings of previous studies in educational fields which stated that the content learned via AR technologies can be kept in memory longer and can be easily recalled compared to the traditional way of learning (Adedokun-Shittu et al., 2020; Cascales et al., 2013; Huang et al., 2019; Ivanova & Ivanov, 2011; Radu, 2014; Sommerauer &

Müller, 2014; Valimont, 2002). Additionally, there have been also some studies supporting this finding in the field of ELT in that when the content is taught through AR integrated materials, learners had better retention and comprehension of this content (Barreira et al., 2012; Safar et al., 2017; Solak & Çakır, 2015). This finding can be explained by the fact that the visuals and multimedia embedded through AR technology can appeal to different senses and thus can enhance the retention of information, which is also in line with two studies conducted on the implementation of AR technology for vocabulary learning (Doğan, 2016; Santos et al., 2016).

Another benefit of AR technology is its contribution to interactional patterns in the classroom. Some pre-service EFL teachers commented that AR technology can facilitate the language learning process by increasing the interaction among teacher, learner, and language learning material. This finding is in line with the studies claiming that AR technology promotes and facilitates the interaction among input, output, and learner (Bacca et al., 2014; Hsiao et al., 2016; Dunleavy et al., 2009; Yuen et al., 2011). In the field of ELT, Safar et al. (2017) worked with pre-school children in order to find out if the use of AR in teaching English alphabet in the state of Kuwait and concluded that the learners' level of interaction with the English alphabet through AR technology was quite high, which also supports the pre-service EFL teachers' point of view regarding the impact of AR technology on interactional patterns. In the similar vein, Majid and Yunus (2018) prepared an AR-based mobile application for letter recognition and found out that the students interacted more with the letters by pointing, responding, and inspecting while doing the activity. As it can be deduced from the previous studies and the findings of the current study, AR technology can shape and foster the way learners interact with the information or the input. This benefit can be exploited in planning effective learning materials as it was also suggested in the relevant literature (Radu, 2014; Santos et al., 2013).

Furthermore, very few participants remarked that AR-based activities can ultimately contribute to learners' academic achievement. This opinion of the EFL teacher candidates can be supported by findings of the systematic review and meta-analysis studies which reported that academic achievement was one of the mostly indicated

benefit of AR technology in education and training (Akçayır & Akçayır, 2017; Altınpulluk, 2018). This finding seems to be in accord with the studies concluding that AR applications contributed to academic success in various educational context across different levels of education ranging from pre-school to higher education (Batdı & Talan, 2019; Özdemir et al., 2018; Yilmaz & Batdı, 2016; Yılmaz, 2018). As for the studies confirming this finding in the field of ELT, Vate-U-Lan (2012) designed an AR 3D pop-up book for 3rd grade learners in Thailand and reached the conclusion that AR 3D pop-up book led to an increase in learners' achievement. In a correlational study, Safar et al. (2017) found out that the relationship between learners' interaction with the English alphabet and their achievement test scores was strong and linear, which supports the finding of the present study in that AR technology can contribute to learners' academic achievement. These findings may be somewhat limited by the fact that the number of studies focuses on the impact of AR technology on academic achievement in ELT field is quite a few and therefore requires further investigation.

Concerning the affordance of AR technology for their teaching career, the EFL teacher candidates believed that having learned and experienced AR technology before they graduate will be helpful for their technological knowledge as a prospective EFL teacher because they stated that most of the teachers do not benefit from instructional technology tools and most likely are not aware of this technology either. This affordance is in consistent with the study of Buchner and Zumbach (2020) because only demonstrating how AR technology works at a technical level would not be enough to prepare users for practice in a real classroom environment. Therefore, it is of significance that teachers themselves need to have a sense of designing and implementing AR embedded activities in order for them to exploit these technologies in classrooms (Cuban, 2001). Additionally, as digital/ ICT literacy is one of the core skills according to 21st century learning framework (Kereluik et al., 2013), 21st century teachers are to meet the requirements of technological and pedagogical knowledge so that they can both keep pace with the recent technologies and benefit from these technologies appropriately and efficiently (Kaenchan, 2018).

Lastly, a minority of the respondents indicated that AR technology can also be useful for distance education as learners can do revision or redo the activities on their own whenever they want. This finding confirms the study of Li (2010) who concluded that the integration of AR into remote education "yields superior quality compared to the traditional form of remote education" (p.1). This finding can also be supported with the previous studies which indicated that AR technology is effective in conveying information and acquiring knowledge in learning environments outside the classroom (Facer et al., 2004; Williams et al., 2005). This finding also confirms the view that AR technology can overcome the barriers of time and place and thus enable learners to reach the relevant information "for just-in-time learning" (Wang et al., 2018, p.4). Thus, AR technology can aid in open and distance learning by providing "supplementary and contextual information" (Martín-Gutiérrez et al., 2010; Liu et al., 2007). Nevertheless, a note of caution is due here since studies focusing on the implementation of AR technology in distance education have not been observed and investigated fully in practice including the field of ELT. However, there has been a recent attempt by Altınpulluk et al. (2020) who scrutinised the usability of AR technology as part of online and distance education in relation to universal design principles. The utility of AR technology in open and distance learning still needs further research.

To conclude, the majority of the pre-service EFL teachers reported that AR technology can increase enjoyment, attract learners' attention, and enhance learning motivation. They also stated that AR technology can facilitate learning process and increase learners' engagement. They expressed that AR technology can promote effectiveness of the lesson, increase retention of information, and enhance reality. Additionally, AR technology was believed to provide interaction, improve imagination and creativity, and increase learner achievement. In addition to that AR technology enables visualisation, AR applications were regarded as practical, easy to use, paper friendly, and cost-effective. A minority of the participants indicated that having knowledge on and experience with AR technology can be beneficial for their technological knowledge. Lastly, AR technology was considered to be useful for distance education. These findings bear similarities with the previous studies in the relevant literature.

5.2.1.2. The Pre-service EFL Teachers' Perceptions about the Constraints of AR Technology

In the current study, the sub-questions of the first research question sought to investigate the drawbacks of AR technology from the perspectives of pre-service EFL teachers. The analysis of data revealed a variety of disadvantages of AR technology, which are presented in Figure 5.2.

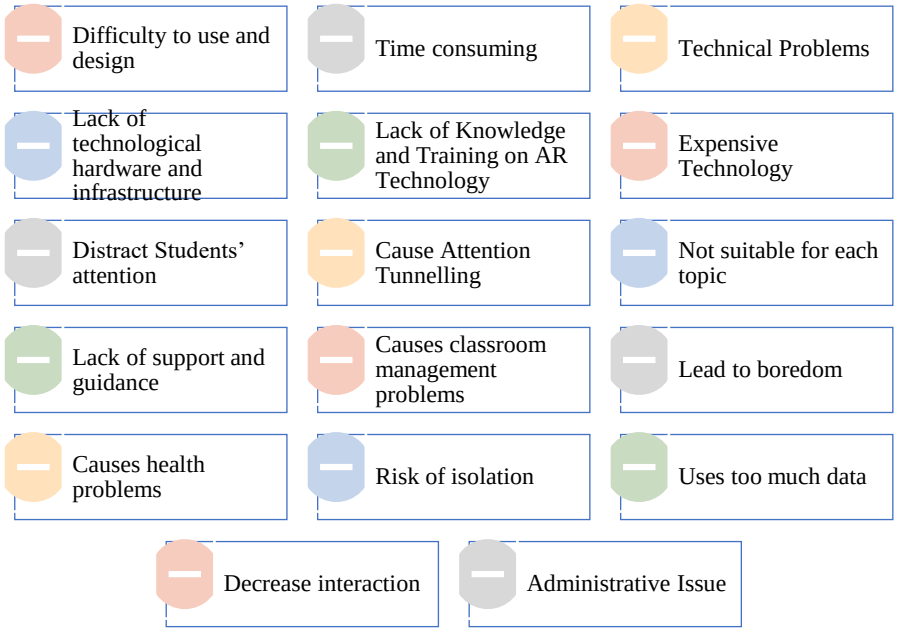

Figure 5.2. Constraints of AR Technology According to Pre-service EFL Teachers

One of the main limitations of AR technology remarked by the pre-service EFL teachers was that AR technology is difficult to use, and some participants had also difficulty in activity design process. They associated this difficulty with the complicated interface of AR applications. This finding is in accord with earlier studies which pointed out AR based activities are hard to design due to the complicated interface of AR applications (Chiang et al., 2014). Concerning the difficulty in designing AR based materials, some prospective EFL teachers stated that they had problems with finding pictures which are compatible with the 3D models of AR application. In the literature, whilst this drawback has not been mentioned, there have

been several studies reporting the problems of AR applications in detecting the markers (Chang et al., 2014). Therefore, the choice of the markers is of significance in order for the activity to go smoothly. Additionally, while adding different scenes were complex process for some participants, some participants found adding transition between the scenes basic because the audio on the first scene does not keep playing through different scenes.

According to the prospective EFL teachers, another disadvantage was that designing AR based language learning activities takes too much time. Therefore, preparing such activities for each lesson can be exhaustive. This finding seems to be in consistence with a previous case study by Delello (2014) who investigated the pre-service teachers' views about implementation of an AR application in a science course and concluded that AR technology was time consuming. In relation to this limitation, implementing AR-enhanced activities in the classroom would take some time as well, which would be a demotivating factor for teachers when the limited hours of English lessons are taken into account (Gavish et al., 2015; Munoz-Cristobal et al., 2015).

Another common constraint mentioned by the respondents were related to technical problems which might possibly occur either during activity design process or during implementation process in the classroom. It was pointed out that AR application depends on technology and technological hardware working properly. One technical problem voiced by the respondents was that AR application might not work properly due to low performance of the application and website from time to time. Another common technical problem indicated by the prospective EFL teachers was about the bad internet connection which could influence both activity design and implementation process in a bad way. All these technical problems can be classified as major drawbacks because AR technology cannot be implemented without the essential requirements like internet connection supplied.

In addition to the technical problems, most respondents highlighted that lack of technological hardware such as computer or internet connection was another concern because they need this hardware for AR technology to function properly, which is also stated as a drawback in the earlier studies (Billinghurst & Dunser, 2012; Delello, 2014;

Furió et al., 2013; Özarslan, 2013). The prospective EFL teachers also indicated that some schools located in certain parts may not be able to provide these facilities, which is in agreement with the findings of Putiorn et al. (2018) who reported that pre-service teachers considered that it would be challenging to implement AR technology in the schools located in rural areas. This finding also supports other previous research proposing that some educators and learners may not have direct access to these applications or even certain digital learning environments like computer laboratories (Azuma, 1997; Chang et al., 2015; Cuban, 2001; Küçük, 2015). Concerning the internet connection, a few participants expressed that another liability of AR application is using too much data, which increases expenses spent by schools or teachers employing AR technology. From the prospective EFL teachers' perspective, some features of AR applications can be expensive when the lack of technological hardware at certain schools are taken into consideration. As an example, some participants pointed out that users are required to pay some fee so as to share their AR-based activities through the website. The high costs of AR technology are similar to the findings of the earlier studies (Billinghurst & Dunser, 2012; Furió et al., 2013; Özarslan, 2013). Nevertheless, these challenges can be overcome with the help of smartphones which allow for using AR applications (Burston, 2017). Nowadays, the Ministry of National Education have attempted to provide learners with tablets so that they can keep studying their courses during distance education, and Education and Information network (EBA) support points were arranged so as to provide internet connection to the learners as of September 2020 (MoNE, 2020). These facilities can foster the use of technological tools including AR technology.

Some participants noted that they did not have any challenges because they are born into this technological era whereas it can be hard for teachers who lack knowledge and training on how to use computers and AR technology. The teachers' lack of knowledge and training on employing AR technology is also presented in the study of Delello (2014), and lack of technological knowledge is also confirmed by da Silva et al. (2019) who asserted that this lack of knowledge is a major barrier for AR technology integration. This finding implicates that unless training for teachers on how to employ AR technology efficiently is carried out, several repercussions of this downside can be

observed at both planning and practical levels. In relation to lack of experience with AR technology, a small number of pre-service EFL teachers found the support provided barely enough and indicated that they need more guidance and support from the website and the application. As all teachers may not be competent enough to navigate through AR websites or applications, the support and guidance provided by these websites and application is of vital importance at the initial stages of designing and implementation of AR embedded activities.

When the design of AR based activities is taken into consideration, it is not viable to teach each topic with the help of AR technology according to the prospective EFL teachers because the system was not eligible for designing certain activities and therefore not appropriate for teaching some topics. This finding bears similarities with the previous studies reporting that AR technology may not be suitable instrument to teach some topics and content (Azuma, 1997; Küçük, 2015; Peña-Rios et al., 2017). As for the implementation of the AR enhanced activities in the classroom environment, there is one administrative issue which is that students are not allowed to use their mobile phones under normal conditions during the school hours, which is a major drawback as smart phones or tablets are essential to conduct AR-enhanced activities. Nevertheless, this drawback can be eliminated by getting permission from the principal. Additionally, even tablets were distributed through FATİH project and now are being distributed for the purpose of maintaining distance education. Taken together, this challenge can be handled.

In the case that the necessary permissions are given, the pre-service EFL teachers expressed their concern that if AR-based activities are not well planned and organised, it can distract students' attention during the implementation process, which can be supported with the findings of Chiang et al. (2014) who concluded that AR technology can distract learners' attention. That is why planning both the activity and implementation process is of vital importance in order to ensure the efficiency of AR embedded activities. Concerning learners' attention, the prospective EFL teachers noted that another drawback could be related to the fact that some learners may pay more attention to various aspects of AR application and neglect the core of the activity.

This finding is consistent with the previous studies and is named as “attention tunnelling” in the literature (Billinghurst et al., 2003; Morrison et al., 2009, Tang et al.,2013). Additionally, the correlation between the learner presence and academic achievement was found to be statistically significant (Chen & Wang, 2018), which indicates that unless AR based activities are carefully planned, learners may go through attention tunnelling which would ultimately lead to decrease in learners’ academic achievement. In addition, another limitation was that AR enhanced activities can cause boredom when the same types of activities are employed all the time. Therefore, some prospective EFL teachers pointed out that AR application should be employed for preparing a variety of activities. When all these aspects of implementation of AR based activities are considered, there may be some classroom management problems, which was stated as another liability of using AR technology in classroom environment. However, this finding must be interpreted with caution because the EFL teacher candidates expressed the possible predicaments they may come across in a classroom environment based on their experience in designing AR enhanced activities. With this in mind, the problems can also happen because some learners may consider AR-based activities only as a game or fun activity. Another explanation for the difficulties in classroom management can be associated with teachers’ lack of training on employing AR technology; therefore, teachers may dominate the lesson and learners may not fully engage in the activity (Kerawalla et al., 2006). Another point indicated by the prospective EFL teachers was that this technology is not appropriate for crowded classrooms, which is also supported by the study of Yoon et al. (2012) and the systematic analysis of Akçayır and Akçayır (2017).

Moreover, according to a few pre-service EFL teachers, AR technology has the potential to decrease the amount of interaction between pairs. This finding can be explained with the impact of attention tunnelling in that learners may feel zoned out while doing AR technology and miss what is going on in front of them, which can alienate learners from their peers and environment. In relation to this, another disadvantage reported was the risk of isolation which arises from the immersive nature of AR technology. In addition, a small number of the respondents stated that AR technology can lead to some health problems like addiction to virtual world if users

spend too much time employing AR technology. Nevertheless, there were not any study supporting these findings even though there are other health problems stated in the literature like its harm for users' eyes (Tsai, 2020). These applications may also cause a rise in cognitive load when they are utilized for complicated tasks (Altinpulluk, 2019; Cheng & Tsai, 2013; Dunleavy & Dede, 2014; Kaenchan, 2018).

In conclusion, regarding the constraints of AR technology, the pre-service EFL teachers expressed that designing and implementing AR-enhanced activities in English language classroom poses some challenges. In terms of activity design process, it was considered to be difficult to use due to complicated interface of AR applications and therefore time-consuming. It was noted that the interface of AR applications does not enable users to prepare activities for each topic. In addition to several technical problems, lack of technology hardware poses a major difficulty. Providing these facilities to the school can be costly when excessive data consumption of AR applications is taken into consideration. Some participants believed that there was not enough guidance given by the applications and the website. Some respondents mentioned that many teachers would not be competent enough to employ AR technology and prepare AR-based activities. Another drawback was about an administrative issue which is learners are not permitted to use their smart phones during the course hours. Additionally, there might be some classroom management problems, and AR technology may be distracting for students and cause attention tunnelling. There might be a decrease in interaction among pupils. Additionally, if the same types of activities are carried out, then learners might lose interest in AR technology. Lastly, spending too much time using AR technology can lead to some health problems and isolate users from their environment due to its immersive nature. Overall, the reported drawbacks share similarities with the earlier studies.

5.2.1.3. The Pre-service EFL Teachers' Recommendations for Using AR Technology

Considering all these downsides of AR technology in educational context, teachers and students may prefer not to utilize this technology for teaching or learning purposes (Yuen et al., 2011). Therefore, it is important to discern and eliminate these limitations

so that learning process and activities proceed smoothly (Batdı & Talan, 2019). As part of the first research question, the pre-service EFL teachers were asked to provide their suggestions on using AR technology. For this purpose, the prospective EFL teachers proposed their suggestions for employing AR technology. Their suggestions focus on various aspects of AR technology and are presented in Figure 5.3.

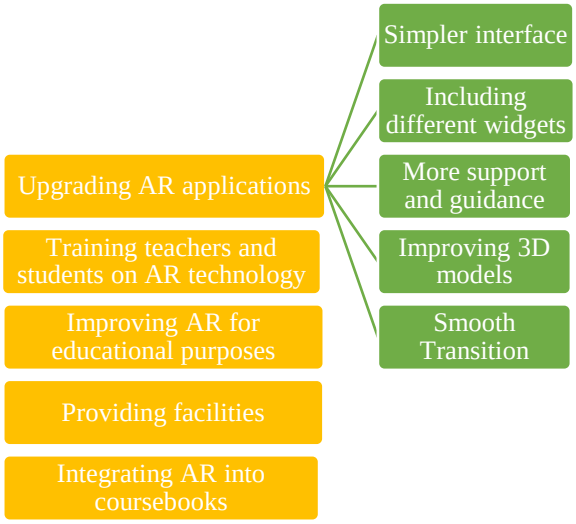

Figure 5.3. Recommendations of the Pre-service EFL Teachers for Using AR Technology

Most of the pre-service EFL teachers recommended that the interface of AR application can be simplified for educators since AR technology was considered to have a too complicated interface. If it is viable, they even suggested that different interfaces for different users can be developed so as to tailor the AR applications according to users' aims because they do not need the features which are more useful for the field of architecture. Over half of the respondents put forward that the variety of widgets included in AR applications can be expanded, which would enable users to prepare various kinds of materials and activities since they found the widgets which are already available limited. In relation to upgrading of the AR applications, a small number of participants indicated that AR applications should supply more options for 3D models and ensure the compatibility of visuals with 3D models as not every format of the pictures is compatible with the 3D models provided in the system. According to the EFL teacher candidates, another aspect of AR application which needs improving

was the transition between the scenes. A few participants offered that there should be a smooth transition between the scenes and there should be an option to keep playing the music even if the scenes change. Additionally, it was also recommended that these applications should provide more guidance and step by step instructions because the support provided by the AR application was not considered to be enough. It was also offered that these instructions should serve in every language not only in English.

In relation to updating the AR tools, the pre-service EFL teachers also made recommendations for improving these tools for educational purposes by including options for pictures or even a picture archive for educators because it was difficult to select an appropriate picture for the activities. Another recommendation for improving AR technology for educational purposes was that a network or platform can be designed for sharing AR-based activities with other educators. Thus, a pool of AR-based activities can be formed. Teachers would save time by working on these readymade activities to tailor according to lessons objectives and learners' needs.

Moreover, regarding the lack of technological hardware and infrastructure, some prospective EFL teachers suggested that the technological hardware should be provided either by the government or the school administration. As the respondents put forward, for AR applications to work smoothly, internet connection should be strong, which is another facility to be supplied by the schools. Concerning the future adoption of AR technology in education, as students are not allowed to use their smart phones during school hours, special rooms should be designated for conducting lessons including AR-based activities according to pre-service EFL teachers.

Furthermore, more than half of the pre-service EFL teachers put forward that both teachers and students should be given training on how to use AR technology. As part of pre-service education, a separate course on emergent technologies like AR technology would be more beneficial for prospective teachers so that they can address to learners of this generation. Like pre-service education, training on how to use AR technology and design language learning materials should be provided to in-service teachers as part of their in-service teacher training. This training should not be limited

to only teachers and should involve students as well for AR-enhanced activities to proceed smoothly in the classroom.

Additionally, some pre-service EFL teachers suggested that AR technology should be integrated into language curriculum and EFL coursebooks in the near future. Thus, it can be integrated into language classes more frequently and efficiently as coursebooks are "the visible heart of any ELT program" (Sheldon, 1988) and utilised as the major source for English language courses. As AR technology paves the way for not only the real-time interaction but also the interaction between the learner and the content with the help of coursebooks designed in a proactive format through AR (Kesim, & Özarslan, 2012; Sanna & Manuri, 2016), integrating this immersive technology into English coursebooks would be fruitful for the learners.

In conclusion, the pre-service EFL teacher put forward their suggestions concerning the AR technology and its use in English language learning. These can be utilised for improving AR applications to be used for educational purposes including ELT field.

5.2.2. The Pre-service EFL Teachers' Acceptance of AR Technology

The second research question of the current study aimed at determining the pre-service EFL teachers' acceptance of AR technology. The data gathered through TAM survey and semi-structured interview were analysed, and the findings are discussed below.

The major reason for determining their acceptance level of this technology was that it is of significance to understand whether teachers are ready to adopt and implement these immersive technologies like AR technology as part of their courses (Dalim et al., 2017) because teachers play the key role in deciding if any technological tool is integrated into the courses or not. The findings indicated that the prospective EFL teachers' experience with this technology for 10 weeks led to a significant difference in their acceptance level of AR technology in English courses. This finding indicates that AR technology gained acceptance of the pre-service EFL teachers, which is in line with the earlier studies (Alkhattabi, 2017; He et al., 2014; Nöhrer, 2020; Sural, 2018). He et al. (2014) examined the application of a mobile-based software including AR technology, which was developed with the purpose of English language learning,

concluded that the teachers indicated their positive perceptions of this immersive technology because the learners improved their academic success at a significant level. In another study conducted with participation of Austrian secondary school language teachers, Nöhrer (2020) scrutinised their perceptions of and experiences with digital instruments, specifically AR and VR, in language teaching and found out that although more than half of the teachers did not have too much hands-on experience and did not know how to utilise this technology for language teaching purposes, they expressed that they held positive views on using the immersive technologies. In a similar context, Sural (2018) investigated the pre-service teachers' views about the integration of AR technology and reported based on their views that AR application would be useful to teach and learn other topics. Even though Alkhattabi (2017) surveyed primary school teachers about their acceptance of AR technology, the acceptance rate of utilisation of AR tools within an e-learning environment was found to be high.

This result can be explained in various ways. The cause of this shift in their point of view is that either the majority of the prospective EFL teachers have not experienced this emergent technology beforehand or they felt hesitant to use this technology although some prospective EFL teachers have heard about this emergent technology. That is why, they did not see any potential in making use of AR technology in language classroom at first. Once they designed AR-based language learning materials, they considered AR technology as "a new language learning strategy" because it enables teachers to design a variety of activities for language teaching and learning. Another indicator of acceptance of a technology is the users' intention to make use of this technology in the future. In relation to pre-service EFL teachers' acceptance of AR technology, they were posed the question of whether they would benefit from AR tools in their future classes both in post-survey and interview. According to data from post-survey, 38 of them stated that they intend to use AR technologies in their English classes in the future whereas four of them were against employing AR-based language learning materials in the future. There were eight participants who were indecisive about implementing AR-enhanced activities in their future English classes due to several reasons. Out of 12 pre-service EFL teachers interviewed, nine of them expressed their intention to benefit from AR technology in the future while three of

them were indecisive about using this technology. Overall, the prospective EFL teachers demonstrated a high level of acceptance in employing AR technology for language teaching and learning. This result is in corroboration with the study conducted by Cabero-Almenara et al. (2019) who investigated learners' acceptance of AR technology and concluded that the learners had a good degree of acceptance and plan to use this technology in the future.

The EFL teacher candidates' intention to benefit from AR technology arise from several motives. First, most of the pre-service EFL teachers were in favour of integrating AR technology into English courses because it is fun, motivating, and engaging. This finding is in agreement with the previous studies (Karacan, 2019; Mundy et al., 2019; Pasalidou & Fachantidis, 2021; Uygur et al., 2018). As part of master thesis study, Karacan (2019) investigated the constructs which project pre-service English teachers' plan to use AR technology in the future by making use of Decomposed Theory of Planned Behaviour and reached the conclusion that the EFL candidate teachers had positive perceptions of AR applications and plan to utilise these applications as they were considered to be useful and affect learners in a positive way. Another study on pre-service teachers' opinions about the use of AR technology in education was carried out by Uygur et al. (2018) who concluded that this technology should be widely employed in educational fields. Additionally, Mundy et al. (2019) carried a study on the evaluation of the implementation of AR technology from the teachers' and administrators' point of view and reported that AR applications were found to be engaging and enjoyable. The opinions of the primary school teachers about using AR technology for educational purposes were scrutinised by Pasalidou and Fachantidis (2021), and the application was regarded as easy to use and enjoyable by the teachers, which are similar to the prospective EFL teachers' views in this study. Moreover, another reason indicating their intention to benefit from AR technology for teaching English in the future was that they can either design different activities on different scenes or keep an activity going on throughout the scenes. Additionally, some preservice EFL teachers mentioned that the use of AR technology would be more common in educational fields in the future, therefore they would try to make use of this immersive technology as well.

As for the rationale behind their initial reluctance to employ AR technology in the future, several reasons can be provided. The very first reason is that this technology may not be accessible in their school due to its location, and the schools in rural areas may lack the necessary hardware and infrastructure for using AR technology. This finding is found to be in accordance with the study of Putiorn et al. (2018) who concluded that teachers considered that it would be challenging to implement AR technology in the schools located in rural areas. In relation with this, the circumstances of the school they will be working at is another cause because the managers' perceptions of AR technology integration into English language classes can affect their intention to benefit from AR technology in their classes. The load of the language curriculum can also play a crucial role in their intention to use because some time needed for both designing and implementation of AR-enhanced activities. This result is in line with the thesis study of Kaenchan (2018) who carried out a mixed-methods study to explore Thai students' experiences with AR technology in their reading course and stated that as long as they had the time and resources, they would be willing to benefit from AR technology in the future. Additionally, the fact that pupils are not allowed to use their smart phones during the class hours can be another possible explanation for their reluctance since they may not want to deal with the procedure to get permission to conduct activities requiring learners too use smart phones during the class hours. On the other hand, the prospective EFL teachers' high acceptance level of AR technology is not confirmed by what Nöhrer (2020) concluded because a minority of participants stated their doubts in relation to rapid spread of implementation of this technology in language teaching in the future. In the current study, there were also a few pre-service teachers who were not in favour of using AR technology in English courses because they do not consider AR technology as an appropriate tool for teaching and learning English, and they would rather use realia than utilise visuals provided by AR applications.

Overall, approximately all the prospective EFL teachers interviewed reported that they were not quite familiar with AR technology before their experience with this technology as part of this study. After the implementation, the participants demonstrated a positive inclination towards the use of AR technology in English

lessons, and all the interviewees expressed their acceptance of this technology. These findings are also confirmed by the results of the previous studies apart from the study carried out by Nöhrer (2020).

5.2.3. The Pre-service EFL Teachers' Self-Efficacy Level in Using AR Technology

The goal of the third research question was to determine the prospective EFL teachers' self-efficacy level in employing AR technology, and TAM survey was administered before and after the activity design process.

The difference between pre-TAM survey and post-TAM survey was not statistically significant, which indicated that their experience with AR technology for ten weeks did not lead to a significant change on their self-efficacy level in using AR technology. The mean score of the self-efficacy level of employing AR technology among all 12 interviewees was 6 which was moderately high, which implied that the pre-service EFL teachers considered themselves as moderately proficient users of AR technology. This finding can be confirmed with the study of Kaenchan (2018) who also discovered that EFL Thai students' self-efficacy level did not significantly differ across three different cases which are Computer Tutorial, Teacher and Student Showcases. However, their self-efficacy level in using AR was reported to be relatively high.

Concerning their self-efficacy level in using AR technology, there are several possible explanations for this result. These explanations can be put into three categories which are intrapersonal factors, interpersonal factors, and technological and technical factors as demonstrated in Figure 5.4.

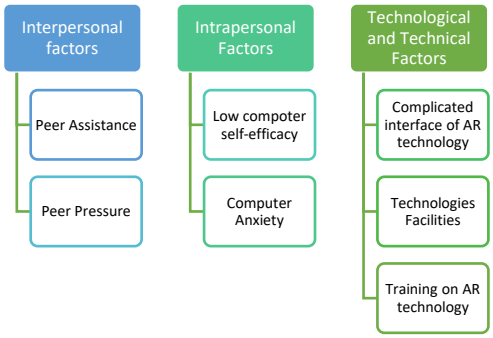

Figure 5.4. Reasons for Low Self-Efficacy Level in Using AR Technology

To start with the intrapersonal factors, computer anxiety was one of the reasons for their low self-efficacy in using AR technology. Their computer anxiety arises from the lack of necessary hardware and difficulty in accessing this hardware not from the software itself. Another rationale for their anxiety is the complicated interface of AR technology. Additionally, although some stated this cause, they do not feel competent enough in using computer and technology. Hence, their self-efficacy in employing AR technology is low. On the other hand, there were also some pre-service EFL teachers who rated themselves as proficient users of AR technology. They indicated that they have not felt any anxiety while using AR technology since AR technology was easy to use and enjoyable for them. Even if they feel any anxiety while using AR technology, they got over their anxiety by making lots of practice. Therefore, their self-confidence in designing AR-based activities was quite high. Furthermore, the second reason is low computer self-efficacy in that the prospective EFL teachers who considered themselves as basic users of AR technology stated that they were not good at using technology for educational purposes. Thus, they had difficulty in designing AR-based activities for teaching English. Nevertheless, this is not the case for the intermediate and advanced users of AR technology because they believe that they can keep up with the technological developments and can improve themselves by making use of the emergent technologies. They can also get the support they need by watching videos and reading the support page of the tool, and they feel competent enough to tackle the difficulties they face.

To go on with the interpersonal factors influencing their self-efficacy level in utilising AR technology, the EFL teacher candidates expressed that some would prefer pair work whereas some would rather work individually. The possible explanation for the choice of pair work is that they can brainstorm ideas for the activities, get help from their peers as well as help others at the points they had had difficulty during AR-based activity design process. As for the rationale behind the preference for individual work, they would like to complete the tasks on their own. Another reason is peer pressure in that some pairs do not tend to collaborate and therefore dominate others both in decision making and activity design processes. Additionally, although this interpersonal factor was not directly stated by the participants, the fact that they were

still pre-service EFL teachers and therefore did not have teaching experience, and this was their first time in designing AR enhanced language learning materials can be a major reason for their low self-efficacy level in employing AR technology.

In the third category, technological and technical factors, lack of training on how to use AR technology can decrease users' self-efficacy in making use of AR technology. Therefore, the prospective EFL teachers pointed out the significance of the input session about how to use Blippar, AR application employed in this study, since this session and the resources helped them throughout the activity design process. This finding implies that orientation session on operating AR technology prior to the implementation is essential for the product of activity design process to be successful and efficient, which bears similarities with the earlier studies reporting the necessity of training pre-service and in-service teachers on how to use AR application in instruction and designing materials (Kaenchan, 2018; Karacan, 2019; Kesim & Özarslan, 2012). Additionally, due to the recent outbreak of COVID-19 pandemic, the vital importance of technology has been recognised more than ever in every walks of life from business to education and transformed the way the courses are delivered. That is why it would be for prospective EFL teachers' benefit to improve both their technological knowledge and practice regarding various educational tools before their graduation. In addition, lack of necessary technological hardware can make not only the activity design process but also implementation process more difficult to handle, which may lead to a decrease in users' self-efficacy level in using AR technology. Another explanation for their low self-efficacy can be related to the complicated computational and operational interface of AR applications. It was reported by EFL teacher candidates that they had difficulty in adding movement and finding appropriate pictures for 3D models to integrate into their activity. These findings are in line with the study of Delello (2014) who investigated pre-service teachers' views about implementation of an AR application in a science course and highlighted the weaknesses as "teachers' lack of knowledge or skills, and lack of infrastructure."

To conclude, the prospective EFL teachers' self-efficacy in employing AR technology did not differ significantly, and they reported there were various factors which

included intrapersonal factors such as computer anxiety and low computer self-efficacy, interpersonal factors like peer assistance and peer pressure, and technological and technical factors consisting of training on AR technology, technological facilities, and complicated interface of AR technology.

5.3. Implications for Practice

This study investigated the pre-service EFL teachers' perceptions about the employment of AR technology for teaching and learning English, their acceptance level of this technology, and their self-efficacy in employing AR technology for preparing AR-based language learning materials. The implications of the current study for practice are discussed under two main headings, namely implications for English Language Teacher Education and Implications for English Language Teaching.

5.3.1. Implications for English Language Teacher Education

According to the pre-service EFL teachers' point of view, some implications for English Language Teacher Education can be provided.

To start with implications for teacher education policymakers and stakeholders, the findings of the current study imply that pre-service English language teachers should be encouraged to benefit from emergent technologies like Augmented Reality in their future classes. The pre-service EFL teachers were found to hold positive views towards employing AR technology for teaching and learning languages. As their positive perception is an indicator for their intention to make use of AR technology in their future classes (Karacan, 2019), this finding can accentuate that teacher educators pay attention to sparking pre-service English teachers' interest towards these emergent technologies. Hence, prospective English language teachers tend to utilise AR technology with the purpose of teaching English.

In addition, this finding offers implications for English Language Teacher Education in that teacher education programs need to integrate educational technology along with the emergent technologies like AR more into their curriculum so as to equip pre-service EFL teachers with the necessary knowledge and skills of digital literacy

(Uygur et al., 2018). Additionally, the self-efficacy of prospective English language teachers in using AR technology can also support teacher educators regarding curriculum redesign and guide curriculum planners to embody courses related to the integration of ICT into ELT. As part of language teacher education programs, some courses can be offered to language teacher candidates so as to make them gain experience with AR-enhanced environment and in designing AR-based materials. As suggested by prospective EFL teachers (see Figure 5.5.), separate courses such Integration of ICT into ELT, CALL, and MALL can be included in English Language Teacher Education curriculum. Along with the courses, training in the form of workshops, input sessions, and webinars can be organised in order to raise EFL teacher candidates' awareness about the emergent technologies and make them have some hands-on experience with AR technology. Thus, such courses and training can boost their self-efficacy in employing AR applications in the future. In this way, pre-service English teachers can be prepared to be competent enough to employ such innovative technologies appropriately. Their readiness for utilising these technologies is of significance because Goldman Sachs (2016) estimated that AR technology will have been employed by 15 million users working in educational fields by 2025.

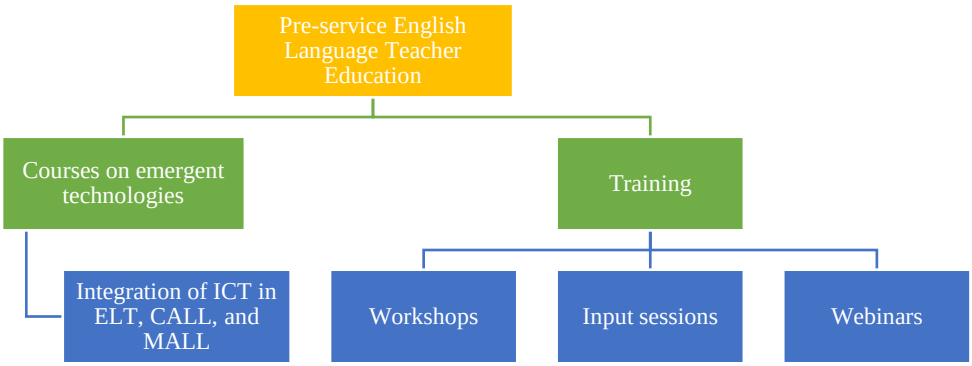

Figure 5.5. Implications for English Language Teacher Education

Overall, pre-service English Language Teacher Education programs can be enriched by embedding courses such as ICT integration into ELT, CALL, and MALL. Some training including workshops, input sessions and webinars can also be designed to promote their awareness of AR technology. In this way, prospective English language

teachers can be prepared to be ready to benefit from the emergent technologies like AR technology.

5.3.2. Implications for English Language Teaching

Based on the findings of the current study, some implications can be drawn for English Language Teaching as well.

The findings of this research also provide insights for language teaching practices because it unearths the prospective English teachers' views on the affordances and constraints of utilising AR technology in language learning and teaching. Although there have been a few studies unveiling pre-service teachers' perceptions of AR technology, what makes this study unique is that all language skills are taken into consideration, and the pre-service EFL teachers gained hands-on experience with AR technology. Therefore, these views can inform language teachers about how to benefit from AR technology in English language classes. The reported benefits and disadvantages of AR technology are supported with the previous studies in the literature so as to improve credibility. Additionally, the previous studies have mostly focused on how to teach vocabulary with the help of activities developed with Augmented Reality. Within the scope of this study, the prospective EFL teachers created AR enhanced activities to teach any language skills (speaking, listening, reading, writing, grammar, and vocabulary) to students at any level of English. Therefore, this study can generate new insights into the utility of AR technology for language teaching and learning. They provided their recommendations on the language skills for which AR technology is the most and the least beneficial. English language teachers can utilise AR technology to design activities for teaching and learning target words. The EFL teacher candidates also offered their suggestions about the topics and activity types for which AR technology can be employed. The visually rich topics can be selected for AR-based materials, and the types of activities can consist of homework, revision, and warm-up activities for a topic. As for how often AR-based materials can be implemented in the classroom, two or three times a month can be recommended when the load of the curriculum and the course hours are taken into

consideration. Taken together, these findings suggest a role for language teachers in promoting their teaching practices with the help of AR technology.

This study revealed that AR-based language learning materials can attract learners' attention, increase enjoyment, be motivating and engaging as indicated in this study and in the literature. Taken together, these results suggest some implications for English language curriculum planners, English language coursebook and material designers. AR-technology can be recommended as an innovative technology to be utilised in language courses in the curriculum. AR-enhanced materials and activities can be integrated into language coursebooks as either activity or supplementary materials. As today's learners are digital natives (Prensky, 2001), they will actively participate to the lessons, and their interest and motivation can also be increased as suggested both in this study and in the literature. That is why, the suggestion that the curriculum of English language and language coursebooks can be rearranged is made so that AR-embedded lessons can cater for digital natives' needs and learning styles (Karacan, 2019). Additionally, considering the constraints of AR technology such as difficult to use and design and time consuming, the possible implication for ELT can be to benefit from a pool of ready-made AR enhanced activities which are stored for teachers' use.

As Dillon (2001) claimed, one of the factors impacting teachers' acceptance of AR technology is the balance between the pedagogical beliefs of the country and the technical circumstances of AR technology. According to language teacher candidates, the lack of technological hardware and necessary infrastructure would prevent them from implementing AR-enhanced language learning materials and creating AR-based learning environment. An implication of this finding is that the technical facilities should be provided to teachers and learners so that they can benefit from AR technology whenever they need. Therefore, special rooms for AR-enhanced activities to be carries out can be constructed. Otherwise, the probability of teachers' employment of AR technology in language teachers may decrease.

The current data highlight the importance of professional development schemes because it was recommended that not only teachers but also students should be trained

on how to employ AR technology for language education. These training can include workshops on using AR technology and designing AR-based language learning materials for the in-service teachers while input sessions about AR-enhanced lessons can be offered to students in order to eliminate possible issues which may arise from lack of training on AR technology.

To summarise, the findings of the present study can inform English language teachers, curriculum planners, material and course book designers in relation to the employment of AR technology in the field of ELT.

5.4. Limitations and Recommendations for Further Research

Notwithstanding the limitations, these findings provide the following insights for future research:

- Fifty pre-service EFL teachers selected by convenience sampling participated in the quantitative phase of the study, and the qualitative phase of the study was carried out with 12 pre-service EFL teachers selected based on a criterion which was their self-reported competency level in AR technology. This denotes two main limitations. Firstly, the sample size of both quantitative and qualitative parts may not be large enough to make deductions about the populations' characteristics in general. In the second place, as the convenience sampling method was utilised in determining the participants for the quantitative phase, the findings of the study might not demonstrate an impartial representation of the population. Therefore, there is a need for further longitudinal studies to be carried out with a larger sample size and employing random sampling method in order to present a more complete understanding of the phenomenon.

- The participants were the pre-service EFL teachers studying at a foundation university offering a B.A. program in ELT, which indicated that generalisability of the findings based on the quantitative and qualitative phases of the research was confined with the pre-service EFL teachers studying at a foundation university, offering a B.A. program in ELT, in Turkey. Therefore,

what is now needed is a national study involving pre-service EFL teachers from different types of universities, namely foundation, state, and private, offering B.A. level teacher education in ELT in Turkey.

- In this study, AR based activity design process took ten weeks, a replication study can be conducted longitudinally to observe participants' self-efficacy level in employing AR technology in the long run.

- Relevant literature implies that there is not enough study on the employment of AR technology for teaching and learning productive skills, speaking and writing, and grammar. These skills would be a fruitful area for further work.

- In the literature, the utility of AR technology for assessment has not been explored yet. A further study can be carried out on whether and how AR technology can be employed for assessing language learning.

- The pre-service EFL teachers indicated that AR technology can be utilised in open and distance learning. The question raised by this study is whether AR technology can be used as part of open and distance learning.

- A further research can investigate in-service EFL teachers' acceptance and self-efficacy level in using AR technology.

- Further work is needed to fully understand the perceptions of in-service EFL teachers and the English language learners on the integration of AR technology into English language courses, English curriculum and coursebooks.

5.5. Conclusion

It can be inferred from content analysis and systematic literature review studies that the number of academic studies conducted on the use of augmented reality in education is increasing yearly (Akcayir & Akcayir, 2017; Altinpulluk, 2019; Arici et al., 2019). The present study adds to the growing body of research by scrutinising the pre-service EFL teachers' perceptions of AR technology, their level of acceptance and self-efficacy in using AR technology for designing language learning materials.

This study was carried out with the participation of 50 pre-service EFL teachers recruited from English Language Teaching Program offered by a foundation university located in Turkey. It was found out that the prospective EFL teachers hold positive views about utilising AR technology for teaching and learning English. In terms of language skills, vocabulary is regarded as the language skill for which AR technology is the most useful whereas AR technology is considered to be the least useful for writing skill. They also recommended that AR technology can be integrated into homework, revision, and warm-up activities.

Additionally, the affordances and constraints of AR technology were explored from English language teacher candidates' point of view. The pre-service EFL teachers expressed that AR technology can offer many affordances for English language teaching and learning process. It helps visualising the content through audios, videos, and 3D models, which draws learners' attention to lessons. It facilitates learning process with the help of various media, which makes learning more permanent and promotes effectiveness of the lesson. Thus, AR technology was believed to contribute to learning outcome and learners' academic achievement. AR-based activities were regarded as engaging and motivating. Therefore, students can both have fun and learn at the same time. Additionally, the prospective EFL teachers found AR application practical and paper friendly because the system enables users to design various activities and games with only one image as trigger. Another advantage was reported that AR technology can be useful for distance education. Lastly, EFL teacher candidates stated that having gained experience with AR technology before they graduated would improve their technological knowledge and help their teaching career as an EFL teacher as well.

As for the drawbacks of AR technology, the pre-service EFL teachers expressed that designing and implementing AR-enhanced activities in English language classroom poses some challenges. In terms of activity design process, it was considered to be difficult to use due to complicated interface of AR applications and therefore time-consuming. It was noted that the interface of AR applications does not enable users to prepare activities for each topic. In addition to several technical problems which are

likely to occur, lack of technology hardware poses a major difficulty. Providing these facilities to the school can be costly when excessive data consumption of AR applications is taken into consideration. Some participants believed that there was not enough guidance provided by the applications and the website. Some respondents mentioned that many teachers would not be competent enough to employ AR technology and prepare AR-based activities. Another drawback was about an administrative issue which is learners are not permitted to use their smart phones during the course hours. Additionally, there might be some classroom management problems, and AR technology may be distracting for students and cause attention tunnelling. There might be a decrease in interaction among pupils. Additionally, if the same types of activities are carried out, then learners might lose interest in AR technology. Lastly, spending too much time using AR technology can lead to some health problems and isolate users from their environment due to its immersive nature.

In addition, the pre-service EFL teachers' acceptance level of AR technology was found to be significantly higher than their acceptance level before the activity design process. The prospective EFL teachers interviewed reported that they were not quite familiar with AR technology before their experience with this technology as part of this study. After the implementation, the participants demonstrated a positive inclination towards the use of AR technology in English lessons, and all the interviewees expressed their acceptance of this technology. However, their self-efficacy in employing AR technology for designing AR based materials did not change significantly after the activity design process. Concerning their low self-efficacy level, there are several possible explanations which can be categorised into three: intrapersonal factors, interpersonal factors, and technological and technical factors.

In conclusion, these findings about the topics, language skills, and activity types can inform English language teachers about how they can benefit from AR technology in English courses. The affordances and constraints stated can shed light on the aspects which the coursebook and material designers should take into account in terms of embedding AR technology into language coursebooks. Despite the high acceptance level, their self-efficacy level in using AR technology was found to be low, which can

support policy makers regarding curriculum redesign and guide curriculum planners to embody courses related to ICT and digital literacy in English Language Teacher Education program so as to equip pre-service EFL teachers with the necessary knowledge and experience.

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APPENDICES

A. APPROVAL OF THE METU HUMAN SUBJECTS ETHICS COMMITTEE

UYGULAMALI ETİK ARAŞTIRMA MERKEZİ
APPLIED ETHICS RESEARCH CENTER

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20 Şubat 2020

Konu: Değerlendirme Sonucu

Gönderen: ODTÜ İnsan Araştırmaları Etik Kurulu (İAEK)

İlgi: İnsan Araştırmaları Etik Kurulu Başvurusu

Sayın Doç.Dr. Perihan SAVAŞ

Danışmanlığını yaptığınız **Ayşegül OKUMUŞ**'un **"Exploring the Perceptions of Pre- Service EFL Teachers about the Integration of Augmented Reality Technology into ELT: A Mixed-Method Study"** başlıklı araştırması İnsan Araştırmaları Etik Kurulu tarafından uygun görülmüş ve **071-ODTU-2020** protokol numarası ile onaylanmıştır.

Saygılarımızla bilgilerinize sunarız.

Prof.Dr. Mine MISIRLISOY
Başkan

Prof. Dr. Tolga CAN
Üye

Doç.Dr. Pınar KAYGAN
Üye

Dr. Öğr. Üyesi Ali Emre TURGUT
Üye

Dr. Öğr. Üyesi Şerife SEVİNÇ
Üye

Dr. Öğr. Üyesi Müge GÜNDÜZ
Üye

Dr. Öğr. Üyesi Süreyya Özcan KABASAKAL
Üye

B. CONSENT FORM

This study is conducted by Ayşegül OKUMUŞ, master student at the Department of English Language Teaching at Middle East Technical University under the supervision of Assoc. Prof. Dr. Perihan SAVAŞ. This form is designed to inform you about the research conditions.

What is the purpose of the study?

This study aims to reveal the perceptions of pre-service teachers of ELT Department at a Turkish foundation university about the integration of Augmented Reality Technologies into English language courses.

How do we ask you to help us?

If you agree to participate in the survey, you will be asked to fill out pre-survey and post-survey before and after the intervention, which will take between 10 to 15 minutes, and complete reflection papers during the intervention. After the results of the survey are analysed, you may be invited to take part in an interview via e-mail to confirm the accuracy of the data analysis and answer additional questions. The smart phone will be used to record the interviews.

How will we use the information we collect from you?

In the survey, you are asked for no information identifying your identity or institution. Your answers will be kept completely confidential and will only be evaluated by the researcher. The information obtained from the participants will be evaluated collectively and used in scientific publications. The data you provide will not be matched with the credentials collected on the voluntary participation forms.

What you need to know about your participation:

No risk and no benefits are anticipated as a result of your participation in this study. Your participation in the research is entirely voluntary. You have the right to withdraw from the study at any time without consequences.

At all times, your identity will be kept confidential. Your information will be assigned a code number and the list connecting your name to this number will be accessible to only us as the researchers. The list will be destroyed when the study is complete, and the data have been analysed. Your name will not be used in any report.

If you would like more information about the research:

At the end of the survey, your questions about this study will be answered. Thank you in advance for participating in this study. For further information about the study, you can contact with Ayşegül OKUMUŞ, a master student at the Department of English Language Teaching at METU (E-posta: aysegulokumus@baskent.edu.tr).

Agreement:

I have read the procedure described above. I voluntarily agree to participate in this study.

Participant Name Surname: _____

Date: ___/___/____ **Signature:** _____

C. PRE-SURVEY

A. Demographic Data and Experience in Technology (Cirit, 2014)
Please fill in the information below about yourself.

Age:		
Gender:		Female
		Male
Class Status:		Freshman
		Sophomore
		Junior
		Senior
1. How long have you been using computer, smart phones and internet technologies?		1-5 years
		6-10 years
		+11
2. For how many hours do you use a computer and a smart phone daily?		Less than an hour
		2-4 hours
		5+
3. How do you access the Internet? (You can choose more than one option.)		on the desktop computer/ laptop
		through the cell phone
		through tablets
		Other: _____
4. Have you ever received a formal training or attended a workshop or conference on computer and internet technologies? (If YES, please specify.)		Yes: _____
		No
5. Have you ever taken any courses in instructional technology? (If YES, please specify)		Yes: _____
		No
6. How proficient do you feel as an Internet user?		Basic
		Intermediate
		Advanced
7. For what purpose do you use the computer mostly? (You can choose more than one option.)		To study my lessons
		To learn new things
		To interact with other people
		To have fun
		Other: _____

B. Attitude toward Technology (Cirit, 2014)

Please fill in the parts below by selecting the number that applies:
4: Strongly Agree 3: Agree 2: Disagree 1: Strongly Disagree

1.	I use the Web 2.0 tools (wikis, blogs, social networking sites etc.) actively in my daily activities.	4	3	2	1
2.	I believe I am more motivated by the use of technology in my courses.	4	3	2	1
3.	I think technology should be integrated to our lessons more.	4	3	2	1
4.	I learn better if I get to practice what I have learned with the help of multimedia such as images, videos, maps etc.	4	3	2	1
5.	Technological tools distract me in my learning.	4	3	2	1
6.	I believe the use of technological tools will contribute to my success in English courses.	4	3	2	1
7.	I would like to see more examples of the use of technology in English classes.	4	3	2	1
8.	I believe the use of technological tools improve my success in my courses.	4	3	2	1
9.	I think I need the help of a classmate when I am learning with technology.	4	3	2	1
10.	I would like to use technology to teach English to my students when I graduate.	4	3	2	1

C. Experience in Augmented Reality

1. Do you know what "Augmented Reality" is?		Yes
		No
2. Do you have any experience with Augmented Reality? (If **Yes**, please answer questions 3 and 4. If **No**, please skip 3rd and 4th questions below.)		Yes
		No
3. How many times have you tried Augmented Reality?		Once
		Twice
		Three times
		More than three times
4. Which Augmented Reality tools do you have experience with?		Blippar
		HP Reveal
		Augment
		Unified AR
		Other:____

D. Opinions about use of Augmented Reality Technologies in English courses (Cirit, 2014)

I. Please fill in the parts below by selecting the number that applies:

4: Strongly Agree 3: Agree 2: Disagree 1: Strongly Disagree

1	I believe Augmented Reality will be useful for listening skill.	4	3	2	1
2	I believe Augmented Reality will be useful for speaking skill.	4	3	2	1
3	I believe Augmented Reality will be useful for reading skill.	4	3	2	1
4	I believe Augmented Reality will be useful for writing skill.	4	3	2	1
5	I believe Augmented Reality will be useful for grammar.	4	3	2	1
6	I believe Augmented Reality will be useful for vocabulary.	4	3	2	1

II. Which skill is the Augmented Reality tool most useful for? Why?

……
……
……

III. Which skill is the Augmented Realty tool least useful for? Why?

……
……
……

D. POST-SURVEY

a) Demographic Data and Experience in Technology (Cirit, 2014)
Please fill in the information below about yourself.

Age:		
Gender:		Female
		Male
Class Status:		Freshman
		Sophomore
		Junior
		Senior
4. How long have you been using computer, smart phone and internet technologies?		1-5 years
		6-10 years
		+11
5. For how many hours do you use a computer and a smart phone daily?		Less than an hour
		2-4 hours
		5+
6. How do you access the Internet? (You can choose more than one option.)		on the desktop computer/ laptop
		through the cell phone
		through tablets
		Other: _____
4. Have you ever received a formal training or attended a workshop or conference on computer and internet technologies? (If YES, please specify)		Yes: ……
		No
5. Have you ever taken any courses in instructional technology? (If YES, please specify)		Yes:……..……..
		No
6. How proficient do you feel as an Internet user?		Basic
		Intermediate
		Advanced
7. For what purpose do you use the computer mostly? (You can choose more than one option.)		To study my lessons
		To learn new things
		To interact with other people
		To have fun
		Other: _____

b. Attitude toward Technology (Cirit, 2014)

Please fill in the parts below by selecting the number that applies:

4: Strongly Agree 3: Agree 2: Disagree 1: Strongly Disagree

1.	I use the Web 2.0 tools (wikis, blogs, social networking sites etc.) actively in my daily activities.	4	3	2	1
2.	I believe I am more motivated by the use of technology in my courses.	4	3	2	1
3.	I think technology should be integrated to our lessons more.	4	3	2	1
4.	I learn better if I get to practice what I have learned with the help of multimedia such as images, videos, maps etc.	4	3	2	1
5.	Technological tools distract me in my learning.	4	3	2	1
6.	I believe the use of technological tools will contribute to my success in English courses.	4	3	2	1
7.	I would like to see more examples of the use of technology in English classes.	4	3	2	1
8.	I believe the use of technological tools improve my success in my courses.	4	3	2	1
9.	I think I need the help of a classmate when I am learning with technology.	4	3	2	1
10.	I would like to use technology to teach English to my students when I graduate.	4	3	2	1

c. Experience in Augmented Reality

1. Do you know what "Augmented Reality" is?		Yes
		No
2.Do you have any experience with Augmented Reality? (If **Yes**, please answer question 3 and 4. If **No**, please skip 3rd and 4th questions below.)		Yes
		No
3.How many times have you tried Augmented Reality?		Once
		Twice
		Three times
		More than three times
4.Which Augmented Reality tools do you have experience with?		Blippar
		HP Reveal
		Augment
		Unified AR
		Other: ……..
5. How competent do you feel in using AR (Blippar) technologies?		Basic
		Intermediate
		Advanced

d. Opinions about use of Augmented Reality Technologies in English courses (Cirit, 2014)

I.Please fill in the parts below by selecting the number that applies:

4: Strongly Agree 3: Agree 2: Disagree 1: Strongly Disagree

1	I believe Augmented Reality will be useful for listening skill.	4	3	2	1
2	I believe Augmented Reality will be useful for speaking skill.	4	3	2	1
3	I believe Augmented Reality will be useful for reading skill.	4	3	2	1
4	I believe Augmented Reality will be useful for writing skill.	4	3	2	1
5	I believe Augmented Reality will be useful for grammar.	4	3	2	1
6	I believe Augmented Reality will be useful for vocabulary.	4	3	2	1

II. Which skill is the Augmented Reality tool most useful for? Why?

……
……
……

III. Which skill is the Augmented Realty tool least useful for? Why?

……
……
……

e. Open-ended Questions and Suggestions

1. What are the things that you liked about Augmented Reality activities in class? Please, write at least three by giving reasons.

……
……
……

2. What are the challenges you faced while you are using Augmented Reality while designing activities, if any?

……
……
……

3. Would you like to use Augmented Reality tools in your future English lessons? Why? Why not?

……
……
……

4. In what other ways would you suggest Augmented Reality to be used in English lesson? (For example, how often and for which topics?)

……
……
……

5. Any other comments or questions about Augmented Reality?

……
……
……

E. REFLECTION FORM

1.Please fill in the parts below by selecting the number that applies: (Cirit, 2014)

4: Strongly Agree 3: Agree 2: Disagree 1: Strongly Disagree

1.	This task would help my students to learn English language skills better.	4	3	2	1
2.	This task would make the content of the lesson more interesting for my students.	4	3	2	1
3.	The Augmented Reality tool that was used for this task was appropriate.	4	3	2	1
4.	Using Augmented Reality tool to design this task was easy.	4	3	2	1
5.	Using Augmented Reality tool for designing this task was motivating for me.	4	3	2	1
6.	To use this Augmented Reality tool to design this task for teaching this skill was appropriate.	4	3	2	1
7.	I would prefer traditional way of teaching without technology instead of using Augmented Reality tool to teach English with the help of the task I designed.	4	3	2	1
8.	After I graduate, I plan to use Augmented Reality tool to teach this skill in English classes to my students as an EFL teacher.	4	3	2	1

2. Please state 3 advantages, 3 disadvantages of the Augmented Reality tool as an instructional technology tool, and how to improve it.

Advantages:

a) ……
b) ……
c) ……

Disadvantages:

a) ……
b) ……
c) ……

Suggestions for improvement:

a) ……
b) ……
c) ……

F. TAM SURVEY (Kaenchan, 2018)

a. Acceptance of Augmented Reality Technology

Please fill in the parts below by selecting the number that applies:

4: Strongly Agree 3: Agree 2: Disagree 1: Strongly Disagree

1.	I find the AR system to be useful for my students' learning.	4	3	2	1
2.	Interacting with the AR system does not require a lot of mental effort.	4	3	2	1
3.	Assuming I had access to the AR system, I intend to use it.	4	3	2	1
4.	I have control over using the AR system.	4	3	2	1
5.	Working with the AR system would make my students nervous.	4	3	2	1
6.	I find using the AR system to be enjoyable.	4	3	2	1
7.	Using the AR system for my students' learning would increase their productivity.	4	3	2	1
8.	I find the AR system to be easy to use.	4	3	2	1
9.	Given that I had access to the AR system, I predict that I would use it.	4	3	2	1
10.	I had the resources necessary to use the AR system.	4	3	2	1
11.	The AR system makes me feel uncomfortable.	4	3	2	1
12.	The actual process of using the AR system is pleasant.	4	3	2	1
13.	Using the AR system would enhance my students' effectiveness for their learning.	4	3	2	1
14.	I find it easy to get the AR system to do what I want my students to do.	4	3	2	1
15.	I plan to use the AR system in the near future.	4	3	2	1
16.	Given the resources, opportunities and knowledge it takes to use the AR system, it would be easy for me to use the system.	4	3	2	1
17.	The AR system makes me feel uneasy.	4	3	2	1
18.	I had enjoyment while using the AR system.	4	3	2	1
19.	Using the AR system would improve my students' learning performance.	4	3	2	1
20.	My interaction with the AR system is clear and understandable.	4	3	2	1
21.	I am determined to integrate the AR system for my students' future learning.	4	3	2	1
22.	Resources needed to use the AR systems are sufficient for me.	4	3	2	1
23.	Using the AR system scares me.	4	3	2	1
24.	My students would have fun using the AR system.	4	3	2	1

b. **Self-Efficacy of Augmented Reality Technology:** For each of the conditions, please indicate whether you think you would be able to complete the job using the augmented reality technology. Please rate your confidence about your first judgement, by selecting the number that applies:

4: Totally confident 3: Moderately Confident 2: Slightly Confident 1: Not at all confident

	I could complete the task using the augmented reality technology…				
1.	if there was no one around to tell me what to do as I go with the AR system.	4	3	2	1
2.	if I had never used the AR system before.	4	3	2	1
3.	if I had only the AR system manuals for reference.	4	3	2	1
4.	if I had seen someone else using the AR system before trying it myself.	4	3	2	1
5.	if I could call or ask someone else for help if I got stuck.	4	3	2	1
6.	if someone else had helped me get started.	4	3	2	1
7.	if I had a lot of time to complete the task for which the AR system was provided	4	3	2	1
8.	if I had the built-in help facility for assistance.	4	3	2	1
9.	if someone showed me how to do it first	4	3	2	1
10.	if I had used similar system(s) before this one to do the same task.	4	3	2	1

G. INTERVIEW PROTOCOL

Interview Protocol

The purpose of this interviews is to gather pre-service EFL teachers' personal reflections, perspectives, and accounts of their experience in designing AR enhanced language learning activities. This interview protocol is used as a guideline to elicit the participant's experience. The interview questions were adopted from previous thesis studies on technological tools and Augmented Reality (Cirit,2014; Kaenchan, 2018)

Interview Overview

This interview is expected to take typically 20-25 minutes. Each invited/selected research participant will spend this time to elicit his/her personal information, learning
experience, and how (s)he has designed AR enhanced language learning activities for English courses.

Part 1: Introduction by interviewer

Say to the interviewee:

Thank you very much for your time to participate in my research study. My name is Ayşegül OKUMUŞ, the researcher of this study. Before we start the interview, I would like to explain the objective of this study and this particular interview to you first. The purpose of the study is to investigate your perceptions, attitudes and acceptance of augmented reality technology in language classrooms. This also includes the investigation of your own judgment of how well you manage to do what you want to do with technology; your beliefs and how they influence your beliefs about your teaching practice. The interview will take about 20-25 minutes. If my interview questions are not clear to you at any point, please do not hesitate to ask for clarification. You can also request to withdraw from the interview session at any time if you feel uncomfortable. Do you, as of now, have any question before we start?

Part 2: Interviewee's experience towards the use of augmented reality

1. Attitude, acceptance, and perception about augmented reality technology

1.1 Prior to the course, you attended an AR orientation. Could you please explain what AR or augmented reality is, based on your understanding?

1.2 How do you perceive the use of augmented reality technology in particular? Do you think it is important in your learning? If yes, how and to what extent? **1.3** Please explain some benefits you can find in integrating augmented reality technology in language learning activities in the classroom.

1.4 Please explain some disadvantages you can find in integrating augmented reality technology in language learning activities in the classroom.

1.5 How do you find augmented reality technology useful in education? Do you think augmented reality technology can be beneficial for your future?

1.6 Do you think you are successful in using augmented reality technology in your classrooms? How would you rate yourself as a user of such technology in general? From a scale of 1 to 10 point, how many points would you rate yourself as a confident or competent user of augmented reality?
1.7 What technical constraints/ difficulties you have faced when using augmented reality technology in your classroom? Do you have enough support and resources? What kind of support and resources you think are important? Please explain.
1.8 Do you feel any frustration or anxiety while using augmented reality technology? Do you feel nervous or fear that you would not be able to use it effectively? Please explain.
1.9 Do you think using augmented reality technology in language learning or language classrooms is fun and enjoyable? Please explain.
1.10 If you could provide suggestions/comments for future development of this particular AR application (Blippar), what would you tell the development team?

2. AR Enhanced Activity Design Process

2.1. In the training "Integrating Augmented Reality Technology into ELT", the same tool was used for each one of the 6 tasks. Do you think it is better to use a different tool or the same tool for each task? Why?
2.2. Which one or ones of the tasks do you think is more useful and attractive? Why?
2.3. Do you think such tasks in the present study and their equivalents should be developed to teach any English language skills to the students? What could its contribution to the language learning be?
2.4. When you compare your situation before and after the task implementation process, have there been any changes in your thoughts in terms of integrating Augmented Reality tools to English courses?
2.5. You designed the tasks/activities in pairs. If you had a chance, which one would you choose, working on your own or in pairs?

3. Future adoption of augmented reality:

3.1 How do you think augmented reality technology can be adopted in education in the future? Please explain.
3.2. Are the tasks that you did in the training "Integrating Augmented Reality Technology into ELT " of any help to your teaching career as an English language teacher? Why?
3.3. When you become a full-time EFL teacher, which one or ones of these tasks can you adapt to your lessons? Why?
3.4. Would you use Augmented Reality tools in your classes? Why? Why not?

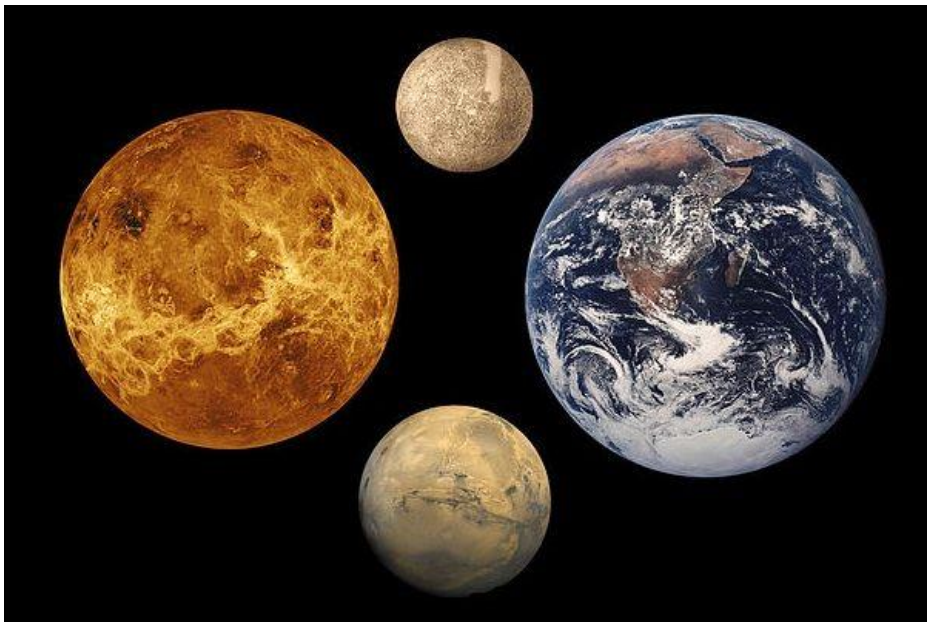
4. Other

4. Are there any questions that you would like to ask to the researcher or any comments that you would like to make?

H. SAMPLE AR-BASED TASKS

ACTIVITY WITH AUGMENTED REALITY	
Skills Integrated	Grammar, reading, spelling
Students' Level of Proficiency:	A1
Students' Age:	9-10
Class Size:	15 students
Duration of the activity: (not less than 15 min.)	15 minutes
Lesson Topic / Theme:	Prepositions of place
Lesson Focus (Teaching Point):	Putting the correct preposition for the places
Pre-requisite Knowledge:	We assume that students have already learned these prepositions. This is an exercise for them.
Objectives:	At the end of this activity, students will be able to; -use the correct preposition for places -talk about places by using prepositions of place -write these prepositions correctly
Test Code: (Blippar)	1458562
Procedure: There is a map in the scene. The girl in the map moves place to place. When the girl stops at a place, students will click on the writing (next to the place) and will answer the question. If they answer it correctly, they will click on "next" and go to the next place. If they answer it wrong, they will click on "go back" and go back to the same question until they find the correct answer.	
Reference(s) for your picture:	https://www.shutterstock.com/tr/image-vector/cartoon-map-river-250467817 https://tr.pinterest.com/pin/544372673706649953/ https://www.shutterstock.com/tr/image-illustration/abstract-gray-background-508982365 https://www.shutterstock.com/tr/image-vector/green-check-mark-icon-tick-symbol-522874111 https://www.vectorstock.com/royalty-free-vector/cross-mark-and-check-mark-vector-12286409

ACTIVITY WITH AUGMENTED REALITY	
Skills Integrated	**-Vocabulary**
Students' Level of Proficiency:	**B1**
Students' Age:	**16-17**
Class Size:	**20 students**
Duration of the activity: (not less than 15 min.)	**15 minutes**
Lesson Topic / Theme:	**Solar System**
Lesson Focus (Teaching Point):	**Knowledge of the planets**
Pre-requisite Knowledge:	**Students need to have science lessons**
Objectives:	**At the end of this activity students will be able to;** **-learn about the arrangement of the planets** **-learn information about the planets**
Test Code: (Blippar)	**1488206**
Procedure: There are planets on the screen. Students need to click on each of them and read the information provided on the screen which will help them to practice and learn more about the planets that they have been taught in the class.	
Reference(s) for your picture:	**1. https://www.space.com/17028-terrestrial-planets.htm** **2. https://tr.pinterest.com/pin/552253973027790414/** **3. https://svs.gsfc.nasa.gov/30362** **4. https://www.solarsystemscope.com/textures/** **5. https://www.deviantart.com/magentameteorite/art/Fictional-Venus-Cloud-Map-727293905** **6. https://www.planetminecraft.com/project/mars-map/** **7. https://www.roblox.com/library/250052648/Neptune-Texture** **8. https://www.solarsystemscope.com/textures/** **9. https://www.deviantart.com/magentameteorite/art/Uranus-Texture-Map-2017-727689611** **10. https://www.deviantart.com/bob3studios/art/Mercury-Texture-Map-Used-By-Solar-Walk-2-760181790**



İ. SAMPLE PAGE OF CODE AND THEMES

Raw Data	Code	Theme/Category
Interview Q1.9. Do you think using augmented reality technology in language learning or language classrooms is fun and enjoyable?		
Well, I definitely think it is more fun and enjoyable than regular classes because it puts rare and difficult sights into picture to our real world with the help of, of course, hardware but that just puts a whole different level to teaching. To be able to literally bring stuff right in front of your students and you as well, that just makes the lesson more fun and enjoyable. [Cade, interview]	Increases enjoyment	Affordances of AR technology
Interview Q1.4. Please explain some disadvantages you can find in integrating augmented reality technology in language learning activities in the classroom.		
The disadvantages of this technology are that it takes too much time to prepare the material. For example, for one task, it took two hours to prepare it, which is too much. With technology, we cannot always do the things we want to. These are the disadvantages for me. [Rose, interview]	Time consuming	Constraints of AR technology
Interview Q1.6. Do you think you are successful in using augmented reality technology in your classrooms? How would you rate yourself as a user of such technology in general? From a scale of 1 to 10 point, how many points would you rate yourself as a confident or competent user of augmented reality?		
I think I'm six. I'm not really bad. I know a lot of things related to technology, but I know that I can improve so much better. I mean, it would be better if we have a separate course for such technologies. I know we had some computer courses in the university, but it wasn't enough for implementing augmented reality. I mean, teachers and such technologies, we need to have some separate courses for that so that my knowledge is not enough to go outside and use all the tools related to augmented reality. I know how to use Blippar because I practiced it more than once. But there are a lot of tools and we actually it would be better if we learn some other tools as well. … [Janet, interview]	Training teachers and students on AR technology	Recommendation for the use of AR technology

J. TURKISH SUMMARY / TÜRKÇE ÖZET

İNGİLİZCE ÖĞRETMEN ADAYLARININ ARTIRILMIŞ GERÇEKLİK TEKNOLOJİSNE İLİŞKİN ALGILARI VE YETKİNLİKLERİ: KARMA YÖNTEM ÇALIŞMASI

1. GİRİŞ

Bilgisayarlar ve akıllı telefonlar gibi teknolojik araçlar 21. yüzyılda daha yaygın hale geldi ve bilginin aktarılma şeklini etkilerken dönüştürdü. Son yıllarda, akıllı telefonlar gibi mobil teknolojilerin yaygınlaşmasının bir sonucu olarak Artırılmış Gerçeklik (AG) Teknolojisi yaygınlaştı (Zhang vd., 2020). AG, dijital görüntüleri gerçek dünyaya ekleyerek gerçek ve sanal dünyalar arasındaki boşluğu dolduran bir teknolojidir (Azuma, 1997; Mohn, 2015). AG teknolojisinin üç türü bulunmaktadır: işaretçi tabanlı AG, işaret tabanlı olmayan AG ve konum tabanlı AG (Wojciechowski & Cellary, 2013). Bu üç tür arasında görüntü tabanlı olan işaret tabanlı AG eğitim alanında sıklıkla kullanıldığı görülmüştür (Bacca vd., 2014). AG teknolojisinin çalışması için kullanılan teknolojik donanım, kullanılan AG uygulamasına bağlı olarak başa takılan ekranlar, tabletler ve akıllı telefonlar gibi elde tutulan ekranlar ve tutam eldivenlerden oluşur (Kesim & Özarslan, 2012). Şu anda kullanılan AG uygulamaları şunlardır: "Blippar, HP Reveal, ARToolkit, Unity, Aurasma, ZooBurst, Augment, Layar, ve Daqri". Son on yılda, AG teknolojisi şu alanlarda kullanıldı: askeri; ilaç, mühendislik, tasarım; robotik; tele robotik; imalat, bakım ve onarım uygulamaları; tüketici tasarımı; 1990'ların başından beri psikolojik tedaviler (Azuma vd., 2001). AG teknolojisinin kullanımı turizm (Fritz vd., 2005), arkeoloji (Vlahakis vd., 2001), ticaret, reklamcılık, eğlence, tasarım (Alkhamisi vd., 2013), ve inşaat (Vasilevski & Birt, 2020) alanlarında da gözlemlenmiştir. AG teknolojisinin kullanımı bu alanlarla sınırlı kalmadı çünkü eğitici eğlence için de kullanılabilir (Kesim & Özarslan, 2012). "NMC Horizon" Yüksek Öğrenim Raporunda (Johnson vd., 2016), AG ve Yapay Gerçeklik (YG) teknolojisinin iki ila üç yıl içinde daha yaygın hale geleceği tahmin ediliyordu. Tahmin edildiği gibi, AG teknolojisinin uygulanması çeşitli alanlarda yaygınlaşmıştır, ancak kullanımı son zamanlarda İngiliz Dili Eğitimi alanında

gözlemlenmiştir (Hockly, 2019). AG teknolojisinin dayandığı teorik çerçevelerin Yapılandırmacılık, Bağlantıcılık, Konumlandırılmış Öğrenme, Oyuna dayalı öğrenme ve Sorgulama temelli öğrenmeyi içerdiği belirtilmiştir (Bower vd., 2014; Wang vd., 2018). İlk olarak, AG teknolojisi "yapılandırmacı öğrenmenin güçlü yolu" olarak değerlendirilmektedir (Robinson & Coltz, 2013, s. 3353) çünkü öğrencilerin görevler, kavramlar ve kaynaklarla daha derin bir düzeyde etkileşime girmesine izin verir ve bu da onların bilgi tabanları içinde kalıcı bağlantılar kurmalarına yardımcı olur (Kerawalla vd., 2006). AG teknolojisi, zaman ve yerin engellerini aşmada etkilidir ve öğrencilerin "tam zamanında öğrenme için" ilgili bilgilere ulaşmasını sağlar (Wang vd., 2018, s.4). Ek olarak, AG teknolojisi, "gerçek dünyayı sınıfa getirerek özgün ve bağlama dayalı öğrenme" oluşturmaya yardımcı olması açısından Konumlandırılmış Öğrenme için faydalı olabilir (Bower vd., 2014, s.7).

AG uygulanmasının ilk kez kullanılmasından bu yana, eğitim bağlamlarında bu teknolojinin yeterlilikleri ve kısıtlamaları hakkında bazı deneysel araştırmalar yapılmıştır. AG'nin K-12 eğitiminde, yükseköğreniminde ve yetişkin eğitiminde kullanımına yönelik sistematik analizde Akçayır ve Akçayır (2017) AG teknolojisinin faydalarının yanı sıra zorluklarını özetledi ve bunları öğrenen sonuçları, pedagojik katkılar ve etkileşimler ve diğerleri başlıkları altında üç ana kategoriye ayırdı. Öğrenci çıktıları kategorisi şu faydaları içeriyordu: artan akademik başarı, artan öğrenme motivasyonu, gelişmiş öğrenme, olumlu tutum, artan memnuniyet, düşük bilişsel yük, artan güven ve gelişmiş mekansal yetenek. İkinci kategori, pedagojik katkı ve etkileşimler şu faydalardan oluşuyordu: artan zevk, artan öğrenci katılımı, artan ilgi, öğrenciler ve öğretmenler arasında artan etkileşim ve iletişim ve kendi kendine öğrenmeyi teşvik etmek. Son kategori şunları içeriyordu; soyut kavramların görselleştirilmesine, kullanımı kolay ve uygun maliyetli olmasına yardımcı olur. AG teknolojisinin eğitim bağlamındaki dezavantajlarına gelince, Akçayır ve Akçayır (2017) AG teknolojisinin kullanımının ve tasarımının zor olduğu, zaman alıcı olduğu, kalabalık sınıflar için uygun olmadığı, teknik zorluklara ve bilişsel yüke neden olduğu, öğrencilerin dikkatini dağıttığı ve öğretmenin teknolojiyi kullanma becerisinin yetersiz olduğu sonucuna varmıştır.

AG teknolojisi, dil öğretimi ve öğrenimine yeni yeni girmeye başladı (Hockly, 2019) ve AG teknolojisinin "hala dil öğretiminin metodolojik sınırlarında" olduğuna inanılıyor (Nöhrer, 2020, s.2). AG teknolojisinin eğitim amaçlı uygulanması için çeşitli etkinlikler önerilmiştir (Yuen vd., 2011). Birincisi, yerler ve nesneler hakkında daha fazla bilgi edinme fikrine dayanan ve genellikle müzelerde, tarihi veya kültürel yerlerde kullanılan keşfe dayalı öğrenme aktivitesidir. Örnek olarak, Holden ve Skyes (2012) tarafından yürütülen Mentira Projesi'nde, ABD'deki İspanyol üniversite öğrencilerinin, yerel halkla İspanyolca konuşarak AG tabanlı bir cinayet-gizem oyununu çözmek için kanıt toplamaları bekleniyordu. Diğer bir aktivite türü, nesne, mekân veya bina tasarlamak için AG teknolojisinden yararlanabilecekleri için tasarımcı veya mimarlık eğitimi almış öğrencilere hitap eden nesne modellemedir. Ayrıca, kullanıcıları metin, görüntü, ses veya videodan oluşan sanal bir ara yüze yönlendiren QR kodları veya görüntüler gibi tetikleyiciler kullanılarak AG tabanlı 3 boyutlu kitaplar hazırlanmıştır. Önceki çalışmalar, AG 3 boyutlu kitapların Türkçe ve İngilizce öğretiminde kullanımıyla ilgilenmiştir (Bursalı &Yılmaz, 2019; Mahadzir & Phung, 2013; Vate-U-Lan, 2012). AG teknolojisinin bir başka kullanımı da mesleki eğitim ve öğretimde beceri eğitimidir. AG oyunlarının en son örneği Pokémon Go'dur. Dil öğrenme amaçlı MondlyAR tasarlandı. Sanal bir dil öğrenme asistanı ve bir akıllı telefon ile çalışır ve kullanıcıların çeşitli aktiviteler aracılığıyla 41 dil öğrenmesini sağlar (MondlyAr, t.y.). Bunlara ek olarak, Bonner ve Reinders (2018), "kampüs turu oluşturma, talimat verme ve takip etme, konuma dayalı bulmaca hazine avları, okumalar için anında erişimli tamamlayıcı materyaller sağlama, bilgi boşluğu etkinliklerinde rolleri otomatik olarak atama ve sınıf çalışması veya ev ödevi sırasında öğretmenle arka planda çalışma" dahil olmak üzere AG ile geliştirilmiş dil öğrenme etkinlikleri için bazı pratik fikirler ortaya koydu.

Bu teknolojinin ortaya çıkışından bu yana neredeyse otuz yıl geçmiş olmasına ve çeşitli olanaklar sunmasına rağmen, AG teknolojisinin hala emekleme döneminde olduğu düşünülmektedir (Wu vd., 2013; Yuen vd., 2011). AG teknolojisinin faydalarını tanıyan önemli miktarda alan yazın olmasına rağmen, bu teknoloji ilk, orta veya üniversite düzeyinde dil eğitimine tam olarak girmemiştir (Bonner & Reinders, 2018). AR ile geliştirilmiş dil öğrenme materyallerinin sayısı son zamanlarda artmış

olsa da bu materyallerin uygulama örnekleri oldukça nadirdir. (Hockly, 2019). Bu nedenle, bu teknolojinin eğitim amaçlı kullanımı üzerine yapılan araştırmalar, AG teknolojisinin hızlı gelişimine ayak uyduramıyor (Bower vd., 2014). Sonuç olarak, AG teknolojisinin öğretme ve öğrenme süreci üzerindeki etkisine ilişkin yeterli kanıt toplanamamıştır (Wu et al., 2013).

AG teknolojisinin sınıf ortamında uygulanmasına ilişkin kanıt eksikliğinin ana nedenlerinden biri, öğretmenin teknolojiyi kullanma becerisinin yetersiz olmasıdır (Akçayır & Akçayır, 2017). Bu nedenle, İngilizce öğretmen adaylarının AG teknolojisine yönelik algılarını, bu teknolojideki kabul ve öz-yeterlik düzeylerini incelemek önemlidir çünkü beklenmedik olayların meydana geldiği bu zamanlarda İngilizceyi yabancı dil olarak öğretmek için teknolojiden yararlanacaklardır. Önceki çalışmalara kıyasla, bu çalışma önemlidir çünkü hizmet öncesi İngilizce öğretmenlerinden, herhangi bir İngilizce dil yeterliliği düzeyine yönelik herhangi bir dil becerisini öğretmek için AG destekli dil öğrenme materyalleri tasarlamaları beklenmektedir.

Yakın zamanda ortaya çıkan COVID-19 salgını nedeniyle, teknolojinin hayati önemi, işten eğitime kadar hayatın her alanında her zamankinden daha fazla kabul edildi ve derslerin sunulma şeklini değiştirdi. Sonuç olarak, Acil Uzaktan Eğitim (EDE), farklı eğitim seviyelerinde eğitim uygulamalarını sürdürmek için ideal bir çözüm olduğu için gerçekleştirilmek zorunda kaldı. İngilizce Öğretimi (ELT) alanında bilgi ve iletişim teknolojisini (BİT) kullanabilme yeteneğine atıfta bulunan teknoloji ve dijital yeterliliklerin önemi uzun yıllardır belirtilmesine rağmen (Vladescu, 2016), EDE sırasında yapılan öğretim uygulamaları bazı öğretmenlerin bu ani değişime uyum sağlayacak kadar teknolojik yeterliklerinin olmadığını ve teknolojinin eğitimsel amaçlarla nasıl daha verimli kullanılacağına dair eğitime ihtiyaç duyduğunu belirtmiştir (Mishra vd., 2020). Hodges vd. (2020), çevrimiçi eğitimin yalnızca acil durum çevrimiçi uygulamalarla sınırlı kalmaması gerektiğini ve çevrimiçi eğitimin kalitesinin, öğretim süreçlerinin kapsamlı bir şekilde planlanması ve tasarlanmasıyla artırılması gerektiğini ifade etmiştir. Bu nedenle, öğretmenlerin her zamankinden daha yetkin olmaları gerekmektedir ve yeni mezun olan İngilizce Öğretmenlerinden bile

teknolojik araçları kullanma yeterlilik düzeylerini belirtmeleri istenmiştir. Ek olarak hem hizmet öncesi İngilizce öğretmenleri hem de aday öğrencileri dijital yerliler olacak ve 'teknoloji meraklısı' olacaklar (Prensky, 2001). Bununla birlikte, dijital yerlilerin sahip olması beklenen bilgi ve becerilerden yoksun olduğu görülmüştür (Bennett vd., 2008). Bu dijital yerliler için uygun bir öğrenme süreci sağlamak ve salgın veya doğal afetlerden kaynaklanan eğitimde ortaya çıkan zorlukları aşmak için, öğretmen adaylarının öğretim teknolojisi araçlarını daha fazla kullanmaları beklenmektedir. Bu nedenle, sadece hizmet içi öğretmenler değil, öğretmen adayları da lisans eğitimlerinin bir parçası olarak bu amaçla eğitilmelidir. Sonuç olarak, 2020'yi yeniden yaşamak ve eğitim uygulamalarını telafi etmek mümkün olmayabilir, ancak öğretim teknolojisi araçlarıyla ilgili bilgi ve becerilerimizi güncellemek mümkündür (Gao & Zhang, 2020). Aksi takdirde, teknolojiyi kullanma konusunda yeterince yetkin olmayan öğretmen ve öğrencilerin çevrimiçi eğitimin gerisinde kalma olasılığı yüksektir (Hubbard & Levy, 2006; Adedoyin & Soykan, 2020).

İngilizce Öğretimi (ELT) alanına gelince, motivasyon, öğrenme çıktıları ve AR teknolojisinin etkinliği üzerine araştırmalar yapılmıştır. Dil becerileri açısından, bu alandaki çalışmaların çoğu, kelime öğretiminde odaklanmıştır (Akçayır & Akçayır, 2016; Karacan, 2019). Şimdiye kadar, Karacan'ın (2019) yüksek lisans tezi çalışmasının yanı sıra, öğretmen adaylarına bu teknoloji ile ilgili bir eğitim verilmemiştir ve ELT alanında bu ortaya çıkan teknolojiye dair hala çok az bilimsel çalışma vardır. Saforrudin ve ark., AG teknolojisi hakkında bilgi ve deneyim sahibi olmak, dil öğretmenlerinin çoğunun sahip olması arzu edilen bir özelliktir (2011). Bu nedenle, teknolojik yeterlilik için mevcut yüksek talep ve şimdiye kadar yapılan çalışmalar göz önüne alındığında, AG ile geliştirilmiş dil öğrenme materyallerinin uygulanması için araştırma yapılması gerekmektedir (Kljun vd., 2020).

Bu çalışma kapsamında, İngilizce öğretmen adaylarına AG uygulaması hakkında bilgi verildikten sonra, her yeterlik seviyesinde İngilizce becerisini öğretmek için "Blippar" kullanarak beş etkinlik tasarlamaları istenmiştir. Bu çalışmada, öğretmen adaylarının AG uygulamasına ilişkin görüşleri, AG teknolojisinin sağladığı olanaklar ve kısıtlamalar ortaya konulmaya çalışılmıştır. Diğer bir amaç, bu teknolojiyi kabul etme

seviyelerini ve AG teknolojisini kullanmadaki öz yeterlilik seviyelerini belirlemekti. Etkinlik tasarım süreci öncesinde ve sonrasında uygulanan anketler, yansıtma formları ve yarı yapılandırılmış görüşme yardımıyla ilgili veriler toplanmıştır. Bu kapsamda, çalışmada ele alınan ana sorular şu şekildedir:

1. Artırılmış Gerçeklik (AG) teknolojilerinin İngilizce derslerine entegrasyonu konusunda eğitim alan öğretmen adaylarının İngilizce öğretmek için Artırılmış Gerçeklik kullanımı (dinleme, konuşma, okuma, yazma, kelime hazinesi, gramer) konusundaki görüşleri nelerdir?

1.a. İngilizce öğretmek için AG teknolojilerini kullanmanın avantajları nelerdir?

1.b. İngilizce öğretmek için AG teknolojilerini kullanmanın dezavantajları nelerdir?

1.c. İngilizce öğretmek için AG teknolojilerinin kullanımına yönelik İngilizce öğretmen adaylarının önerileri nelerdir?

2. İngilizce öğretmek için AG destekli etkinlikler tasarlama deneyiminden sonra, İngilizce öğretmeni adaylarının artırılmış gerçeklik teknolojisi etkinliklerini kabul düzeyi nedir?

3. Aktiviteleri tamamladıktan sonra, İngilizce öğretmeni adayları artırılmış gerçeklik teknolojisini kullanma konusunda hangi düzeyde öz-yeterlik deneyimi yaşadılar?

2. YÖNTEM

Bu çalışmada, hizmet öncesi İngilizce öğretmen adaylarının AG teknolojisinin İngilizce derslerine entegrasyonuna ilişkin algıları hakkında daha derinlemesine bilgi elde etmek ve AG teknolojisinin kabul ve öz yeterlik düzeylerini belirlemek için karma yöntem araştırma tasarımı benimsenmiştir. Bu çalışma, Creswell ve Plano Clark (2003) tarafından tanımlanan, karma yöntem araştırma desenlerinden biri olan sıralı açıklayıcı tasarım kullanılarak yürütülmüştür.

Bu araştırmanın evreni, Türkiye'deki İngilizce öğretmen adaylarıdır. Ancak, bu öğretmen adaylarının tümüne ulaşmak zaman ve maliyet açısından verimli

olmadığından, araştırmacı Kolaylı Örnekleme yöntemi uygulayarak bir örneklem grubu belirlemiştir. Bu tesadüfi olmayan örnekleme yönteminde, uygun şekilde ulaşılabilir olan ve katkıda bulunmaya istekli katılımcılar araştırma amacıyla işe alınır (Fraenkel vd., 2012). Bu nedenle çalışma Ankara'da bulunan bir vakıf üniversitesinin İngilizce Öğretmenliği Programı'nda öğrenim gören İngilizce öğretmen adaylarının gönüllü katılımıyla gerçekleştirildi. Bu çalışmaya 220 öğrenciden oluşan ilk kohorttan Öğretmenlik Uygulaması dersine kayıtlı 50 öğrenci katılmıştır.

Çalışmanın nicel aşamasına 50 gönüllü İngilizce öğretmen adayı katılırken, nitel aşamasına ise 12 gönüllü İngilizce öğretmen adayı katılmıştır. Katılımcıların yaşı 21-28 arasında değişiklik göstermektedir ve çoğu kadındır. Anket sonrası katılımcılardan AG teknolojisindeki yetkinlik seviyelerini bildirmeleri istendi. Bu kritere göre, temel, orta ve ileri olmak üzere üç kategori vardı ve her kategoriden deneyimleri hakkında daha fazla bilgi vererek çalışmaya katkıda bulunmak isteyen dört görüşmeci mevcut çalışmanın nitel aşamasında yer aldı.

Ön anket, demografik verileri, teknolojik deneyimlerini, teknolojiye karşı tavırları, AG konusundaki önceki deneyimleri, AG hakkındaki görüşleri hakkında veri toplamak için tasarlandı. Ön anket dört ana bölümden oluşuyordu; Demografik veriler ve teknolojide deneyim (Bölüm A), Teknoloji Algısı (Bölüm B), Artırılmış Gerçeklikte Deneyim (Bölüm C), İngilizce dersinde Artırılmış Gerçeklik teknolojilerinin kullanımına ilişkin görüşler (Bölüm D). Son ankette altı ana bölüm vardı; Demografik veriler ve teknolojide deneyim (Bölüm A), Teknoloji Algısı (Bölüm B), Artırılmış Gerçeklikte Deneyim (Bölüm C), İngilizce kurslarında Artırılmış Gerçeklik teknolojilerinin kullanımına ilişkin görüşler (Bölüm D) ve Açık Uçlu Sorular ve Öneriler (Bölüm E).

Daha sonra yansıma formu katılımcılara tanıtılmış ve uygulama sürecinde yansıma formu kullanımının arkasındaki mantığı anlamaları sağlanmıştır. Yansıma formu, her bir görevi tamamladıktan hemen sonra her katılımcı tarafından doldurulmuştur. Görev uygulama sürecinde veri toplamanın amacı, katılımcıların tasarladıkları görevleri unutmadan fikirlerini keşfetmektir. Her 5 görev için aynı yansıma kağıdının kullanılması, araştırmacının, görev uygulama sürecine ilişkin katılımcıların algılarında

meydana gelen değişiklikleri gözlemlemesini sağladı. Yansıma formu iki bölümden oluşuyordu; ilk bölümde 4'lü Likert ölçeğinde tasarlanmış 1'den 4'e kadar değerler içeren 8 ifade bulunurken, ikinci bölümde katılımcılara görev uygulama sürecinde karşılaştıkları 3 avantaj, 3 dezavantaj ve 3 öneri belirtmelerini isteyen açık uçlu sorular yer almaktadır.

İngilizce Öğretmen adaylarının AG teknolojisinin ne derece kabullendiklerini ölçmek amacıyla Venkatesh ve Bala (2008) tarafından önerilen çerçeveye dayalı TAM3 anketi kullanılmıştır ve bu anket iki bölümden oluşmaktadır. Birinci bölümde AG teknolojisinin kabulü ile ilgili 4'lü Likert ölçeğinde tasarlanmış 24 maddeden oluşmaktadır. İkinci bölümünde, AG teknolojisinin kullanımında öz-yeterlik düzeyine atıfta bulunan 10 madde, 4 puanlık Likert ölçeğinde şu şekilde kodlanmıştır: 4: Tamamen emin; 3: Kısmen Kendinden Emin; 2: Biraz Kendinden Emin; 1: Hiç emin değilim.

Hizmet öncesi İngilizce öğretmenlerinin AG teknolojisindeki deneyimlerini kapsamlı bir şekilde anlatmak amacıyla, on iki katılımcı ile yarı yapılandırılmış görüşmeler gerçekleştirildi. Görüşmeler, son anket uygulandıktan bir hafta sonra yapıldı. Katılımcıların anket sonrası AG teknolojilerini kullanmadaki öz yeterlik düzeylerine ilişkin yanıtlarına göre, yarı yapılandırılmış görüşmelere katılmak isteyen dört katılımcı, temel, orta ve ileri olmak üzere her yetkinlik düzeyinden 4 kişi seçilmiştir. Görüşmenin başında, görüşmeye katılmanın gönüllülük esasına dayalı olduğu ve rahatsızlık duyduklarında herhangi bir sebep göstermeden görüşmeden her an çekilebilecekleri açıkça belirtildi. Ayrıca seslerinin kaydedileceği ve her görüşmenin başında sözlü onay verdikleri belirtildi. Görüşmeler İngilizce yapıldı.

Yarı yapılandırılmış görüşme toplamda üç bölümden ve 20 sorudan oluşuyordu. İlk bölüm, görüşülen kişinin artırılmış gerçeklik kullanımına yönelik deneyimini, AG teknolojisi hakkındaki kabulleri ve algıları ve bu teknolojideki öz yeterlikleri hakkında on soru sorarak incelemeyi amaçladı. İkinci bölüm, hizmet öncesi EFL öğretmenlerinin AG teknolojisiyle ilgili deneyimlerini daha da derinlemesine incelemek için AG geliştirilmiş etkinlikler tasarım süreciyle ilgili sorular içeriyordu. Üçüncü bölümde AG teknolojisinin eğitim alanında geleceği hakkında ne

düşündüklerini ve öğretmen adaylarının gelecekte AG teknolojisini kullanmayı planlayıp planlamadıklarını öğrenmek amacıyla 4 soru yer aldı. Dördüncü bölümdeki son soru ile katılımcılara araştırmayla ilgili başka soruları, görüşleri ve önerileri olup olmadığı sorulmuştur.

İngilizce derslerinde eğitim teknolojilerinin kullanımına ilişkin öğretmen adaylarının algılarında önemli bir değişiklik olup olmadığını anlamak için, Wilcoxon İşaretli Sıra Testi, ön ve son anketler yoluyla toplanan veriler üzerinde uygulanmıştır. Hizmet öncesi İngilizce öğretmenlerinin dil becerileri için AG kullanımına ilişkin görüşlerini ortaya çıkarmak için, anket öncesi ve sonrası (Bölüm E) veriler, Wilcoxon İşaretli Sıra Testi ile analiz edildi.

TAM anketinin verilerine gelince, tanımlayıcı istatistiklerin ardından verilerin normal dağılıp dağılmadığı Kolmogorov-Smirnov'un testi ile kontrol edildi. TAM anketinin her bir bölümü için veriler, katılımcıların AG teknolojisinin kabulü açısından bakış açılarını değiştirip değiştirmediğini ve öz-yeterlik düzeyleri arasında anlamlı bir fark olup olmadığını araştırmak için eşleştirilmiş örneklem t-testi ile analiz edildi.

Yansıma formundaki veriler betimsel olarak analiz edildikten sonra, nicel verilerin normalliği Kolmogorov-Smirnov'un testi ile hesaplandı. Uygulama sürecinde yansıma formu beş kez uygulandığından, İngilizce derslerinde AG teknolojisine ilişkin görüşlerinde istatistiksel olarak önemli bir değişiklik olup olmadığını kontrol etmek için tekrarlanan ANOVA ölçümlerinin parametrik olmayan eşdeğeri olan Friedman testi gerçekleştirildi. Yansıtma formu ve yarı yapılandırılmış görüşmeler yoluyla toplanan nitel verilerin analizine gelince, sürekli karşılaştırmalı yöntem kullanıldı. Araştırma kalitesini ve güvenilirliğini artırmak amacıyla, İngilizce Öğretmenliği Programı mezunu ve Bilgisayar Eğitimi ve Öğretim Teknolojileri alanında doktora derecesine sahip bir uzman yardımıyla kodlayıcılar arası güvenilirlik analizi yapılmıştır.

3. BULGULAR

AG'nin eğitimde kullanımına ilişkin yapılan akademik çalışmaların sayısının her geçen yıl arttığı içerik analizi ve sistematik literatür taraması çalışmalarından

görülebilmektedir (Akçayir ve Akçayir, 2017; Altınpulluk, 2019; Arıcı vd., 2019). Bu çalışma, hizmet öncesi İngilizce öğretmenlerinin AG teknolojisine ilişkin algılarını, kabul düzeylerini ve dil öğrenme materyallerini tasarlamak için AR teknolojisini kullanmadaki öz-yeterliklerini inceleyerek artan alan yazınına katkıda bulunmaktadır.

Aday İngilizce öğretmenlerinin AG teknolojisinin İngilizce öğretmek ve öğrenmek için kullanılması konusunda olumlu görüşlere sahip olduğu ortaya çıktı. Dil becerileri açısından kelime bilgisi, AG teknolojisinin en yararlı olduğu dil becerisi olarak kabul edilirken, AG teknolojisinin yazma becerisi için en az yararlı olduğu düşünülmektedir.

Ek olarak, AG teknolojisinin avantaj ve dezavantajları İngilizce öğretmeni adaylarının bakış açısından araştırıldı. Hizmet öncesi İngilizce öğretmenleri AG teknolojisinin İngilizce öğretme ve öğrenme süreci için birçok fayda sağlayabileceğini ifade etmişlerdir.

- İçeriğin sesler, videolar ve 3D modeller aracılığıyla görselleştirilmesine yardımcı olur ve öğrencilerin dikkatini derslere çeker.

- Öğrenmeyi daha kalıcı hale getiren ve dersin etkililiğini artıran çeşitli ortamların yardımıyla öğrenme sürecini kolaylaştırır. Bu nedenle, AR teknolojisinin öğrenme çıktılarına ve öğrencilerin akademik başarılarına katkıda bulunduğuna inanılıyordu.

- AR tabanlı faaliyetler ilgi çekici ve motive edici olarak kabul edildi. Böylelikle öğrenciler aynı anda hem eğlenebilir hem de öğrenebilirler.

- Ek olarak, AR uygulaması pratik ve kağıt dostu bulundu çünkü sistem, kullanıcıların az materyal ile çeşitli etkinlikler ve oyunlar tasarlamasına olanak tanıyor.

- AG teknolojisinin uzaktan eğitim için yararlı olabileceği bir diğer avantajdır.

- Son olarak, İngilizce öğretmen adayları, mezun olmadan önce AR teknolojisi hakkında bilgi ve deneyim kazanmış olmanın teknolojik bilgilerini

geliştireceğini ve aynı zamanda İngilizce öğretmeni olarak öğretmenlik kariyerine yardımcı olacağını belirtmişlerdir.

AG teknolojisinin dezavantajlarına gelince, hizmet öncesi İngilizce öğretmenleri, İngilizce sınıflarında AG destekli aktiviteler tasarlamanın ve uygulamanın bazı zorluklar yarattığını ifade ettiler.

- Etkinlik tasarım süreci açısından, AG uygulamalarının karmaşık ara yüzleri nedeniyle kullanımının zor olduğu ve bu nedenle zaman alıcı olduğu düşünülmüştür.

- AG uygulamalarının ara yüzünün, kullanıcıların her konu için aktivite hazırlamasına imkân vermediği kaydedildi.

- Ortaya çıkması muhtemel birkaç teknik soruna ek olarak, teknolojik donanım eksikliği büyük bir zorluk oluşturmaktadır.

- AG uygulamalarının aşırı veri tüketimi dikkate alındığında bu olanakların okul tarafından sağlanması maliyetli olabilir.

- Bazı katılımcılar, uygulamalar ve web sitesi tarafından verilen yeterli yönlendirme olmadığına inanıyordu.

- Birçok öğretmenin AG teknolojisini kullanmak ve AG tabanlı etkinlikler hazırlamak için teknolojik olarak yeterince yetkin olmayacağını belirtildi.

- Diğer bir dezavantaj, öğrencilerin ders saatleri içinde akıllı telefonlarını kullanmalarına izin verilmemesi idari bir konuydu.

- Ek olarak, bazı sınıf yönetimi sorunları olabilir; AG teknolojisi öğrenciler için dikkat dağıtıcı olabilir ve dikkat tüneline neden olabilir.

- Öğrenciler arasındaki etkileşimde bir azalma olabilir.

- Aynı tür etkinlikler gerçekleştirilirse, öğrenciler AG teknolojisine olan ilgilerini kaybedebilir.

- Son olarak, AG teknolojisinin aşırı kullanımı, bazı sağlık sorunlarına yol açabilir ve sürükleyici doğası nedeniyle kullanıcıları çevrelerinden izole edebilir.

Sonuç olarak, hizmet öncesi İngilizce öğretmenleri AG teknolojisinin İngilizce öğreniminde kullanımı ile ilgili önerilerini ortaya koydu. Önerileri şunlardan oluşuyordu: uygulamaları basitleştirerek AG uygulamalarını geliştirme; daha fazla 3D model seçeneği dahil etmek; daha fazla destek ve rehberlik sağlamak, sahneler arasında daha yumuşak geçiş yapmak; öğretmenleri ve öğrencileri AG teknolojisini kullanma konusunda eğitmek; AG uygulamalarını eğitim amaçlı geliştirmek, teknolojik donanım ve internet bağlantısı gibi kolaylıklar sağlamak; AG teknolojisini İngilizce ders kitaplarına ve müfredatına entegre etmek.

Ayrıca, İngilizce öğretmen adaylarının AG teknolojisini kabul düzeyinin, etkinlik tasarım sürecinden önceki kabul düzeylerinden önemli ölçüde daha yüksek olduğu görülmüştür. Mülakat yapılan aday İngilizce öğretmenleri, bu çalışmanın bir parçası olarak bu teknoloji ile ilgili deneyimlerinden önce AG teknolojisine pek aşina olmadıklarını bildirdiler. Uygulamadan sonra katılımcılar, AG teknolojisinin İngilizce derslerinde kullanımına olumlu bir eğilim gösterdiler ve tüm görüşmeciler bu teknolojiyi kabul ettiklerini ifade ettiler. Bununla birlikte, AG tabanlı materyalleri tasarlamak için AG teknolojisini kullanmadaki öz yeterlilikleri, öz yeterlilik seviyeleri orta derecede yüksek olmasına rağmen, aktivite tasarım sürecinden sonra önemli ölçüde değişmedi. AG teknolojisini kullanmadaki öz-yeterlik düzeyleri ile ilgili olarak, şu şekilde kategorize edilebilecek birkaç olası açıklama vardır: içsel faktörler, kişilerarası faktörler ve teknolojik ve teknik faktörler.

4. TARTIŞMA VE SONUÇ

Aday İngilizce öğretmenlerinin AG teknolojisinin İngilizce öğretmek ve öğrenmek için kullanılması konusunda olumlu görüşlere sahip olduğu ortaya çıktı. Bu sonuç, alan yazındaki çalışmaların bulguları ile desteklenebiliyorken (Delello, 2014; Kaenchan, 2018; Karacan, 2019; Putiorn vd., 2018; Sural, 2018; Uygur vd., 2018), AG kullanmanın İngilizce öğrenmeye doğrudan katkı sağlamayabileceğini ifade eden

önceki araştırmaya aykırıdır (Alizadeh ve ark., 2017). Dil becerileri açısından kelime hazinesi, AG teknolojisinin en yararlı olduğu dil becerisi olarak kabul edildi ve bu bulgu çeşitli seviyelerde yapılan çalışmaların bulgusunu da doğruladı (Barreira vd., 2012; Chen & Wang; 2015; Çakır vd., 2015; Çevik vd., 2017; Doğan, 2016; He vd., 2014; Jalaluddin vd., 2020; Safar vd., 2017; Solak & Çakır, 2016; Tandoğan, 2019; Yaacob vd. 2019). Ama bu bulgu, AG teknolojisinin kelime öğrenmede önemli bir fark yaratmadığını öne süren önceki çalışmalarla örtüşmemektedir (Juan vd., 2010; Chen & Chan, 2019). Öte yandan AG teknolojisi, yazma becerisi için en az yararlı olan olarak kabul edilmiştir ve bu bulgu alan yazındaki bazı çalışmalarla örtüşmemektedir (Helwa, 2019; Liu & Tsai, 2013; Wang, 2017a; Yılmaz & Göktaş, 2017). Bununla birlikte, İngilizce öğretmen adaylarının öne sürdüğü AG teknolojisinin avantajları ve dezavantajları ilgili çalışmaların bulgularını destekler niteliktedir (Akçayır & Akçayır, 2017; Altinpulluk, 2019; Altınpulluk vd., 2020; Bacca vd., 2014; Billinghurst & Dunser, 2012; Karacan, 2019; Uygur vd., 2018)

Ayrıca, İngilizce öğretmen adaylarının AG teknolojisini kabul düzeylerinin, anlamlı derecede arttığı bulunmuştur. Uygulamadan sonra katılımcılar, AG teknolojisinin İngilizce derslerinde kullanımına olumlu bir eğilim gösterdiler ve tüm görüşmeciler bu teknolojiyi kabul ettiklerini ifade ettiler. Bu bulgu, AG teknolojisinin daha önceki çalışmalarla uyumlu olarak öğretmen adayları tarafından kabul gördüğünü göstermektedir (Alkhattabi, 2017; He vd., 2014; Kaenchan, 2018; Nöhrer, 2020; Sural, 2018).

Bununla birlikte, AG tabanlı materyalleri tasarlamak için AG teknolojisini kullanmadaki öz yeterlilik seviyeleri tasarım sürecinden sonra önemli ölçüde değişmedi ve bu sonuç Kaenchan'ın (2018) çalışmasıyla doğrulanmıştır. Bu bulgunun nedenleri şu şekildedir: içsel faktörler, kişilerarası faktörler ve teknolojik ve teknik faktörler. İçsel faktörlerle başlamak için, bilgisayar kaygısı, AG teknolojisini kullanmadaki düşük öz yeterliliklerinin nedenlerinden biriydi. Kişilerarası faktörler akran yardımı ve akran baskısı ile ilgilidir. Teknolojik ve teknik faktörler, AG teknolojisinin nasıl kullanılacağına ilişkin eğitim eksikliği ve gerekli teknolojik araç ve gereçlerin eksikliği hakkındadır.

Sonuç olarak, hizmet öncesi İngilizce öğretmenleri AG teknolojisinin İngilizce öğreniminde kullanımı ile ilgili önerilerini ortaya koydu. Önerileri şunlardan oluşuyordu: uygulamaları basitleştirerek AG uygulamalarını yükseltme; daha fazla seçenek dahil olmak üzere 3D modeller; daha fazla destek ve rehberlik sağlamak, sahneler arasında daha yumuşak geçiş yapmak; öğretmenleri ve öğrencileri AG teknolojisini kullanma konusunda eğitmek; AG teknolojisini eğitim amaçlı geliştirmek, teknolojik donanım ve internet bağlantısı gibi kolaylıklar sağlamak; AG teknolojisini İngilizce ders kitaplarına ve İngilizce müfredatına entegre etmek.

İngilizce öğretmen adaylarının AG teknolojisine yönelik algılarına, bu teknolojiyi kabullenme düzeylerine ve bu teknolojiyi etkinlik tasarlamak için kullanma konusundaki öz yeterliliklerine yönelik bulgular sunmaktadır. Mevcut çalışmanın uygulama için çıkarımları iki ana başlık altında tartışılmaktadır: İngilizce Öğretmen Eğitimi için çıkarımlar ve İngilizce Öğretimi için Çıkarımlar.

Öğretmen eğitimi politika yapıcıları ve paydaşlar için çıkarımlar, hizmet öncesi İngilizce öğretmenlerinin gelecekteki sınıflarında AG gibi yeni ortaya çıkan teknolojilerden yararlanmaya teşvik edilmesi gerektiğini ima etmektedir. İDÖ Eğitimi müfredatına BİT'in İDÖ'de kullanımı, bilgisayar ve mobil dil öğrenimi gibi ek dersler dahil edilebilir. İngilizce öğretmen adaylarının ortaya çıkan teknolojiler hakkında farkındalıklarını artırmak ve AR teknolojisi ile bazı uygulamalı deneyimler kazanmalarını sağlamak için atölye çalışmaları, girdi oturumları ve web seminerleri şeklinde eğitimler düzenlenebilir.

Dahası, bu çalışma AG tabanlı dil öğrenme materyallerinin yeterliliklerini ve kısıtlamalarını vurgulamaktadır ve bu sonuçlar müfredat planlayıcıları, ders kitabı ve materyal tasarımcıları için bazı çıkarımlar önermektedir. Ek olarak, dil öğretimi uygulamaları için de iç görü sağlar.

Mevcut veriler, mesleki gelişim planlarının önemini vurgulamaktadır çünkü sadece öğretmenlerin değil, öğrencilerin de dil eğitimi için AG teknolojisinin nasıl kullanılacağı konusunda eğitilmesi önerilmiştir. Bu eğitimler, AG tabanlı dil öğrenme materyalleri tasarlama konusunda seminerler, web seminerleri veya atölye

çalışmalarını içerebilirken, olası sorunları ortadan kaldırmak için öğrencilere AG destekli dersleri deneyimleme ile ilgili girdi oturumları sunulabilir.

Teknolojik donanım ve gerekli altyapı eksikliği bulgusu, öğretmenlere ve öğrencilere ihtiyaç duydukları her an AG teknolojisinden yararlanabilmeleri için teknik ve kolaylıkların sağlanması gerektiğine işaret etmektedir.

Bu çalışmanın sınırlılıklarına gelince, çalışmanın nicel aşaması 50, nitel aşaması ise 12 gönüllü katılımcı ile yürütülmüştür ve çalışmanın nicel grubunun belirlenmesinde uygun örnekleme yöntemi kullanılmıştır. Çalışma grubu, sadece bir vakıf üniversitesi ile sınırlıdır. Hem katılımcı sayısından hem de örnekleme yönteminden dolayı bulgular evrenin tarafsız resmini ortaya koyamayabilir.

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