Croatian Journal of Education
Vol.18; No.4/2016, pages: 1067-1085
Preliminary communication
Paper submitted: 9th February 2015
Paper accepted: 15th December 2015
doi: 10.15516/cje.v18i4.1729

Investigating the Role of Augmented Reality Technology in the Language Classroom

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Abstract

The purpose of this study was to inform about some of the current applications and literature on Augmented Reality (AR) technology in education and to present experimental data about the effectiveness of AR application in a language classroom at the elementary level in Turkey. The research design of the study was quasi-experimental. Sixty-one 5th grade students from a state elementary school participated in this research on a volunteer basis. The participants were divided into the experimental and control group, where new vocabulary items were introduced to the experimental group through augmented reality technology. A post-test and a retention test were administered upon the implementation of the program. The results of the study revealed that participants from the experimental group achieved higher scores than participants in the control group and they also performed better in recalling the learnt information. This study suggested that the use of AR technology in a language classroom at the elementary level increased learners' performances and made vocabulary learning more effective in comparison with the traditional methods.

Key words: *augmented reality; AR technology in language learning; educational technology; technology and language learning.*

Introduction

Augmented reality (AR) technology has been utilized in many fields such as entertainment, military, marketing, engineering, medicine, psychology, advertisement, with the developments in the software and hardware technology used in augmented reality technology (Azuma et al., 2001; Kirner et al., 2012). Due to the advanced technology and rich learning environment that AR offers, it is observed that its implementation in educational area came into prominence. Research studies prove that

the technological tools used in education contribute to the activation of motivation, introduce new opportunities, provide more enjoyable learning atmosphere and increase the interaction between learners, making the learning process more active, effective and meaningful (Sumodi & Rambli, 2010). Similarly, AR technology drew attention to researchers in education because it gives way to interaction between real and virtual objects and offers a learning environment by experience (Singhal et al., 2012). Walczak et al. (2006) suggested that AR technology helps to embody abstract objects, to demonstrate dangerous cases, to present complicated topics and to teach invisible objects and events. Moreover, AR technology provides flexibility to learners (Schrier, 2006), boosts creative thinking skills (Ivanova & Ivanov, 2011), interpretation and problem-solving abilities (Schrier, 2006).

Lee et al. (2011) emphasize that many studies on the use of technology and internet in education revealed the importance of learners' characteristics and technology use for boosting learning performances. Wu et al. (2013) state that the use of AR technology in education is a new topic in comparison with other modern technologies such as multi-media and web-based platforms.

Yang (2011) maintains that the best way for learning a foreign language is to stay in the community where the target language is spoken for a longer time, collaborating with its cultural surroundings. However, this is not feasible for many language learners due to time and financial restraints. Therefore, authenticity can be provided via AR technology by introducing real-life into the language classroom. Although AR technology has been practiced in many branches of education such as physics, chemistry, mathematics, geometry, health, history and geography, current literature proves that it has been rarely studied in both theoretical and practical basis in foreign language teaching, especially teaching of English, which is considered lingua franca in the world. Considering the advantages of AR technology in education, using this technological tool might contribute a lot to foreign language teaching field in many aspects. Therefore, the purpose of this research is to inform about some of the current applications and literature on AR technology in education and present experimental data about the effectiveness of AR application in language classroom at the elementary level in Turkey. The results of the study can provide pedagogical implications about the effectiveness of this recent technology on English language teaching area, particularly teaching new vocabulary items in the target language, which is one of the essentials of language learning.

Conceptual Framework

Carmigniani and Furht (2011, p. 352) define Augmented Reality (AR) as "a real-time direct or indirect view of the physical real world environment that has been enhanced / augmented by adding virtual computer generated information to it".

According to Azuma (1997, p. 356), the AR system embodies three main characteristics: "a combination of real and virtual worlds, real-time interaction, and accurate 3D registration of virtual and real objects."

Milgram et al. (1994) highlight two approaches in augmented reality as broad and restricted approaches. While the broad approach refers to "augmenting natural feedback to the operator with simulated cues", the restricted approach is "a form of virtual reality where the participant's head-mounted display is transparent, allowing a clear view of the real world" (p. 283). The restricted approach is related to early literature on augmented reality because of the lack of modern technology at early times and a head-mounted display forms the core of augmented reality technology.

Klopfer and Squire (2008) oppose the idea of restricting augmented reality and they consider the augmented reality "a situation in which a real world context is dynamically overlaid with coherent location or context sensitive virtual information" (p. 205)

Liu (2009) thinks that using augmented technology in a broader sense makes this technology more productive, because it can be used via different technologies like desktop computers, hand held devices, head-mounted displays and so on.

Various findings of some researchers about the educational attainment of AR technology can be summarized as follows: facilitating comprehension (Ivanova & Ivanov, 2011), providing interaction and making learning more appealing and effective (Wojciechowski & Cellary, 2013), increasing motivation (Di Serio et al., 2013), drawing attention (Aziz et al., 2012), establishing links with real life experiences (Ternier et al., 2012), helping students enjoy the learning process (Núñez et al., 2008), providing opportunities for more authentic learning and appealing to multiple learning styles (Yuen, 2011), helping better understanding of the concepts/processes (Klopfer & Squire, 2008).

Review of Literature

El Seyad et al. (2011) state that studies on AR technology mainly focused on the development, usability, and technologies. Wu et al. (2013) found the research method of the studies as partly simple, short-term and including small-sample size. While design-based research (Klopfer & Squire, 2008) and case studies (Dunleavy et al., 2009) have been preferred in terms of methodology, there have been only few studies which employed the quasi-experimental design (Liu, 2009). Therefore, this study adopts a quasi-experimental design which aims to fill a gap in the field.

Elaborating some literature on AR application in education and foreign language teaching, Ibanez et al. (2011), and Perez-Lopez and Contero (2013) examined the role of AR technology in Spanish teaching. They designed learning activities in augmented virtuality environment as exploration, collaboration and mixed reality activities. The results of their study suggested that using augmented reality in learning Spanish increased students' motivation and learning outcomes.

Tan and Lui (2004) designed a Mobile-Based Interactive Learning Environment (MOBILE) to help Japanese elementary school students to improve their English proficiency. The system aimed to teach body parts and creation of species in and

outside classroom through mobile learning tools on theme-based learning activities. At the end of the implementation, post-test results and a questionnaire revealed that MOBILE clearly drew learners' attention and made a positive impact on learners' performances regarding traditional methods.

Lui et al. (2010) planned a mobile English learning environment called HELLO and through this technology, learners could benefit from mobile context-aware learning material in Taiwan. This system was implemented by university students and as a result of the survey and a case study upon practice, their satisfaction with the system was at a high level.

Barreira et al. (2012) investigated the effectiveness of the augmented reality technology in the 3rd grade of an elementary school in Portugal. The age range of the participants was from 7 to 9 and animal words in English were taught to the experimental group via AR technology while the traditional method was used in the control group. The research revealed that the group taught with AR technology performed better than those in the control group according to the posttest results.

Perez-Lopez and Contero (2013) studied the role of AR technology in teaching digestive and circulatory systems at an elementary school. The research findings revealed that AR technology was helpful in boosting learners' motivation and interest and learners' performance was higher upon using AR technology. Moreover, it was also understood that AR technology helped to retain information longer in the memory in comparison with the traditional way.

Mahadzir and Phung (2013) examined the role of AR technology pop-up books to motivate and to help students increase their English language proficiency. They designed a pop-up book via ZooBurst tool and it was integrated with Keller's ARCS model of motivation. The elementary school students were taught via AR pop-up book for a year and a semi-structured interview was administered at the end of application. The study showed that AR technology helped boost students' performance by providing a more motivating learning environment for students.

Methodology

The model of the study can be described as quasi-experimental. This method is used to determine the cause and effect relationship between variables and identify the reactions of the participants against variables as a result of implementation under certain conditions. The quasi-experimental method is a design which involves disregarding random distribution in sending participants to control and experimental groups. This model compares the results in case of no random distribution by intervening two or more groups. The stages of this method are:

- one experimental and control group are formed by random selection
- a pretest is administered to both groups
- while experimental group is exposed to experimental studies, no intervention is performed to control group
- a post test is administered to both groups (Fraenkel & Wallen, 2006).

Therefore, this study investigates the effect of activities designed in accordance with augmented reality technology on academic achievement and retention of the information.

In this study, 3D educational materials were designed to create an appropriate language learning environment via augmented reality technology, taking into consideration students' learning styles. Colorful pictures, text, voices which were interesting and appropriate for students' level were embedded into markers through augmented reality technology. The purpose of this material was to improve target vocabulary items at the basic level, which was also compatible with the school syllabus.

In the experimental group, the target vocabulary items were presented with 3D augmented reality technology. During the presentation, each vocabulary item was introduced through animation first, and then pronunciation and the use of a vocabulary item in a sentence were given in a classroom environment. Figures 1 and 2 illustrate the implementation of the AR technology in the experimental group.

Figures 1-2. The implementation of AR technology

In the control group, the target vocabulary items were introduced through traditional methods. Each vocabulary item was written on the board, practiced in a sentence and then pronounced several times. Then, students repeated the words and made use of their own sentences by using new items in it. Fifteen new vocabulary items were presented each week in both groups.

An achievement test was prepared by taking into consideration the aims and the gains of the unit in the English language syllabus of fifth graders. Expert views of two academic staff and two fifth grade English teachers were taken during the preparation process of the achievement test. This test was piloted on fifth graders and validity and reliability of the test was measured and put into final form. There were 40 multiple choice questions in the tests.

Pretests and posttests were administered to control and experimental study groups in terms of cause and effect relationships. The implementation took three weeks and a recall test was administered to the two groups after four weeks upon the posttest.

The following hypotheses questions were answered in this study.

1. Was there a significant difference between experimental and control groups upon the implementation of augmented reality technology in the language classroom?

2. Was there a significant difference between the experimental and control groups upon the implementation of augmented reality technology in terms of gender?
3. Did the use of augmented technology make a significant difference on the retention of vocabulary learning in the language classroom?

Participants

Since an early start in language learning is encouraged both in Turkey and around the world, participants were chosen among fifth grade students on a volunteer basis. They are also considered digital natives as they are exposed to many technological media in their social life. Their age ranges from 10-11, their social and educational backgrounds exhibit similar characteristics. They take an English course with 3 credits a week in accordance with the national curriculum. In the experimental group, there were 30 students in total, and 46.7% were males, while 53.3% were females. The control group comprised 31 students, 45.2% males and 54.8% females.

Results

Two-sample t test was administered to establish whether there was a significant difference between the pretest results of the control and experimental groups. The pretest results of the control and experimental groups are presented in Table 1.

Table 1

The pretest results of the control and experimental groups

Groups	N	$\overline{X}$	SD
Control	31	39.50	11.73
Experimental	30	40.40	12.9

It was observed that the pretest results of the control group ($\overline{X}$=39.50) were close to the pretest results of the experimental group ($\overline{X}$=40.40). According to this result, no statistically significant difference was found between the two groups (t(59)=-2.28; p>0.00). This result proved that the readiness level of the participants in the two groups was almost equal.

Table 2

The differences between the success of the participants in terms of groups and gender

Source	Sum of Squares	df	Mean Square	F	P	R2
Corrected Model	2923.24	3	974.41	12.27	.000	.17
Intercept	317618.44	1	317618.44	3985.48	.000	.95
Group	2899.86	1	2899.86	36.38	.000	.39
Gender	13.68	1	13.68	.17	.680	.03
group * gender	6.61	1	6.61	.21	.774	.02

With regard to the results of 2*2 Mixed design ANOVA, there was a significant difference in terms of the success of the participants (F(3, 57)=36.38, p<.05, R2=.39). The mean achieved by the participants in the experimental group ($\overline{X}$=79.28; SD=

11.32) was higher than that of the control group ($\overline{X}$=65.50; SD=9.83). Partial Eta Square results showed that 39% of the variance in independent variable was clarified by group variables. No statistically significant difference was found between female and male participants in terms of mean (F(3, 57)=0.17, p>.05, R2=.03).

As for group and gender relations, no interaction was observed in terms of success of the participants (F(3, 57)=0.21, p>.05, R2=.02). In other words, the activities supported with augmented reality technology made a positive contribution to the participants' academic achievement.

Table 3 displays the result of the retention test which was administered to the control and experimental groups four weeks upon the post-test.

Table 3

The result of the retention test

Groups	N	$\overline{X}$	SD
Control	31	51.15	11.28
Experimental	30	71.67	13.34

According to the result of the retention test, the mean of the participants in the experimental group ($\overline{X}$=71.67) was higher than the mean of the control group ($\overline{X}$=51.15). In other words, it can be stated that there was a statistically significant difference in favor of the experimental group with regard to the two-sample t test, (t(59)=-5.58, p<0.05). Although some decrease was observed in both groups according to the post-test result, it was lower in the experimental group in comparison with the control group. This result proved that the activities designed with augmented reality technology led to longer storage in long term memory.

Discussion and Conclusion

This study investigated the effectiveness of AR technology in language classroom at the elementary level in the Turkish context. Since the recent introduction of AR technology, especially in language learning field, it was anticipated that the results of this study would provide some clues about the effectiveness of such technology in this area. In addition, the pedagogical implications of this study aimed to make a contribution to the current literature in terms of research design, because there have been very few experimental studies about the effectiveness of AR technology in the language classroom.

The pretest results revealed that the readiness level of participants in both experimental and control groups was almost equal. After the implementation of the AR technology, the posttest results proved that there was a statistically significant difference in favor of the experimental group. In other words, the activities supported with augmented reality technology made a positive contribution to the academic achievement of the participants in learning new vocabulary.

AR technology has been considered to be effective in reaching these results. Gün (2014) found that AR technology was amusing, remarkable and helped to facilitate learning and to visualize the abstract concepts in mind.

The findings of this study were consistent with the results of the current literature, because all the experimental studies reported positive outcomes and effectives on behalf of AR technology application (Barreira et al., 2012; Gün, 2014; Silva et al., 2013; Tan & Lui, 2004). For example, Perez-Lopez and Contero (2013) revealed that AR technology contributed to students' achievement and longer memory retention. In addition, their applications in various contexts suggested that AR technology be utilized in mobile systems in and outside the classroom, be effective on university students besides young learners and AR could be helpful in teaching vocabulary items in various topics.

Furthermore, no statistically significant difference was found in terms of gender, though male participants in the experimental group performed better than the female participants. In other words, AR was equally effective for both genders in learning new vocabulary items in the language classroom. In the existing literature, no study was found investigating the role of gender in AR applications in the foreign language learning field.

According to the result of the recall test, the mean of the participants in the experimental group was higher than the mean of the control group. In other words, this study proved that there was a statistically significant difference in favor of the experimental group, though some decrease was observed in both groups, it was lower in the experimental group in comparison with that of the control group. This result proved that the activities designed with augmented reality technology led to longer storage in the memory. This result was in line with the findings of Perez-Lopez and Contero (2013), who also found that AR technology made a positive contribution in knowledge retention in biology teaching.

In conclusion, the research revealed that AR application in the language classroom at the elementary level increases academic performance of learners and helps store new vocabulary items in memory longer than that of traditional method. Therefore, new materials and course books should be designed with AR technology according to the level and interest of the language learners. It is suggested that AR technology is more effective for young learners and its implementation at this level increases the motivation and the satisfaction of learners in comparison with other technology tools.

The results of this study only reflect the achievement of students at the fifth grade of elementary schools in learning vocabulary in a foreign language. In addition, students' achievement is also limited with the quantitative dimensions. Similarly, the findings can be supported through interviews with the participants and observations as a qualitative method. As an implication for further research, cognitive processes are not investigated in this study, therefore the cognitive aspect can be explored in future studies. Moreover, a syllabus can be designed supported with AR technology and other factors influencing language learning such as grammar teaching and older age groups can be tested within the concept of AR technology in a longer experimental process.

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Istraživanje uloge tehnologije proširene stvarnosti u nastavi jezika

Sažetak

Svrha ovoga istraživanja bila je predočiti neke od aktualnih primjena tehnologije proširene stvarnosti (dalje u tekstu AR tehnologije) i literature vezane uz AR tehnologiju u obrazovanju. Nadalje, cilj je bio prikazati eksperimentalne podatke o učinkovitosti primjene AR tehnologije u nastavi jezika na razini osnovne škole u Turskoj. Istraživanje je polueksperimentalne prirode. Uzorak se sastojao od 61 učenika petoga razreda osnovne škole koji su dobrovoljno sudjelovali u istraživanju. Učenici su bili podijeljeni u dvije skupine: eksperimentalnu i kontrolnu. U eksperimentalnoj skupini učenici su se susreli s novim vokabularom koristeći se AR tehnologijom. Posttest i test pamćenja provedeni su nakon završetka programa. Rezultati istraživanja otkrili su da su učenici u eksperimentalnoj skupini ostvarili bolje rezultate od učenika u kontrolnoj skupini te su također bili bolji u prisjećanju naučenoga. Ovim istraživanjem pokazalo se da upotreba AR tehnologije u nastavi jezika na razini osnovne škole povećava postignuća učenika te je učenje vokabulara učinkovitije u odnosu na tradicionalne metode poučavanja.

Ključne riječi: *proširena stvarnost; AR tehnologija u nastavi jezika; obrazovna tehnologija; tehnologija u učenju jezika.*

Uvod

Tehnologija proširene stvarnosti (Eng. *Augmented reality*, u daljnjem tekstu AR) koristi se u mnogim poljima kao što su zabava, vojska, marketing, inženjerstvo, medicina, psihologija, oglašavanje, zajedno s razvojem programskih paketa i sklopovlja koji se koriste u AR tehnologiji (Azuma i sur., 2001; Kirner i sur., 2012). S obzirom na naprednu tehnologiju i bogato okruženje za učenje koje nudi AR istaknula se primjena te tehnologije u području obrazovanja. Istraživači potvrđuju da tehnologijski alati koji se koriste u obrazovanju doprinose aktivaciji motivacije, nude nove prilike, osiguravaju ugodnu atmosferu za učenje, povećavaju interakciju među učenicima, čine proces učenja aktivnijim, učinkovitijim i smislenijim (Sumodi i Rambli, 2010). Na sličan način AR tehnologija privlači pažnju znanstvenika u obrazovanju jer

prednost daje interakciji stvarnih i virtualnih objekata te stvara okruženje koje potiče iskustveno učenje (Singhal i sur., 2012). Walczak i sur. (2006) smatraju da AR tehnologija pomaže u predočavanju apstraktnih stvari, u prikazivanju opasnih slučajeva, prikazivanju složenih tema, zatim u poučavanju nevidljivih stvari i događaja. Nadalje, AR tehnologija učenicima osigurava fleksibilnost (Schrier, 2006), potiče vještine kreativnog razmišljanja (Ivanova i Ivanov, 2011), sposobnosti interpretacije i rješavanja problema (Schrier, 2006).

Lee i sur. (2011) naglašavaju da mnogi znanstvenici koji istražuju upotrebu tehnologije i interneta u obrazovanju ukazuju na važnost karakteristika učenika i upotrebu tehnologije za poboljšanje rezultata učenja. Wu i sur. (2013) tvrde da je upotreba AR tehnologije u obrazovanju nova tema u odnosu na ostale moderne tehnologije kao što su multimediji i mrežne platforme.

Yang (2011) smatra da je najbolji način učenja stranoga jezika dulji boravak u zajednici u kojoj se ciljni jezik govori, surađujući s kulturnim okruženjem. Međutim, to nije izvedivo za mnoge učenike jezika s obzirom na vremenska i financijska ograničenja. Stoga se autentičnost može osigurati putem AR tehnologije, uvodeći stvarni život u nastavu jezika. Iako se AR tehnologija koristi u mnogim granama obrazovanja kao što su fizika, kemija, matematika, geometrija, zdravstveni odgoj, povijest i geografija, današnja literatura potvrđuje da se njezina primjena rijetko proučavala teorijski i praktično u području poučavanja stranoga jezika, pogotovo kod poučavanja engleskoga koji se smatra *linguom francom*. S obzirom na prednosti AR tehnologije u obrazovanju, upotreba ovoga tehnologijskog alata mogla bi osigurati i doprinose u području poučavanja stranoga jezika u nekoliko aspekata. Stoga je cilj ovoga istraživanja prikazati neke od aktualnih primjena AR tehnologije u obrazovanju i dati prikaz literature o toj temi. Nadalje, cilj je prikazati eksperimentalne podatke o učinkovitosti primjene AR tehnologije u nastavi jezika u osnovnoj školi u Turskoj. Rezultati istraživanja imaju pedagoške implikacije o učinkovitosti te novije tehnologije u području poučavanja engleskoga jezika, točnije poučavanja vokabulara na ciljnome jeziku, što je ključni element učenja jezika.

Konceptualni okvir

Carmigniani i Furht (2011, str. 352) definiraju proširenu stvarnost (AR) kao „izravni – u stvarnom vremenu ili neizravni pogled na fizičko stvarno okruženje koje je obogaćeno / prošireno time što mu se dodaju virtualne, računalno generirane informacije".

Prema Azumi (1997, str. 356) sustav AR utjelovljuje tri osnovne karakteristike: „kombinaciju stvarnog i virtualnog svijeta, interakciju u stvarnome vremenu, i precizno 3D evidentiranje virtualnih i stvarnih objekata."

Milgram i sur. (1994), naglašavaju dva pristupa kod proširene stvarnosti, onaj šireg i onaj užeg pogleda. Širi pogled na proširenu stvarnost odnosi se na „proširivanje prirodne povratne informacije korisniku sa simuliranim znakovima", a iz užeg pogleda

to vidimo kao „vrstu virtualne stvarnosti u kojoj je korisnikov naglavni uređaj / ekran, transparentan, odnosno omogućuje jasan prikaz stvarnoga svijeta" (str. 283). Uže shvaćanje proširene stvarnosti povezano je s prijašnjom literaturom o proširenoj stvarnosti s obzirom na to da je u to vrijeme nedostajala moderna tehnologija, a naglavni je uređaj ključ tehnologije proširene stvarnosti.

Klopfer i Squire (2008) odbacuju ideju ograničavanja proširene stvarnosti i proširenu stvarnost smatraju „situacijom u kojoj je kontekst stvarnoga svijeta dinamično prekriven s usklađenom lokacijom ili kontekstno ovisnom informacijom" (p.205)

Liu (2009) smatra da korištenje proširene stvarnosti u širem smislu toj tehnologiji omogućuje veću produkciju jer se koristi različitim tehnologijama poput računala, ručnih uređaja, naglavnih uređaja.

Različita zaključci nekih istraživača obrazovnih postignuća AR tehnologije mogu se sažeti na sljedeće: pomaže u razumijevanju (Ivanova i Ivanov, 2011), osigurava interakciju i učenje postaje privlačnije i učinkovitije (Wojciechowski i Cellary, 2013), povećava motivaciju (DiSerio i sur., 2013), privlači pozornost (Aziz i sur., 2012), uspostavlja veze sa stvarnim, životnim iskustvima (Ternieri sur., 2012), pomaže učenicima da uživaju u procesu učenja (Núñez i sur., 2008), nudi mogućnosti za autentično učenje koje je podložno mnogim stilovima učenja (Yuen, 2011), pomaže boljem razumijevanju pojmova/procesa (Klopfer i Squire, 2008).

Pregled literature

El Seyad i sur. (2011) tvrde da se istraživanja AR tehnologije uglavnom usredotočuju na razvoj, korištenje i tehnologije. Wu i sur. (2013) smatraju da su metode istraživanja koje su se koristile uglavnom jednostavne, kratkoročne i nastale na malom uzorku. Dok se nacrt istraživanja (Klopfer i Squire, 2008) i istraživanja slučaja (Dunleavy i sur., 2009) preferiraju s obzirom na metodologiju, postoji samo nekoliko istraživanja koja se koriste kvazieksperimentalnim dizajnom (Liu, 2009). Kako bi se taj nedostatak u istraživanjima smanjio, ovo se istraživanje koristi kvazieksperimentalnim nacrtom.

U objašnjavanju literature o primjeni AR tehnologije u obrazovanju i poučavanju stranoga jezika, Ibanez i sur. (2011), Perez-Lopez i Contero (2013) proučili su ulogu AR tehnologije u poučavanju španjolskoga jezika. Izradili su aktivnosti učenja u proširenom virtualnom okruženju u obliku istraživanja, suradnje i aktivnosti mješovite stvarnosti. Rezultati njihova istraživanja ukazuju na to da proširena stvarnost u učenju španjolskoga jezika povećava motivaciju učenika i ishode učenja.

Tan i Lui (2004) oblikovali su Mobile-BasedInteractiveLearningEnvironment (MOBILE) kako bi pomogli osnovnoškolcima u Japanu da poboljšaju svoje znanje engleskoga jezika. Sustavom se poučavaju dijelovi tijela te stvaranje vrsta u učionici i izvan nje koristeći se mobilnim alatima za učenje i tematski zasnovane aktivnosti učenja. Po završetku primjene, rezultati testa i upitnika otkrili su da MOBILE svakako privlači pažnju učenika i ima pozitivan učinak na učenička postignuća u usporedbi s tradicionalnim metodama.

Lui i sur. (2010) isplanirali su mobilno okruženje za učenje engleskoga jezika koje su nazvali HELLO. Putem te tehnologije učenici u Tajvanu mogli su profitirati od mobilnog sadržajno osviještenog materijala za učenje. Sustav su implementirali studenti na sveučilištu, a rezultat istraživanja i studije slučaja u praksi bilo je njihovo vrlo visoko zadovoljstvo sustavom.

Barreira i sur. (2012) istražili su učinkovitost tehnologije proširene stvarnosti s učenicima trećeg razreda osnovne škole u Portugalu. Učenici u uzorku bili su između sedam i devet godina starosti, a učili su engleske riječi za životinje u eksperimentalnoj skupini koristeći se AR tehnologijom, dok je tradicionalna metoda poučavanja bila primijenjena u kontrolnoj skupini. Istraživanje je otkrilo da je skupina koja je poučavana primjenom AR tehnologije imala bolje rezultate od učenika iz kontrolne skupine prema rezultatima posttestiranja.

Perez-Lopez i Contero (2013) proučavali su ulogu AR tehnologije kod poučavanja probavnog sustava i krvožilnog sustava u osnovnoj školi. Rezultati istraživanja otkrili su da je AR tehnologija korisna za poticanje motivacije i interesa učenika, a njihovo je postignuće bilo bolje nakon primjene AR tehnologije. Štoviše, AR tehnologija omogućila im je da znanje zadrže dulje u odnosu na tradicionalnu metodu.

Mahadzir i Phung (2013) proučili su ulogu koju AR tehnologija ima u trodimenzionalnim knjigama (Eng. *pop-up books*) kod motivacije i pomoći u povećanju znanja engleskoga jezika učenika. Oni su osmislili trodimenzionalnu knjigu koristeći se alatom ZooBurst koja se integrirala Kellerovim ARCS modelom motivacije. Učenici osnovnih škola poučavani su primjenom AR trodimenzionalne knjige cijelu godinu, a nakon primjene bili su podvrgnuti polustrukturiranom intervjuu. Istraživanje je pokazalo da ja AR tehnologija pomogla u poticanju učenikovih postignuća osiguravajući motivirajuće okruženje za učenje.

Metodologija

Model istraživanja može se opisati kao kvazieksperimentalan. Ta metoda koristi se kako bi se odredio uzrok i posljedica odnosa između varijabli i kako bi se identificirale reakcije sudionika nasuprot varijablama, a kao rezultat implementacije pod određenim uvjetima. Kvazieksperimentalna metoda je dizajn koji uključuje zanemarivanje nasumične distribucije kada se ispitanici grupiraju u eksperimentalnu i kontrolnu skupinu. Ovaj model uspoređuje rezultate u slučaju u kojem distribucija nije nasumična na način da intervenira dvije ili više skupina. Faze te metode istraživanja su sljedeće:

- Jedna eksperimentalna i kontrolna skupina formiraju se jednom bez nasumičnog izbora
- Obje skupine imaju predtest
- Dok je eksperimentalna skupina podvrgnuta eksperimentalnom istraživanju, u kontrolnoj skupini nema intervencije
- Obje skupine imaju posttest (Fraenkel i Wallen, 2006).

Stoga ovo istraživanje proučava učinak aktivnosti osmišljenih u skladu s AR tehnologijom na akademsko postignuće i pamćenje, odnosno zadržavanje informacija.

U ovome istraživanju osmišljeni su 3D obrazovni materijali kako bi se stvorilo primjereno okruženje za učenje jezika putem AR tehnologije, uzimajući u obzir učeničke stilove učenja. Slike u boji, tekst, zanimljivi i primjereni glasovi za razinu učenika uključeni su u markere putem AR tehnologije. Svrha ovoga materijala bila je poboljšati ciljni vokabular na osnovnoj razini, što odgovara i školskom silabu.

U eksperimentalnoj je skupini ciljni vokabular prikazan kroz 3D AR tehnologiju. Za vrijeme prezentacije svaka riječ bila je najprije uvedena putem animacije, zatim izgovora i na kraju upotrebom riječi u rečenici. Slika 1. i 2. pokazuju primjenu AR tehnologije u eksperimentalnoj skupini.

Slike 1 i 2

U kontrolnoj je skupini ciljni vokabular predstavljen tradicionalnim metodama. Svaka riječ napisana je na ploču, upotrijebljena u rečenici i izgovorena nekoliko puta. Nakon toga su učenici ponovili riječi i upotrijebili ih u vlastitim rečenicama. Petnaest novih riječi predstavljeno je svaki tjedan u obje skupine.

Test postignuća pripremljen je uzimajući u obzir ciljeve i ishode učenja u silabu za engleski jezik u petome razredu. Kod sastavljanja testa postignuća u obzir smo uzeli mišljenja stručnjaka, dva nastavnika engleskoga jezika petih razreda. Test je pilotiran nad učenicima petoga razreda, a izmjerena je valjanost i pouzdanost testa. Test se sastojao od 40 pitanja višestrukoga izbora.

I kontrolna i eksperimentalna skupina imale su predtest i posttest kako bi se odredili odnosi uzroka i posljedice. Implementacija je trajala tri tjedna, a test pamćenja dobile su obje skupine četiri tjedna nakon posttesta.

U istraživanju smo pokušali odgovoriti na sljedeća pitanja odnosno hipoteze.

1. Postoji li značajna razlika između eksperimentalne i kontrolne skupine s obzirom na primjenu AR tehnologije u nastavi jezika?
2. Postoji li značajna razlika između eksperimentalne i kontrolne skupine kod primjene AR tehnologije s obzirom na spol?
3. Je li upotreba AR tehnologije dovela do značajne razlike u zadržavanju naučenog vokabulara u nastavi jezika?

Ispitanici

S obzirom na to da se rano učenje stranoga jezika potiče i u Turskoj, i u ostalim dijelovima svijeta, ispitanici su birani među učenicima petih razreda na dobrovoljnoj osnovi. Te učenike danas smatramo i digitalnim urođenicima jer su izloženi mnogim tehnologijama u društvenom životu. Njihova je dob 10 i 11 godina, a društvena pozadina podjednakih karakteristika. Nastavu engleskoga imaju tri puta tjedno, što je u skladu s nacionalnim kurikulom. Osobni podaci ispitanika prikazani su u sljedećoj tablici.

U eksperimentalnoj skupini bilo je ukupno 30 učenika od čega 46,7 % muških i 53,3 % ženskih. U kontrolnoj skupini bio je ukupno 31 učenik, od čega 45,2 % muških i 54,8 % ženskih.

Rezultati

T-test na temelju dva uzorka koristio se da bi se utvrdilo postoji li značajna razlika između rezultata predtesta u kontrolnoj i eksperimentalnoj skupini. Rezultati predtesta prikazani su u Tablici 2.

Tablica 1

Uočeno je da su rezultati predtesta u kontrolnoj skupini ($\overline{X}$=39,50) bliski rezultatima u eksperimentalnoj skupini ($\overline{X}$=40,40). Prema tom rezultatu nije izmjerena statistički značajna razlika između tih dviju skupina (t(59)=-2,28, p>0,00). Taj rezultat dokazao je da je razina spremnosti ispitanika u obje skupine gotovo identična.

Tablica 2

S obzirom na rezultate 2*2 ANOVA mješovitog modela uočena je značajna razlika s obzirom na uspjeh ispitanika (F(3, 57)=36,38, p<,05, R2=,39). Srednja vrijednost ispitanika u eksperimentalnoj skupini ($\overline{X}$=79,28; SD=11,32) bila je veća od one u kontrolnoj skupini ($\overline{X}$=65,50; SD=9,83). Parcijalni Eta kvadrat rezultati pokazali su da je 39 % varijance u nezavisnoj varijabli objašnjeno varijablama skupine. Nije izmjerena statistički značajna razlika između muških i ženskih ispitanika s obzirom na srednju vrijednost (F(3, 57)=0,17, p>,05, R2=,03).

Što se tiče odnosa skupine i spola nije uočena interakcija s obzirom na uspjeh ispitanika (F(3, 57)=0,21, p>,05, R2=,02). Drugim riječima, aktivnosti koje su podržane AR tehnologijom imale su pozitivan doprinos na akademski uspjeh ispitanika.

Tablica 3. pokazuje rezultat testa pamćenja kontrolne i eksperimentalne skupine četiri tjedna nakon posttesta.

Tablica 3

Prema rezultatima testa pamćenja srednja vrijednost rezultata ispitanika u eksperimentalnoj skupini ($\overline{X}$=71,67) bila je veća od srednje vrijednosti u kontrolnoj skupini ($\overline{X}$=51,15). Drugim riječima, može se reći da postoji statistički značajna razlika kod eksperimentalne skupine s obzirom na t-test s dva uzorka, (t(59)=-5,58, p<0,05). Iako je prema rezultatima posttesta uočen pad u obje skupine, manji je pad izmjeren u eksperimentalnoj skupini. Taj je rezultat potvrdio da su aktivnosti potpomognute AR tehnologijom dovele do boljeg dugoročnog pamćenja.

Rasprava i zaključak

Ovo istraživanje proučilo je učinkovitost AR tehnologije u nastavi jezika na razini osnovne škole u turskom kontekstu. S obzirom na nedavno uvođenje AR tehnologije u područje učenja jezika bilo je očekivano da će rezultati ovoga istraživanja ponuditi

neke indicije o učinkovitosti takve tehnologije u područjunastave jezika. Nadalje, pedagoške implikacije ovoga istraživanja nastojale su dati doprinos literaturi kada je riječ o nacrtu istraživanja s obzirom na to da postoji vrlo malo eksperimentalnih istraživanja o učinkovitosti AR tehnologije u nastavi jezika.

Rezultati predtesta otkrili su da je razina spremnosti ispitanika u obje skupine gotovo jednaka. Nakon primjene AR tehnologije rezultati posttesta pokazali su da postoji statistički značajna razlika kod eksperimentalne skupine. Naime, aktivnosti koje su podržane AR tehnologijom imale su pozitivan doprinos na akademski uspjeh ispitanika kod učenja novoga vokabulara.

Smatra se da je AR tehnologija potpomogla u ostvarivanju tih rezultata. Gün (2014) je zabilježio da je AR tehnologija zabavna, izvanredna, te da je pomogla u poticanju učenja i vizualiziranju apstraktnih pojmova.

Rezultati ovoga istraživanja u skladu su s rezultatima navedenima u recentnoj literaturi jer su sva eksperimentalna istraživanja izvijestila o pozitivnim ishodima kod primjene AR tehnologije (Barreira i sur., 2012; Gün, 2014; Silva i sur., 2013; Tan i Lui, 2004). Na primjer, Perez-Lopez i Contero (2013) otkrili su da je AR tehnologija doprinijela postignuću učenika i dugoročnom pamćenju. Nadalje, njihova primjena u različitim prilikama ukazuje na to da se AR tehnologija može koristiti u mobilnim sustavima i izvan učionice, da može biti od koristi studentima na sveučilištu a ne samo učenicima i da AR može biti koristan i za poučavanje vokabulara različitih tema.

Nadalje, statistički značajna razlika nije uočena s obzirom na spol iako su muški ispitanici imali bolje rezultate u eksperimentalnoj skupini od ženskih ispitanika. Drugim riječima, AR tehnologija jednako je učinkovita za oba spola kod učenja novoga vokabulara u nastavi jezika. U postojećoj literaturi nismo naišli na istraživanja o ulozi spola na primjenu AR tehnologije u učenju stranoga jezika.

Prema rezultatima testa pamćenja srednja vrijednost rezultata ispitanika u eksperimentalnoj skupini bila je veća od srednje vrijednosti rezultata u kontrolnoj skupini. Drugim riječima, ovo istraživanje dokazalo je da je postojala statistički značajna razlika kod kontrolne skupine, iako je mali pad primijećen u obje skupine, no manje opadanje bilo je izmjereno u eksperimentalnoj skupini u odnosu na kontrolnu. Taj rezultat dokazuje da aktivnosti koje uključuju AR tehnologiju ostaju zabilježene dulje u dugoročnom pamćenju. On je u skladu s nalazima Perez-Lopez i Contero (2013) koji su također otkrili da AR tehnologija ima pozitivan doprinos u zadržavanju znanja kada se radi o poučavanju biologije.

Zaključno, istraživanje je otkrilo da primjena AR tehnologije u nastavi jezika na razini osnovne škole povećava akademsko postignuće učenika i pomaže kod pamćenja vokabulara duže od učenja tradicionalnom metodom. Prema tome, novi nastavni materijali, uključujući udžbenike, trebali bi biti osmišljeni AR tehnologijom s obzirom na razinu i interes učenika. Smatra se da je AR tehnologija učinkovitija za mlađe učenike i da njezina primjena na toj razini povećava njihovu motivaciju i zadovoljstvo u odnosu na upotrebu ostalih tehnologijskih alata.

Rezultati ovoga istraživanja samo su odraz postignuća učenika u petome razredu osnovne škole u učenju vokabulara stranoga jezika. Nadalje, postignuće učenika ograničeno je kvantitativnim dimenzijama. Rezultati se mogu potvrditi intervjuima s ispitanicima i promatranjima kao kvalitativnim metodama. S obzirom na to da se u ovome istraživanju nisu uzimali u obzir kognitivni procesi, daljnja istraživanja mogu se usmjeriti na kognitivni aspekt. Nadalje, mogao bi se izraditi silab koji podržava primjenu AR tehnologije. Ostali faktori koji utječu na učenje jezika, gramatika, starije skupine učenika, također se mogu testirati u vidu AR tehnologije za dugoročni eksperimentalni proces.