Analyzing the Views of Pre-Service Teachers on the Use of Augmented Reality Applications in Education *

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Abstract: It was aimed in this study to determine the teacher candidates' views on the augmented reality applications in education. It is a descriptive study to identify the present situation. Survey model, one of the quantitative research methods, was used in the research. The sample group of the study is comprised of 220 teacher candidates who are studying in the 2nd Grade of 8 departments in Mersin University Faculty of Education. Consisting of 4 sections, 22 items and an open-ended question, a questionnaire was used as a data collection tool in the study to determine the views of teacher candidates about the augmented reality applications in education. The findings obtained from the analysis of the data were shown in frequency and percentage. Qualitative findings obtained from the open-ended question were classified into codes and themes through content analysis method, and frequency and percentages of codes were given. It was found in the study that the teacher candidates did not know well enough about the augmented reality applications and that those who knew them found these applications very entertaining, motivating and facilitating learning, and were also of the same mind to use them widely in education.

Keywords: *Augmented reality, technology, digital generation, teacher candidates.*

Introduction

Educational systems are dynamic systems that are constantly being renewed and developed and adapted to the requirements of the time. It has been one of the biggest searches of educators for a long time to increase the quality of educational output by improving the quality of education. In this regard, new methods and techniques are being tried and applied in accordance with the requirements of the age in higher education as well as in all levels of education, and it is aimed to train high-qualified and well-equipped graduates who will be able to respond to the current needs of the society by firstly qualifying them with individual competencies. Today as considered to be the technology age, there is a growing need for the use of information communication technologies in higher education and the integration of these technologies into education systems.

A great majority of students studying in higher education today have come to the world at a time called technology age where technological developments and devices have developed at a dizzying pace, and they have grown up directly in technology. Therefore, this generation is called "digital generation" and many studies have been done in this area (Montgomery, 2007; Gren and Hannon, 2007; Ryan, 2014; Shen, 2015; Langan et al., 2016; Somyurek, 2014; Cinar and Akgun, 2015). In this sense, the use of technology-supported learning-teaching processes in higher education, which is the last stage of education that can meet the needs of employment and qualified labour force different from other levels of education, is more important in terms of increasing student motivation and qualifications.

The importance of the teacher in upbringing the individuals in society is an unignorable truth. If the goal is to educate people for the information society, teachers should be equipped with the qualities that can be a model to the people of the information society (Yilmaz, 2007; 158). At this point, information communication technologies (ICT) supported training which can respond to the needs and demands of the digital generation in education faculties has become a very important factor in terms of improving the professional field knowledge and skills of the teacher candidates as well as being qualified to be a model graduate for information society. It is seen, when the teacher qualifications developed and presented by MONE in 2017 are examined, that the importance of information communication technologies has been

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emphasized in creating effective learning environments and managing these environments (MEB, 2017). Not only teachers but also teacher candidates can gain these qualifications by being provided with ICT-supported training in undergraduate education. ICT is a field that involves many applications in itself. It is seen that the augmented reality applications are an ICT application frequently used in learning environments in recent years and are often preferred by educators. There are many studies conducted in which augmented reality applications are used in educational environments as an ICT application in recent years (Salmi, Kaasinen & Kallunki, 2012; Chen, & Tsai, 2012; Nincarean, Alia, Halim & Rahman, 2013; Bower, Howe, McCredie, Robinson, & Grover, 2014; Bitter & Corral, 2014; Hanafi, Said, Wahab, Samsuddin, 2017; Ati, Kabir, Abdullahi, Ahmed, 2018).

Literature Review

Increased reality is the simultaneous interaction between real and virtual objects by adding the virtual objects on the real world image (Azuma, 1997). According to Kye and Kim (2008), the augmented reality is the technology that enables virtual objects to be connected to the specified target points while the image of the real environment is captured by the camera, and the end result to be interpreted through programs. Different from traditional methods of teaching and learning, educational augmented reality applications use multimedia materials such as picture, text, sound, 3D object, 2D or 3D animation and video in accordance with their learning goals (Wang et al., 2013).

It seems in this context that, depending on its nature of integrating the real and the virtual, the augmented reality fills the gap between theory and practice on the basis of visuality and creativity in the educational process, thus facilitating learning and making it permanent (Artemis and Kucuksarac, 2015). In other words, the augmented reality is the whole of real and virtual objects environments created with virtual objects placed on the real world environment in order to develop the experience and in recent years has attracted the attention of education researchers and begun to take place rapidly in educational environments (Erbas & Demirer, 2014; Kucuk, 2014). According to Sayimer and Kucuksarac (2015), the augmented reality is a new and important technology that is believed to have the potential to provide new methods and pedagogical value to the field of education. Bujak et al. (2013) state that augmented reality applications are a new method being used in education and rapidly becoming widespread.

In summary, augmented reality is a new-generation technology that enables 3D, 2D images, audio and video files to be read and visualized via visible/embedded QR codes on the non-mobile (interactive board, smart board, PC, etc.) or mobile (laptop, tablet, smartphone, etc.) devices. Augmented reality in education is the creation of an interactive educational environment in which real and virtual environments are combined with mobile or non-mobile devices through augmented reality application.

It has been seen in many researches that the use of educational applications enriched with augmented reality applications which can be run through mobile and non-mobile devices equipped with different contents such as QR code, 3D and 2D pictures, animations, videos, audio files and simulations has become popular in various educational areas and been a method preferred by educators (Onder, 2016; Erbas, C. and Demirer, 2014; Yilmaz, 2014; Kye and Kim, 2008; Bujak et al., 2013; Cinar and Akgun, 2015; Kucuk, 2014; Carlson and Gagnon, 2016; Yilmaz, 2016; Huang, Chen and Chou, 2016; Kidd and Crompton, 2016).
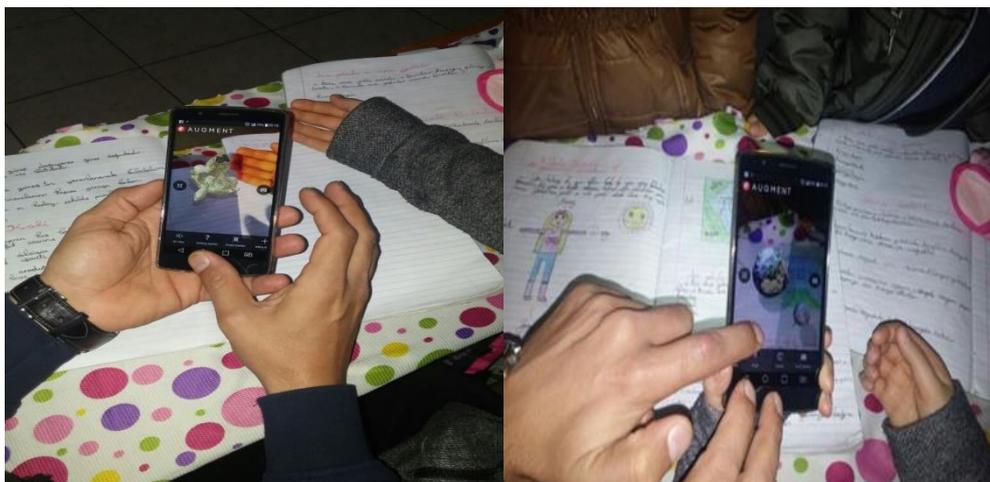

Photo 1. Sample Activities for Augmented Reality Applications (3D Applications)

Photo 2. Sample Activities for Augmented Reality Applications (QR Code-Based Applications)

Somyurek (2014) lists the main application areas of augmented reality as follows:

> ➢ giving a third dimension to two-dimensional books,
> ➢ providing training on cognitive and psychomotor maintenance/repair tasks,
> ➢ 3D representations of concepts or performing experiments in such areas as physics, chemistry or biology,
> ➢ following the various phenomena in the science museums in videos or visuals and doing experiments,
> ➢ visualizing the concepts and spatial relationships in mathematics and geometry,
> ➢ visualizing the concepts in geography education,
> ➢ providing various knowledge and skills in the field of health education, and guiding the medical interventions,
> ➢ providing experience in military personnel training through meaningful and authentic tasks,
> ➢ gaining experience for classroom management in teacher education,
> ➢ gaining knowledge/skills about tools and materials in engineering education.

It is observed when international literature is reviewed that some remarkable studies related to the educational application of augmented reality have been done. In their 3D augmented reality application named Construct 3D, Kaufmann and Schmalstieg (2003) distributed small cards containing the barcodes of geometric shapes to teacher candidates. Then students were asked to look at these barcodes with a spectacled system they have put on their heads, which gives them the opportunity to perceive 2D objects as 3D objects, to recognize the objects by rotating and looking at them from different angles, and to be able to see the different aspects of the objects. Elford (2013) conducted the work on augmented reality application in teacher education with the participation of secondary school teachers. The teachers worked in a secondary school classroom simulator with a large projection screen where they will interact with 3D avatars of teacher candidates. The students practised classroom management strategies during their lectures. In the "MagicBook" application developed by Billinghurst, Kato and Poupyrev (2001), instead of 2D visuals in books, they placed 3D avatars and visuals into the texts that could move in accordance with the flow of a story and that the reader would encounter when holding a handheld device on the book. In this way, a fun textbook, which can be defined as hybrid books, consisting of 2D texts and pictures as well as 3D designs, audio and video files were created.

According to Gungor and Kurt (2014), the augmented reality is a technology developed long ago. However, the number of applications used in this technology has only increased in recent years. That's because the use and the prevalence of mobile communication technologies have made this application more usable in recent years. Parallel to this, the educational of augmented reality has become widespread in the last few years. According to the digital news titled as "Governments Investing in AR & VR for Education(2018)" of *www.augment.com* official website; In November 2015, the U.S. Department of Education first announced the EdSim Challenge calling on developers and the education technology community to explore new ideas that will benefit next-generation learning through the use of simulation technologies such as augmented reality and virtual reality. The French Ministry of National Education was also expressing their support of augmented reality technologies in the classroom. In their revised national curriculum, the Ministry included AR as a recommended technology to be used in middle school technology courses. Korean Virtual Reality – Augmented Reality Complex (KoVAC) will provide resources and support to a wide range of fields in AR/VR, in particular, education. For part of KoVAC's plans is to run an education centre across 20 campuses by the year 2020 (Shin, 2018).

The augmented reality applications of which use has increased in education in recent years are a technology useful for teacher candidates with the potential they have. These technologies enable the virtual objects to interact with the real image. The functional richness of the environment is increased, and the different cognitive channels work in learning

since augmented reality technologies allow for transforming textbooks, bulletin boards in classrooms and stable objects in learning environments into multimedia means (Onder, 2016).

Methodology

Research Goal and Research Gap

Increasing the awareness levels of teacher candidates, as future teachers currently studying in educational faculties, about the augmented reality applications and providing them with learning to use this method offer them a possibility to enrich their teaching practices in the teaching profession. In this respect, this study aimed to determine the views of teacher candidates in Turkey on augmented reality applications in education. It was also questioned in which subjects and contents teacher candidates wanted to see the augmented reality applications during the learning-teaching process, and recommendations were given accordingly. It was also aimed to contribute to the field with this study in that there is no study analyzing the knowledge, needs and interests of teacher candidates studying in faculties of education in Turkey.

In this context, the problem and sub problems of the study were determined as follows.

Problem Statement:
What are the views of teacher candidates on the augmented reality applications in education?

Sub-Problems:

1. What are the views of teacher candidates regarding their interest and knowledge of the augmented reality applications?

2. What are the views of teacher candidates about the effects of the augmented reality applications on the learning-teaching process?

3. What are the views of teacher candidates about the benefits that augmented reality applications will provide in the learning process?

Type of the Study

The study is a descriptive study to determine the present situation. Survey research, one of the quantitative research methods, was used in the study. Survey researches allow for measuring attitudes, thoughts and beliefs using effective measurement procedures and also help to analyze the relationship between variables and to make predictions (Christensen and Turner, 2015: 371). Numerical interpretation and generalization are made in the quantitative research method and the sample group representing the population is asked to express their opinions about the topic to be researched (Yildirim and Simsek, 2006). The study was also supported by the qualitative data generated by the responses of teacher candidates to one open-ended question. Content analysis method was used in the analysis of qualitative data. The content analysis method involves the systematic classification of the coding and theming of texts in which subjective interpretations are present (Hsieh & Shannon, 2015).

Sample and Data Collection

While the teacher candidates of 2nd year in Turkey constitute the target population of the study, the accessible population of the study consists of the teacher candidates who are studying in the 2nd year of the 2015-2016 academic year at Mersin University, Faculty of Education. In determining the sample, criterion sampling technique of the purposeful sampling was employed with regard to the random sampling. Teacher training in Turkey is a five year period of instruction. The first year is a preparatory grade for English and the four years period is for the professional main courses. According to the criterion sampling, teacher candidates who were studying in the 2nd grade were selected because they took a computer course at near time. 220 teacher candidates from a total of 438 studying in the 2nd Grade of 8 departments in Mersin University Faculty of Education were taken as the sample. The sample covers 50,22% of the universe. The qualitative data were collected from 32 pre-service teachers.

The numerical distributions of the teacher candidates in the sample according to their age, gender and education programs are given in Table 1, Table 2 and Table 3 below, respectively.

Table 1. Distribution of Teacher Candidates by Age

Age	N	(%)
20 years and below	109	49,8
21-25	106	47,9
26-30	5	2,3
Total	220	100,0

According to Table 1, 49.8% (109) of the candidates are under 20 years old, 47.9% (106) are between 21-25 years old and 2.3% (5) is between 26-30 years old.

Table 2. Distribution of Teacher Candidates by Gender

Gender	N	(%)
Female	152	68,9
Male	68	31,1
Total	220	100,0

According to the Table 2, 68.9% (152) of the teacher candidates are female and 31.1% (68) of the teacher candidates are male in the research group.

Table 3. Distribution of Teacher Candidates by Education Program

Departments	N	(%)
Computer Education and Instructional Technology (CEIT)	20	9,1
Guidance and Psychological Counseling (GPC)	48	21,9
Elementary Mathematics Education	39	17,8
Science Education	30	13,7
Primary School Education	17	7,8
Early Childhood Education	24	11,0
English Language Education	22	9,6
Turkish Language Education	20	9,1
Total	220	100,0

According to the Table 3, 21.9% (48) of the teacher candidates study at GPC, 17.8% (39) at Elementary Mathematics Education, 13.7% (30) at Science Education, 11% (24) Early Childhood Education, 9.6% (22) at English Language Education, 9.1% (20) at Turkish Language Education, 9.1% at CEIT and 7.8% at Primary School Education.

Data Collection Tools

The questionnaire developed by Sayimer and Kucuksarac (2015), based on Pacheco's (2013) study entitled "The Development of Augmented Reality Systems in Informatics Higher Education", was used in the study. The questionnaire consists of 4 sections, 22 items and an open-ended question. The age, gender and education programs of the teacher candidates are asked in the first part; the items about their interest and knowledge about augmented reality applications in the second part; the items about the effects of augmented reality applications on teaching-learning process in the third part; and lastly, an open-ended question to get their views on the benefits of augmented reality applications in learning process in the fourth part. The expressions in the questionnaire were arranged in such a way as to be suitable for teacher candidates. Before the questionnaire was applied, it was decided to implement it after applying to 8 randomly selected teacher candidates from the 2nd year to ensure there was not an unclear item and taking the opinions of experts (2 instructors in the department of education curriculum and instruction).

The qualitative data was collected via an open-ended question form. Only one question was asked to collect the data. And the question was developed as written; "What are your views on the benefits of using the augmented reality applications in lessons?"

Analyzing of Data

Data from the first three sections of the questionnaire were analyzed in the SPSS program. The descriptive statistics (number and percentage) of the information obtained from the first part of the questionnaire were given. The data obtained from the second and third parts of the questionnaire were entered into the SPSS program and their distributions were presented as frequency and percentage. In the fourth part of the questionnaire, the qualitative findings obtained from the open-ended question were classified into the codes and themes by the content analysis method, and the frequency and percentages of the codes are given. The Miles-Huberman coder reliability formula was used for the encoder reliability of the findings obtained through the open-ended question. As a result of the implementation of the encoder reliability formula, the fit between the encoders was found to be .90, which proves that the coding was done reliably (Miles & Huberman, 2016: 65).

Validity and Reliability of the Study

Validity and reliability are important factors in survey researches. Reliability of the measurement tool used in the research is also important to support the reliability of the survey research. In this context, it contributes to the reliability that the questionnaire was translated and developed in accordance with the Turkish education system. Another issue to be considered in the research is internal validity. According to Buyukozturk et al. (2008), the reasons which may negatively affect the internal validity are the loss of the subject, the environment in which the data is collected, and the deterioration in the quality of the data collection tool. The sample of this study covers 50,2% of the population. There was no loss of subjects in the data entry. The data were collected during the break time or in the classroom during the lesson with the permission of the course instructor. The data collection tool was kept original and safe as it was directly distributed and applied by the researchers to the teacher candidates.

Results and Discussion

Results

In this part, findings obtained the analysis of the data collected in the research are given and interpreted according to the sub-problems.

Findings and Interpretations Regarding the First Sub-problem

It was aimed in the first sub-problem of the study to get the views of the teacher candidates about their interests and knowledge of the augmented reality applications. Accordingly, the first sub-problem of the research was formed as "What are the views of the teacher candidates about their interest and knowledge of the augmented reality applications?" In order to find the answer to this sub-problem, they were first asked the question "Are you familiar with the augmented reality applications?" Findings regarding the answers to this question are given in Table 4 below.

Table 4. The familiarity of Teacher Candidates with Augmented Reality Applications Depending on Their Departments (N=220)

Department	Familiarity	N	(%)
Computer Education and Instructional Technology (CEIT)	yes	17	85,0
	no	3	15,0
Guidance and Psychological Counseling (GPC)	yes	25	52,1
	no	23	47,9
Elementary Mathematics Education	yes	7	17,9
	no	32	82,1
Science Education	yes	21	70,0
	no	9	30,0
Primary School Education	yes	12	70,6
	no	5	29,4
Early Childhood Education	yes	6	25,0
	no	18	75,0
English Language Education	yes	13	57,1
	no	9	42,9
Turkish Language Education	yes	11	55,0
	no	9	45,0
TOTAL	yes	112	50,9
	no	108	49,1

According to Table 4, teacher candidates stated that they are familiar with the augmented reality applications at the rate of 85.0% (17) in CEIT, 52,1% (25) in GPC, 17,9% in Elementary Mathematics Education, 70,0% (21) in Science Education, 55,0 (12) in Primary School Education, 25,0% (6) in Early Childhood Education, 57,1% (13) in English Language Education and 70,6% (11) in Turkish Language Education. In total, about 50.9% (112) of those were found to be familiar with this application while 49.1% (108) of them were not. It is seen that about half of the students in the study group are aware of the augmented reality applications.

Another question directed to the teacher candidates as to the first sub-problem of the research was built up as "Have you ever used or do you use the augmented reality applications?" Findings related to the answers given to this question are given in Table 5 below.

Table 5. Views of Teacher Candidates on Using the Augmented Reality Applications (N=220)

Views	N	(%)
Yes	48	21,8
No	172	78,2
Total	220	100,0

According to the findings in Table 5, only 21.8% (48) of the teacher candidates stated that they had used the augmented reality applications before. On the other hand, 78.2% (172) of the teacher candidates stated that they never used the augmented reality applications before.

In the context of this problem, the participants who answered "No" were asked the reasons for not using the applications while the one who said "Yes" were asked for what purpose they used them.

Findings of the answers given by teacher candidates as to the reasons why they did not use the augmented reality applications are given in Table 6 below.

Table 6. Views about Reasons for Not Using the Augmented Reality Applications (N=172)

Views	f	(%)
I don't know how to use this technology.	67	39
I have no interest in them.	60	35
I cannot find an opportunity or chance to use them.	45	26
Total	**172**	**100**

According to the findings in Table 6, 39% (67) of a total of 172 people who answered "no" stated that they did not know how to use this technology while 35% (60) were not interested, and 26% (45) could not find an opportunity or chance to use.

The participants who answered "yes" to the question "Do you use the augmented reality applications?" were asked for what purpose they use them. Findings of the answers given to this question are given in Table 7 below.

Table 7. The Areas of Augmented Reality Applications Use (N=48)

The Areas of Use	f	(%)
Education and Developments	15	24,5
Game and Entertainment	14	23
Material Design	10	16
Cinema	8	13
Health	6	10
Social Media	4	6,5
Culture & Art	3	5
Other	1	2
*Total	**61**	**100**

(*Some teacher candidates indicated more than one area.)

According to the findings in Table 7, 24.5% (15) of the teacher candidates expressed that they used the augmented reality application in "Education and Developments", 23% (14) in "Games and Entertainment", 16% (10) in "Material Design", 13% (8) in "Cinema", 10% (6) in "Health", 6,5% (4) in "Social Media", 5% (3) in "Culture & Art" and 2% (1) in "Other" areas.

Regarding this sub-problem, the teacher candidates were also asked whether or not they prepared an augmented reality application by using any application tool. Findings of answers to this question are given in Table 8 below.

Table 8. Views about Designing Augmented Reality Applications (N=220)

Views	f	(%)
Yes	18	7.8
No	202	91.8
Total	**220**	**100**

According to the findings in Table 8, it was stated that 7.8% (18) of the teacher candidates had already prepared the augmented reality application while 91.8% (202) of them did not.

Findings and Interpretations Regarding the Second Sub-problem

It was aimed in the second sub-problem of the study to determine the views of the teacher candidates on the effects of the augmented reality applications on the learning-teaching process. Teacher candidates were requested to respond as

"yes", "no", or "partly" to the expressions prepared about the effects of the augmented reality applications on the learning-teaching process. Findings of the answers given by the teacher candidates are given in Table 9 below.

Table 9. Views of the Teacher Candidates about the Effects of Augmented Reality Applications on the Learning-Teaching Process (N=220)

Expressions	Yes		No		Partly	
	f	%	f	%	f	%
Due to the visualization feature, they make it easier to understand and learn the content you cannot easily comprehend.	160	72,7	20	9,1	40	18,2
They allow the learned information to remain in memory for longer.	151	68,6	21	9,5	48	21,8
They help you enjoy the learning process.	144	65,5	14	6,4	62	28,2
They increase your interest/motivation in the lessons/subjects you do not like.	123	55,9	27	12,3	70	31,8
They facilitate the integration of theory and practice.	121	55,0	18	8,2	81	36,8
They improve your creativity.	111	50,5	26	11,8	83	37,7
They develop your critical thinking and problem-solving skills.	80	36,4	25	11,4	115	52,3
They enable you to establish social relations and develop your cooperation skills.	62	28,2	72	32,7	86	39,1

According to the findings in Table 9, 72.7% (160) of the teacher candidates stated that, due to the visualization feature of the subjects, the augmented reality applications make it easier to understand and learn the contents which are normally not easily understood. 68.6% (151) of them expressed that the augmented reality applications allow the learned information to be kept longer in memory while they were indicated by 65.5% (144) to make the learning process enjoyable, by 55.9% (123) to increase interest and motivation in disliked lessons / subjects, by 55% (121) to facilitate integrating practice with theory, by 50.5% (111) to develop creativity, by 36.4% (80) to improve critical thinking and problem solving skills, and lastly, by 28.2% (62), though a low rate, to help establish social relations and improve cooperation skills.

Findings and Interpretations Regarding the Third Sub-problem

It was aimed in the third sub-problem of the study to determine the views of the teacher candidates on the benefits of the augmented reality applications. Accordingly, the question "What are your views on the benefits of using the augmented reality applications in lessons?" was asked to teacher candidates. Teacher candidates' views regarding this question were classified in two dimensions as the cognitive and affective dimension as a result of the content analysis. The findings are given in Table 10 below.

Table 10. Findings of the Views of Teacher Candidates on the Benefits of Augmented Reality Applications (N=32)

THEME	Benefits of Augmented Reality Applications		
		f	%
Codes	1. Facilitate learning	9	19.14
	2. Augmenting reality	8	17.02
	3. Visualize	7	14.89
	4. Provide 3D image	6	12.76
	5. Animate	5	10.63
	6. Offer virtual support	5	10.63
	7. Draw interest	5	10.63
	8. Increase motivation	2	4.25
Total		47	100

According to the findings in Table 10 above, 47 expressions are classified under 8 codes. According to Table 10, expressions about the benefit provided by the use of the augmented reality applications, it was pointed out by 19.14% (9) of the teacher candidates that these applications facilitate learning, by 17.02% (8) that they augment reality, by 14.89% (7) that they provide visualization of the subjects, by 12.76% (6) that they provide 3D images, by 10.63% (5) that they animate the subjects, by 10.63% (5) that they offer virtual support, by 10.63% (5) of the teacher candidates emphasized that these applications draw interest and by 4.25% (2) of them expressed that they increase motivation.

Discussion

Today, the vast majority of students studying at higher education institutions in our country are named as the digital generation or Z-generation. The generation including the people who came into the world between 1995 and 2010 is defined as Z generation (Biztazar, 2017: 39, Buyukuslu, 2017: 12). In this sense, the field puts emphasis on the importance of technology-based education, which can draw interest of digital generation from primary education to higher education (Bayne and Ross, 2007, Beck and Wade, 2004, Bittman et al., 2011, Oblinger and Oblinger, 2005,

Palfrey and Gasser, 2008; Prensky, 2001). It has been argued in this context that the augmented reality applications are evaluated in this study from the point of view of the students as a method which attracts and motivates the digital generation. The results are discussed below according to sub-problems.

According to the findings of the first sub-problem of the survey, it is determined that only half of the teacher candidates are familiar with the augmented reality applications and these applications are mostly known by the teacher candidates who are studying in the Department of Computer Education and Instructional Technology (CEIT). We can allege that this is due to the fact that the augmented reality has been in the world for the last 10 years while it is the newly recognized technology in Turkey and that the augmented reality applications have been used by the educators for the last few years. It can be argued that the fact that the teacher candidates of CEIT know about the augmented reality applications more than of the other departments is because the students of this department follow the issues related to technology more closely by force of their department and that the teaching staff working in the department of CEIT are more knowledgeable about this issue, and thus, guide their students in this direction. In a similar study conducted by Sayimer and Kucuksarac (2015) with communication faculty students, it was found that the rate of students knowing the augmented reality applications is 52%.

A large majority of teacher candidates indicated that they did not use the augmented reality applications. The main cause of this situation is thought to be due to the fact that the augmented reality applications are not well recognized by the teacher candidates. Teacher candidates indicate that the reason for not using these applications is because they do not recognize this technology, which can be considered as an indicator of this situation. Teacher candidates stated that they use the augmented reality applications most in the areas of "Education and Development" and "Games and Entertainment". The reason for the use of the applications most in "Education and Development" is supposed to be due to the study group of teacher candidates and, therefore, education applications are more attracting in this sense. Game and entertainment applications (Ingress, Father.IO, Ghostbusters Paranormal Blast, PulzAR, Table Zombies, Warp Runner, Pokemon GO, etc.) are the most common areas of use of the augmented reality applications both in the world and Turkey, which may have led the teacher candidates to state game and entertainment applications take the second place in using them. In the context of this problem, it was also questioned whether the teacher candidates designed an augmented reality application using any application tool. The majority of the teacher candidates stated that they did not design any augmented reality applications. Designing these applications requires a knowledge of how to create this medium through programmes such as Augment, Aumentaty and Aurasma and make the teachers be aware of these tools. It can be argued that the number of teacher candidates indicating that they did not prepare augmented reality applications is high due to their lack of knowledge in this regard.

In the second sub-problem of the research, views of the teacher candidates about the effects of the augmented reality applications in the learning-teaching process were determined. Most of the teacher candidates stated that thanks to the visualization feature of the subjects, augmented reality practices make it easier to understand and learn contents that are normally not easily understood. They strongly agreed that the learned information stayed longer in memory via augmented reality applications. It can be said in this respect that the capacity of augmented reality applications to create interactive and entertaining educational environments, including 3D audio and video files according to the areas of use, resulted in such views.

It was tried in the third sub-problem of the research to determine the opinions of the teacher candidates about the benefits of using the augmented reality applications in the lessons. According to the expressions of the teacher candidates, it was mentioned that; these applications facilitate learning and draw the interest of the students in the learning process.

Recommendations

The following recommendations were made based on the results of the study:

1. Teacher candidates' familiarity with the augmented reality applications and their level of knowledge of these practices were found at a very low level. It is recommended in order to increase the low level that teacher candidates should be given training on the theoretical structure of the augmented reality applications, the areas of use and then the training applications.

2. It is suggested that the teacher candidates in education faculties should be applied the augmented reality applications as a method of executing the course content and also be taught the application principles and software-hardware requirements to enrich their teaching experiences, which helps increase the motivation, interest and thus academic success of teacher candidates.

3. Teacher candidates expressed the opinion that the use of the augmented reality applications in the lessons would have a very positive effect on themselves. It is recommended in this respect that the instructors use these applications in their courses when possible.

4. It is accordingly proposed to organize a training course for instructors of teacher candidates. Since today's students, whom we define as digital natives, are to share the same environment with digital immigrant

teachers and parents who have come to know technology culture, later on, a bridge between two generations should be established and a solution should be provided (Cetinkaya and Sutcu, 2016). In this respect, it is very important for the instructors to develop themselves in terms of technological competence. According to Somyurek (2014), traditional learning methods and environments are not enough to attract the students' attention as they could in previous generations. At this point, an important responsibility of the teaching staff in education faculties at higher education institutions is not to lag behind the teacher candidates, who are the digital natives, in terms of technology and become digital immigrants by using technology effectively in education methods. From this point of view, today, technology-assisted teacher education has become a necessity rather than a need for increasing quality.

5. Regarding the positive effects of augmented reality applications on teacher candidates, it is suggested that these applications should be made more widespread in the education faculties, that the necessary technical infrastructure should be established in this direction for free use of students and that students should be encouraged to develop such applications.

6. Finally, researchers who will work on the augmented reality applications are recommended to conduct their studies in different faculties and fields and to do experimental research if the technical infrastructure is provided.

Conclusion

In teacher training as in all fields of higher education, ICT-supported teaching methods and techniques are being tried to be applied and developed in line with the needs of the digital generation. It was aimed in this regard to take opinions of teacher candidates about the augmented reality applications, which is one of the new digital technologies used in education. In this regard, the following conclusions are reached by analyzing the findings obtained in the study.

1. Teacher candidates were found to be at an insufficient level in terms of their awareness of augmented reality applications.

2. Accordingly, it was concluded in the research that augmented reality applications motivate teacher candidates, facilitate learning and make the lesson enjoyable. As it is known the new generation lives in the digital age, therefore, technologies such as augmented reality will be effective in their learning process and teaching process of the teachers.

3. The inadequacy of teacher candidates in terms of recognition and use of these applications is due to the fact that they do not know how to use them and are not interested in them.

4. The areas in which teacher candidates use the augmented reality applications most frequently were found to be "Education and Development" and "Games and Entertainment".

5. It was found that, due to their visualization feature of subjects, the augmented reality applications are viewed by teacher candidates as a way to facilitate learning by making hard-to-understand content easier, to help learned information stay longer in memory and to enjoy the learning process.

Limitations

The sample of this research was consisted of from one of the state university education faculty students. For this reason, the sampling was one of the limitations of this research in generalizing the results.

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