PRESERVICE SOCIAL STUDIES TEACHERS' OPINIONS ABOUT MOBILE AUGMENTED REALITY APPLICATIONS *

Abstract: The aim of this study is to reveal the opinions of social studies preservice teachers about their experiences during an action research on mobile augmented reality. In line with the aim of the study, a total of 46 preservice teachers (25 female, 21 male) studying in the second year of a social studies education program of a state university in the spring semester of the 2018-2019 academic year were determined as the study group. In the data collection phase of the research; focus group interviews, researcher diaries, observation reports were used. During the interview data analysis, the content analysis method was used. The findings obtained from the interviews were also supported by the observation and researcher diaries. Finally, the data about the devices that the participants have and their level of using these devices were collected through the personal information form, and then tabulated and interpreted. The knowledge background of the participants required to perform Mobile Augmented Reality (MAR) activities was found to be inadequate. The participants reported that the use of AR on mobile devices increases accessibility, fosters interest, supports active participation, and improves perception. On the other hand, they reported that that its use in education concretizes the abstract concepts, ensures learning retention, enhances success and encourages collaborative learning. The MAR was also found to be perception-changing, enjoyable, motivating, growth-enhancing, and facilitative from students' perspective. From educators' perspective, the findings indicate that MAR increases productivity, supports the resourcefulness of the teacher, and keeps the teacher social.

Keywords: Educational technologies, Augmented Reality, mobile augmented reality, social studies, teacher candidates

Değirmenci, Nail
Ph.D.Student
Uşak University
Social Studies Education
Turkey
E-mail:
naildegirmenci1@gmail.com
ORCID: 0000-0001-7537-7345

İnel, Yusuf Ph.D.
Assoc. Prof. Dr.
Uşak University
Social Studies Education
Turkey
E-mail: ysf.inel@gmail.com
ORCID: 0000-0003-0739-5730

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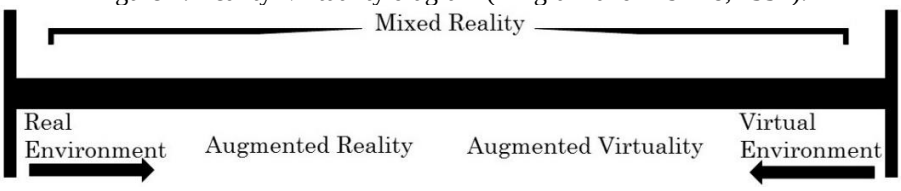
INTRODUCTION

Technology involves putting the knowledge and experience of the humankind into practice, and the synthesis of awareness, comprehension and implementation. Thanks to technology, the individual and society more easily adapt to the changes in their environment and the world, yielding increased productivity. However, technology affects people and society not only physically but also socially and psychologically (Satchwell and Dugger Jr., 1996). Especially in recent years, with the advances made in the ICT, the interaction between individuals and societies has been very intense, which manifests itself in all fields and disciplines of humanities. Undoubtedly, one of the most important of these fields is education. It has been suggested that integrating technology into education will be the driving force behind the developments in the future of education (Bellamy, 1996). As the main purpose of educational technologies is facilitating learning and making it more permanent (Teo and Lee, 2010), it can be said that the use of technology in education is a means to achieve this purpose (Heidegger, 1998).

While initially chalkboards were used in Turkey, later the use of white boards and smart boards was adopted, with the educational technologies becoming increasingly diverse over time (Tarman, 2011). Therefore, using technology as a tool to make education and training more active and effective can be expected to offer some significant benefits (Dargut and Çelik, 2014), and it will play a vital role in increasing students' interest in the course, ensuring that they achieve the targeted outcomes and preventing time loss (Katrancı and Uygun, 2013). Furthermore, using technology as a tool in educational environments can help the educator access appropriate, well-organized, and advanced educational materials faster and achieve the targeted learning outcomes and skills in a more effective way (Kaya, 2006). Today, it is crucial for educators to follow the technological advances as closely as possible, to try to use the educational technologies that can yield the maximum benefit, and to view themselves as competent in using such technologies (Kurbanoğlu and Akkoyunlu, 2002). The training of teachers, who are the target audience of the current study, is also an important factor in the effective use of educational technologies.

Considering the technological developments in portable devices in the recent past, one of the technologies whose use and prevalence has increased, is Augmented Reality (AR) (Ramazanoğlu and Aker, 2019). AR is the enrichment of spaces or objects in the real world with virtual objects and environments (Altınpulluk and Kesim, 2014; Erbaş and Demirer, 2014). In this case, instead of completely isolating from the real world, an increased environment is provided by adding reality and virtuality on top of each other. The degree to which these two environments are integrated is the main difference between augmented and virtual reality, which is clearly demonstrated by The Reality-Virtuality diagram created by Milgram and Kishino (1994).

Figure 1. Reality-Virtuality diagram (Milgram and Kishino, 1994).



With the development of factors such as cameras and processors used in mobile devices, it is seen that AR technologies have become widely used in mobile environments. The fact that it can be used in mobile devices has also brought positive effects in the field of education, and thus, the AR has become usable at the level of university, high school, middle school, primary school and even kindergarten. A general one of the available communication technologies is digital inequality, which can converge at different levels and with those who are close.

However, for other people for this help, the cost, prevalence and information may be much easier than communication and educational technologies. It is designed by the people mentioned.

This technology is also expected to contribute to equal opportunity in education by its widespread impact and the mission it assumes in education. Furthermore, it makes lessons more enjoyable and learning more permanent (Wu, Lee, Chang, and Liang, 2013), increases interaction and communication between student groups, and helps to better understand cause-effect relationships (Ivanova and Ivanov, 2011), provides students with a large amount of information quickly and concisely (Kaleci, Tepe and Tüzün, 2017; Çoruh, 2011; Sırakaya; 2015) and makes the lesson easier to understand (Kerawalla, Luckin, Selijefot, and Woolard, 2006). It has also been shown that in cases where the subject is difficult or impossible to understand, it helps the learner to understand it by virtual demonstrations of it (Shelton and Hedley, 2002).

The review of the related literature reveals that there are various studies about the use of AR at different levels of education. Some studies about the AR by education level is given in Table 1.

Table 1. AR by education levels

Educational Level	Studies
University	*Baysal and Uluyol, 2016; Cabero-Almenara, Challenor and Ma, 2019; Chang and Liu, 2013; Fernandez-Batanero and Barroso-Osuna, 2019; Çakır, Solak and Tan, 2015; Gül and Şahin, 2017; Jamali, Shiraduttin and Wong, 2014; Koşan, 2014; Martin-Gutierrez, Fabiani, Benesova, Meneses and Mora, 2015; Önal, 2017; Pombo and Marque, 2018; Ramazanoğlu and Aker, 2019; Sünger, 2019; Yıldız-Durak, Sarıtepeci and Bağdatlı-Çam, 2020; Wang, Duh, Li, Lin and Tsai'nin, 2014.*
High School	*Cevahir, 2017; Çetin, 2019; Dunleavy, Dede and Mitchell, 2009; Ersoy, Duman and Öncü, 2016; Ibáñez, Di Serio, Villaran ve Kloos, 2014; Korucu, Yavuzaslan ve Usta, 2016; Lee and Wong, 2014; Şener, 2016; Tzima, Styliaras and Bassounas, 2019.*
Secondary School	*Atasoy, Gün-Tosik and Kocaman-Karaoğlu,2017; Bursalı and Yılmaz, 2019; Di Serio, Ibanez and Kloos, 2012; Durak and Karaoğlan-Yılmaz, 2019; Küçük, Yılmaz and Göktaş, 2014; Gün, 2014; Lund-Nielsen, Brand and Swensen, 2016; Petrov and Atanasova, 2020; Sırakaya and Kılıç-Çakmak, 2016; Velazquezande Mendez, 2018.*
Primary School	*Alkhattabi, 2017; Bistaman, Idrus and Rashid, 2017; Büyükuygur and Güneş, 2018; Chiang, Yang and Hwang, 2014; İzgi-Onbaşılı, 2018; Kerawalla, Luckin, Seljeflot and Woolard, 2006; Özbek, 2018; Persefoni and Tsikanos, 2016.*
Pre School	*Campos and Pessanha, 2011; Gaikwad, Bonde, Kolge and Mahajan, 2017; Huang, Li and Fong, 2015; Kuzgun, 2019; Lee, Chau, Chau and Ng, 2017; Safar, Al-Jafar and Al-Yousefi, 2017.*

When the studies about the use of AR in different education levels are examined, it can be seen that there are not enough studies to reveal the effects of AR in the Turkish education system. Regarding the use of AR in different disciplines; in science education, studies by Lund-Nielsen, Brandt and Swensen (2016); Tsichouridis, Bastila, Vavougius and Ioannidis (2011); Swensen (2016); Tekedere, Göker 2016; Cheng, (2018); Bonner and Reinders (2018), Akgül and Tanrıseven (2019), in mathematics and geometry education, Somyürek, 2014; Tobar-Munoz, Fabregat and Baldiris, 2015; Topraklıoğlu, 2018; Coimbra, Cardoso and Mateus, (2015); Akkuş and Özhan, (2017), Radu, McCarthy and Kao (2016), Yingprayoon, 2015, in history education, studies by Kysela and Storkova (2014); Challenor and Ma (2019); Coruh (2011); Di Martino and Longo (2019); Lim and Lim (2020), and in geography education, studies by Adedokun-Shittu, Agent, Nuhu and Shittu, 2019; Arslan and Elibol, 2015; Demir, Ağaçsapan, Sarı, Aksoy and Çabuk, 2019; İmamoğlu and İmamoğlu, 2018; Özel and Uluyol, 2016; Shelton and Hedley, 2002; Turan, Meral and Şahin (2018) have been found. Studies on AR in the field of social studies are very limited. Koçoğlu, Akkuş, and Özhan (2017) conducted a study examining how AR applications can contribute to social

knowledge. Another study in this field aimed to measure the effect of using AR in social studies by Gümbür (2019) on students' academic achievements, attitudes and motivations. Toledo-Morales and Sanchez-Garcia (2018) aimed to determine the effects of AR on Spanish students' academic performance and their perception of AR. T present study was conducted to contribute to the relevant literature, given the lack of any other studies in the field of social studies other than those mentioned above. In addition, there is no study in the social studies field focusing on training preservice teachers to design AR activities. Considering the benefits provided by AR, it is thought that it is very important in terms of education to teach pre-service teachers how to develop applications in this context. It is a very important issue in terms of teaching that teachers, who are the implementers of the curriculum, use this technology in their classrooms as a tool to implement and gain achievements. Based on the aforementioned importance of this study, it is thought that there is a significant threshold in transferring it to teacher candidates. On the other hand, teaching prospective teachers to design AR activities is the first in the field, which reveals the originality of this study and its difference from other studies. The fact that it is the first in the field to teach pre-service teachers how to design AR activities reveals the originality of the current study. The purpose of this study is to find out the opinions of preservice social studies teachers about the experiences they had during the MAR action research they carried out. Can a textbook be structured and made into an MAR application with social studies teacher candidates? What are the opinions of the participants on this issue? These questions constituted the problem statement of the study and the answers to the following questions were sought:

1) What are the opinions of the participants about the implementation process?
2) What are their views on its use in education?
3) What are their views on its use in fields other than social studies?
4) What are the participants' suggestions about improving the use of AR in education?

METHOD

RESEARCH DESIGN

In this study, a part of the MAR action research conducted with the teacher candidates was used. It was aimed to reveal the opinions of the participants about the MAR work they performed during their action research. Action research is a qualitative research method in which data is collected throughout the research process about the problem. By continuous evaluation throughout the process, the development, change and interactions of the study group can be understood in depth (Yıldırım and Şimşek, 2018).

STUDY GROUP

The participants of this study 46 preservice teachers (25 female and 21 male), studying in their second year (sophomore) in the Social Studies department of the Faculty of Education of a state university in the spring term of 2018-2019.

As seen in Table.2, the gender distribution of the participant group is balanced. Considering the technological tools that the participants have, almost all of them had mobile phones (f: 43, 95.5%). 17.7% of the participants owned a tablet (f: 8). As such, the participants were able to view their activities on their mobile devices. Further, they had a laptop computer (f: 30, 66.6%) and a desktop computer (f: 7, 15.5%) to perform the AR activities. Considering that the participants were divided into groups and carried out these activities, they had the necessary devices to perform the AR activities. The rate of internet availability in the place of residence (f: 41, 91.2%) shows that all the participants were able to perform the activities given as homework. The participants assessed their mobile phone use competency level as very good (f: 7, 15.5%), good (f: 18, 40%), moderate (f: 19, 42.2%) and very little (f: 4, 8.8%). Their competency in using a tablet were very good (f: 2, 4.3%), good (f: 5, 10.8%),

moderate (f: 24, 52.2%), very low (f: 12, 26.1%), and no competency at all (f: 2, 4.3%). Their competency level in using the Internet was very good (f: 5, 10.8%), good (f: 18, 40%), intermediate (f: 18, 40%), and very little (f: 4, 8.8%). Based on these data, it can be concluded that the participants had enough knowledge to carry out AR activities and that they were competent enough to perform these activities on their technological devices.

Table 2. Participant information

		f	%
Gender	Men	21	45,6
	Women	25	54,4
Owned technological tool	Mobile phone	43	95,5
	Tablet Pc	8	17,7
	Laptop	30	66,6
	Desktop Pc	7	15,5
Internet in the place of residence	Yes	41	91,2
	No	4	8,8
Cell phone usage level	Very good	7	15,5
	Good	18	40
	Moderate	19	42,2
	Very little	4	8,8
Laptop usage level	Very good	2	4,3
	Good	5	10,8
	Moderate	24	52,2
	Very little	12	26,1
	Not knowing at all	2	4,3
Internet usage level	Very good	5	10,8
	Good	18	40
	Moderate	18	40
	Very Little	4	8,8

STEPS OF IMPLEMENTATION

The UNITY, VUFORIA and ANDROID STUDIO applications were selected to design the MAR activities for the study. The UNITY was chosen because it is open source, free of charge, a program known by the researchers, compatible with VUFORIA, and supports a wide range of AR activities. VUFORIA was chosen because it is an application that helps turn the visuals in the textbook into a marker for the AR. ANDROID STUDIO was included because it contains the android versions necessary to make it a mobile application. After this stage, the lesson plan was prepared and submitted for expert review. With the final revisions made in line with the opinions and suggestions of the expert group consisting of a professor, an associate professor and a lecturer, the implementation phase was initiated. Throughout the process, pre-service teachers were given homework for each of the steps of the process shown in practice and they were asked to structure the social studies 7th grade textbook within the scope of what they learned. As a result of this process, which continues by adding new AR features to each application lesson, all of the participant groups have developed their own augmented reality mobile application when the application process is completed.

The research continued for 14 weeks. The work done during the implementation phase is summarized on a weekly basis in the Table 3.

Table 3. Practice

Weeks	Descriptions
1. Week	• Augmented Reality, mobile augmented reality concepts are introduced. • The necessity of using this technology for education and educators was mentioned. • The programs to be used (UNITY, VUFORIA,) were introduced.
2. Week	• The programs were installed on the computers and their usage was demonstrated practically. • Groups were created.
3. Week	• Integrating video into visuals in the 7th Grade Social Studies textbook was demonstrated. • The 1. Unit of the textbook was given homework to the participants to be restructured within the scope of the lessons taught.
4. Week	• The videos and educational games shot by the participants were integrated into the relevant visual. • 3D object integration demonstrated with practice. • The 2. Unit of the textbook was given homework to the participants to be restructured within the scope of the lessons taught.
5. Week	• Video and 3D object integration have been repeated for consolidation purposes. • Shown adding sound, narration behind 3D object. • The 3. Unit of the textbook was given homework to the participants to be restructured within the scope of the lessons taught.
6. Week	• Adding more than one 3D object to a visual in unit 4 and adding sound and narration behind this multiple 3D object were shown. • The 4. Unit of the textbook was given homework to the participants to be restructured within the scope of the lessons taught.
7. Week	• The study was suspended due to the mid-term exams. • Homework done up to the 7. week were collected and evaluated using Rubric.
8. Week	• Mid-term exams.
9. Week	• In the 5. unit, more than one scene was added on a visual, and the addition of different 3D objects and videos in each scene was shown. It was explained how to perform the transition between the scenes through the buttons. • It was demonstrated how to integrate multiple 3D objects by turning multiple images into a single trigger in the 5. unit. • The aforementioned unit was given to the participants as a homework to be restructured in the context of what was explained and demonstrated.
10. Week	• Integrating the educational games prepared by the participants and the structured videos. • Animated 3D objects were shown. • It has been shown to add features such as enlarging, shrinking, rotating 3D objects for use on mobile devices by touching or dragging. • The 6. Unit of the textbook was given homework to the participants to be restructured within the scope of the lessons taught.
11. Week	• Introducing historical sites and adding videos of interviews to the 7. unit. • It was demonstrated to increase the interaction between virtual and real by adding a virtual button on a real object. • The last unit was reconstructed in the context of what was shown and given to the participants as homework.
12. Week	• Post tests applied. • Focus group interviews and semantic differences scale were applied.
13. Week	• Focus group interviews continued.
14. Week	• Final exams week. • The studies carried out after the midterm exams were collected and the assignments were evaluated using the Rubric.

Image 1. Practice Examples

DATA COLLECTION

This study includes the data collected from the focus group interviews conducted by the first author as part of his master's thesis. The data were obtained through focus group interviews, researcher diaries and observation reports.

Focus Group Discussions focused on the semi-structured interview questions, which were prepared by the researcher and consisted of 12 questions revised and finalized based on the opinions of two researchers who were experts in their field. The participants' views were collected in about 20-40 minutes in an environment separate from the other groups. During this period, the participants were not intervened in any way, and permission was asked to use a tape recorder before starting the interviews. These focus group interviews were held with all the participants to reveal the effects of their experiences on the subject they worked on previously (Ryan, Gandha, Culbertson, and Carlson, 2013). Researcher diaries allow the researcher to keep a record of his/her own opinions and feelings on the flow of the research (Yıldırım and Şimşek, 2018). Further, the observation reports kept throughout the study enabled recording the reactions of the participants to the research process, situations that led to in-group solidarity or conflict, and the points that the participants improved or failed to show during the study.

DATA ANALYSIS

In analyzing the data, the qualitative data analysis procedures detailed by Miles and Huberman (1994) were followed. Accordingly, as the first step, the data obtained by the researcher through data collection tools were classified and reduced in line with the subject and scope of the research. In the second step, the data were made concrete and analyzable within the scope of the research. Thus, more general and meaningful wholes were obtained based on the data obtained. In the final step, reaching the result and verification is aimed. Thus, the findings were revealed during the interpretation of the data and what they meant was stated. The verification of these data was achieved by comparing the diaries kept by the researcher and the results of studies on similar subjects in the relevant literature.

The verbal data obtained in the analysis of the focus group interviews were transcribed and analyzed by using the content analysis method, which allowed identifying certain codes, categories and themes. Next, the documents were sent to an expert to obtain the confirmation of the identified holistic approaches. While the obtained data was turned into findings and interpreted, they were was also supported by the researcher diaries. With the researcher diaries, the problems faced by the participants during the implementation, and their attitudes towards it were reported. The cooperation between the participants during the research and the conflicts arising during the implementation were also added to the report.

RESULTS

"What are the opinions of the participants about the implementation process?" is the first sub-problem of the study. The focus group interview data were descriptively analysed, and the findings are presented in the tables below.

Table 4. Categories related to the participants' opinions on the implementation process

Theme	**Categories**
Views On The İmplementation Process	Infrastructure
	Program Oriented
	Mobile Usage

The theme "Views on the implementation process" consists of the categories "Infrastructure, Program Oriented and Mobile Use". The codes and interpretations that make up the categories are given below.

Table 5. Codes for the Infrastructure Category

Category	**Codes**
Infrastructure	Difficult (Hardware, Infrastructure And Language)
	Cost (Hardware)
	Difficult
	Difficult But Achievable
	Cost (Time)
	Complicated Structure And Heavy To Operate

Under the category of "infrastructure", there are "difficult (hardware, infrastructure and language), cost (hardware), difficult, difficult but achievable, cost (time), "complicated structure and slow to operate" codes. One of the most common codes under this category is the "difficult (hardware, infrastructure and language)" code. With regard to this, P1(Participant 1) reported *"You know, it would be much better if the program were in Turkish rather than English. You find your mistakes more easily. You can be more creative. It can be done more easily. It may be faster. It also gets harder when we don't speak the language."* In addition, P2 stated that *"For example, we are generally not familiar with computers. We have a little difficulty with it because we do not have the necessary background knowledge.*" Regarding the "Cost (Hardware)" code, P3 stated *"We had difficulties because we did not have a computer. It would be much easier if everybody had PCs. For example, we do not have internet in the dormitory."* P4 commented on the "Difficult" code by saying *"There is a lot of difference between what we did at the beginning and what we do now, and we have come to a very advanced level now we can do everything but we only had a little difficulty".* Regarding the "difficult but achievable" code, P5 commented: *"Actually, it is not the direction we do not like, but because we never knew it before, so we have a little difficulty because we saw it for the first time. There is nothing difficult, we can actually do it when we learn."* The participants reported experiencing difficulties because they encountered Augmented Reality for the first time, but stated that these difficulties could be overcome as they gained experience. Regarding the "cost (time)" code, P6 said *"We can consider it a disadvantage that it takes too much time."* On the "heavy to operate" code, P8 commented: *"Handy but works a little bit too slow and turns on very slowly."* It is observed that the background of the participants is too limited to use the AR properly, and their devices are not at the most advanced level in terms of hardware, causing difficulties while developing activities. The limited knowledge of English is another important factor in the emergence of such a result. However, the participants stated that these limitations can be overcome by repeated use and more attention.

Table 6. Program-Based Codes

Category		**Codes**
Program Based	*Positive Features*	Clear
		Usable In Different Areas
		Attention Requiring
		Functional
		Facilitating
		Socializing
	Negative Features	Update
		Complicated (Program)

The “Program-based” category was grouped under two headings as the positive and negative qualities of the program. While the negative qualities consist of “clear, usable in different fields, attention-requiring, functional, facilitating and enabling socialization” codes, positive qualities include "updating, complicated (program), and program change”.

The first code emerging from the opinions of the participants who have positive thoughts about the programs used while carrying out AR activities is "Clear". With regard to this, P2 stated: *"I think it is quite understandable that there are such things as getting code from VUFORIA. In my opinion, whether a serial application is in UNITY, getting a code from VUFORIA, these are serial operations."* About the code "Usable in different fields", P12 stated: *“Especially the program we use helps us to make games. In this respect, we can also earn money."* Regarding the "Attention-Requiring" code, P11 stressed that *"I wouldn't have paid much attention before, but I feel like my attention has increased."* Regarding the "functional" code, P13 stated *“What's the plus side? It serves its function and you can do something 3-dimensional."* Regarding the "facilitating" code, P6 stated *"An easy application in terms of functionality, the kind of application that a verbal (track) student can understand, whether it be writing the codes or something else."* Regarding the "Enabling socialization" code, P2 reported: *“I started to visit (my friends) for the augmented reality activities and topic posts helped us to socialize more.”*

The first code obtained from the opinions of the participants who had negative thoughts or experiences about the programs is the "Update code". Related to this, P14 stated: *“We had a lot of trouble when there was an update notice because we couldn't figure it out. It has become a more comfortable practice now we do not have to update it anymore."* Regarding the "Complicated (Program)" code, P7 stated: *“Frankly, the program sounds a bit complicated.”* Concerning the program-based category, the participants generally focused on the positive features of the applications used. The common opinions are expressed as “programs are sufficient for the actions, provide guide dance to facilitate the activities, intolarable to human errors thus requires more attention. The negative features comprise the lack of the necessary background or language skills, insufficiency of technological equipment or devices, and unfamiliarity with these programs due to using them for the first time.

Table 7. Codes related to the "Use on Mobile" category

Category		**Codes**
Use on mobile	Usage-oriented	Simplifying
		Facilitating the work of the educator
		Ease of access
		Usability
		Accessibility
		Wide applicability
	Educational effects	Academic achievement
		Reinforcement of what is learned
		Saving (time)

Effects of AR activities on the use of mobile devices, the codes that make up the "use on mobile" category are grouped under two headings as use-oriented and educational effects. While effects on use consisted of codes of "simplifying, facilitating the work of the educator, ease of access, user-friendliness, accessibility, widerange of applicability", the educational effects category includes the codes of “academic achievement, reinforcement of what has been learned and saving (time)”.

Regarding the "Simplifier" code, which emerged from the opinions about the usage of AR activities on mobile devices, P22 commented: *"In a school where there is no projector, we cannot do anything without projecting so it is simpler for me to show Augmented Reality by using a computer or a tablet or a phone."* In relation to the code "facilitates the work of the educator", P21 stated that *"The teacher has to prepare materials for the lesson, but it is enough to have a phone only, so he does not need to do anything extra."* Regarding the "ease of access" code, P15 stated: *“Not everyone can buy or use a computer, but I think it would be very useful since anyone can use the phone. At least we carry the phone with us and, whenever necessary, we turn it on and use it."* was commented. Regarding the "user-friendliness" code, P16 commented: *"As technology is everywhere now, I think using it on the phone is very handy and nice thing."* In relation to the "Accessibility" code P18; *“I think the access time is shorter than the books. It can be reached in a shorter time."* Regarding the "wide range of applicability" code, P19 stated: *“It is an application applicable down to, you know, PlayStation. I mean, something that can be put into life even outdoor, even in buses, that is, something that can be in every moment of daily life."*

Related to "Academic Success", which is one of the codes that emerged about the effects of using AR activities on mobile devices, P18 drew attention to the fact that the use of AG on mobile devices increased success by stating *"It directly enhances the success in the course."* Regarding the code "reinforcing what has been learned", P20 commented: *“When the student doesn't understand (a subject) at school, having it on the tablet or phone in the same way helps him reinforce it at home, too. It offers ease of learning."* Regarding the "Saving (Time)" code, P17 stated: *"It makes learning easier. It helps in terms of time."* The participants agreed that using AR activities on mobile can make accessing and using information very easy for students and teachers. They stated that because of the widespread use of mobile devices, they will save time and effort when using AR on mobile devices. They also think that this will increase academic success and will be beneficial in reinforcing the learned subject and ensuring retention. The question “What are the opinions of the participants about the use of the research in education?” was the second sub-problem. The data obtained through the content analysis of the data collected through focus group interviews are given below in tables and direct quotations.

Table 8. Themes and categories for use in education

Themes	**Categories**
Contribution to Education	Contribution to Teaching
	Contribution to The Student
	Contribution to The Educator

The theme of "Contribution to education" consists of the categories of "Contribution to teaching, contribution to the student, contribution to the educator". Each category consists of codes determined through the analysis. The categories and the codes that make up these categories are given in separate tables below.

Table 9. Codes for the "Contribution to Teaching" category

Category	Codes	
Contribution to Teaching	*Cognitive Contribution*	Benefit (Pragma)
		Collaborative Didactic Structure
		Persistence
		Facilitating
		Useful
		Instructive
		Concretive
		Technology Integration
	Affective Contribution	Improving Skills
		Appealing To The Senses
		Increasing Participation
		Motivation
		Multi-Support
		Increasing Focus
		Reinforcing

The category of "Contribution to Teaching" consists of the cognitive and affective development codes. The cognitive contributions comprise the “benefit (pragma), collaborative didactic structure, retention, facilitating, useful, instructive, concretizing, technology integration codes, while the affective contributions include the codes of "enhancing skills, appealing to the senses, increasing participation, motivation, multi-support, increasing focus, reinforcing".

Regarding the "Benefit (Pragma)" code, P37 stated: *"I think it is useful because we are studying teaching, we need to be intertwined with technology. We need to convey these to our students in the future, but it is useless when we cannot learn. So we need to learn."* Regarding the “Collaborative Tutorial Structure” code, P34 commented: *“When something happened to my computer, it did not open the application. We said that our friend has a computer, so let's build it from there. Then we gathered at his home. As 6 people, we worked rotationally. The videos were not boring anyway, I can say that our friendship has strengthened because of spending a long time together.”* It can be said that performing the AR activities as a group strengthened the communication between the participating groups. Regarding the "retention" code, P25 said, *"It would be more permanent, if I do not forget this in life."* Regarding the "facilitating" code, P18 said, "*For example, instead of explaining a topic to the child on 2-page long explanation, you can make it easier for the child to learn the subject by uploading a single photo, a video, a game or something."* Regarding the "useful" code, P21 said, *"Although difficult, they are very useful to me. It provides both memorability and you do something different, how can I say, which is a very nice thing in my opinion.”* He found the description. Regarding the “instructive” code, P43 said, *“We only go through the subject, the students do not understand, so things happened in our case. We get stuck in historical events. For example, I think that I can learn better when the augmented reality is included in the curriculum, illustrating what happened where, or something.”* Regarding the "concretization" code, P24 said, *"We turn something abstract into concrete. For example, we say it rained or we say hailed, students do not know what the hail is, but when we show hails in 3D, they see what it is like. Therefore, because we turn something abstract into concrete, something becomes more understandable."* Regarding the "Technology Integration" code, P23 said: *"In other lessons, you only learn about the subject, but you learn something by doing it with a computer, that is, by doing it yourself."* P35 commented: *"You use technology more effectively, I can say that is very different in that way."*

Regarding the "Enhancing Skills" code, which is one of the codes obtained on affective contributions to teaching, P29 said: “*It encourages students to think differently. It improves*

your creativity. They gain the ability to make different programs. They have more control of the computer. I think it has benefits in this way and I think it brings in a different learning style." Regarding the "Appealing to the senses" code, P22 commented: *"I think it might be a plus for students. As I said, because it appeals to their visual intelligence and auditory intelligence, it is a plus for students who can understand better by hearing."* Regarding the "Increasing participation" code, P7 stated: *"This will be more of an interest when it comes to primary school students. They will be more engaged in the lessons and they have more time than we do."* Regarding the "Motivation" code, P28 commented: *"It attracts the student's attention. You know, they become more motivated for the next lesson, they will think that they have fun during the lesson.*" Regarding the "Multi Support" code, P18 stated: *"For example, because some learn by seeing and some by hearing, in the augmented reality applications we do there is sound, there is a picture. This only leaves written text, which is in the textbooks*. P28 commented: *"All the senses are involved: hearing, seeing, all involved. Besides teacher support is given, anyway."* Regarding the "Increasing Focus", P30 said: *"We started with the blackboard, for example, then the whiteboard came along, and then the smart board. Whether it was the slides or presentations, the smart board focused the students so much on the lesson. Now, with the arrival of this application and that it is applicable to all kinds of devices, the students will focus more on the lessons. Seeing a moving object interests even me much more than usual."*

Regarding the "Reinforcing" code, P29 said: *"A picture, an official Turkish flag, for example. We also do it and even shoot our own video there in the application and integrate it into it. In this way, the student can both understand the subject aloud and reinforce it."* On the other hand, P5commented: *"It further reinforces the subject that the student has learned. So, we presented the subject as usual, but we made the subject more interesting with augmented reality."* The participants reported that using AR activities in education can play an important role in reinforcing what has been taught. They agreed that AR applications will contribute significantly to learning. It can be said that AR activities support cognitive and affective characteristics in particular and offer remarkable benefits in terms of continuity and effect of teaching inside and outside the classroom.

Table 10. Codes for the "Contributions to the Student" category

Category	**Codes**	
Student Contributions	*For cognitive development*	Infrastructure impact
		Early education
		Effective participation
		Enhancing effect
		Facilitating
		Complementary
	For affective development	Perception-changing and developing
		Unifying
		Motivating
		Interesting-remarkable
		Increasing interest
		Enjoyable (pleasurable)

"Student contributions" category is grouped under two headings as cognitive development and affective development. The aspect of cognitive development includes the “Effect on the background knowledge, early childhood education, effective participation, enhancing effect, facilitating studying, complementary” codes, while affective development comprises the “perception-changing and developing, unifying, motivating, interesting-remarkable, increasing interest, enjoyable (pleasurable)” codes.

Regarding the "Effect on the Background Knowledge" code, which is one of the codes found for the contribution of AR to the cognitive development of the student, P15 commented: *"I think that students will have an idea in their mind because they will see it beforehand, and they will not approach the program with prejudice."* Regarding the "Early Childhood Education" code, P37 stated: *"It would be more appropriate to use it in primary and secondary schools because it may not be of interest in high school. You know, when the student reaches a certain age, heor she may find this practice childish, but it attracts much more attention from younger people and they become more interested in the lesson. He wants to attend the class. That's why it has to be put into lessons. Let the teachers do it."* Regarding the code of "Effective Participation", P16 said: *"The lesson can become more fun, but the teacher should know this very well and reflect this to the students. I think a student can participate in the lesson more effectively."* Regarding the "Enhancing Effect" code, P27 said: *"I think it has a positive effect because it opens up your horizons. It adds a colorful style. It is a little different from a monotonous life of always reading, memorizing and writing. This brought a different perspective, I think."* Regarding the " Facilitating Studying " code, P20 commented: *"It makes it easier for the student to learn more quickly. In addition, since social studies and history are based on memorization, I think better learning can be facilitated with the help of the program."* Regarding the "complementary" code, P34 stated: *"For example, when a lesson is has to be skipped, when it is incomplete, for example, when April 23 (national holiday) coincides with a school day, we can deal with that issue with augmented reality. There is no need to waste time for the student."*.

Regarding the "Perception Changing and Developing" code, one of the codes for the contributions of AR to the affective development of the student, P21 commented: *"It would be more fun, they would be more willing. In this lesson, we would address a terrible judgment. You know, we change the point of view of the lesson."* Regarding the "Unifying" code, P19 stated: *"Having just a few people was more enjoyable. At least we spent time together. Normally, we sit somewhere and play computer games all day, but this way (by using MAR) we at least did some homework until the evening, so we did homework together. I can say that it was definitely more unifying."* Regarding the "Motivating" code, P21 said: *"Now they talk at recess, saying we will have fun activities in the lesson, and even among themselves."* Regarding the "Interesting (Remarkable)" code, P32 commented: *"With mobile augmented reality, really productive lessons can be taught while fully keeping up with the modern technology and the era, and our lessons were geared towards adapting to improving them. The old tactics do not attract the attention of their children anymore, but being able to teach with technology can be a great advantage since they are dealing with the current technology in the current mobile augmented reality."* Regarding the "Increasing Interest" code, P7 commented: *"First of all, students' interest in the lesson increases. Our motivation also increased during the times we used it. We liked that this will increase the interest of the students."* Regarding the "Enjoyable" code, P2 stated: *"They enjoy it. It makes us entertained even at this age, for example, I remember adding music or something to the CDs, and having a lot of fun with them. When we showed them as a picture and so on, the videos were very entertaining for us. I think that because it appeals to us, it will affect our students who are younger than us."* The participants agreed that lessons taught using AR applications generally supported students cognitively and affectively. In particular, they agreed on the permanence of teaching, increasing the interest in the lesson, simplifying abstract and difficult-to-grasp concepts, completing the missing subjects anytime and anywhere, and breaking biases, and thus having positive contributions to the student.

Table 11. Codes for the "Contributions to the Educator" category

Category	Codes	
Contributions to the Educator	*Cognitive contributions*	Keep up with the age
		Support equipment
		Benefit (vocational)
		Keep them social
		Productivity-enhancing
	Affective contributions	Awareness effect
		Motivation
		Pleasure
		Responsibility
		Creativity development

The category of "Contributions to the Educator" is grouped under two headings as cognitive and affective contributions. The cognitive contributions of the AR include the codes of "keeping up with the age, supporting ICT knowledge, utility (vocational), keeping social, and enhancing productivity, while the affective contributions consist of the awareness effect, motivating, pleasurable, responsibility, fostering creativity, and enhancing productivity.

Among the codes regarding the cognitive contributions of AR to the educator, regarding the "Keeping Up with the Age" code, P2 commented: *"At least we keep pace with the times, with augmented reality, that's why. There is a big difference between classical lecture and this one, for the future."* It can be said that the participants learn and use the AR technologies in their lessons as an important tool in adapting to the technology-oriented era we are in, fulfilling the requirements and supporting education with this technology and keeping up-to-date. Regarding the "Supporting ICT Knowledge" code, P7 said *"We will not at least hesitate or be frustrated when something like this comes up. We will know what is what. It's a nice thing in terms of our own knowledge. Since we have seen this before, we will be able to convey this to the student in a smooth and efficient manner. It's a beautiful thing in that way."* It can be said that the participants foresee that teaching this technology will reflect positively on the their ICT knowledge and that they will be able to teach students efficiently. Regarding the utility (Vocational) code, P2 stated: *"It may have an effect on professional development as follows: If I am going to be a teacher and they will be used in the next 20-30 years, it is a plus for me to know them now. In other words, in the future technology age, this will be my biggest strength. I will have a leg up compared to other teachers. I'll always be one step ahead. "* Regarding the code "Keeping Social", P32 stated: *"As a social studies teacher, we need to know all the social factors. It is something that will keep us social, that is, keep us vigorous and keep us up to date. Also, what we are learning now is a forward-looking investment. This also encourages curiosity, leading to other curiosities and all these pieces of curiosities will lead to a whole. I think this augmented reality will keep us social and vigorous all the time."* Regarding the "Enhancing Productivity" code, P35 stated that being able to do AR activities by using will foster teachers' productivity by enabling them to design educational games: *"With this program, you can be more productive, for example, you can create games."*

Among the codes emerging related to the affective contributions of AR to the educator, regarding the "Awareness Effect" code, P19 said: *"No matter how much we are in the age of technology, none of us clearly know how to use technology. Everything is a game. It's Instagram, it's Facebook, we know that style. As we do these things, I think we learn the actual technology. Actually, this (MAR) is the real technology, so what we (usually) do is just wasting time."* Regarding the "Motivating" code, P4 said *"At first I was doing a lot of things if I made a mistake or something, but now I realized that I can do it. It happens when you really go on something, when you try and make an effort. I noticed it. The advantage of this lesson to me is that it made me embrace technology, and most importantly, I realized that I could do some things."* Regarding the "Pleasurable" code, P6 commented: *"At first, I was*

more biased against this augmented reality. As I practiced, made mistakes and corrected those mistakes, the more it became enjoyable for me." Regarding the "Responsibility" code, the P19 stated: *"I think there is more agreement rather than conflict because there is nothing to be in conflict. When everyone knows their own responsibilities, nobody is disturbed by each other, and no problem arises."* Regarding the "Fostering Creativity" code, P15 commented: *"We do something ourselves. We prepare projects ourselves. Our creativity is enhanced in this way. Because the more different things we do, the more kids will remember them."* Thus, the educators agreed that doing AR activities and applying them in the lessons would turn them into educators who can keep up with today's technology and can follow social variables. The reported that they developed their affective and cognitive skills, increased their awareness about using technology, and became educators who enjoy doing and applying.

The codes and categories obtained for the third research question, "What are the views of the research on the use of the research in areas other than Social Studies?" are given below.

Table 12. Codes Regarding the Theme of "Different Disciplines"

Theme	**Categories**	**Codes**
Different disciplines	*Numerical fields*	Biology
		Science and technology
		Physics
		Geometry
		Chemistry
		Mathematics
		Medical education
	Verbal fields	Geography
		Pre-school education
		History
		Multi-course

As seen in Table 12, this theme consists of the categories of numerical and verbal fields. The numerical fields category consists of biology, science and technology, physics, geometry, chemistry, mathematics and medical education. The verbal fields category is consists of geography, pre-school education, and history. The multi-course code was also included under the theme of different disciplines.

Regarding the use of AR in the biology course under the category of numerical fields, for the "Biology" lesson, P23 stated: *"For example, animals in biology do not know the development stages of a living thing, we can show it."* Regarding the "science and technology" code, P4 said: *"For example, the science and technology lesson is not liked by the students. For example, the digestive system, the excretory system have many issues, and they can see them in 3D."* Regarding the "Physics" code, P2 commented: *"MAR can also be applied in numerical lessons. For example, it may be useful to show the electric wave in 3D in Physics class.*" Regarding the "Geometry" code, P32 stated: " *It can be used in Geometry especially to show shapes. In order to explain the figures, it may be a little more difficult for students with low achievement levels to understand, especially since they are abstract concepts. I think using 3D to show the pyramids or something can definitely help them understand the subject."* Regarding the "Chemistry" code, P28 said: *"I think it will be pretty good in chemistry class."* Regarding the "Mathematics" code, P11 stated: *"For example, children do not understand the problems. Problem questions. With this, for example, it can be shown in 3D, that is, by converting the problem into 3 dimensional shape, it can be ensured that children understand better."* Regarding the "Medical Education" code, P41 commented *"It may be used in medicine. In medical faculties, internal organs can be shown to the students for educational purposes. It can be shown how the surgery will be performed, so it can be effective in this respect."*

Regarding the use of AR in the geography subject under the verbal fields category, P37 said: *"There are mountains, valleys in the geography lesson. (Using MAR) would be more interesting, too. In augmented reality, for example, the valley will come in 3D. Like the shape of a V, we memorized them. It would be very convenient in geography. I wish it could be done right now."* Regarding the "Preschool Education" code, P9 stated: *"I think it can be useful for preschool teachers. For example, they can play games. Like I said they can use it for the game. It can be interesting for children. Frankly, it caught my attention."* Regarding the "History" code, P7 said: *"If a history book is structured as MAR in history lessons, if it is integrated into the book and the student sees this, it will be very interesting. History is an interesting lesson. I think that such a thing in history lessons would double this interest."*
Regarding the "Multi Course" code, which is not included in any category under the theme of different disciplines, P36 said: *"I think it can be used in anything that can be learned visually. So this is not just limited to science, social studies, and mathematics. For example, if you want to show the inside angles of the triangle. It can also be used in math class. If you want to show the crescent tactic by the Ottoman Empire during a war, it can be used there."* AR's concretizing abstract concepts or presenting them from different perspectives under the control of the user is the main reason for finding this technology as useful in many subjects in the field of education. This feature was also prioritized in the opinions of the participants. Although it was stressed that MAR can be applied to concretize abstract concepts in numerical lessons, many participants agreed that MAR can be actively used in verbal lessons as well.
The codes obtained regarding the fourth question of the study, "What are the suggestions of the participants about improving the effect of AR in education? are given below.

Table 13. Categories and Codes for the Theme of "Suggestions"

Theme	**Categories**	**Codes**
Suggestions	*Instructional*	Feedback
		Generalizability
		Necessity
		Vitality principle
		Readiness
		Permanence (hologram)
		Controlled usage
		Relative to the student
		Continuity
		Compulsory course
	Hardware	Hardware support
		Developability
		Necessary infrastructure

Table continues…

As can be seen in Table 13, the suggestions theme consists of two categories, instructional and equipment. The instructional category consists of "Feedback generalizability, necessity, vitality principle, readiness, permanence (hologram), and controlled use, relative to the student, continuity, and compulsory course" codes. The professional knowledge category consists of the "equipment support, developability, necessary infrastructure" codes. Furthermore, the codes are observed to concentrate mainly on instructional suggestions.
One of the suggestions made by the participants under the instructional category in terms of increasing the effect of AR in education was coded as "Feedback". Regarding this code, P34 stated: *"We have to wait another 5 years. Or, for example, if it becomes widespread, its deficiencies will be revealed, and everyone will have an idea. Which happens to us too. So we can convey our thoughts then. But looks like it is enough for now."* Regarding the "Generalizability" code, P43 commented: *"It can be used in other courses. We can use it not*

only in geography and social studies, but also in biology, that is, in physical education." Regarding the "Necessity" code, P24 said: *"I think it is something that should be integrated into education because we, as the Turkish society, missed a train while we were in the industrial revolution. We are already pulling a little bit of that train in the current difficulties. You know, we are talking about a new future trend and we are talking about trains like industry 4.0 - 5.0. The things that are necessary for us to catch them already need to be integrated, because we are going to miss a bigger train and a wider train, so it really needs to be integrated so we don't miss it."* Regarding the "Vitality Principle" code, P44 stated: *"In my opinion, it needs to be integrated into daily life a little. Because education does not attract people's attention in daily life. When I say I teach you, one does not want to take it, but it would be easier if you teach the student without him or her noticing that he or she has been taught something."* With these statements, the participants thought that training should be carried out using MAR not only in schools but in all areas of daily life. for the "Readiness" code, P40 commented: *"It can also be inbuilt inside the smart board. The file on each unit can be stored there. It is already open during breaks. So the students watch movies and they play music. I think it might be better to use them if we look at it from a positive side. Maybe they can work from there during the exam times."* Regarding the "Permanence (Hologram)" code, P25 said: *"Maybe it will be very utopian and difficult to do, but I think learning will be more permanent if the 3D object is more like a hologram."*

Regarding the "Controlled Use" code, P37 stated, *"It should be used, I think it's a good thing, but there is also something like this. Since the device constantly emits radiation, its use must take place in a certain period of time. I think it should be under control for health. And children say that it is the future of society. So I think it should be only allowed for a certain time, it should be under control."* Regarding the "Relativity to the Student" code, P13 stated: *"For example, we are teaching a subject and we can make a small game that covers all of the subjects related to that subject. Everything all together, all in one. As a mobile application."* Regarding the "Continuity" code, P41 commented: *"Having it used (by the students) continuously. Giving feedback in every lesson. For example, it may be effective if the teacher identifies and shows the mistakes."*. Regarding the "Compulsory Course" code, P15 said: *"It must be a compulsory course. If it happens, the number of teachers who use it will increase in schools as well, as they will graduate as teachers who have been taught already this, so it will be more common."*

One of the codes under the "Equipment" category is "Equipment Support." Regarding this code, P11 said: *"For example, something like this could be done. If we try to apply this in the village schools, the children there may not be able to afford it after a certain period of time. Such applications can be supported by a project such as FATİH project. Thus, even the poorest children can be reached more easily."* Regarding the "Developability" code, P19 stated: *"I think it is a good application that needs to be focused on. There must be enthusiasm. We need to learn, but I think we need to learn something. Let me say that at least this is the case for me."* Regarding the "Necessary Infrastructure" code, P35 commented: *"First and foremost, a student needs to know how to use the computer, for this application tom work."* Regarding the same code, P42 said: *"Computer training should be intensified."* The participants made a significant number of suggestions to increase the effect of MAR on teaching in their suggestions for using MAR more effectively. The participants agreed that this technology is one of the important educational technologies of today and the future, that it can benefit from different technologies such as hologram to offer more concretization in teaching, and it can be used in many lessons, but its healthy use should be monitored and ensured by the educator. On the other hand, they stated that in order for educators and students to use this technology actively, IT infrastructure and equipment should be strengthened and teachers and teacher candidates should be trained on this subject.

CONCLUSION AND DISCUSSION

The aim of this study is to determine the opinions of preservice social studies teachers about their experiences in an action research conducted on mobile augmented reality (MAR). The research lasted for an academic semester. During this period, pre-service teachers integrated video and 3D models, added educational games they prepared, added multiple 3D models and used multiple visuals as a marker, added sounds and expressions to the 3D models, added multiple scenes to the visual prepared as a marker and AR features such as connecting with button, added animation to the 3D model, and taught by virtual object guidance, increasing interaction between real-virtual by adding virtual button on real object. The 7 units in the social studies textbook were given to the participants throughout the study as homework to be structured within the scope of what was taught. Focus group discussions were held to reveal their experiences and opinions on the MAR during this process, and the data supported by researcher diaries and observation reports were analyzed by content analysis.

The analysis showed that the readiness levels of the participants before the applications were similar. However, it was found out that their background IT knowledge was insufficient to design MAR activities. It is thought that the main reason why they see the studies as difficult and complicated is this lack of background. The language problem is compatible with this limitation. However, the slow running of the program depending on the processors and graphics of the technological devices they have is a phenomenon that puts some of the participants in a difficult situation. While evaluating the trainings encountered, the fact that they do not have sufficient education and experience in technology at the beginning can be shown with certainty about technology, this competence has not received sufficient education and an adequate education.

These results clearly support the finding by Yıldız-Durak, Sarıtepeci and Bağdatlı-Çam (2020) which revealed that designing AR activities are time-consuming and require high-level technical knowledge, which similar to the findings of Akçayır, Akçayır, Pektaş and Ocak (2016), concluding that designing AR materials requires technical knowledge.

The participants interpreted the UNITY and VUFORIA programs used to carry out Mobile AR activities as complex, demanding, facilitating, understandable, functional and usable in different fields. They also thought that the use of AR on mobile devices would offer ease of access, increase interest, facilitate, provide active participation, complement and improve and change the perception towards the lesson. Participants generally mentioned the benefits of the programs used to develop AR. As it can be understood from the interview data, it was determined that the majority of the participants had problems because the language used in the programs was English. However, as a result of the experiences they have gained during the implementation process, they have overcome this problem and the positive comments they have made on this subject show.

These findings support the conclusion by Durak and Karaoğlan Yılmaz (2019) that MARs positively affect students' attitudes towards the course, make the course more attractive and effective, and contribute positively to academic success; and those by Sırakaya and Seferoğlu (2016), who reached the conclusion that AR activities made students more active in the lesson and increased participation. It also coincides with the findings of Küçük, Kapakin and Göktaş (2015) who concluded that using MAR in education provides ease of use. It is in line with the findings of Di Serio, Ibanez, and Kloos (2012) who concluded that the use of augmented reality in education will increase students' interest in the lesson.

The results obtained from the findings about the use of MAR in education are classified into three parts: 1) Contribution to teaching 2) Contribution to students 3) Contributions to teachers. Regarding their contribution to teaching, it was found that MAR means technology integration into education, it can concretize abstract concepts, supports teaching and ensures

permanence in teaching, increases motivation, keeps the focus on the course for a longer time, can be used to reinforce what has been learned, supports creative thinking, and fosters collaborative learning. In addition, it was stated that it is possible to show it in the classroom, in cases that are difficult to depict or go and see on the spot, dangerous and costly, and it is possible to display it in 3D and in the classroom environment with the closest to the reality, and this situation will make significant contributions to education. Considering the contributions to the student, it was found that it is interesting and it can make the lessons more enjoyable, it is a motivating element, it helps the student to grow, it encourages active participation, it is complementary to the subjects missed by the student, and it is an element that facilitates learning for students. Regarding its contribution to the teacher, it was viewed by the participants as the future educational technology, that designing MAR events will provide a significant professional benefit, increase the productivity of the trainer, contribute to the personal and professional knowledge, help educators keep up with the age, keep them social, create an awareness effect, and have a motivating effect on the educator. Ersoy, Duman and Öncü (2016) besides Ramazanoğlu and Aker (2019) reached the conclusion that AR significantly increases the motivation and success of students, offers ease of learning and positively affects motivation. Chen and Tsai (2012) found that MAR had a significant positive effect on the student interest and motivation towards the course, Özdemir (2017) concluded that AR plays an important role in concretizing abstract concepts, Aytekin, Yakın and Çelik (2019), who reached the finding that appeals to different sense organs, and Yılmaz (2012) found that it helped break the prejudices against the course and improved perception. Similar to Aker (2019) and Batdı, (2016) Yalçın Çelik (2019), found that AR materials are pleasurable, entertaining and will gain professional benefit by helping the educator to eliminate the problem of preparing material. Ramazanoğlu (2019) found that AR can be used in daily life as well as to improve the creativity of teachers.

As can be understood from the findings based on the group interviews, the MAR technology can be used not only in the field of social studies but also in many educational fields. However, a particular emphasis should be placed on the subjects of geography and history. On the other hand, MAR can be used effectively in medical education as well as courses such as geometry, physics, biology, chemistry, mathematics, science, and technology. This conclusion is also supported by İmamoğlu and İmamoğlu (2018), who found that it would be beneficial to use AR in the field of Geography, and Koçoğlu, Akkuş and Özhan (2017), who reached the conclusion that it positively contributed to the academic achievement and spatial intelligence of students in Mathematics and Geometry. It is also in line with the findings of Avcı and Taşdemir (2019), who found that AR has increases academic success in Chemistry and the Technology courses.

It is thought that it is important for the participants to make suggestions on the more effective use of AR in education based on the experience they have gained during the study, since they are pre-service teachers. The participants in the current study generally made suggestions on increasing the impact of this technology on education. They agree that it will foster learning retention when supported by technologies such as holograms, it should be a required course for preservicer teachers in education faculties, and that AR-supported mini-games can be added to the subjects at the end of the units in textbooks. However, they emphasized that since this technology will be installed in mobile devices, some health problems may occur, so it should be used in a regulated and supervised manner. In addition, the participants emphasized that the MAR should not be limited to the field of education only, but can be used effectively for the education of the general society.

Considering the results of this research, it is thought that it will be useful to consider the following suggestions: In order to minimize the problems that arise while developing AR applications, applications with a simpler and Turkish interface can be developed. On the other

hand, academic studies that compare AR studies in Turkey with AR studies abroad and show how we are in this regard can be carried out. Finally, AR studies, which are very rare in the field of social studies, can be carried out with much larger audiences at different levels of education.

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