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Investigation of Primary School Teachers Opinions on the Use of Augmented Reality Supported Course Materials

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Abstract

Augmented reality (AR) technology is seen as a factor affecting teaching processes with digital transformation. In this context, the main purpose of this research is to determine the views of primary school teacher on the use of augmented reality supported course materials. The research was conducted with a case study design in accordance with the qualitative method. The study group of the research consists of 25 primary school teacher working in the Lüleburgaz district of Kırklareli province in the 2022-2023 academic year. The research data were collected by focus group interview technique using a semi-structured interview form. Based on the analysis of the findings of the research; it is possible to say that the participants lack knowledge and misconceptions about AR teaching materials, that the participants cannot use AR-supported course materials in lessons because they find their own digital skills insufficient, and that teachers need applied training to improve their digital skills. In the case of using AR materials, it was determined that they tended to use them as an attention-grabbing tool in the introduction of the lesson, to visualize Mathematics and Science lessons, and to eliminate the lack of materials in the lessons. Considering the primary school program and classroom conditions, it was concluded that AR-supported course materials will become useful only with laboratory environments to be established in schools.

Keywords: Augmented Reality Technology, Teaching Materials, Classroom Teachers, Digital Revolution

Introduction

Throughout history, technology has been a force that has affected and changed the dynamics of humanity in various ways. This power continues to change dynamics rapidly today. Digital tools that have emerged with technological changes in all areas of life have gained an undeniable place in human life. According to Alamri et al. (2020), people's use of digital tools in every field is a major factor in the formation of the digital revolution.

The advantages offered by the digital revolution to humanity show its effect in the field of education as in every field. When educational environments are examined, it is seen that teachers and students want to integrate digital tools into the teaching process (Billinghurst & Dünser, 2012). Different digital tools have been produced for this purpose. Among these tools, AR-supported instructional materials have become the focus of scientific research because of their high potential in the field of education.

The concept of AR, which is frequently encountered in studies conducted in various disciplines, has also been the subject of studies conducted in the field of education by expanding its scope. Azuma (1997) defines AR as the combination of concrete materials with abstract objects. Carmigniani and Furht (2011) defined it as the instant visualization of computer-generated data in the real world. When all the definitions in the literature are examined, it is possible to express the concept of AR as the connection of abstract objects and concrete objects with each other.

According to Wu et al. (2013), AR technology offers new solutions to teaching processes. Teachers and students frequently prefer AR technology because of the solutions it offers. Çokçalışkan (2024) concluded in his study that augmented reality supported education environment increased students' spatial abilities, made the lesson interesting and fun, and made the education permanent. In other findings of the study, it was determined that the majority of the students did not have difficulty in using the augmented reality supported course material, but the students did not have knowledge about augmented reality technology. Based on this study, it is possible to say that teachers, who are the implementers of the curriculum, are insufficient in integrating current technological materials into the teaching process.

In order for teachers to be able to combine technology and teaching; they need to adapt to digital life, keep up to date with the technology applications integrated into education and have the competence to apply the developing technology.

When the literature on AR applications in the field of education is examined; it is seen that mixed studies are emphasized (Keleş, F. & Yavuz, S. (2022)). When we look at the distribution of the examined AR technology studies in the field of education, it is possible to say that the most researched branches are science and mathematics.

In the studies of Akgün & Üstün (2023) and Çiloğlu et al. (2021), it was concluded that researchers mostly preferred to work with university students in the participant level dimension.

It is possible to come across many studies from different disciplines on augmented reality supported course materials. However, there are not enough studies examining the views of primary school teacher on AR applications at primary school level. Primary school teacher views on AR-

supported instructional materials play a major role in the context of integrating AR technology into the teaching process.

Therefore, there is a need to investigate the views of primary school primary school teacher, who are the implementers of the curriculum, on AR-supported instructional materials.

In this context, this research aims to;

- It will pave the way for cooperation with teachers in the dimension of material production in line with the opinions of teachers who are the implementers of the teaching-AG integration process
- It will contribute to the trainings expected to be provided to increase teachers' digital skills,
- By contributing to the literature as a qualitative study, it is thought that the findings to be obtained from this research will guide future studies.

Purpose of the Study

The main purpose of the study is to determine the opinions of primary school teacher on the use of augmented reality supported course materials. The sub-objectives of this study aiming to determine the opinions of primary school teacher are listed below;

Primary school teacher;

- What are their views on the concept of augmented reality?
- What is the first opinion that comes to their mind when they think of augmented reality?
- What are their views on the integration of augmented reality applications into education?
- For what purposes do they use AR-supported instructional materials, if they use them?
- What are their views on the usefulness of augmented reality supported instructional materials in lessons?
- How do they feel competent about augmented reality-supported teaching practices?

Method

Research Model

This study, which aims to examine the opinions of primary school teacher on the use of augmented reality supported course materials, was structured according to the case study design.

According to Creswell (2007), case study is a qualitative research approach in which the researcher examines limited situations in depth through the resources created by the researcher and presents the examined data in the form of a case description. In case study, the design of studying what is understood from the situation in the most perfect way instead of generalization is emphasized (Denzin & Lincoln, 1985: 435) (cited in Aytaçlı, 2012).Case study is frequently preferred as a research strategy in qualitative research in the field of education (Aytaçlı, 2012).

Yıldırım and Şimşek (2008) categorized the steps to be followed in the case study planning phase into eight categories;

- Developing Research Questions

- Developing the Sub-Problems of the Research
- Determination of the Unit of Analysis
- Determining the Situation to be studied
- Selection of Individuals to Participate in the Research
- Collecting the Data and Relating the Collected Data to the Sub-Problems
- Analyzing and Interpreting Data
- Reporting the Case Study (cited in Aytaçlı, 2012)

In this context, case study was determined as an appropriate design to examine in depth the views of primary school teacher who directly use instructional materials on the use of AR-supported course materials.

Samlple Group

The study group of the research consists of 25 primary school teacher working in the Lüleburgaz district of Kırklareli province in the 2022-2023 academic year. Six primary schools were randomly selected from Lüleburgaz district to conduct the research. Interview appointments were taken from the selected schools and focus group interviews were conducted with volunteer teachers. In the selection of volunteer teachers, different years of professional experience and gender balance were taken into consideration.

Table 1. Demographic Information of the Participant Group

Participant Code	Gender	Lengthof Service	Career Title	Grade Level
K1	Female	11.Year	Expert teacher	2.Grade
K2	Female	34. Year	Headteacher	2.Grade
K3	Male	18. Year	Expert teacher	2.Grade
K4	Male	12.Year	Expert teacher	2. Grade
K5	Female	21.Year	Expert teacher	3 Grade
K6	Male	21.Year	Expert teacher	3.Grade
K7	Female	29.Year	Headteacher	2.Grade
K8	Male	10.Year	Expert teacher	1.Grade
K9	Female	1.Year	Teacher	4. Grade
K10	Female	17. Year	Expert teacher	2. Grade
K11	Female	23. Year	Expert teacher	4. Grade
K12	Female	17.Year	Expert teacher	4. Grade
K13	Male	24. Year	Teacher	4. Grade
K14	Male	32. Year	Headteacher	2. Grade
K15	Female	20. Year	Expert teacher	2. Grade
K16	Male	17.Year	Expert teacher	3. Grade
K17	Female	35. Year	Headteacher	2. Grade
K18	Female	35. Year	Headteacher	4. Grade
K19	Female	28. Year	Expert teacher	2. Grade
K20	Female	16. Year	Expert teacher	1. Grade
K21	Male	38.Year	Expert teacher	4. Grade
K22	Male	30.Year	Headteacher	2. Grade
K23	Male	35.Year	Headteacher	3. Grade
K24	Female	23.Year	Expert teacher	4. Grade
K25	Female	20. Year	Expert teacher	4. Grade

Data Collection Tool

In this study, which aims to determine the opinions of primary school teacher on the use of augmented reality supported course materials, a semi-structured interview form was used as a data collection tool. The interview form was structured in accordance with the sub-objectives. The form, which was created with various questions by conducting a literature review, was finalized by taking expert opinion. Ten open-ended questions were determined for the semi-structured interview form. Care was taken to ensure that the questions were not directive and judgmental.

Data Collection

The study data were collected through focus group interviews. In line with this goal, focus group interviews were conducted with a total of 25 primary school teacher from 6 different primary schools. Prior to the focus group interview, schools were visited and teachers who wanted to voluntarily contribute to the study were met and the day and time were planned.

Before the interview was started, each participant group was informed about the research and a 'Participation Acceptance Form' was signed. Before starting the interview, the participants were informed that a voice recorder would be used in accordance with ethical rules. The data collection process started after the participant approval was obtained. Each participant group was interviewed for an average of 45-60 minutes. In the study, the participants' answers to 10 interview questions were recorded digitally and the recordings were transcribed and systematic arrangements were made. The audio recordings were permanently deleted after the approval of the researchers for transcription was obtained.

Analysis

The interview questions of this study were analyzed using the descriptive analysis method. According to Ültay (2021), descriptive analysis is defined as the stage of examining and organizing the research in depth and then determining general trends. The aim of descriptive analysis is to interpret the data obtained under themes and present them to the reader. In research using descriptive analysis, quotations should be given directly to protect the validity of the study (Yıldırım & Şimşek, 2021).

Findings

In this part of the study, the interview questions prepared within the framework of the stated sub-objectives are analyzed, interpreted and presented.

Views on the Concept of Augmented Reality (AR)

Participants conveyed their first opinions that come to mind when the concept of AR is mentioned by giving examples of applications. Participant groups were united in their views on 'Atatürk Portrait' and 'Virtual Museum Trip', '3D' and 'Artificial Intelligence'. When the application examples that come to mind when it comes to AR are examined, it is possible to say that some participants created misconceptions about augmented and virtual reality.

' Normally, for example, on certain days and weeks, especially on November 10, you can reflect Atatürk. For example, you can take a photo with the child or while explaining something and there are applications. I am not very

familiar with the applications. For example, the layers of the world in 3D... there are many different applications. I don't remember what it's called, you download it to your phone and then you can see it in front of your eyes, in the way the child can see it. I mean, for example, these are the ones I can think of right now, I'm not exactly sure' (K1).

'Virtual museum trips, there are virtual museum trips we do in the classroom.' (K3)

'3 dimensions.' (K4)

'.... Now, for example, he said cotton or Ani Ruins or Atatürk. He normally goes there to see it, but he moves it to the virtual environment, so it is a little more abstract.'(K8)

'Atatürk's photography is not in the lesson or there were museum trips or something ... panoramic trips.' (K24)

'When I think of AG, I think of the virtual world. A virtual world created with artificial intelligence. AR applications come to mind.'(K10).

Among the participants, P8 reported that the first thing that came to his mind about the concept of AR was 'abstracting the concrete', while K4 and K5 expressed their opinions on concretizing the abstract.

'*.....You are trying to make it concrete.*' (K4)

'It's not reality, it's virtuality becoming reality. It looks like reality. Is it reflecting things that cannot happen in the classroom environment?' (K5).

''I think it is like abstracting the concrete. Now, for example, he said Pamukkale or Ani Ruins or Atatürk. He normally goes there to see it, but he moves it to the virtual environment, so it is actually a little more abstract.'(K8)

Based on the views expressed by the participants; it is possible to say that some participants have no knowledge about the concept of AR.

'Augmented reality. More realistic methods?' (K2).

'I don't know what augmented reality is' (K6).

'Is it that they buy land from space?' (K19).

'For example, its value was not that much, but showing it as if it is valuable with someone's name increases its value' (K21) (K19, K20 participated).

Opinions on the Integration of AR Supported Course Materials into the Educational Process

Participants expressed common views that negative as well as positive situations may arise in the process of integrating AR-supported course materials into the teaching process.

Opinions on the Positive Impact on the Teaching Process

The participants had a common opinion that AR materials are remarkable and facilitate learning. In addition to these views, they expressed common views that AR materials have a supportive quality in the teaching process and that using AR-supported materials in the dimension of dangerous or inaccessible materials will positively affect their teaching processes.

'It can attract attention, it can facilitate learning, and as I said, it can support. I mean, I don't know if it can be done only with it. I mean, I think that something should be done with it in other activities.' (K1).

'I mean, augmented reality is the newest application that attracts students' attention among other technological applications. But it is probably the most difficult one.'(K4).

'In materials or situations that we do not have access to, yes, it would be very useful, that is, when children see it in 3D, it causes a different excitement in them, it attracts attention. It attracts attention.'(K24).

Opinions on the Negative Impact on the Teaching Process

Participants shared the common opinion that there could be many problems when using AR materials. Participants emphasized that five sense organs should be used for permanent learning and stated that AR applications are abstract materials due to the fact that students cannot touch them and that they can dull students' imagination.

'For example, he can't touch, touch is very important, you know, in these 5 sensory organs, the child should be able to call out under normal conditions, yes, learning can take place from there, it can attract attention, he can see it in 3D form, it has many things, but we can't say that all of them are okay, I think it can only be a supporting part.' (K1).

'I think it dulls the imagination.' (K5).

'Touching is always touching, so the more you address people in the eastern environment, the more useful it is.'(K6)

Some participants expressed the view that it is difficult to adapt AR technology to the activities and that there may be concentration losses due to the crowded classes in the lessons where it is adapted.

'While teaching in the classroom, it is difficult to concentrate the children there... I mean, if they are interested, they will automatically concentrate, but if a child who distracts their attention makes a different movement, for example, it is difficult to maintain concentration at that moment' (K4).

'I mean, maybe because the classes are very crowded, so could there be a problem at that moment? Or can I waste time with him when I can give him differently? I mean, I think it is related to the subject you are going to give. I think the same way with him, just as there are positive and negative aspects in all of them.' (K2).

'They cannot use it in every subject. I can say that we have problems both in terms of time and material.'(K3).

One participant stated that AR applications have become widespread and started to be used in every field, and if they are frequently used in teaching processes, their attractiveness will decrease.

'...and if it is something that is easily accessible, when it is easily accessible in everyone's hands, there is an indifference to it, it becomes normalized, it becomes ordinary.' (K13).

When all the opinions of the participants regarding the integration of AR materials into the teaching process were analyzed; two participants interviewed in different groups reported two opposite opinions on the point of 'imagination'.

'Imagination increases, children have imagination, but we keep them constantly playing games with computers, tablets, whatever, they can't

imagine. They are not well immersed in the game. They learn better by seeing.' (K22)

'I think it dulls the imagination.' (K5).

Opinions on Purposes of Use

When the opinions of the participants regarding the purposes of using AR materials were examined; they unanimously reported that they can be used as an attention-grabbing tool in introductions to the lesson, for visualization purposes in mathematics and science lessons, and to eliminate the lack of materials or the need for dangerous materials.

'Now especially math and science. The opportunity to see and examine more concrete thin 3-dimensional tools at that moment...There may be natural phenomena, there may be 3-dimensional objects in 3-dimensional mathematics.' (K1)

'For example, I think it is very productive in math and geometry, yes, it is only productive there, but also in science, you know, the movements of the earth, the planets, they are very good, I think it is productive in them.' (K24)

'...it's like if you don't have a material, we were able to show that material by using it' (K8)

'I think visuality is very important. Of course, I mean, bringing something that is not possible to life.'(K7)

'Augmented reality can be used in experiments or something like that which can be dangerous.' (K23)

Opinions on the Usefulness Dimension of AR Supported Course Materials;

Participants stated that the only phone they could use while implementing AR supported activities was their own and that this situation would cause a waste of time. As a solution to the lack of tools in the classrooms, it is among the common opinions that the state should support each school.

'If we make applications with our phones, it would be a waste of time because students would look at them one by one. The state should provide opportunities' (K9).

'Computer classes were created in time, but they were left halfway. If those computer classes had continued, there would have been time for that. Each child would have a computer in front of them' (K21).

'Schools should be supported and if necessary, laboratories should be built in schools.' (K5).

'If we say that it is free to come to school with phones today, they will all come with phones and there will probably be chaos.' (K13).

In order to use AR-supported materials in teaching processes, all students should have access to these materials. Participants had 2 common views about the solution of this issue. The first opinion was that students should bring tablets/phones to school, but it was not seen as a viable solution because bringing phones/tablets to class would weaken the teachers' control of the classroom and not all students have equal opportunities. The second opinion is that the state should support schools and AR laboratories should be established. When the opinions of the participants are analyzed, it is among the common opinions that it would be easier to

integrate AR materials into the teaching process if laboratories are established.

Some participants were of the opinion that the digital tools used in teaching are visually useful, but they prevent students from learning by touch. They stated that screen addiction has increased due to the fact that students are exposed to too much technology in their daily lives, and as a result, AR applications should not be used at the primary school level.

'I think that children should be removed from the screen as much as possible.'(K25)

'Not suitable for primary school.'(K24)

'I think the child should be away from the screen or such things from our childhood until they finish primary school, they should first encounter these things, for example in the fourth grade.' (K13)

Primary School Teacher Opinions on the Competence of Using AR Supported Course Materials

Most of the participants stated that they did not consider themselves sufficient in terms of using AR-supported instructional materials, but that every teacher could learn new technologies if they were given training on this subject.

'I mean, first of all, we can think of it as our transition to smart boards. My concerns and worries were small at that time, but I said that I could overcome them, but since I see it as a little more elaborate, and you know, yes, I can say that it is enough for me when you do this and that application with these, I can conscientiously say that it is enough for me, so I didn't go there too much. That's why I don't consider myself enough. But if you say, let's open a training program or something like that, I believe that I can do it more willingly with guidance. I can have some difficulty on my own.' (K1).

'Not for now, of course we need to learn something. Of course, after learning it, we can adapt ourselves to its use as we see fit, that is, we can adapt quickly, but the important thing is to learn it, that is, how to use it, how to do it.' (K13)

'I do not consider myself sufficient. I believe that every teacher can learn easily if the environment is prepared a little more. How did the teacher learn the smart board? Therefore, he/she will learn that method as well. Everything is education' (K19).

'I came for 5 days and someone lectured to us, but it is still not possible. If you want it as a practice, for example, if we had a coordinator, if there was a solution to our problems, if there was such a thing.... I think a team should be established.(K5).

Some participants stated that they could not allocate enough time to learn AR-supported instructional materials due to their concerns about the curriculum, the high number of students in the classes, and the excessive amount of chores such as filling notebooks. In addition, they reported that they experienced the difficulty of using AR-supported materials and that these difficulties reduced their motivation.

'I do not consider myself sufficient. Because sometimes I am overwhelmed by the workload. I mean, I can't spare time for this because of our work outside the classroom. Our classes are crowded, we have classes of 37 or

38 students here. Sometimes when I say I will finish an application, 3 classes end. This time everything breaks down for us, in terms of planning, I mean in other classes. I don't consider myself sufficient anyway. I guess I don't have that motivation because I see that difficulty when using augmented reality.'(K4).(Other participants also approved)

'I mean, if we try, I don't want to be so cocky, but we can all do it. If we all try, yes, we can do it, but that should be our priority, that is not the priority. Our priority is to educate the curriculum, our priority is to prepare children for something and if this is our priority, we can do it.' (K6).

Participants stated that they received information from phenomenon teachers who share posts on social media in order to learn about current technological materials. Based on the opinions of the participants, it is possible to say that teachers are open to learning and use social media as a tool to support teaching.

'This thing, it's a sea, so when there is a need, when you search, you find it. I use it when I need it, but there are many. As my friend said, there are a lot of these things especially on social media, and we should congratulate the teachers who are trying hard.' (K3).(Other participants approved)

When we examine the teaching tools used by pre-service teachers in faculties of education in recent years, it is possible to say that digital tools are used a lot. Pre-service teachers who know and use digital tools adapt to digital tools faster than teachers who do not have technological infrastructure. Teachers with less tenure have an advantageous situation in terms of adaptation to digital tools compared to teachers with more tenure. K7 and K2, who have the title of head teacher, reported that they had difficulties when they were exposed to digital tools, but they overcame these difficulties by making an effort. According to the views of the participants, the reason why their digital skills are insufficient is that they do not have a technological education background. They emphasized the permanence of learning by doing and experiencing processes and stated that trainings should be face-to-face and applied.

'Maybe young people are different, I mean, let me talk for teachers over 20 years of experience, I mean, our main acquaintance with technology was during the pandemic process, so yes, we learned to cope with the problems or work there, in fact, it is definitely not enough, you know, smart boards are a very big problem, etc. Of course, we cannot handle it ourselves, we get help, maybe we are getting help about it right now and courses are organized, but it is not like that, I think we need to do the same as we tell our children by doing and living.'(K7) (K1,K3 participated)

'I don't use it. I couldn't get to this stage anyway because I felt inadequate in terms of technology and infrastructure.' (K2)

Discussion and Conclusion

In this study, the opinions of primary school teacher on the use of augmented reality supported course materials were determined.

When the first opinions brought to mind by the concept of AR were examined, the participants were united in application examples. The most repeated application example of the participants was determined as 'Atatürk Portrait'. In the study of Türksoy & Karabulut (2020), it was

concluded that the participants characterized the AR concept as an application.

When the application examples given by the teachers to express their opinions were examined, it was concluded that they had misconceptions about augmented reality and virtual reality technologies. When the opinions of Türksoy & Karabulut, R. (2020) on the AR concept knowledge of primary school teacher are examined, it is seen that approximately half of the participants do not know the concept or explain it incorrectly. From this point of view, it is thought that primary school teacher do not have sufficient knowledge about the concept of AR.

The dimension of integrating AR-supported materials into the teaching process was determined in two sub-themes as positive and negative opinions.

Most of the participants stated that AR materials would contribute positively to the teaching process in terms of increasing students' interest in the lesson and providing easy learning by concretizing the subjects. Based on the findings, it was concluded that primary school teacher have a positive approach to the integration of AR-supported materials into the teaching process.

When similar studies in the literature are examined, the results support the views of the participants. In Dikmen & Bahadır's (2021) study, it was concluded that AR applications positively affected the teaching processes. In the study conducted by Sontay & Karamustafaoğu (2023), it was stated that teachers can use AR applications to concretize the teaching process and facilitate teaching.

Although the participants were of the opinion that AR applications would make positive contributions to the teaching process, negative opinions were also expressed. Based on the negative opinions expressed by the participants, it can be said that AR-supported materials alone are not sufficient to ensure permanent learning, and if they are used continuously in teaching processes, their attractiveness will decrease, and teachers may have difficulty in collecting students' attention in classes with high class size. According to Demirel et al. (2004), the frequent use of digital materials alone in teaching environments is not enough to increase academic achievement and curiosity. Therefore, in order to use AR-supported materials efficiently in teaching processes, it is recommended to prepare the lesson plan in detail and use the materials within certain limits.

Attracting students' attention at the beginning of the lesson process increases their curiosity and motivation. Students who are curious about the lesson are active in the process and realize permanent learning. When the opinions of the teachers regarding the purposes of using AR materials are examined, it is seen that they agree on using it as an attention-grabbing tool at the introduction stage of the lesson. Başaran et al. (2022) concluded in their study that AR-supported materials raise students' curiosity to the highest level. Other studies in the literature also support these results. (Akpınar &Urhan (2017), Sontay & Karamustafaoğlu (2023), Önal (2017)).

Within the framework of the findings related to the usefulness dimension of augmented reality supported instructional materials in the lessons; the opinions that the technical problems and lack of tools that may be

experienced while using AR applications will negatively affect the attention of the students and the teacher's classroom dominance are dominant. Based on the findings, it was concluded that in order to increase the usefulness of AR materials, the number of students in the classes should be reduced and state-supported laboratories should be established.

Another factor affecting the usefulness of AR materials is the age level of the students. When the opinions of the participants were analyzed, it was seen that it is an early period to use AR materials in primary school. Çakmak (2015) emphasized in his study that the emotional development of children exposed to technology at an early age is negatively affected.

When the competence views of the participants regarding the use of AR materials are analyzed, it is determined that the majority of them have the view of 'inadequacy'. Based on the opinions of the participants, it can be said that teachers cannot spare time to learn and apply current teaching materials due to their high workload. Among the common findings is the view that teachers overcome their lack of knowledge from the phenomenon teacher profiles sharing on social media. From this point of view, it was concluded that teachers are open to learning AR technology. Studies have indicated that social media applications can support teachers' skills such as cooperative learning and problem solving (Kıcı & Dilmen, 2014).

It is seen that the participants agree on the need for practical training in order to increase their competencies in AR technology. It can be said that the concept and competency dimension findings of this study have reached a common solution. It is thought that the applied in-service training recommended to be given to teachers will increase the level of knowledge of teachers about AR applications and ensure that teachers have sufficient skills.

Recommendations

- Face-to-face and practical in-service trainings can be organized for teachers on using AR-supported materials.
- AR laboratories can be established in schools for AR applications.
- Activities can be organized to increase teachers' professional motivation.
- Updates can be made in the curriculum by integrating activities into units suitable for AR technology.
- Within the scope of AR-supported instructional material production, cooperation with teachers, who are the implementers of the teaching process, can be ensured.
- The effects of AR applications on primary school students can be investigated.
- Primary school teacher opinions on AR-supported instructional materials can be further analyzed.
- Does the presence or absence of AR applications in teaching make a difference in education? The question can be investigated.

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