

The Effect of Augmented Reality Technology on the Performance of University Students

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Abstract—In this study, which was created with distance education and augmented reality technology, it was aimed to determine the effect on the performance of university students. When the research is examined, it is seen that the quantitative research method is used. The study was carried out in the fall semester of 2021–2022. A total of 422 volunteer university students who continue their achievements in the study participated in the research. In the research, augmented reality, virtual technology and distance education were taught to university students for 5 weeks via online application training. The data collection tool, which was developed by the researchers and organised by experts in the field, was used in the study, simply called ‘Augmented Reality’. The data collection tool was used to collect data of the people who participated in the research and created the research by solving it with the help of virtual programmes. In the analysis of the collected and compiled data, frequency analysis and *t*-test were used by using the SPSS programme, which is preferred in many studies, and the results were added to the research in the presence of tables. According to the results obtained from the research, it was concluded that university students’ views on distance education and augmented reality were high and there was a difference.

Keywords—distance education, augmented reality, university students

1 Introduction

Information and communication technologies in society and in the world have become an ordinary part of our learning experience, both social and virtual learning environments, and tools and are known to have emerged as tools that enhance the learning process [19]. The courses along with application programmes and skills make communication effective and efficient as possible in the process of teaching based on learning new technologies and methods to be implemented and the result is that it is relevantly observed in studies [1]. One of the technologies for students’ courses is augmented reality and virtual lessons, and technologies defined by extended or augmented reality expressions have been used in this environment [17]. The research examined

and looked at the augmented reality applications in the literature, which showed that it has three characteristics: blending in real and virtual-to-real environments, real-time interaction and three-dimensional environments. It is known that the positioning of these elements is in the form mentioned earlier [4]. While the concept of augmented reality with distance education is shown in the real–virtual continuity diagram, it is seen that the continuity really extends towards distance education within this time frame [12]. Studies on distance education in an environment have enhanced augmented reality and real-sanalik has increased to a target that is closer to the real world. It is also observed in the virtual world that augmented reality apps atrium during instructional activities provide learners abstraction from the real environment, instantly offering more fun, and meaningful interactions can make the learning process interesting [14]. In addition to students' reaction to mobile technologies, it also allows them to react to learning content with their smart devices by enriching the interaction of the content being taught and the content being studied [18]. In other words, effective learning takes place as long as the learner has fun in the learning process and actively participates in the learning process, and the interaction element that has an important role at this point can be provided by augmented reality applications [8]. Applications of augmented reality merging into the educational process provide students, educators and professionals real-life-like interactive experiences between media and content; learners can freely explore their learning experiences by organising elements of real life by implying aspects that are provided to enable one to learn by doing and experiencing [16]. Problem-based somutlastirild, such as abstract concepts and different learning styles, offer one the opportunity to be flexible in the learning process learner-centred approach that provides support materials to be placed in the real world of virtual elements, which is possible with augmented reality technology development

It is seen that educational environments designed with augmented reality technology enable learning experiences to be experienced at the points of enhancing the effectiveness and attractiveness of teaching processes in education, enriching the content of education and supporting and increasing the perceptions of learners [7]. Virtual environments for distance education basic education it is known that they are indifferent to this change is performed, is also traditional and distance education has evolved with the changes in the information age digital books digital book with augmented reality technology is placed inside interactive e-book emerged samples [3]. The ability to transfer multimedia-enhanced course materials to students and the creation of an educational context allows students to become individuals who actively structure information in the form of recipients. Augmented reality is emerging as a technology that can be used to provide learners with a meaningful learning experience by presenting their language skills and fields in an interactive way in a real-world context [10]. Education is effective, efficient and attractive and different teaching methods are used in order to make the use of computer technology, a requirement of these methods, which is supported with our age and education are intertwined continuously [20]. The effective use of this technology is that students will increase in their classes the interest, motivation and success. In this article, it will continue to be designed by patterning for this purpose.

1.1 Related research

Eldokhny and Drwish (2021) aimed to investigate the effectiveness of augmented reality in online distance learning in their study and, as a result, emphasised that it is more effective in supporting augmented reality in distance education. In general, they have concluded that augmented reality or an animation is an effective method for learning patterns effectively in online distance learning during the pandemic period [9].

Wang and chin (2021) investigated students in the field of cultural heritage for an activity that enabled us to observe and learn the basic information about authentic learning-based mobile augmented reality. Augmented reality technology is a system, and as a result, it is used to investigate whether students' interest in learning and outdoor environments, enhancing the potential to improve learning achievement and carry-based mobile type system when applying the results showing the performance and content of recall increases have got interest in learning [6].

In Kaya and Bicen's (2019) study, augmented reality applications were used in almost all educational and training environments [11]. In this study, applications of augmented reality in educational environments of use perceived usefulness, attitudes and the relationship between benefits, as well as the relationship between attitude and academic achievement levels is intended to applications related to augmented reality in educational environments, and as a result, students' attitude levels are strongly and positively perceived with ease; they have reached the results that it has an effect on attitude levels and academic success.

As can be seen from the relevant research, it is believed that augmented reality and distance education always benefit students in studies, while it is always thought that this environment will benefit areas and topics that are well prepared for them and meet well with students within the field. In this research, it is aimed to design good research for the field.

1.2 Purpose of the study

In this section, distance education and augmented reality technology are designed with the aim of determining the effect of the people participating in the research on their performance. In addition, answers were sought to the following questions regarding this situation:

1. What are the time periods for the augmented reality applications of the people included in the research during the day?
2. What are the frequency rates of the time periods spent by students included in the research for distance education?
3. What are the devices that the students participating in the research access while using applications for research and distance education technology?
4. What are the opinions of the people included in the research about distance education and augmented reality?
5. Is there a significant difference in order between distance education and augmented reality situations according to the class grouping of the students included in the research?

2 Method

In this section, which continues the research, information about which model the method is in is written and when the method part is discussed, it is mentioned which method and model is used in the study and it is seen that information about this subject is included.

2.1 Research model

In this section, it is seen that information is provided about which model was used in the study. It is also seen that the quantitative research method used in most studies was used in the study. It is known that the quantitative research model is used to reach a conclusion, categorise and interpret numerically excessive actions in the future and in the past [15]. This study was designed according to determining the effect of distance education and augmented reality technology on university students' performance through the quantitative research method.

2.2 Working group/participants

Working groups are known as the section where there are people who are in the study, and it is seen that there are 422 participants in the research voluntarily. The data collection tool was applied and collected with the help of electronic media.

Gender. In this section, it can be seen that the distinctions of the participants in the research according to the concept of gender are presented in Table 1.

Table 1. Distribution of the university students participatissng in the study according to the gender variable

Gender	Male		Female	
	F	%	F	%
Variable	220	52.13	202	47.87

When the gender variable of the students included in the study is considered, distributions are determined according to the gender variable and numerical values are added to Table 1 by considering additional relevant information. In this context, 52.13% (220 people) were male university students, while 47.87% (202 people) were female university students. In the gender section, the findings reflect the actual gender distribution.

Situations where university students devote time to augmented reality applications during the day. The time periods of the people included in the study allocating time to the augmented reality applications in a 1-day period are discussed and categorised and the analysed data are added.

Table 2. The situations where university students devote time to augmented reality applications during the day

Times of Augmented Reality Applications	1–2 Hours		3–4 Hours		5 or More Hours	
	F	%	F	%	F	%
Variable	87	20.62	175	41.47	160	37.91

In order to be a little closer to the purpose in the study, some applications were developed and brought together with university students and it was expected that they would follow-up and take time during the day. These data are presented in Table 2. In this context, when Table 2 is examined, 20.62% (87 people) expressed devoting time to augmented reality for 1–2 hours, 41.47% (175 people) were in the range of 3–4 hours and, finally, 37.91% (160 people) for over 5 hours. In this context, it is observed that the situations of university students devoting time to augmented reality applications during the day are mostly preferred in the range of 3–4 hours and.

The time spent by university students for distance education. While some information is given in this part of the study, it is seen that the duration of use of the people included in the research in the daily time frame for distance education has been examined and presented in Table 3.

Table 3. The time spent by university students when using distance education

Distance Education	1 Hour		2 Hours		3 Hours		4 Hours	
	F	%	F	%	F	%	F	%
Variable	67	15.88	81	19.19	107	25.35	167	39.58

In this section, the frequency of time spent by the people included in the study while using distance education was examined and it is seen that it was collected upon request from the people participating in the research. 19.19% (81 people) stated that they used distance education for 2 hours, 25.35% (107 people) stated that they used distance education for 3 hours and, finally, 39.58% (167 people) stated that they used distance education for 4 hours. In this context, it is seen that university students prefer the amount of distance education used in the research, with a frequency of 4 hours the most.

Class status. In this section, the class grouping of the people included in the research is included.

Table 4. The distribution of university students according to their class status

Department	2. Class		3. Class		4. Class	
	F	%	F	%	F	%
Variable	105	24.88	111	26.30	206	48.82

When Table 4 is examined, the numerical values of the people included in the research according to their class status are discussed and the information of university students. In this context, when Table 4 is considered, it is seen that 24.88% (105 people) are in the second year, 26.30% (111 people) are in the third year and, finally,

48.82% (206 people) are in the fourth year. It appears that most of the students were in the fourth year.

2.3 Data collection tools

In this section, it is seen that some information about the data collection tool is included in the research. The data collection tool was created and arranged by the researchers. The data collection tool, on the other hand, was examined by experts in the field of augmented reality and distance education within the participants and the unsuitable items were removed from the study and corrected. A personal information form called ‘Augmented Reality’ data collection tool, which was applied to the participants with the MS Teams form and developed by the researchers, was used. The content validity of the developed measurement tool was shown to three professors and two associate professors working on augmented reality and distance education, and the meaningless items were removed from the data collection tool.

1. First form: Some information, such as gender, class etc., was given in this form and the participants were requested for the same.
2. Second form: A 5-point Likert-type questionnaire was prepared in order to get information about the opinions of the participants in order to improve their augmented reality and distance education status, and also to be better. 17 items out of the 23-item measurement tool were used and 6 items were extracted by the experts in the data collection tool. University students’ opinions were sought from two factorial dimensions, i.e., ‘Distance Education’ and ‘Augmented Reality’. The Cronbach alpha reliability coefficient of the measurement tool as a whole was calculated as 0.93. The measuring tool was in the range of ‘strongly disagree’ (1), ‘disagree’ (2), ‘undecided’ (3), ‘agree’ (4) and ‘strongly agree’ (5). The measurement tool was also collected by the researchers in the form of MS Teams.

2.4 Application

In this section, it is seen that information about the application part is given. 422 volunteer university students attending different educational institutions in the Kazakhstan region were determined and a live course environment was planned to develop the concepts of augmented reality and distance education. In addition to the education in the school environment, it is aimed to continue the use of augmented reality terms and appropriate applications and technologies, and this situation is explained to university students. Providing live lessons with distance education and combining this situation with distance education technologies’ support was received by the researchers, and when the activity part of the research was finished, the measurement tool was sent via MS Teams to university students and it was implemented, determining how often they learn and use distance education applications, augmented reality applications and videos to university students in education and how often augmented reality situations are used with distance education. Such situations were given to university students in the form of education with technology and university students were expected to attend the event on this subject every week. After the 5-week activity, the data collection tool and

the information form were applied online to the people who participated in the research, and it is seen that the data are given in the findings section in tables. It is explained how university students will respond to the measuring tool collected with the help of MS Teams online form. The distance education side of the education is distributed into five sections over the MS teams meet application programme used by most schools, and each determined section has been arranged to be limited to a maximum of 85 university students, distributed over the weeks and minutes. the Measurement tool applied to university students was transferred to the SPSS programme by coding them in the computing software environment.

2.5 Analysis of data

When we look at the analysis part, it is seen that the numerical values obtained in the research include frequency (f), percentage (%), mean (M), standard deviation (SD), *t*-test, ANOVA and options. The numerical values obtained from this application have been added to the relevant places.

3 Findings

In this section, it is seen that the other information of the participants included in the study is digitised and tables are added as explanations.

3.1 Applicants participating in the research and devices that they access when using distance education technology

Table 5 presents the findings of the students and examines the applications for study and the devices they prefer while using distance education technology.

Table 5. The devices accessed by the students participating in the study while using applications and distance education technology

Department	Mobile Phone		Tablet Computer		Other	
	F	%	F	%	F	%
Device	289	68.49	101	23.93	32	7.58

In light of the findings presented in Table 5, it is seen that the students participating in the research have information about the devices they prefer while using distance education technologies and various applications. Within these explanations, it is seen that 68.49% (289 people) of the students using smartphones chose mobile phone, 23.93% (32 people) stated that they use tablet computers and, finally, 7.58% (32 people) stated others. According to the findings in the table, it is seen that 289 people use mobile phones the most.

3.2 Opinions of the students participating in the research on distance education and augmented reality

Table 6 shows the opinions of the students participating in the study with regard to distance education and augmented reality, and the descriptive statistical results consisting of 17 expressions are given in order to get these opinions.

As seen in Table 6, the opinions of the students who participated in the research for the practices and activities they took after the study on distance education and augmented reality were consulted, and detailed information is given in Table 6. The expressions were handled in separate groups and evaluated numerically; it is seen that each value has positive findings. After the research was conducted, it was seen that the numerical values of the data collection tool sent to the participants, although there was a significant difference in many expressions, the most prominent statement of the students participating in the research was ‘I used the augmented reality QR codes correctly in relevant places’ (M=4.68). In addition, one of the most prominent expressions of university students was ‘Seeing augmented reality and distance education in my other courses makes me happy in terms of my motivation and consciousness’ (M=4.63). In addition, it is seen that the most distinctive different expressions of university students was ‘Using augmented reality technologies gives me pleasure’ (M=4.62). In addition, from the statements of university students, ‘Augmented reality applications increase my knowledge about the subjects’ had an average of M=4.53. In addition, from the statements of university students, ‘I saw that I became more conscious in my social life by using these technologies’ had an average of M=4.3.

Table 6. Opinions of the students participating in the research on distance education and augmented reality

No	Ingredients	M	SD
1	Using augmented reality technologies gives me pleasure	4.62	0.67
2	Augmented reality applications increase my knowledge about topics	4.53	0.93
3	Augmented reality applications increase my motivation for the lesson	4.41	1.06
4	Augmented reality applications make the lesson I'm listening to more fun.	4.33	1.15
5	I don't understand how time passes when using augmented reality applications	4.37	1.11
6	I have loved and used augmented reality applications from the first day of the show	4.38	1.14
7	Technology gives me pleasure when using augmented reality applications	4.21	1.01
8	I have adopted the combination of distance education with augmented reality	4.22	1.43
9	Augmented reality, which I have seen using distance education technologies, is suitable for the course	4.39	1.20
10	I have seen and understood that distance education contributes to courses	4.42	1.08
11	I have used augmented reality QR codes correctly in the relevant places	4.68	0.75
12	I connected to events and applications from anywhere thanks to the live course links provided	4.53	0.93

(Continued)

Table 6. Opinions of the students participating in the research on distance education and augmented reality (*Continued*)

No	Ingredients	M	SD
13	In line with this technology, I have always used my time effectively and on the spot	4.47	1.06
14	Even if I had problems with distance learning, I got support and help thanks to the number given	4.33	1.12
15	I continued to use distance learning with augmented reality after the study	4.38	1.09
16	I have seen that I have become more conscious in my social life by using these technologies	4.53	0.96
17	I am happy to see augmented reality and distance education in my other courses in terms of my motivation and consciousness	4.63	1.05
	Grand Total	4.43	1.04

Finally, it is seen that the overall average of the participants included in the study is M=4.43. With these findings, the students participating in the research increased the effect of augmented reality and distance education on performance, their motivation increased with these technologies and they felt better when using them, they immediately adapted to the environment, they found the environment to be positive, they liked their course applications and there were many other meaningful values seen.

3.3 Distance education and augmented reality situations of the students participating in the study according to the class variable

According to the class variable, the data were researched on the students participating in the research and it was seen that the relevant information was added to the research. In this section, Kruskal–Wallis H test results are given in order to determine the results of the comparison of distance education and augmented reality situations.

Table 7. Students participating in the study were asked about distance education and augmented reality situations according to the class variable

Distance Education and Augmented Reality Situations	Class	N	Rank Average	SD	X ²	P
	2. Class	105	4.20	.580		
	3. Class	111	4.48	.762		
	4. Class	260	4.51	.502	4.39	.000
	Total	352	4.07	.614		

As can be seen in Table 7, the distance education and augmented reality situations of the students participating in the research were examined according to the class variable, and the results of the comparison between the analysed data are included. A significant difference was found between the classes of the university students ($\chi^2=4.39$; $P=.000$; $P<0.05$). In light of the values seen according to the class variable, fourth-year students

who participated in the study had the highest average ($M=4.51$), followed by third year ($M=4.48$) and second-year students ($M=4.20$)

4 Discussion

Maiti et al. (2021), with a mixture of augmented reality in teaching strategies in the virtual classroom into a virtual learning, attempted to develop the application, and as a result, increased the real modelling environment, students' hardware that allows augmented reality achieve a better understanding of the concepts embedded. In this context, when discussing the results of research studies, augmented reality and their impact on performance, it is observed that by adopting provide distance education students, it can be said that augmented reality technology, when used correctly, benefits university students and people using this technology, most importantly, it is successful in education [13].

In the study conducted by Borgen et al. (2021), they found that interactive augmented reality (AR) technology, the transfer of skills between university aviation students learning and traditional paper-based teaching and as a result has attempted to compare task that uses augmented reality and augmented reality users a significant reduction in execution times among students in pre-mission 'dramatisation and the game' also increase observation skills, while also learning strategies for educators and education mission to develop the business of the industry they achieved using augmented reality. In this context, when the results of the research are considered, it is seen that the research has reached the conclusion that university students use smartphones for live lectures and augmented reality. In this context, it is seen that smartphone and gamification are important today within the research. While these technologies benefit the field article, it is expected that augmented reality and gamification technologies will be combined in another study [2].

Cai et al. (2021) in the year of the work they have done in technology improved the students' self-efficacy and physical desenleyer to investigate the impact of learning on concepts prepared to, and as a result, self-efficacy, concepts, top-level cognitive skills, application, understanding and communication, as stated in the guidance rather than low ones learning the physics of high-level thoughts more deeply and to learn to be more prone to students' motivation can promote that they achieved. When this value is combined with the result of the research, it is seen that university students with distance education and augmented reality enjoy adopting this environment and even feel better in social life thanks to this environment and important results are achieved in the research [5].

5 Conclusion

When the results part of the research is considered, it is seen that the order and data of the participants are added first. Known as the backbone of Audience Research, in research with these numbers always updating, won his seat by concepts it is known that, in this context, the results of the research according to the results of 422 university

students participated and used by the applications have been achieved. If another value according to the results of the research, the students who participated in the research in order to gain some sense and increase the dominance of auxiliary augmented reality applications and were expected to be selected and used in this context, the research of university students in the state of augmented reality apps for 3–4 hours in the day and most of the time allocation is in the range and preferred above and it is seen that the conclusion is reached that could relate to the purpose. Another value of the research is seen as how often the students participating in the study devote time to distance education, in this context, when the results are considered for the purpose of the study, it is seen that the amount of distance education use is 4 times more often than the university students prefer to use the result.

When selecting devices that can access applications and when using it for practicality at all times, students benefit from it. In this context, the results of the research of university students using distance education technologies included in the study between volunteer applications and access devices on the information researched, and as a result, it is seen that 289 people mostly use mobile phones. Another result of the research is that after the study on distance education and augmented reality of university students, their opinions were applied and some positive results were reached in light of the detailed information about the applications and activities that they participated in and received; while they expressed correctly using the relevant places in augmented reality QR codes, augmented reality and remote training courses, what you want to see other grandpa also, what gave them pleasure the use of augmented reality technologies, augmented reality, applications and their knowledge of issues raised. Augmented reality and remote training increases the effect on performance, college students and motivation with these technologies and using it when you feel better, immediately adapted to the environment. It is seen that they liked the application of the course by finding the environment positive and many more meaningful results were achieved. According to the latest research results discussed in the class variable distance education college students and augmented reality have been given the results of the comparison between the data observed and analysed situations and college students, it was inferred that there is a significant difference between classes. The ones with the highest perceptions were fourth-year students.

It has been concluded that the views of university students on distance education and augmented reality are high and there is a difference within the study.

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