

# Use of Augmented Reality Technology as a Way to Increase Learning Motivation of Students

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## Abstract

Educational technologies are rapidly developing today. The learning process is being improved by new methods and methods of teaching students. The use of augmented reality technology in the classroom is of certain interest among students and teachers. The purpose of the authors' work is to study the effectiveness of using augmented reality technology in teaching students, as well as the impact of using augmented reality technology in the classroom on the educational motivation of students. In the work, the authors used methods of analysis, synthesis and generalization of theoretical information, as well as an experimental method. The article describes the main features of the concept of augmented reality. Experimental and experimental proof of the effectiveness of using augmented reality in teaching students is presented. The practical significance of the work and the novelty lies in the creation of materials for working with augmented reality in the classroom in the discipline Pedagogy and psychology in professional activities. The materials developed by the authors can be used by teachers as part of their work in a digital educational environment.

## Keywords <sup>1</sup>

student training, augmented reality technology, educational motivation, digital educational environment, e-learning.

## 1. Introduction

In the modern world, innovative technologies are becoming more and more important. In the educational system, participants, both students and teachers, perform various tasks, actively using modern teaching technologies that can expand the boundaries of pedagogical possibilities [1]. Modern digitalization makes it possible to complement the real world with virtual reality. Augmented reality presents new potential opportunities in the digital educational environment. It is an interactive visualization technology that complements images of the real world with virtual elements. Modern teachers often face the problem of low student motivation for the subjects studied [2]. Students in the classroom use personal gadgets, smartphones not for educational purposes, but to meet their personal needs for information [3]. The problem of using augmented reality in education is currently capable of arousing interest in the student environment, in this regard, it is important to study the impact of the use of augmented reality technologies on the educational motivation of students.

## 2. The purpose and objectives of the study

The purpose of our work is to experimentally substantiate the effectiveness of using augmented reality technology in teaching students at a university, as well as to study the effect of this technology

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on the educational motivation of students. As part of the implementation of this goal, we have developed the following tasks:

- study the theoretical aspects of the concepts of augmented reality and educational motivation;
- to reveal the features of the use of augmented reality technology in the classroom;
- to carry out experimental work to substantiate the effectiveness of the application of this technology in teaching students;
- conduct a study of the level of educational motivation of students
- analyze and statistically process the data obtained.

### 3. Literature review

Augmented reality (AR) is a technology realized by supplementing existing reality with images and information from virtual reality. Augmented reality technology provides the most intuitive form of human interaction with the virtual world through information technology in the real world. The real world is combined on a mobile device or computer with electronic data, video, superimposed on top of the real image [4]. To see augmented reality, you need a computer webcam or a camera of a mobile device (smartphone, tablet, AR-glasses), as well as a special application that superimposes digital information (three-dimensional models, video, audio, texts) on the image of the real world received from the camera. and displays the result on the screen. When you point a smartphone or tablet camera at a flat image surface, interactive content opens, that is, the user sees a 3D object with animation or video, as well as an information block through which control takes place in real space.

Augmented reality technology was one of the first to be developed by Ivan Edward Sutherland, an American computer scientist from Harvard University in the 60s of the 20th century. He viewed this technology as a system for superimposing computer graphics on an image of the real world [5]. The term "augmented reality" appeared thanks to T.P. Caudel, an employee of Boeing Corporation in 1992, the company used the system to assist workers in assembling and installing electrical cables on aircraft [6]. An important contribution to the study of the possibilities of augmented reality was made by the American scientist Ronald Azum, he considers AR as a system that synthesizes the virtual and the real, creating a new level of perceived reality, working on the basis of digital technologies [7].

The education sector is currently undergoing a period of transformation. Traditional forms of education are being replaced by modern, more technological ones [8]. The educational process is impossible without the use of visual aids, teaching materials for laboratory and practical work. The use of augmented reality software products makes it possible to provide all students with these materials. With the help of augmented reality, teachers can increase the visibility of the presentation of educational material. Augmented reality layers enable the student to explore a fully functional 3D model of any object, as well as to visually demonstrate the entire cycle of a process [9]. At the same time, the student gets the most realistic sensations. All this arouses some interest among students.

The issue of educational motivation of students is dealt with by both Russian and foreign scientists, such as B.A. Werner, S.G. Grigoriev, V.V. Grinshkun, S.A. Zhurkin and E.P. Ilyin, [10]. Learning motivation is determined by a number of specific factors and characteristics, such as [11, 12]:

- the nature of the education system;
- the peculiarity of the organization of the educational process in the educational organization;
- student characteristics (gender, age, intellectual development, abilities, self-esteem, personal preferences);
- personality of the teacher, his attitude to the taught subject and to the student;
- specificity of the subject

In our work, under educational motivation, we consider the process of encouraging students to educational activities in order to achieve the educational goal, under the influence of internal and external factors.

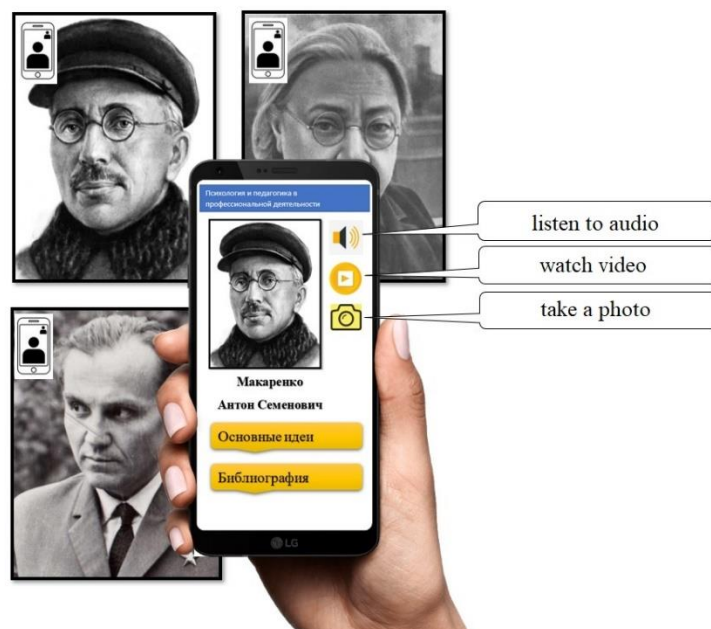
## 4. Methodology

The study of the effectiveness of the use of augmented reality technology in teaching students was carried out at the site of the Federal State Budgetary Educational Institution of Higher Education "Russian State Agrarian University - Moscow Timiryazev Agricultural Academy". The experimental work was attended by students of the Faculty of Gardening and Landscape Architecture, studying the discipline - Psychology and pedagogy in professional activities, in the amount of 96 people. The trainees were divided into experimental and control groups.

The experimental work took place in three stages: ascertaining, formative and control.

At the ascertaining stage of the experiment, testing was carried out in both groups in order to determine the level of knowledge in the studied discipline, as well as testing according to N.V. Kalinina and M.I. Lukyanova to determine the level of educational motivation of students [13].

At the formative stage of the experiment in the experimental group, classes were conducted using augmented reality technologies, in the control group, traditional visual methods and teaching technologies were used [14]. To conduct classes in the experimental group, cards with a QR code were developed (Fig. 1). Students had to download a special AR app. When you point the smartphone camera at the card, an interactive menu appears on the monitor, allowing students to work in augmented reality space.



**Figure 1:** Flashcards and augmented reality app interface

The application allows you to listen to audio information on a topic and view a video file. Also, students had the opportunity to take a photo that combines a real picture with a virtual image using the technology of layers (aura). So, for example, in a lesson devoted to the study of the theories of A.S. Makarenko, the students were able to take a photo with this famous scientist, and include this photo material in the presentation during the speech. The augmented reality technology was used by the teacher mainly for conducting classes aimed at learning new material. Independent work of students with AR objects was organized by means of drawing up semantic flowcharts based on the information viewed, as well as through presentations using materials obtained using the application. At the end of the formative stage, repeated testing was carried out in both groups to determine the level of students' knowledge, as well as the level of educational motivation.

At the control stage of the experiment, we carried out statistical processing and analysis of the data obtained as a result of the experimental work.

## 5. Results

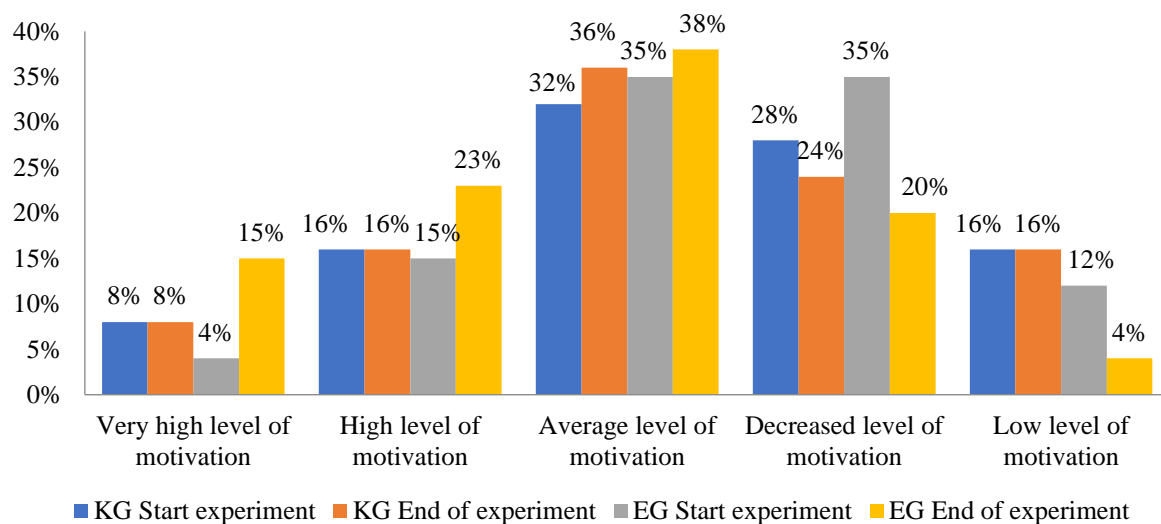
Based on the results of testing at the ascertaining stage of the experiment, we received the following data, presented in table 1. The progress in the experimental group increased significantly in comparison with the beginning of the experiment. The number of students with “excellent” grades increased by 13%, while the number of students with “satisfactory” and “unsatisfactory” grades decreased by 10% and 4%, respectively. The students' grades in the control group remained the same with a slight deviation of 2%.

**Table 1**

Analysis of student progress in the control and experimental groups

Group		EG		KG	
		%	people	%	people
Fine (solved 86-100%)	Start experiment	25	12	33	16
	End of experiment	38	18	35	17
	Deviation	13	6	2	1
Good (70-85% solved)	Start experiment	48	23	44	21
	End of experiment	50	24	46	22
	Deviation	2	1	2	1
Satisfactory (50-69% solved)	Start experiment	23	11	21	10
	End of experiment	13	6	19	9
	Deviation	-10	-5	-2	-1
Unsatisfactory (resolved <50%)	Start experiment	4	2	2	1
	End of experiment	0	0	0	0
	Deviation	-4	-2	-2	-1

Analysis of the data obtained as a result of testing aimed at studying the level of educational motivation, indicates that in the experimental group this indicator has significantly increased during the experimental work (Fig. 2). Very high and high motivation to learn was recorded in 15% and 23% of the experimental group, respectively, which is higher than these indicators for the period of the beginning of the experiment by 11% and 8%. This suggests that these students strive to follow the instructions of the teacher, perform tasks in good faith, do not miss classes and take a responsible approach to learning activities. In the control group, changes in the level of motivation to learn are not significant.



**Figure 2:** results of diagnostics of the level of educational motivation of students

In the course of our work, we identified certain features of using AR technology. The use of augmented reality technologies in the handout has the following effect on students:

- adding visualization to the handout increases the value of the teaching material;
- visualized text or audio material is perceived by many students more easily, which has a positive effect on their academic performance;
- audio-visual content has a certain attractiveness for students in comparison with conventional printed material;
- the addition of visualization functions introduces new opportunities in the field of building a lesson, gives scope for creativity of teachers and students.

Based on the data obtained, we can talk about the effectiveness of using augmented reality technology in teaching students. Classes that include elements of augmented reality increase the level of student motivation and student activity in the classroom.

## 6. Discussion

Augmented reality technology is an interactive innovative technical solution that opens up a world of new opportunities for educational subjects. The construction of the educational process within the digital educational environment is ensured by the introduction of electronic learning tools [15]. The use of this technology in education has a high potential. The effectiveness of this technology is achieved through the "immersion effect" and maximum involvement of students in the educational process [16]. The main advantages of this technology are accessibility, ease of use, clarity, safety and focus of attention [17]. The main disadvantages are associated with material costs (most mobile applications are paid), as well as the amount of time required to create educational materials with elements of augmented reality [18, 19].

## 7. Conclusion

In the process of work, we studied the level of students' motivation for learning, as well as their academic performance, developed and tested classes using augmented reality technology. The goal and objectives set in the study have been achieved. The results of the study show that the use of elements of augmented reality in the classroom has a positive effect on student performance, this proves the effectiveness of this technology. The use of augmented reality in education has practical value; it is one of the few technologies that has been able to make its way from the entertainment field of computer games to aircraft construction, medicine and education, where this technology brings social benefits [20]. This direction began to develop relatively recently, but it is currently one of the

most promising in the field of computer technology. Augmented reality creates new opportunities for the development of innovative educational products that have new and original ideas in the field of education.

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