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## Implementing virtual and augmented reality technology into the curriculum for preparing future primary school educators

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**Abstract:** Nowadays, technology is developing rapidly and affecting every aspects of life. Relative to a few years ago, there have been noticeable changes, including habits and lifestyle. This research work presents the result of a survey conducted on 203 students enrolled in the “Pedagogy and Methods of Primary Education” program at M. Utemisov West Kazakhstan University. The hypothesis of this article suggests that the usage of augmented reality (AR) and virtual reality (VR) tools in education, particularly for students in the pedagogical fields can provide to the development of information of information competence (IC). The article describes the research methodology which includes pedagogical observations the creation of a questionnaire and test that includes questions about the perception and use of digital technologies in the educational process via platform such as CoSpaces Edu and Eyejack Creator, as well as the assessment of the role of VR and AR in shaping the information competence of upcoming primary school teacher. Based on gathered data the survey results are analyzed and interpreted. The article presents key findings and trends identified in the student’s responses, such as the level of information competence, interests in using VR and AR in education, and expectations regarding its application in the pedagogical process.

**Keywords:** information competence, virtual and augmented reality, integration of VR and AR.

## Introduction

The digitalization of education and the implementation of new technologies are playing a progressively crucial role in modern educational system. In the early 2000s, education started using interactive whiteboards, e-books and online classes. Now, in the 2020s, virtual and augmented reality are becoming important for learning, representing a significant innovation in the field of education [1]. These technologies create interactive and immersive educational environments that can develop the learning process and enrich experience of future teachers. Technology is designed to boost economic productivity and simplify daily life. Therefore, developing new educational systems and methods is always part of a research program that includes new technologies to address educational issues. The digitalization of education covers almost all levels of training. These present an opportunity for highly efficient use of information and communication technologies in the learning process. Virtual platforms create the environment of classroom. They are also secure for conducting experiments, the use of which would be fraught with certain risk [2]. Virtual platforms frequently resemble conventional classrooms and provide a safe setting for conducting experiments that would be dangerous in the physical world [3]. Although the transformation of learning methods has taken place, there is still a requirement for training and research to support innovation and generate new knowledge in order to facilitate the challenges of the present era [4].

The diverse educational systems found worldwide have experienced crucial changes to meet the changing needs of society. Technology advancement have influenced both the learning and teaching processes because they have impacted all aspects of lives. The dramatically increasing volume of information, complexity of content and the aspiration for enhanced learning experiences are the key factors driving the adoption of educational technology in universities [5]. VR and AR both forms of virtual technology are the latest innovations that have only recently started to be actively integrated to enhance educational practices in higher educational institution [6].

Meanwhile, virtual and augmented reality represents a new paradigm in education, transforming educational materials and assignments into engaging and visually appealing formats. Currently, virtual tours, excursions and interactive lessons using 3D objects which stimulate the development communication skills which significantly used in school education [7]. This article aims to determine the levels of influence of virtual and augmented reality technology on the development of information literacy among future primary school teachers. This technology in education offers numerous advantages such as developing creative and critical thinking, support and collaboration in education as well as preparation for real – life situations in pedagogical activities. VR and AR also allow students to immerse themselves in virtual environments that can simulate real – life situations and provide practical knowledge [8].

As part of the higher educational curriculum, computer science is important in developing student's informational competence. It aims to build knowledge and skills for working with computer – based learning tools and other information technologies [9]. In the context of the development and implementation technologies the increasing demand to update the content

of the computer science curriculum comes along. Nevertheless, the same technologies can be used to improve the effectiveness of studying certain topics of the curriculum [10]. Cognitive load is reduced by working in immersive situations augmented and virtual reality techniques enable students to learn abstract and difficult to understand subjects in a more hypothetical approach. Moreover, the ability to apply theory instantly to practice increase theory retention. For instance, students maintain 75% of what they learned in virtual reality opposed to only 5-10 % saved when learning through other means [11]. The practical approach generates an emotional response in the student resulting in a long – term impact.

## **Research Methodology**

The following research methods were employed in this study:

Theoretical methods: analysis of scientific and pedagogical literature related to research problems, analysis of materials.

Empirical methods: surveys/ questionnaires, pedagogical observation, testing.

Statistical methods: data processing methods, analysis and processing of the formation of information literacy among primary school teachers.

Moreover, the research process involved a series of consecutive steps:

The initial step to assess the relevance of the topic and explore the existing knowledge on the impact of virtual reality technologies on students' learning effectiveness. The next step was to construct the research framework for the article. A group of participants was chosen and a curriculum was created for the experimental group, which was then integrated into the program. The third step involved explaining a task to both groups of participants and conducting a training session for the experimental group of students. The final step involved merging the academic performance findings incorporating forms of integration for both the control and experimental groups.

## **Discussion**

Integrating digital technologies in education has become a key factor in enhancing student learning effectiveness in the 21st century. Every educational institution strives to maximize the benefits of educational technologies that align with specific standards [12]. However, there are differing opinions among researchers regarding the capabilities of virtual reality, as it may distract students, reduce their focus on the learning process, and require specific skills to operate the devices [13].

The study is unique because it involves the introduction of a virtual reality training program at M. Utemisov West Kazakhstan University to assess its impact on students' academic performance and information competence via implementing educational program "Methods of Teaching Computer Science in Primary School" for students majoring in "Pedagogy and Methods of Primary Education".

Reviewing scientific literature, teaching experience in higher education, and exploring the educational potential of augmented reality technology provide numerous factors and ideas that

can be utilized to create a thematic section for inclusion in the syllabus. This section will serve as a foundation for enhancing the educational program in teaching computer science in primary schools at the higher education institution. Implementing this integration should focus on the interconnection between the subject of study and the instructional tools while considering the developed approaches to utilizing the visual elements of virtual and augmented reality technology.

The survey commenced in October 2022, with students initially filling out a questionnaire to evaluate their comprehension and proficiency with VR tools. Subsequently, the students proceeded to the module on Methods of Teaching Computer Science in Primary Schools, encompassing a section on Virtual and Augmented Reality Technologies. The control group of participants utilized the conventional training plan for program implementation. As planned per the schedule, the group of respondents in the experiment was trained to use VR/ AR tools. Thus, computer science teachers delivered two weekly lectures and practical laboratory sessions for the experimental group. In particular, Meta Quest 2 VR glasses, Eye Jack development environment, and CoSpaces Edu software were used for creating VR and AR objects. A specially designed program included multiple 3D models of characters, locations, and so on. For the first two classes, students were acquainted with the principles and major capabilities of the software. Afterward, they were given examples of problems to be solved during the course from creating cases in a graphic editor to broadcasting situations from YouTube. Thus, each task simulating in the VR mode was designed as if it was real homework for the future primary school teacher.

This research investigated the impact of virtual reality technologies as stimuli for practice-oriented learning on the development of information competency in students preparing to become elementary school teachers.

To achieve this goal, the following objectives were set:

- 1) To integrate the section "Virtual and Augmented Reality Technologies" into the syllabus of the educational program "Methodology of Teaching Computer Science in Primary School."
- 2) To conclude the influence of the integrated section on the changes in students' proficiency and utilization of augmented and virtual reality tools in real -word task.

**Table 2**

**Components of the "Virtual and Augmented Reality Technologies" section**

Purpose and content of the course	Formatting skills and competencies
Explore the basics and real – world uses of advanced augmented and virtual technologies in various aspects of life and activities.	Information literacy:
	Information search and analysis: <ul style="list-style-type: none"> <li>– Ability to effectively search for information on modern virtual and augmented reality technologies.</li> <li>– Critical evaluation and analysis of the obtained information to select the most relevant and reliable sources.</li> </ul> Evaluation and selection of tools and resources: <ul style="list-style-type: none"> <li>– Ability to assess various tools and resources for working with virtual and augmented reality technologies.</li> <li>– Selection of the most acceptable tools and resources for solving specific tasks and projects.</li> </ul>

	Content creation and processing: – Skills in creating and processing content for virtual and augmented reality, including images, videos, sound, and text. – Ability to use relevant software and tools for content creation and editing.
	Visualization and representation of information: – Ability to visualize information using virtual and augmented reality technologies. – Skills in presenting data and ideas in an engaging and understandable manner through visual elements and interactive means.
	Collaboration and information sharing: – Ability to collaborate effectively and exchange information with colleagues and partners in projects related to virtual and augmented reality technologies. – Utilization of appropriate communication and collaboration tools to achieve common goals.

## Results

Due to pedagogical observation, students were familiar with virtual and augmented reality definitions. They knew the tools associated with these technologies, such as headsets, glasses, and gyroscopes. However, while studying the "Virtual and Augmented Reality Technologies" section of the syllabus, they had no experience developing QR codes, creating cards in augmented reality using EyeJack Edu, and creating interactive dialogue using CoBlocks in CoSpaces Edu. These platforms were new to the students. Throughout the experiment, students mastered these programs. They completed a series of practical assignments, including creating an interactive panel, creating a drawing in augmented reality, transforming a picture into augmented reality and publishing it, animating an object using the CoBlock system, and working with web and mobile applications of the before-mentioned platforms. Analyzing the results of the pre-test and post-test, high levels of effectiveness can be observed, as described in Table 2.

**Table 2**

**Measurement of students' knowledge level in the field of "Pedagogy and Methods of Elementary Education" before and after studying the section "Augmented and Virtual Reality Technologies"**

Evaluated indicators reflecting the level of students' comprehension of the material in the "Augmented and Virtual Reality Technologies" section	Initial Testing	Testing after studying
Ability and skills in using virtual learning tools	3,8	4,2
Key principles of interacting with virtual and augmented reality	2,4	3,6

The process of adapting an augmented reality model	2,2	3,2
Technical means used to apply augmented reality	2,6	3,4
Platforms for creating objects of virtual and augmented reality	2,2	3,2
Average score	2,44	3,52

Based on the overall average score, which was consider from tests before and after completing the section, it shows that the augmented and virtual reality teaching methods works well in the studied education program. This is show by a 1.08-point gap between the average scores at the start and end of the test. As a result of studying the "Augmented Reality Technology" section, the overall level of students' information competence through VR/AR technology, who participated in the experiment, increased by 44% from the initial level. From this, the students can effectively assimilate the information in the augmented reality technology curriculum. This confirms the hypothesis of the feasibility of implementing changes in the "Teaching Informatics Methodology" educational program, with the possibility of including virtual and augmented reality technology as a teaching tool.

The outcomes of this study show that students need to lead more skills to use virtual and augmented reality technology well in school and daily life. Adding a "Virtual and Augmented Reality Technology" section to the educational program of the future primary school teachers contribute to developing such competence among students.

## Conclusions

The research contains creating educational methods, including the application of modern technology to address issues in education. The research is novel in that it implements a virtual reality training program at M. Utemisov West Kazakhstan University and analyses its effects on students' academic performance and information competence. Accordingly, the current study search to determine how the virtual reality technologies affecting for formatting information competence on future primary school teachers. Hence, to majority of students had mediocre academic performance, according to the preliminary study of their performance. However, teachers' observations showed that students in the experimental group were more eager to participate in assignments and seminars when classes were conducted utilizing virtual reality platforms. Based on the findings the experimental group's overall academic performance was 3,52. In higher educational, augmented reality technology fosters the growth of critical thinking, creativity and proficiency with cutting – edge information technology and visual programming. Additionally, it provides students with an interactive experience when they studying intricate phenomena or real-world processes. In the 21st century, modern students use the Internet and gadgets almost round the clock and daily. Hence, it is important to utilize this time to apply innovative technologies for educational purposes, such as creating presentations with augmented reality elements or developing augmented reality cards, QR codes, etc. Integrating

augmented reality into the learning process ensures active student participation and increases their engagement in educational activities. The article's practical importance is to investigate how virtual reality technologies might increase Kazakhstan educational system. AR/VR technologies are beneficial to education and can assist students to learn more efficiently.

### **Author's contribution**

The experimental part of the article included **L.Y. Ramazanova** III-year Ph.D student of the educational program "Pedagogics and methods of primary education", K.Zhubanov Aktobe Regional University.

**K.Zh. Turebayeva** – Doctor of Pedagogical Sciences, Professor, K.Zhubanov Aktobe Regional University, contributed to the Discussion and the final part of the article and made comments.

Acting **A.V. Grinshkun** – Candidate of Pedagogical Sciences, Associate Professor of the Russian Academy of Education, Institute of Correctional Pedagogy of the Russian Academy of Education worked on the introductory, basic and methodological techniques of the article. In addition, responds to the design of the article and comments of the editors.

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### **Болашақ бастауыш сынып мұғалімдерін дайындауға арналған оқу бағдарламасына виртуалды және толықтырылған шындық технологиясын енгізу**

**Андатпа.** Қазіргі уақытта технология қарқынды дамып, өмірдің барлық салаларына әсер етуде. Бірнеше жыл бұрынғы жағдаймен салыстырғанда, әдеттер мен өмір салтын қоса алғанда, айтарлықтай өзгерістер болды. Бұл зерттеу мақаласында М.Өтемісов атындағы Батыс Қазақстан

университетінің «Бастауыш оқытудың педагогикасы мен әдістемесі» бағдарламасы бойынша оқитын 203 студентке жүргізілген сауалнаманың нәтижесі берілген. Осы мақаланың гипотезасы виртуалды шындық (VR) және толықтырылған шындық (AR) құралдарын білім беруде, әсіресе педагогикалық саладағы студенттер үшін пайдалану ақпараттық құзыреттілік (IC) ақпаратын дамытуға ықпал етуі мүмкін деп болжайды. Мақалада CoSpaces Edu және Eyejack Creator сияқты платформалар арқылы білім беру процесінде цифрлық технологияларды қабылдау және пайдалану туралы сұрақтарды қамтитын сауалнама мен тест құру, педагогикалық бақылауларды қамтитын зерттеу әдістемесі, сондай-ақ оның рөлін бағалау сипатталған. Болашақ бастауыш сынып мұғалімінің ақпараттық құзыреттілігін қалыптастырудағы VR және AR жиналған мәліметтер негізінде сауалнама нәтижелері талданады және түсіндіріледі. Мақалада ақпараттық құзыреттілік деңгейі, VR және AR-ды білім беруде пайдалану қызығушылықтары және оны педагогикалық процесте қолдануға қатысты күтулер сияқты студенттің жауаптарында анықталған негізгі тұжырымдар мен тенденциялар берілген.

**Түйін сөздер:** ақпараттық құзыреттілік, виртуалды және толықтырылған шындық, VR және AR интеграциясы.

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### **Внедрение технологий виртуальной и дополненной реальности в учебную программу для подготовки будущих учителей начальных классов**

**Аннотация.** В настоящее время технологии стремительно развиваются и затрагивают все аспекты жизни. Относительно того, что было несколько лет назад, произошли заметные изменения, в том числе в привычках и образе жизни. В данной исследовательской статье представлены результаты опроса, проведенного среди 203 студентов, обучающихся по программе «Педагогика и методика начального образования» Западно-Казахстанского университета имени М. Утемисова. Гипотеза данной статьи предполагает, что использование инструментов виртуальной реальности (VR) и дополненной реальности (AR) в образовании, особенно для студентов педагогических специальностей, может способствовать развитию информационной компетентности (ИК). В статье описана методология исследования, включающая педагогические наблюдения, создание анкеты и теста, включающего вопросы о восприятии и использовании цифровых технологий в образовательном процессе через такие платформы, как CoSpaces Edu и Eyejack Creator, а также оценку роли VR и AR в формировании информационной компетентности будущего учителя начальных классов. На основе собранных данных анализируются и интерпретируются результаты опроса. В статье представлены ключевые выводы и тенденции, выявленные в ответах студентов, такие, как уровень информационной компетентности, интерес к использованию VR и AR в образовании, ожидания относительно их применения в педагогическом процессе.

**Ключевые слова:** информационная компетентность, виртуальная и дополненная реальность, интеграция VR и AR.

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