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VIRTUAL REALITY TECHNOLOGY IN THE PREPARATION OF GEOGRAPHY TEACHERS

P. V. Zakharov (a)*, E. A. Ereemeev (b), E. N. Bavykina (c), O. N. Makarova (d)

*Corresponding author

(a) The Shukshin Altai State Humanities Pedagogical University, Vladimira Korolenko St, 53, Biysk, Russia,
zakharovpv1@rambler.ru

(b) The Shukshin Altai State Humanities Pedagogical University, Vladimira Korolenko St, 53, Biysk, Russia,
engkent007eu@gmail.com

(c) The Shukshin Altai State Humanities Pedagogical University, Vladimira Korolenko St, 53, Biysk, Russia,
bawikina.82@mail.ru

(d) The Shukshin Altai State Humanities Pedagogical University, Vladimira Korolenko St, 53, Biysk, Russia,
fmfmak.on@mail.ru

Abstract

The article considers the possibility of using virtual and mixed reality in the preparation of geography teachers. The modern regulatory framework and requirements for teachers in Russia were analyzed. It is shown that new pilot projects in education require teachers with skills in working with virtual reality. The experience of preparing students of a pedagogical university in geography without the use of this technology is generalized; problems and their possible solutions using virtual technologies are indicated. Attention is paid to the application of technologies of mixed and virtual reality in the study of various areas in the training of geography teachers. VR headsets were used in practical classes with students. During study of complex spatial objects, virtual reality technology allowed students to learn more the object of study, understand the essence of the studied object, and understand the three-dimensional model, while panoramic pictures increased the degree of immersion. The application of this technology is appropriate for tasks that do not require the making of complex content for a virtual reality environment, due to the need to create a large amount of content, its dynamics, as well as ease of use.

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1. Introduction

Training highly qualified specialists is an important task of higher education. This problem is especially acute in the field of teacher training for secondary and high schools, where in many regions there is a severe staff shortage in a wide range of specialties. At the same time, there is an active promotion of national projects, the main of which is “The National Education Project”. New technologies incorporated in several national programs: “The National Education project”, “The Digital Economy Program”, “Digital School”, “Modern Digital Educational Environment” and several others. So the project “Digital educational environment” implies the introduction of new digital technologies in 25% of pilot educational institutions by 2024 (The National Education Project, 2020).

In modern realities it is impossible to imagine the educational process without involving a variety of technical teaching aids, and, first of all, we are talking about computer technologies. Today it is difficult to imagine a cycle of classes in any discipline without the use of modern technologies. New technologies are especially relevant in studying of the natural science disciplines, where visualization of complex processes is required. Frequently it is hardly possible to conduct some experiments in physics, chemistry, biology etc. due to their safety requirements and cost. In this case, computer technology is indispensable. The massive use of photo and video materials no longer provides the necessary effect of maintaining attention and immersing students in the topic. The active development of modern computer technology allows reproducing natural phenomena and processes with greater reliability. One of the core technologies is virtual reality (VR), along with the associated augmented reality (AR) and mixed reality (MR) technologies. The use of virtual reality makes it possible to conduct complex educational experiments (Grivokostopoulou et al., 2017), which helps to expand the capabilities of students by increasing interactivity and contributes to a practical understanding of learning (De Freitas et al., 2010; Duncan et al., 2012; Christopoulos et al., 2016). This technology has been applied in various fields (Grivokostopoulou et al., 2015; Grivokostopoulou et al., 2016) and is very useful for providing learning processes, while some authors note that it contributes to better cohesion and cooperation between students (Pellas, 2014; Potkonjak et al., 2016).

A number of works emphasize the effectiveness of VR technology in combination with other teaching methods. In particular, special emphasis is placed on gaming technology. This trend is obvious, since virtual reality allows you to easily create game situations, thereby increasing interest in the learning process. Thus, in the article (Doak et al., 2019), the authors stress that gamification allows motivate students through the use of game design elements. Also, during the experiments they obtained very specific results, indicating the rapid adaptation of students to a virtual laboratory. Besides, there was a decrease in incorrect answers by 50%, when correct answers increased by 14%. Simultaneously, it is emphasized that the virtual laboratory does not replace the teacher but is an addition to the educational process (Doak et al., 2019; Iquira et al., 2019). The author of the next article (Sharhorodska, 2019) writes about the gamification and virtual reality, where it is concluded that the creation of virtual worlds allows us to explain complex and abstract concepts, and also contribute to student motivation.

There are a number of aspects that are necessary for the training geography teachers. The first of them is the inability to clearly demonstrate geographical objects, landscape elements, climatic phenomena, etc. Photo and video materials used for these purposes often do not reflect the essence of the phenomena.

Considering the works on the application of virtual reality in teaching geography (Chen, 2006; Cho, & Chun, 2019; Detyna, & Kadiri, 2019; Geng et al., 2019; Priestnall et al., 2019; Turan et al., 2018; Zhang et al., 2018), we often see a discussion of the problems of using this technology in schools for teaching children, while the preparation of teachers for using VR is missed. However, in one of the latest works (Cho & Chun, 2019), where the experience of VR use by Korean teachers of geography is considered, the authors discuss the teacher's professional development program. In particular, national applications are discussed that open up new horizons for teaching and studying geography. At the same time, it is concluded that geospatial virtual reality offers a realistic three-dimensional learning environment and provides exciting, spectacular and interactive features and virtual tours (Cho & Chun, 2019). But there is a problem — teachers who apply it in real classes still have a lack of experience (Cho & Chun, 2019). Based on this conclusion and taking into account the speed of technology development, it is necessary to emphasize the need for methodological support of teachers, as well as future teachers using VR technology.

Another article (Priestnall et al., 2019) focuses on the use of VR for studying the types and forms of landscapes through virtual excursions. There were carried out an in-depth analysis, the result of which are recommendations on the types and forms of application of this technology, as well as highlighted disadvantages. Geng et al. (2019) discuss the use of virtual reality video for geography teachers. It is emphasized that in order to use the technology of VR it is necessary to carry out advanced training.

In this article, we consider the issue of using virtual and mixed reality in the preparation of geography teachers, both from a methodological point of view and from the position of creating content for virtual space.

2. Problem Statement

Despite the active development of information technologies over the past 3 decades and their penetration into almost all areas of our lives, there are still a large number of people unfamiliar with virtual reality technology and its capabilities. This is especially important for future teachers who will face in their professional activities with the problems of attention deficit and the need to interest students in the topic of the lesson, since the use of virtual reality technology is still not widespread, that allows making the material more demonstrative and attractive for the student.

3. Research Questions

It is necessary to answer the following questions:

- How many students (future geography teachers) are familiar with VR technology?
- What percentage of the number of these students will agree to use VR technology in their future professional activities after the demonstration of its opportunities?
- Which part of the students who do not have a special training in computer science will be able to make their own content for use in VR headsets?

4. Purpose of the Study

The purpose of this work is to demonstrate to the future geography teachers the possibilities of using VR technology and making of their own educational content in their future professional activities, as well as finding out how ready they are to use this educational technology on their own.

5. Research Methods

We used equipment and basic ClassVR software (ClassVR Virtual Reality Headset, 2020) as the environment of virtual, augmented and mixed reality, which allows us to control the operation of each headset and at the same time provide an individual approach to each student. The portal system also allows you to download your own content, which is extremely important in considering unique tasks. The portal has ready-made content that can be applied in classes in a wide range of disciplines, both school curriculum and higher education. This opportunity opens up a wide methodological potential for teacher training. Since a modern teacher should be not only the one who reproduces the material, but also the one who creates it.

The communication mechanism of three-dimensional models of objects and a cube of mixed reality through the built-in ARC application will let work with models efficiently.

Besides, control over the focusing of the student's gaze allows you to more accurately track the activity and, if necessary, make adjustments to the learning process.

To analyze the readiness of students for the familiarization and application of virtual reality technology, a questionnaire was compiled to estimate their readiness to use this technology, as well as a questionnaire on assessing their own capabilities to create geographic content for a virtual reality environment.

We divided the students into 2 groups to check out the results. In the first group we used traditional methods of the learning with following control of knowledge. In the second group we used VR technology with created spherical panoramas. In this group, before starting training, students were asked to answer the following questions: "Are you familiar with virtual reality technology?"; "Rate the potential use of VR in your future professional career using a five-point scale (1 — useless, 5 — very useful)"; "Rate on a five-point scale how difficult it is for you to create content for lessons using VR?" (1 — easy, I can do, 5 — difficult, I cannot do). Students also answered the same questions after a cycle of classes using VR. In addition, to estimate students' interest, they were asked to rate on a five-point scale the application of traditional demonstration methods and VR technology. Questions for estimation of the level of interest among students in using VR technologies: rate the degree of visibility of traditional means of demonstration; rate your interest degree in presenting material using traditional technologies; rate your interest degree in demonstration content using VR; rate the degree of visibility of VR.

At the final stage, the knowledge of students in both groups was monitored in the form of a test on the studied topics.

6. Findings

At the beginning of the study, students were asked to answer questionnaire to evaluate their familiarity with VR technology. The majority of the students gave positive answer (yes) to the first question

about getting to know VR — 80% of those who participated in the experiment. The remaining students answered that they are not sure about the correct understanding of this technology. When they saw the VR headsets, they also confirmed that they had met with this technology outside the educational space.

Figure 01 shows a comparison of the results of assessing by the students (future geography teachers) the perspectives of using VR in their professional activities before and after using headsets in the classroom.

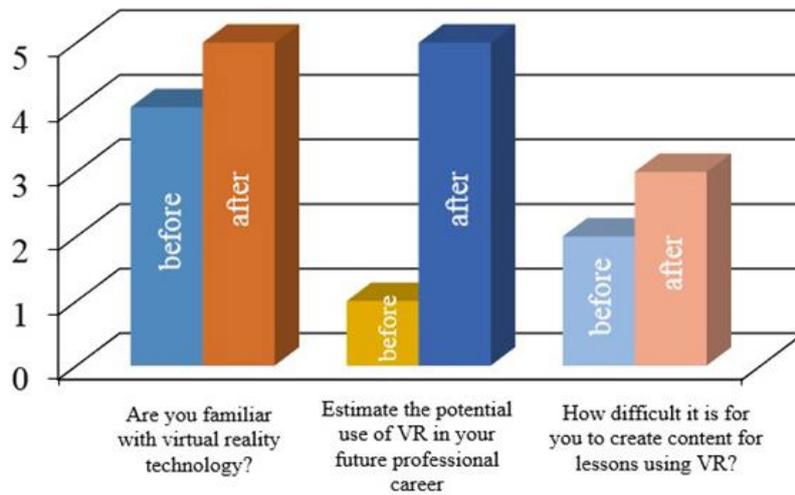


Figure 01. The estimation of the use of the VR technology in the future profession and difficulties in the making of the content for the lessons (the average value in points)

Figure 02 shows the distribution of students' (future geography teachers) opinions after using VR technology on the practicability of using this technology and traditional demonstration methods.

We have to note that the most of the students positively estimated VR technology and their points of view did not coincide only in the necessary volume of its usage.

The training of geography teachers requires special attention in connection with the development of modern technology and the need to hold the attention of students in school. The teacher's ability to interest students in a subject is often determined by their professionalism and personal qualities. The ability to apply a various technical tools makes a significant contribution to the professionalism of future geography teachers.

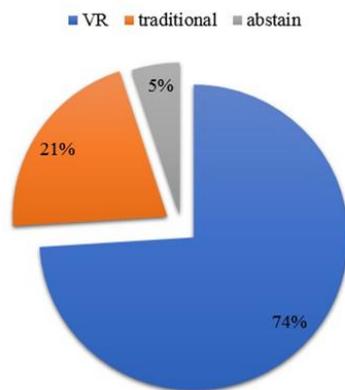


Figure 02. Comparison of traditional demonstration methods and VR technologies

The data obtained from the questionnaire results indicate a high interest of future geography teachers in the use of such teaching aids as a virtual reality.

The demonstration of the ready materials was not the cause for any difficulties in studying of the relevant topics. However, when they tried to integrate these materials into their lessons, 21% of students had difficulties due to their little experience working with such technical means as virtual reality headsets, and they preferred traditional teaching aids. About 5% of students have not decided whether they are ready to use VR technology or not.

Due to the presence of a regional component in school geography courses, students were asked to make their own content for virtual reality headsets. In particular, this is the creation of panoramic spherical photographs (photospheres) demonstrating regional features of the nature and relief. Figure 03 presents such panorama made by students.



Figure 03. A photosphere (360° panorama) showing the significant element of the local relief (the Vth terrace of the Biya River) and the development of the erosional process

Next, students were asked to develop three-dimensional models of the landscape. For these purposes, they needed to independently choose a software product and landscape element for modeling. This task caused significant difficulty in its implementation — students could not solve this problem due to insufficient knowledge in the field of information technology and modern GIS systems. The solution can be the use of ready-made models in the lessons without taking into account the attachment to a specific locality, which, of course, can reduce the degree of immersion of students, but will ensure the overall quality of the topic.

7. Conclusion

Based on the results of the conducted study, a number of conclusions can be drawn. First of all, it should be noted that the interest of students in virtual reality technology and their more active attendance of classes at which the use of VR headsets was announced is increased. During the studying of complex

spatial geographical objects, virtual reality technology allowed students to get acquainted with the object of study in more detail, and panoramic spherical photographs contributed to the understanding of theoretical material, providing communication with real-world objects.

We also want to note that creating content for students (future geography teachers) caused more difficulties than expected. If there were no fundamental problems with the creation of panoramic spherical images, the vast majority of students had difficulties with creating 3D models of objects connected with the lack of skills of work in 3D graphics applications. The way out of this situation is the introduction into the curriculum of additional disciplines related to information technologies in the field of graphics and modeling.

The obtained results indicate the practicability of applying this technology in the considered direction of student learning because of the simplicity of making content for a virtual reality environment.

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