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POSSIBILITIES OF USING VR IN EDUCATION AS A PEDAGOGICAL TOOL

Abstract. The paper presents studies and experience of their application and impact of VR in education. Their influence on thinking and psychological state of a person is traced. Virtual reality is considered as a special information environment, in which all objects are presented in three dimensions, there is a wide animation, change of images in real time and experience of effective presence. Thus, it is reasonable to interpret virtual reality as a method, means and technologies of training. Also, some directions of education in which VR gives advantages over other means of visualization and accuracy of reproduction in the safe environment of a lesson are highlighted. Through the power of psychological influence, which is provided by means of virtual reality, depending on a kind of used gadgets, new opportunities and possibilities arise as well as requirements to the lessons and representatives of the sphere of education. New safety rules, lessons design have to consider new possibilities and peculiarities of virtual reality and technologies providing it. Also it is important to take into consideration the issue of socialization in new conditions. This aspect must also be considered in the design of educational process and all its components. Because of enhanced visibility of information the risks of incorrect premises perception might appear as a result of misinterpretation of the information given by a teacher. That is why it is necessary to control the simplicity and rationality of the semantic charge both during theoretical and practical lessons. That is why it is impossible to fully change people for machinery as it is not able to understand wrong interpretation of information by a student whereas an experienced teacher has abstract thinking and life experience required for the task.

Keywords: virtual reality; training programs in a virtual reality; thinking; creativity; methods and means of education

Introduction. Virtual Reality (hereinafter - VR) is a technology of human-machine interaction, which provides a user's immersion in a three-dimensional interactive information environment. It is necessary to pay attention that objects of this environment represent not only qualitatively traced three-dimensional pictures (scenes), they possess certain properties similar to the present objects and being shown at interaction with other virtual subjects. For example, you can set the density of the material and other characteristics, so if you throw a virtual ball in the virtual water, it will float. This is a modern and rapidly developing technology. Their purpose is to expand the physical space of human life by objects created with the help of digital devices and programs and having the character of an image (Voyskunsky, 2010).

The principle of the VR helmets - the image is divided into two separate images for each eye and specially distorted to create an illusion of three-dimensional space for the eyes, which sees the user through special virtual reality glasses. If the person moves or simply turns a head the program automatically reconstructs the image that creates sensation of real physical presence. With the help of controllers (joysticks, etc.) the user can interact with surrounding objects, for example, he can lift a stone and throw it from the mountain - the physical model built in the program will calculate the flight of this stone, which will create an illusion of real space. VR created by means of visualization of three-dimensional objects by methods of computer graphics, animation and programming, is a product of not only information, but also psychological technologies.

Modern ways of constructing a changing virtual environment over time also make it possible to record the observer's position in it, which opens up new research possibilities for experimental psychology and equips it with methods that have a number of advantages over traditional laboratory instruments. The first of these advantages is environmental validity. With



the help of VR systems, it is possible to create not only unrealistic ("lunar") (Voiskunsky, Menshikova, 2008) worlds, but also "similar to the real world" environment and, especially important, to control all parameters of the experimental situation. The second is flexibility. The VR environment is programmed, which allows you to plastically change the parameters of objects and events occurring with them. There is a possibility to present a variety of various variables of stimuli (both fixed and moving) and to track accurately the observer's movements in virtual space. The third is the possibility of polymodal stimulation. VR systems allow simulating visual, tactile, and auditory images at the same time, which is hardly achievable in traditional psychological research. The fourth advantage is the ability to fully record the behavioral reactions of the observer.

The devices currently used are virtual and augmented reality glasses, controllers, headphones, smartphones and tablets. These devices allow people to see and hear digital objects. Feedback gloves are expected to appear in the near future, allowing a person to touch digital objects. Programs are usually created on the same platforms on which computer games are developed (Unity, Unreal Engine, etc.), with the help of various tools for developing virtual and augmented reality programs (Steam VR, Google VR, Oculus, Windows Mixed Reality, Google ARCore, Apple ARkit, Google Tango, Vuforia, etc.).

The essence of virtual reality can be viewed in the traditional cybernetic (software) sense. Following the example of S. Karelov. The essence of VR can be characterized by the following parameters:

- 1) Creation by means of programming of three-dimensional images of objects as close as possible to real ones, models of real objects like holographic ones;
- 2) the possibility of animation (the subject in virtual space can move, look at the object from different sides, "fly" in the universe, "move" inside the biological cell, etc.);
- 3) network processing of data carried out in real time (actions of the subject, for example, his movements, changes in the head inclination, change the image of the object, etc.);
- 4) creation of presence effect by means of programming (a person's feeling of an illusion of assistance in artificially created information reality with objects and/or subjects).

Depending (Selivanov 2014) on the goals of the researcher, the corresponding properties are introduced into the virtual environment, which predetermines the degree of saturation of VR, but, of course, it does not fully reproduce the parameters of the objective world. It should be noted that the VR in question is closely related to psychological developments in the field of visual, tactile, and auditory perception, is based on them and simulates the polymodal nature of human perception and the systemic structure of the intellect (beginning with a mental image, working memory, perceptual hypotheses, and actions in general - a perceptual event or system. A.E. Voiskunsky writes: "Virtual reality (VR) created by means of visualization of three-dimensional objects by methods of computer graphics, animation and programming is a product not only of information, but also of psychological technologies". In the studies, VR methods were singled out as methods of psychological science. Today, in most of the VR developments, the authors support the fact that VR technologies are methods, means and ways of studying and forming mental health. Can VR be used in pedagogy, particularly in didactics? To date, no systematic developments in this field are known. Publications that exist are of an overview, theoretical nature, and a priori the possibility of using VR technologies in education is recognized as appropriate. It is necessary to note the comparative analysis made by A.E. Voiskunsky concerning the difference between the altered states of consciousness (ISS) and the state of presence, the basis of VR. A.E. Voiskunsky has shown that staying in the VR, unlike the ISS, does not cause inadequate thinking, does not reduce the degree of reflection, is not characterized by the presence of a sense of duality, "alienation of one's own self", "out of the body", "separation of body and soul", does not lead to a loss of arbitrariness and purposefulness



of activity, does not provide a feeling of fictitious acquisition of the interlocutor, a feeling of the presence of "other", "higher mind", "space information will". These and other features of VR testify to its advantages (in relation to the traditional, table-top presentation of the content of education), the possibility of using the skills in education, training and other areas, starting from primary school age.

VR technologies are part of immersive education programs. Such programs include the use of modern information technologies in the learning process, which takes place within different virtual worlds and simulations, and often in a game form. This type of learning contributes to increased engagement, communication between students and interest in the subject.

Dozens of studies have been conducted on the impact of augmented reality technologies on the learning process in academic research. The review noted the improvement of students' academic performance, understanding of the material, and motivation level. Also, the degree of involvement in the learning process and interest in the study of the subject is growing, the level of communication between students is increasing.

This article presents only some ideas of how the possibilities of VR (Khe Foon Hew, Wing Sum Cheung, 2008) technologies in the field of education can be used. The ability of this technology to immerse a person in the virtual world determines the main direction for its development in education. Everything that cannot be created in the real world for technical, economic or physical reasons can be created in the virtual world. The opportunity to visit places where it is difficult or impossible to visit in reality. To see electric and magnetic fields, prehistoric animals, underwater worlds, ancient countries, planets and asteroids. In some other cases, there are the following possible applications of VR in education:

1. Art. Among VR programs there are already such that allow you to create three-dimensional objects according to the laws of two-dimensional and three-dimensional graphics. Thanks to similar possibilities it is possible to make VR the space expanding the world of known pictures.

2. Physics. In this field, this technology can allow for laboratory work in modern laboratories or create a simulation of most processes, consider and study them at each possible stage and see the relationship and patterns between the stages.

3. Chemistry. There is already an application in place to study the structure of molecules of different substances. VR technologies also allow to conduct dangerous or expensive experiments, as well as to observe chemical reactions at various stages.

4. Foreign languages. In addition to explaining grammar and vocabulary, it is also important to practice language learning as in any other field. The most important process for language practice is communication with a native speaker. VR allows you to enter virtual spaces where you can only communicate and interact with other users, including native speakers.

5. Literature. Visualize the most vivid moments of artworks.

6. History. VR simulations of the world's museums provide an opportunity to study the difficult-to-access or inaccessible to many materials. Also, the reconstruction of architectural objects, battles or other historical events expands the possibilities for analysis and understanding of history.

7. Geography. The 360-degree cameras allow users to shoot three-dimensional panoramas and videos that can then be used as teaching material. Also, simulations of landscape formation processes under different conditions with different materials are also possible thanks to the technologies and capabilities of VR

8. Biology. VR allows the study of each organ, cell type or DNA molecule. Interactive process simulations help to better understand the structure and functions of the body.



VR in learning are methods and means of learning. A method is a way to achieve a goal, a specific task, more specifically, a set of techniques or operations of practical or theoretical mastering (cognition) of reality. Most definitions of learning methods emphasize that this category includes both teacher and learner activities: "The learning method is a system of consistent, interlinked actions between teacher and learner to ensure the acquisition of educational content. I.Ya. Lerner and M.N. Skatkin distinguish three types of attributes of teaching methods: designation of the purpose of teaching, reflection of the way of assimilation, expression of the nature of interaction of subjects of teaching. The majority of teachers speaks about the method of learning as a way of transfer, assimilation of knowledge, which is closely connected with the actions of subjects of the educational process, with the methods and means of teaching. The method is often understood simply as a set of coordinated, generalized methods of teaching (Ananiev S.A.), as a logical way of mastering knowledge, skills and abilities (Danilov M.A.), as a specific way of joint interrelated activity of tutors and students, aimed at solving the educational problem (Selivanov V.S.). The obtained scientific knowledge, especially new ones, are available only to the chosen ones, they are complex, abstract and intuitive. The task of didactics is to transform such knowledge, make it accessible and understandable for the student. The method of teaching is closely related to understanding (Signs of V.V.) students of scientific knowledge or way of action, it is designed to provide this understanding. How is understanding achieved? (Selivanov, 2014) By transforming knowledge, itself or the content of education. The learning method is thus closely linked to the content of education. The content of education is produced by the teacher, through whom he or she transmits to the student a system of meanings (connotations) and meanings (denotative meanings). A student must perform certain mental actions, thought processes to understand the transmitted meanings and meanings. The criterion of understanding is the correct reproduction of knowledge. In addition, the method of learning is aimed at memorizing certain information, at developing thinking and personality, and practicing practical actions (skills). These tasks are implemented through certain ways of building learning material (cognitive impact), ways and means of its transmission, ways and means of forming attitudes to information (emotional impact). In general, the method of learning is a systemic phenomenon, which includes at least three components in its content: the actions of the teacher, the actions of the learner, and in a certain way structured content of education. The systematic nature of the didactic method also predetermines many classifications of teaching methods. Depending on the chosen basis, appropriate teaching methods are also distinguished. The main source of knowledge is verbal, visual, practical; the logical way of teaching - inductive, deductive, analytical, synthetic; the way of pedagogical guidance - methods of explanation of the teacher, methods of independent work, etc.

However, often the data of the methods classification are based on insignificant, secondary features, they are useful only for the implementation of private didactic tasks. I.Y. Lerner, M.N. Skatkina, write that "... teaching methods reflect target and substantial, psychological (taking into account the laws of assimilation), epistemological (organization of cognitive activity of students) aspects of education. In accordance with the nature of cognitive activity they justified the explanatory-illustrative, instructive-reproductive, problem presentation, heuristic, research method. This classification reflects many goals of developing learning and systematically presents the content of teaching methods. But it is invariant to the peculiarities and structure of educational material. Modern information means of teaching material presentation are so specific and developed that they produce qualitatively new properties of educational content, which were not contained in traditional methods. For example, the same VR radically transforms the principle of clarity, creating a semblance of real objects through information modeling. As a result, the student gets almost the same (or stronger)



personal experience in visual, auditory, tactile, and olfactory perception, in the implementation of actions, as well as in real interaction with such situations. In this respect, the American didactic K. Kerr, who identified four revolutions in teaching methods:

- 1) change of parents-teachers by professional teachers;
- 2) replacement of the oral word with a written one;
- 3) Introduction of the printed word into teaching;
- 4) Introduction of automation and computerization of education (by).

These revolutions reflect not only a change in the means of learning, but also a transformation in the quality of learning materials and the content of education. Virtual reality is one of the vertices of computerized learning. It achieves "super-stimulation" of human senses (similar to the acquisition of real perceptual experience), which is the basis for learning, including intellectual learning. Besides, the way of interaction between the teacher and the student, the content of education (which becomes informational), the actions of the instructor and the learner, and the way of mastering the material radically change. Thus, most of the essential features of the learning method are specific when it comes to VR. This makes it possible to speak of VR as a method of learning. These methods are also implemented in a new type of training (which probably needs to be highlighted) - conditionally it can be called software and information training. Today, the specificity of human interaction with information models of reality is obvious. In education, the use of information systems sharply increases the subjectivity of both teachers and students, expanding the boundaries of the implementation of the principles of visibility and accessibility, inclusive education, the link between learning and life, and the potential for emotional impact on the student. These and other features of VR methods and software and information learning allow us to speak of them as dominating factors in the implementation of subject-specific pedagogy. The essence of subject-education is that the educational process is seen as the interaction of two subjects - teacher and learner (Sampaio, 2010). The main object of pedagogical activity is the subject. The purpose of subjective pedagogy is the formation of the subject in cognition, learning, subject activity, experience, interpersonal and social relations, etc. Subjective pedagogy sets the task of forming a student as a full-fledged subject of life with its self-regulation, self-determination, self-determination, self-education (continuous education) at all stages of life.

Conclusions. Today, in the reality of mass general education, it is rather difficult to imagine the use virtual reality technologies. And it is not about the financial component. The main difficulties are related to:

- The rigidity of the program, which should be successfully assimilated by students in general education. Despite the fact that virtual and augmented reality technologies have a great potential for improving the performance of students, they can also be a significant distraction. Examples of the use of technology show increased involvement and interest in the learning process. Some researchers conclude that these factors lead to improved learning outcomes for students. However, in the event of an overreliance on form to the detriment of the content, the effect may be reversed.
- The use of such technologies is likely to be very effective, but using a standard 45-minute lesson in a school setting would cause a significant disruption to the program, as the time taken to work with the material using these technologies would in one way or another change the curriculum.
- Introduction of such technologies is connected with several difficulties, which are financial in nature: high cost of equipment, lack of a large number of quality applications and, consequently, the need for their development, small experience of using this technology among teachers who need to be trained.



- A modest number and variety of existing applications using VR technologies, especially those created specifically for education, is another "brake". In order to change the situation, state support of such projects, state order, is certainly necessary. Creating even a small application of virtual reality, for example, in the field of history, requires the work of many specialists: historians, artists, programmers, cultural specialists, etc. Such resources can be found either in the presence of serious resources and a request from the state or big business, or when the interests of various parties overlap.

What are the ways to overcome these difficulties? At present, the use of virtual reality technologies is most adequate in the field of supplementary education, which can serve as a vehicle for new ideas, is not as rigidly structured as general education.

Let's illustrate how additional education can overcome difficulties by going through the above points of potential problems of technology implementation.

Supplementary education has a much more flexible system of arrangement than general education. Programs of different levels, different duration of classes, involvement of teachers from specialized organizations for part-time employment. Possibilities of cooperation with specialized industrial enterprises and universities allow to attract competent specialists, as well as potentially provides an opportunity to find ways of solving the issues on the necessary equipment. Particularly interesting is the option of cooperation with other organizations, such as museums, which may be interested in such technologies. Already now there are excursions and specially created expositions, where the possibilities of VR are actively used.

Separately, it is necessary to say about the need not only for training with the help of technologies and VR, but also for training in competence in creating products using these technologies. Pre-professional and professional education must pay attention to these areas of training.

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МОЖЛИВОСТІ ВИКОРИСТАННЯ VR В ОСВІТІ ЯК ПЕДАГОГІЧНОГО ІНСТРУМЕНТА

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Анотація. У роботі представлені дослідження та їх досвід застосування та впливу VR в освіті. Прослідкован їх вплив на мислення та психологічний стан особистості. Віртуальна реальність розглядається в якості спеціальної інформаційної середовища, в якій усі об'єкти представлені в трьох вимірах, присутня широка анімація, зміна зображених в режимі реального часу і переживання ефективної присутності. При цьому обґрунтовано тлумачення



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віртуальної реальності як метода, засоби та технології навчання. Віртуальна реальність має потенціал в педагогічній сфері як педагогічний інструмент не тільки у якості візуалізації але й впливу на якість та швидкість засвоєння знань, умінь та навичок учнями під час уроку. Також освітлені деякі напрямки освіти, в яких VR дає переваги перед іншими засобами у наглядності та точності відтворення у безпечному середовищі уроку. Через посилення психологічного впливу, яке забезпечує віртуальна реальність, в залежності від використовуваних гаджетів, відкриваються нові можливості та вимоги до уроків та представників сфери освіти. Нові правила техніки безпеки, розроблення уроків з урахуванням нових можливостей та особливостей як самої віртуальної реальності, так і технологій, які її забезпечують. Також слід враховувати питання соціалізації в нових умовах. Цей аспект повинен також бути врахованим при розробці навчального процесу та кожного його елемента. Через підвищену наочність інформації, існують ризики засвоєння невірних посилів, які можуть виникати через невірне тлумачення інформації, що подає вчитель. Тому слід пильно слідкувати за простотою та зрозумілістю кожного смислового навантаження, як під час теоретичних, так і під час практичних занять. Через це неможливо буде замінити людину на техніку повністю, так як техніка не зрозуміє хибне тлумачення інформації учнем, тоді як досвідчений педагог має абстрактне мислення та життєвий досвід, необхідний для цього.

Ключові слова: віртуальна реальність; навчальні програми у віртуальній реальності; мислення; креативність; методи та засоби навчання