Development and Use of the Application of Virtual Reality within Training Bachelors and Masters*

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Abstract. The article is considered some methodological and pedagogical aspects of the use of Virtual Reality technology in education. The views of researchers M. Clarke, I.V. Robert on the "Virtual Reality" technology, where there are three approaches to the implementation of information interaction. Virtual Reality technology allows for many learning opportunities that are difficult with the traditional teaching approach. For this, it is necessary to improve the modern educational process, in particular, in the system of training bachelors and masters. Application programming of virtual reality in the form of the prototype on two subjects of physics is offered, which were developed by students during the implementation of the "Virtual Laboratory" project. The development environment for these prototypes was the Unreal Engine 4 program using the C ++ programming language. The approbation of these prototypes has shown their effectiveness in the study of physics.

Keywords: Development, Use, Applications, Technology, Virtual Reality, Prototype, Training in Physics.

1   Introduction

For the last years, the perspective direction in the training of students of the bachelor degree and magistracy is the e-learning directed to increase of efficiency of the educational process, development of competencies necessary for them and individualization of educational activity using remote educational technologies which possibilities constantly extend due to mass implementation of new electronic resources.

As authors of the article [1] T.G. Vezirov and M. E. Elmurzayeva note, e-learning using remote educational technologies will actively be organized in addition to traditional training for future bachelors and masters of pedagogical education.

The creation and development of e-learning using remote educational technologies in Russia are determined by one of the priority directions of the state policy in the field of education.

In this regard, the higher school, very actual for modern pedagogics, development of mechanisms, ways, models, and technologies of vocational training of bachelors means of e-learning using remote educational technologies are represented [19, 20].

One of the trends of modern education is the Virtual Reality technology allowing new technology of interaction of the person and the computer with the opportunity "immersion" of the user in the three-dimensional interactive environment of the studied phenomenon (process) and natural interaction with objects (artificial or real) in the virtual environment.

It provides a new quality of perception of information, increases visualization and interactivity of materials.

2 Virtual Reality in the Educational Process

Implementation of technologies of virtual reality in educational practice assumes carrying out the following stages:

- development of models of the educational environment for technologies of virtual reality;
- design of the personal educational environment (PEE) for teachers and training;
- development of the specialized software for support of technologies of virtual reality;
- design of the specialized websites libraries of the educational modules constructed on technologies of virtual and augmented reality;
- development of specialized programs for the training of teachers in the creation of educational modules of the different orientation;
- the organization of network training with an accurate system of communications between participants of the educational process.

All the above-named stages shall be followed by extensive discussions of the achieved results at specialized forums, virtual conferences, and in-network groups for developers and interested persons.

When developing models of the educational environment for implementation of technologies of virtual reality it is necessary to follow the following principles: information sufficiency, systematicity, objectivity, determinacy, feasibility, visualization, the plurality of models, parametrization, recurrence, reductionism, rationality [9].

Design of the personal educational environment for teachers and trained based on the developed model means the determination of its place in metasystem and determination of the optimum set of the components of the environment providing functional completeness of properties and establishment of necessary communications between components. By functional criterion the structure of POS of the teacher can be separated conditionally into two, dynamically connected and interacting among themselves couples: the first couple is the opposition of the consumer and vendor of educational services, the second – professionally regulated and individual and personal educational and social activity [10].

Development of the specialized software for support of technologies of virtual reality shall be based on the European and Russian experience of use of LMS systems, for example, of the Moodle system. Completion of the interface and educational and managing modules is possible with the use of open workbenches taking into account information security support of sets and databases [12].

Design of the specialized websites libraries of the educational modules constructed on technologies of virtual and augmented reality is possible on the known topology "the ring of the websites" allowing to implement the principle of the integrated resources for users at the level of the country and the international associations [8].

Development of specialized programs for the training of teachers in the creation of educational modules of the different orientation, according to requirements to modules of remote learning assumes broad integration of higher education institutions, so, for programs in physics and mathematics involvement of the leading teachers of technical colleges of Russia and Europe is planned [6].

The organization of network training is necessary for the achievement of synergy effect due to receipt of up–to–date information, not only in training activity but also in the course of the discussion of new ideas and new knowledge by participants of network communications – teachers and trained [7].

3   Virtual Reality in the Preparation of Bachelors and Masters

The readiness of teachers for the implementation of educational programs of the new generation assumes, first of all, mastering of technologies of virtual and augmented reality [11].

For the process of implementation of new technologies, researchers of the leading scientists in the field of multimedia technologies have the defining value.

In the monograph [3] I.V. Robert considers the Virtual Reality technology as the technology of not contact information exchange, implementing utilizing complex multimedia operating environments illusion of direct occurrence and presence at real-time in stereoscopic the provided "screen world" ("the virtual world") when ensuring tactile feelings at the interaction of the user with objects of the virtual world.

Specialists in the field of education highly appreciate the possibilities of this technology. For example, M. Clark in the work [2] notes that Virtual Reality technology allows providing the computer electronic spaces designed by the user in which there is the opportunity to execute any divisions, fillings, researches honor the same as if the user was in these spaces.

Three approaches to the implementation of information exchange based on Virtual Reality technology are selected:

– implementation of the idea of "immersion" to the virtual world;

– providing "window" representation of three-dimensional space of the virtual world via the computer screen;

– implementation of interaction with objects of "the virtual world" the certain "third party" provided by the moving image on the screen and identified with the user.

These approaches implement the main idea of the information exchange provided with the Virtual Reality system, concluding in providing:

– direct participation of the user in the events which are taking place in "the virtual world" and proceeding in real-time;

– the maximum distance of the interface between the user and the computer.

Use of the Virtual Reality technology allows describing training activity as the creative process which is making use of the available experience for creating new.

According to I.V. Robert, the psychology and pedagogical purposes of use of the Virtual Reality technology are defined by the opportunity "build-in" technologies of training on educational Wednesdays, perform the pedagogical influence providing development of visual and figurative, visual and efficient, intuitive, innovative, theoretical thinking [4].

The use of Virtual Reality technology opens many new opportunities in training and education which are too difficult, expensive on time, or are expensive at traditional approaches if not all at the same time. It is possible to select five main advantages of the application of this technology in education: visualization; safety; involvement; focusing; virtual lessons.

Use of the Virtual Reality technology in education assumes that the educational process shall be rebuilt as appropriate.

In internal education, there is the transfer of empirical material through virtual reality in semantic training.

At remote education group occupations with the effect of presence and social interaction are performed.

At the organization of the mixed training, there is the opportunity to be far off in the class, to see the events, and to interact with real pupils and the teacher.

Any of the developed educational courses can be adapted for independent studying. Lessons can be placed in online stores that all had the opportunity to master or repeat the training material independently.

As for the relation to virtual lessons, 97,4% of pupils would wish also further application of technologies of virtual reality at school lessons, and the majority specified physics and chemistry as disciplines.

In general, the experiment showed the success of the application of Virtual Reality technology in education. Modern technologies, despite the long way of development, are still young, but, virtual reality is the following big breakthrough in the development of education. And soon we should see the set of interesting openings in this area.

The technology of virtual reality considerably will facilitate training activity, thanks to it, it is possible to master much quicker and more successfully new rules and subjects.

In the article [5] V. N. Taran notes that for drawing attention and deduction him it is required to include elements of interactivity or practical activities in training activity that will allow cultivating an interest in the subject, which will increase the desire trained to gain new knowledge, deepening already available.

Further, the author notes that the task of the higher school not only to give knowledge, to create skills, and also competencies, but the main thing – to teach to study, i.e. to give the start in life to the professional who is not afraid of new tasks, is

capable to solve creatively any problem and to have a creative approach to unusual situations [5].

4   Project "Virtual Reality in Physics Education"

In 2019 there took place the All–Russian tender "Digital Break" for IT specialists. Tender is one of the key projects of Autonomous Non–Commercial Organization "Russia – the country of opportunities" which was created at the initiative of the President of the Russian Federation V. V. Putin.

The main goal of the project – to create new professional opportunities for talents in the field of the digital economy. The tender will allow participants to start the technology business, to receive assistance in employment, to find adherents and to create project command, and also to win the monetary prize.

I participate in the regional stage, previously having passed the test, students of the Dagestan state technical university developed the VLab project, in other words, "Virtual laboratory" which allows remote access for the decision practical, in our research, specific objectives on physics subjects.

The essence of the project is that anyone can put on the helmet of virtual reality and carry out some laboratory works, investigate the behavior of different objects in these or those conditions. This software product does not limit the user in the actions, allowing to create something unusual, without doing at the same time harm to itself and the environment. The user has the opportunity to make experiments for the reasons, having got the experience and having consolidated at the same time the gained knowledge in practice.

At the moment there are several problems:

– the decrease in the level of interest of the younger generation to the exact sciences;

– the emergence of dangerous situations at operation trained laboratory devices/stands;

– the high cost of laboratory devices/stands, and also their parts finally lead to big costs at their purchase. For example, one laboratory stand on physics will cost 100 thousand rubles.

For the solution of these problems the offered following:

1. Creation of the platform allowing anyone to simulate and visualize independently different experiments without the threat of harming health. The increase of the level of interest in the exact sciences will be the consequence.

2. The experiments made with the use of the Virtual Reality system cannot harm the health of the person.

3. We send to the virtual reality of Pimax 4k with the software PiPlay and the computer will cost approximately 45 thousand rubles. Over time this price will become lower in connection with the development of technologies.

Analog of this software product is the different training videos demonstrating all processes of experimenting. The benefit of our software product is the possibility of the user to participate directly in experimenting.

This software product is oriented on:

– state educational organizations (schools, colleges, HIGHER EDUCATION INSTITUTIONS);

– private educational organizations;

– organizations of additional education;

– parents.

During the passing of the Regional stage, this software product took 1 place, participating in the internal 36–hour hackathon in Makhachkala.

Hackathon – competitive action during which specialists of the IT industry in the line-up from three to five people create prototypes of digital products for a limited time (36 or 48 hours).

The command at the head of Sh. H. Shikhaliyev developed prototypes on two subjects of physics:

1. Research the structure of the atom.

2. The law of Ohm for the complete chain.

The environment for the implementation of these prototypes was created with the use of the Unreal Engine 4 program. During the creation of this Wednesday, the programming language C ++ was used.

5 Conclusion

Approbation of the specified prototypes on subjects of physics showed:

– the pedagogical influence creating the vision of depth of the image;

– development of a tendency to esthetic perceptions of the image, development of the imagination;

– forming of ability to perform the analysis, synthesis, abstraction, generalization;

– initiation of development of operational, visual and figurative, theoretical thinking.

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