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VIRTUAL REALITY IN EDUCATION

GRADUATE QUALIFICATION WORK

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INTRODUCTION

Actuality of the work. With each passing day, information technology is given increasing attention in the modern education system. Each year, there are many new methods of teaching that are based on modern technologies. Not all of them are easy to use, but less dark, with their help the educational process becomes more and more fascinating, and the studied material is absorbed faster. Such conclusions can be made, based on the results of repeated studies among schoolchildren and students. Since the younger generation always shows great interest in new technologies, there is a need to present the information in a form that is relevant to them, meeting modern requirements. For example, in the form of innovative teaching and methodological support: electronic textbooks, simulations, “serious games” and virtual classes.

One of the technologies for creating innovative educational material is the “virtual world”. In terms of the perception of educational material most significant advantage of games and simulations (or trainers), created with the help of this technology is the ability to transfer the student simulator in a realistic game situation. In a properly designed simulator, the student must act in the same way as in a similar life situation. It makes this knowledge more applicable to life than the knowledge gained in the classroom, does not look like a place where students in the future will have to apply their skills. Due to its visual capabilities, the electronic simulator can be more realistic than the lecture. A more realistic educational material is better absorbed.

Research of virtual reality in some areas such as education is considerably little due to the fact that these studies are much more complicated and expensive to finance in our country and foreign ones.

Object and subject of research. The object of research work is the integration of virtual reality technology in the field of education.

As the subject of the study, the influence of virtual reality on various spheres of education.

Purpose and aims of the research. The aim of this research is the development of methods of using the virtual reality training.

Achieving this goal implies the solution of the following **tasks**:

- Studying the relevance of VR technologies;
- The study of the historical formation of the concepts of “Virtuality”, “reality”;
- Analyze the problem use of virtual reality technology for teaching and research;
- Development of teaching methods;
- The use of virtual reality in the learning process and evaluate the impact;
- Development of software for virtual reality systems.

The scientific novelty of the work is to:

- Systematized the basic interpretation of the modern understanding of virtual reality and shows the possible changes of virtual reality, due to the influence of new computer technologies.
- Developed a methodology for using virtual reality in the learning process;
- Developed 3D-objects, information material and software;
- Tested in practical work;

Scientific and practical significance of the research. Materials of the research can be used in the preparation of the relevant sections of courses in computer science, computer graphics, simulation as well as writing textbooks and manuals. In addition, use of these materials in the development of specialized courses.

VR, used in education, acts as a method, means and technology of teaching. This is determined by the fact that educational VR-programs are significant specificity in the activities of the teacher, the pupil, the transformation of educational content, provide for the establishment of a new, informational mode

of filing and learning, are high-tech teaching tools and act as relatively hard action algorithm requirements that provide guaranteed effects.

And also, you can use 3D-objects, information materials and software product

- "travel" throughout the country, the world and the universe;
- to take part in historical events;
- observe a rare phenomenon of nature and manipulate various objects;
- conducting chemical experiments;
- analyze the volumetric diagram;

Defining the hypotheses and research methods. At work is based on the philosophical analysis of the applicable concepts of “virtual”, “real”, “virtual reality”, allows you to select the logical and contextual load these concepts, their structure and logical relationship. The combination of comparative historical method social philosophy and methods of analysis, comparison, synthesis allows maximum versatile approach to the problem of virtual reality.

Moreover, the comparative analysis can identify strengths and weaknesses of various authors nominated concepts and assess the potential synthesis of a number of creative approaches offered by them.

1. THE TECHNOLOGICAL BASIS OF COMPUTER VIRTUAL REALITY

1.1. Description of the concept of “virtual reality”

First, we consider that such a virtual reality. *Virtual Reality (VR)* is a closed computer simulation of a certain environment around the user, which is completely immersed in the virtual world. The task of virtual reality - using various human receptors (sight, hearing, smell, tactile sensations), maximize immersive user in virtual reality. A person begins to feel himself inside a virtual simulation environment, and in the presence of a system with the possibility of feedback, an imitation of physical sensations occurs[10].

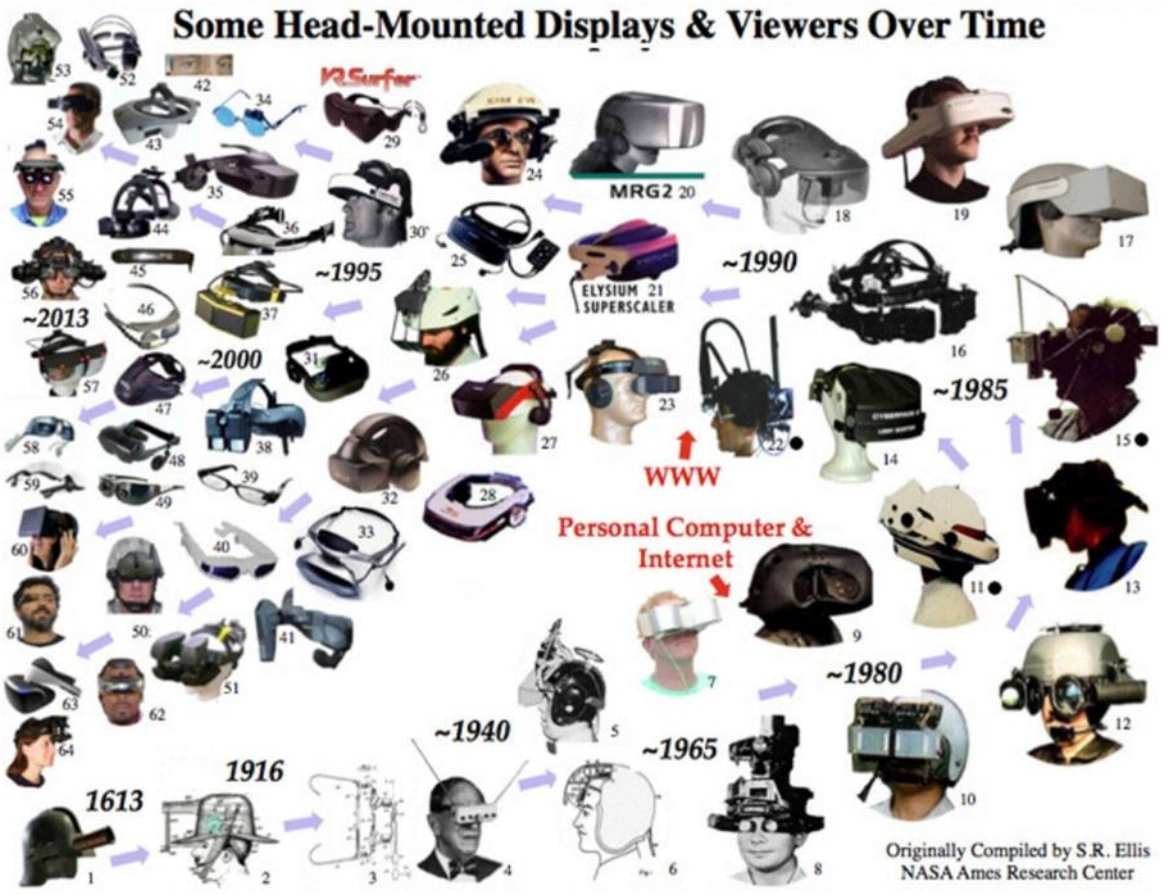


Figure 1.1. Evolution of Head-Mounted Displays

Augmented Reality is superimposing the layers generated by the computer to the existing reality, as a result of which the existing reality improves[10].

The term artificial reality was first formulated by the American computer artist Myron Krueger in the late 60's - the first attempt to create tools that allow you to immerse yourself in the virtual reality began to appear in this period.

Instruments of augmented reality tried to create in the 15th century the architect Filippo Brunelleschi. He drew an object that complemented another existing in the real world - and suggested looking at it through a mirror with a hole.

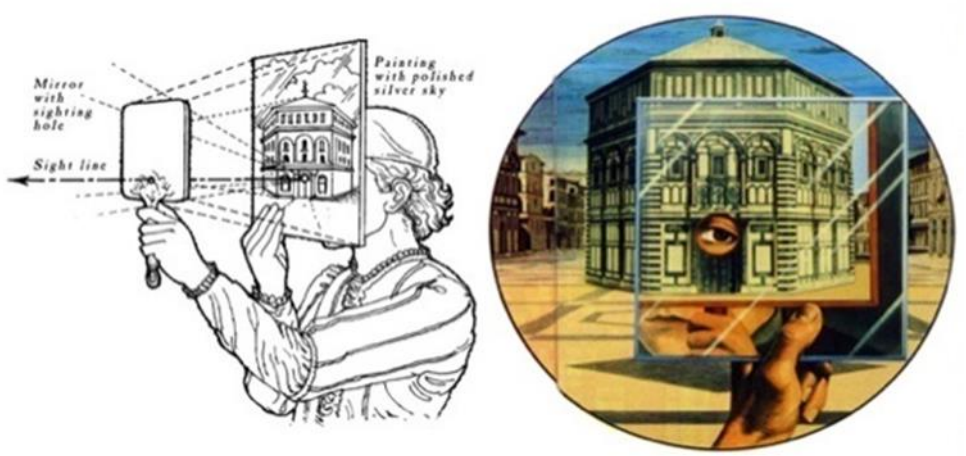


Figure 1.2. An introduction to Filippo Brunelleschi's experiment regarding linear perspective, c. 1420, in front of the Baptistry in Florence.

The word "virtual" in "virtual reality" goes back to the linguistic distinction formulated in medieval Europe. Medieval logician Duns Scott gave the term connotation, which became traditional: the Latin "virtus" was the main point of his theory of reality. He insisted that the concept of a thing contains in itself empirical attributes not formally, but virtually. Although to understand the properties of a thing we may need to go deeper into our experience, the very thing itself already contains in its unity a lot of empirical qualities, but it contains virtually - otherwise they would not be fixed as qualities of this thing. The term "virtual" Scott used to bridge the gap between the formally unified reality (assumed by our conceptual expectations) and our disorderly-diverse experience.

Modern technology of virtual reality began with an attempt to connect visual perception with the perception of movement and sound. Its original use precedes the invention of the computer. It was a flight simulator, in which the original model used a moving picture and pneumatic transmission, like organ pipes. Arm trainer brand "Link Treyner", patented in 1929, forced the simulator to move, rotate, drop, change course, and thus create a satisfactory sense of movement.

In the mid-1950s, a movie company named Morton Heilig decided to create something amazing that would amaze the public. In 1960, he designed something like a game console and called it Sensorama. In the kit to the console came a stereoscopic screen, cooler, odor emitters, a stereo speaker and a moving chair. In 1956, Morton Heylig created the experimental theater "Sensorama", in which a shake, noise, gusts of smoke, smells, and smells were imitated during the demonstration of the film about the trip. There were other attempts to develop various means of imitation, with which a person could get a feeling of pseudo-reality of some artificially created environment. He also created a special TV, which allows you to watch programs in three dimensions. At that time, the audience still passively watched the film, but this was the first step towards the development of virtual reality.

In 1961, engineers from the Philco Corporation developed the first helmet-display, called Headsight. The helmet consisted of a video screen and a tracking system, which the engineers connected to a closed video tracking system. This helmet was designed for use in dangerous situations - the user could observe the real environment as if remotely, adjusting the angle by turning the head. Such a device is used, and pilots. By the helmet was attached infrared cameras that are attached to the bottom of the aircraft, which allows pilots to navigate the terrain, even at night.

In 1965, a scientist named Ivan Sutherland created a new device called "Ultimate Display." With this display, a person could look into a virtual world that seemed to him to be a real world. His invention gave a new impetus to the development of an entire science of virtual space. The concept of Sutherland: the

virtual world, reproduced through the helmet-display, should seem real to any observer.

The results of his research in 1965, he stated in his work "The ideal display", which initiated the technical and technological development, including with his participation, in the field of image processing and output. In 1966, Sutherland designed a new helmet model, which was already connected to a computer system (previously the helmet was connected only to cameras). The computer generated images and displayed them on the screen. The new model of the helmet could reproduce the stereo sound simultaneously with the image, which created a spatial illusion, and when the person turned his head, the image changed instantly.

In 1972, Miron Kryuger coined the term "artificial reality" ("artificial reality") to determine the results that can be obtained using the system object video overlay image (person) in the computer generated image and developed by other means at the time. The main ideas were subsequently published in the book "Artificial Reality" (1983).

The first virtual reality system was the "Aspen Movie Map", created in the Massachusetts Institute of Technology in 1977. This computer program simulated a walk around the city of Aspen, Colorado, giving the opportunity to choose between different ways of mapping the terrain. Summer and winter versions were based on real photos.

The reality spectrum, formulated by Paul Milgram in 1994: from the physical environment (all objects are real, they can be felt) to completely virtual (all objects and the environment are generated by a computer). Denote the differences between the main types of realities.

With the development of NASA's virtual reality science, the Ministry of Defense and the National Science Foundation have begun to fund most of the scientific research in this field. The CIA donated $ 80,000 to Sutherland's research. The first achievements in this branch of science were used mainly for the training of pilots.

Market virtual and augmented reality gaining tremendous momentum, and every year there are more technologies in this field. Let us examine where they can be used.

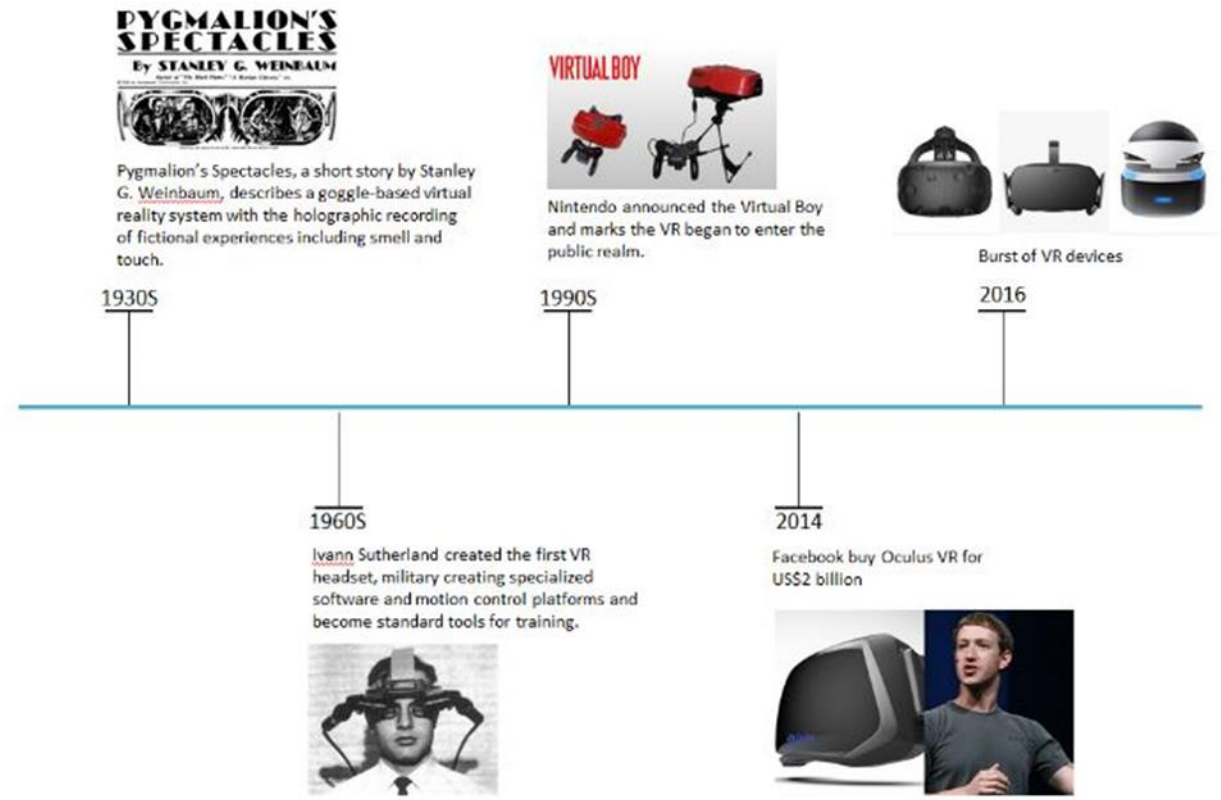


Figure 1.3. The history of virtual reality

1.2. The structure of virtual reality technologies

Equipment for virtual reality

Consider the virtual reality of your eyes are closed, and you can come to something, such as our top photos: a geek wearing a wraparound headset (HMD) or a big powerful computer. Input and output is not similar in between VR and an ordinary computer. For example an ordinary computer makes a use of things such as a keyboard or (more exotically) speech recognition for input, whereas VR makes a use of sensors which can check how your body is moving. Furthermore a PC shows output on a screen, VR uses two screens (one for each eye), stereo or surround-sound speakers, and shapes of haptic feedback as well. Now it will be seen VR input and output devices.

Helmet or glasses virtual reality

Modern head-mounted display are more points than a helmet and contain one or several displays, in which displays images for the left and right eye, a lens system for correcting the image geometry, and tracking system that tracks the device orientation in space. As a rule, the tracking system for the head-mounted display developed on the basis of gyroscopes, accelerometers and magnetometers. For systems of this type are important wide viewing angle, the accuracy of the tracking system for tracking a user tilts and rotations of the head, as well as minimal delay between the detection of changes in head position in space and output a corresponding image on display

MotionParallax3D-displays

For devices of this type include a variety of devices from smart phones to some rooms virtual reality (CAVE). Systems of this type form the user the illusion of three-dimensional object through the withdrawal of one or more specially shaped projections displays virtual objects generated based on the information about the user's eye position. When you change the user's eye position relative to the image display them appropriately changed. All systems of this type involve visual perception mechanism volumetric image motion parallax (Motion Parallax). Also, most of them provide the output of the stereo via stereo displays, cycling stereoscopic vision. Tracking systems for MotionParallax3D-displays track the coordinates of users' eyes in space. For this purpose, various technologies: optical (determination of the user's eye coordinates on the camera image, tracing active or passive markers), significantly less - ultrasound. Often tracking systems can include additional devices: gyroscopes, accelerometers and magnetometers. For systems of this type important position tracking accuracy in user space, and the minimum delay between detecting changes in position of the head in space and output to the corresponding image displays. Systems of this class can be performed in a variety of form factors from virtual rooms full immersion screens to virtual reality the size of three inches.

Virtual retinal display

Devices of this type form an image directly on the retina of the eye. As a result, the user sees an image "hanging" in the air in front of him. Devices of this type are closer to the augmented reality systems, since images of virtual objects that the user sees are superimposed on images of real-world objects. However, under certain conditions (dark room, sufficiently wide coverage retinal image, and also in combination with the tracking system) of the device of this type can be used for immersing a user in virtual reality.

There are also various hybrid embodiments: e.g., CastAR system in which the correct receipt of image projection on a plane is achieved by arranging the projections directly on the glasses and stereoscopic separation - by using a retroreflective surface coating, which is being projected. But as long as these devices are not widely distributed and exist only as prototypes.

Figure 1.4. Room of the CAVE system

At the moment, the most advanced virtual reality systems are projection systems, made in the layout of the room virtual reality (CAVE). Such a system is a room on which all walls are projected 3D-stereo image. The position of the user, the turns of his head are tracked by tracking systems, which allows you to

achieve the maximum effect of immersion. These systems are widely used in marketing, military, scientific and other purposes.

Sound

The multi-channel speaker system localizes the sound source, which allows the user to navigate the virtual world with the help of hearing.

Imitation of tactile sensations

Imitation of tactile or tactile sensations has already found its application in virtual reality systems. These are so-called devices with feedback. They are used for solving problems of virtual prototyping and ergonomic design, the creation of various simulators, medical simulators, remote control robots, including micro- and nano-systems create virtual sculpture.

Control

In order to more accurately recreate the user's contact with the environment, the user interfaces that most realistically match the simulated ones are used: a computer steering wheel with pedals, a device control handle, a gun pointer, etc.

Application for virtual reality

To create a virtual reality, special devices and programs are being developed, but their high cost does not yet allow the introduction of this technology. But soon, virtual reality will also be available to everyone, just like an ordinary computer program.

Figure 1.5. Application interface of virtual reality

VR player

VR player is the future of the gaming world of virtual devices, where everyone will be able not only to participate actively in the process, but also provides the effect of full presence. Also feature of this application is available for viewing video files in a format .mp4 / .mkv / .avi / .mov / .ogg. Now you will not have any problems with the launch and conversion of video, enough to fill a video from youtube and enjoy watching it. Viewing from Youtube is available in 2D and 3D modes. By pressing the buttons with the help of a glance, you can go to the Youtube section, and then in the search to specify the subject matter of the content for viewing. After that, a table with all the video files appears, from which you need to select a suitable video for viewing. Among the basic requirements for gadgets for this application is not less than Android 4.1. On earlier platforms, this application probably will not start.

Computer games

Interactive computer games are based on the player's interaction with the virtual world they create. Many of them are based on identifying the player with the character of the game, whether visible or implied.

1.3. The process of development of virtual reality technologies

Virtual reality experienced several turns of development. We see now a new round in which virtual reality for the first time has a massive effect.

The revolution that we are witnessing now - is a consequence of the emergence of so-called “fourth platform”.

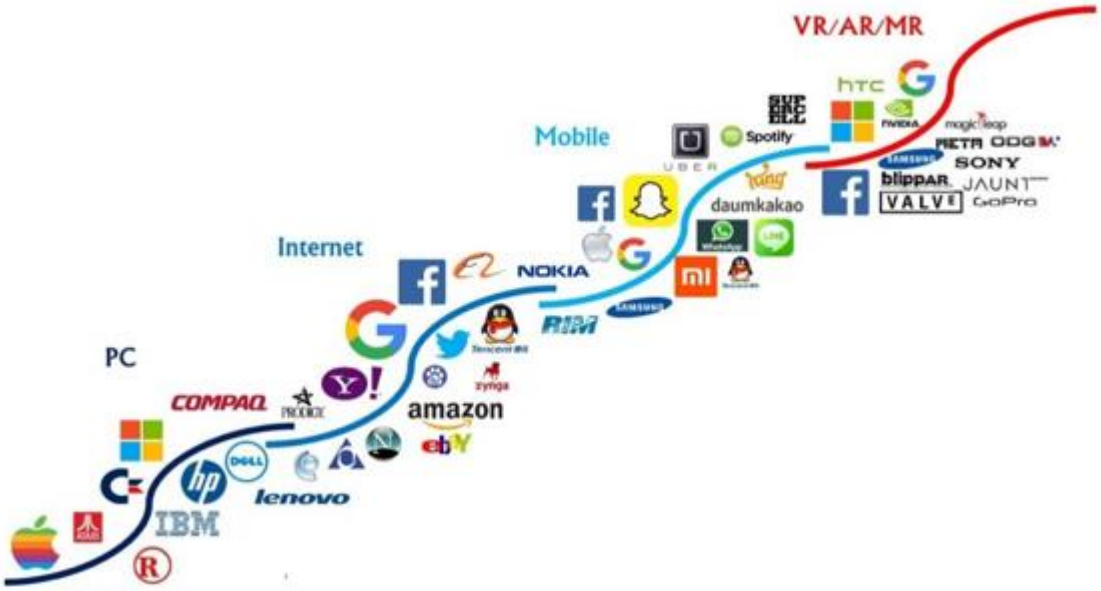


Figure 1.6. Another round of platform development

The first platform - personal computers that appeared in the late 80's - early 90's, then came the Internet, the next stage was mobile technology. Now mobile consumption is more than on personal computers. Virtual and augmented reality is the next platform for which new markets, offers and business will be created.Now the very moment when it is necessary to invest in VR / AR and develop technology in this area[8].

There is a hype cycle - a cycle or a curve of maturity of technologies, which was offered in 1995 by the research company Gartner. Each technology on the market goes through a certain stage of this cycle. The version of 2016 looks like this:

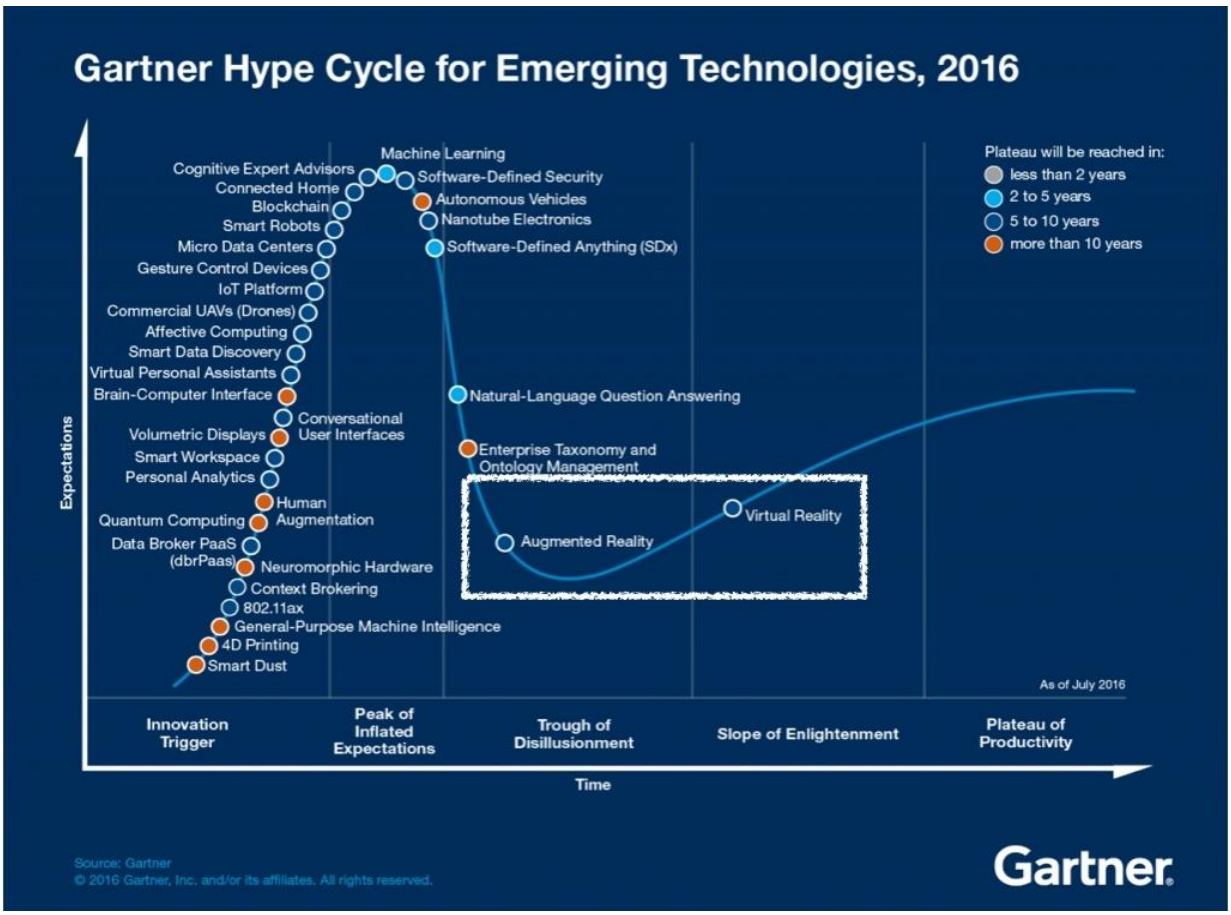


Figure 1.7. Another round of platform development

The first stage - the "trigger", when in the beginning no one knows the way of technology, it is only engaged scholars and enthusiasts, it nobody invests.

The second stage is the "peak of excessive expectations." More and more people learn about technology, the collective expectation of a boom, a surge of interest in it. During this period in the mid-90's Nintendo released gadgets for virtual reality, but they were sold only 700 pieces. Quality content and resolution of existing screens was not enough to create a massive effect[8].

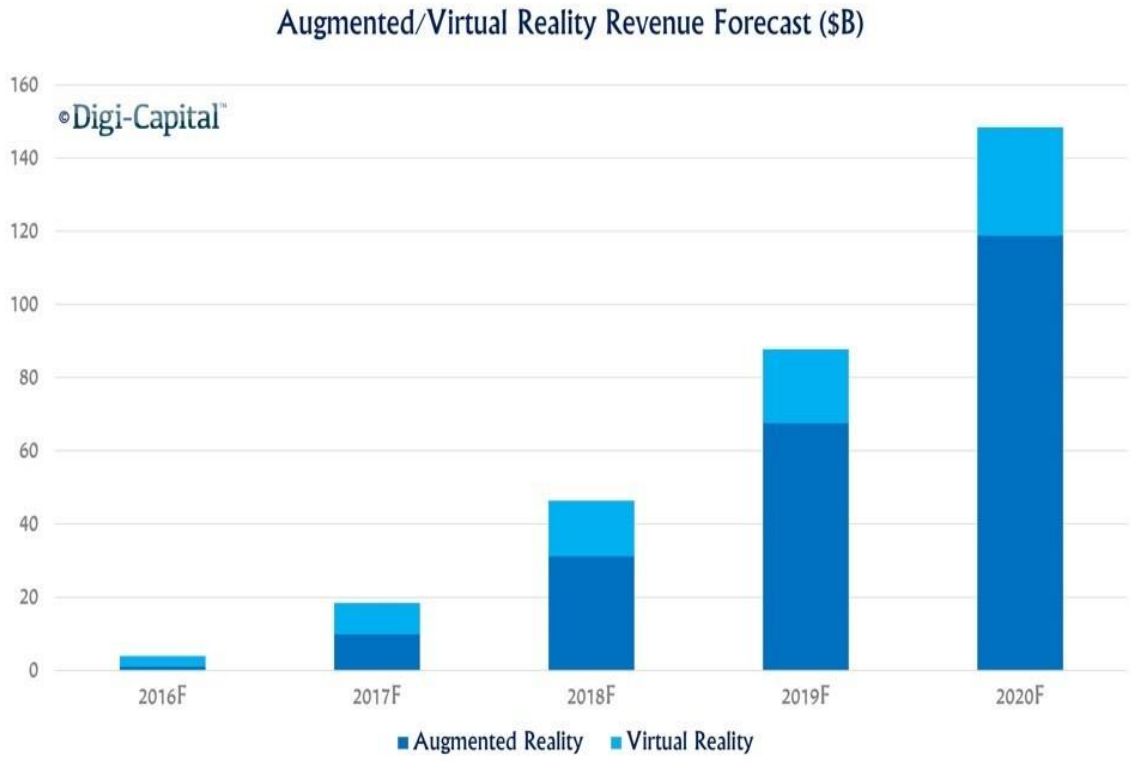
Therefore, in the HYIP, which was a virtual reality in the early to mid-90's, disappointed and began to wait for what happens next. "Disappointment" is the third stage in the cycle of technology maturity. Now there is augmented reality in it.

Now, virtual reality in the cycle of technology maturity is at the fourth stage - "education": solutions have already been found for the main problems of technology, there is a lot of quality content and the audience. At the same time,

VR is approaching the fifth stage - the "productivity plateau", when technology becomes ordinary, its use becomes a routine. An increasing number of people will use virtual reality in everyday life. One driver for the development of the VR market, so that it has become truly massive will be the mobile VR. Samsung and Google put great hopes on him.

Market volume – forecasts

According to analysts, now the volume of the virtual and augmented reality market in revenues from the sale of content and devices is several billion dollars, but by 2020 will be more than $ 150 billion (see the figure).



Figures 1.8. Argument and Virtual reality Revenue Forecast

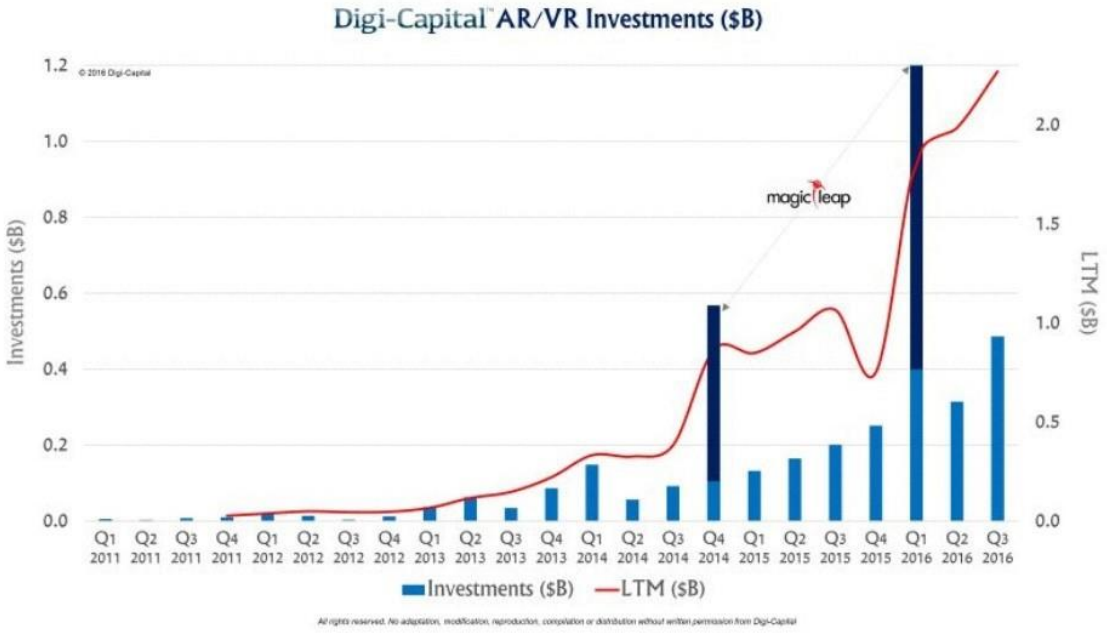
This is a great opportunity for start-ups and investors. Now the main revenue is generated by helmets of virtual reality and the content that is created for them. But the picture will change - a big bet will be made on augmented reality. This can be seen from the diagram above.

The blue chart is the revenue from services, content and points that create an augmented reality. We see that the share of virtual reality in the revenue is much less, although while the main HYIP is created by it.

The projected giant size of the market gives rise to huge opportunities for creating your own business. Let's recall Apple and their mobile applications: iPhone has revolutionized the smartphone market. Who earned the most? Developers who began to make applications for smartphones. Since the application market was very small, the demand for them was great due to the distribution of these devices. It was bought and downloaded almost everything that came to hand - could shoot games that previously seemed generally impossible. Due to the large demand and small supply, an asymmetry was created in the market, on which smart people earned money.

Investing in virtual and augmented reality

Investments in the industry are growing, and several peaks can be observed.



Figures 1.9. Digi-Capital Argument Reality and Virtual Reality(2011-2016)

The first small peak: Facebook buys Oculus in the first quarter of 2014. The next jump occurs in the first quarter of 2016 - the peaks are due in large part to investments in Magic Leap (it was invested by more than $ 1.5 billion by

Andreessen Horowitz, Kleiner Perkins, Google, JPMorgan, Fidelity, Alibaba). All the major players moved into this field: Google, Apple, Samsung. Now there is not just a HYIP, - market players and analysts have confidence that this technology will fire. The only question is who will collect the cream.

The forecasted revenue from sales of content and products in virtual reality is $ 30 billion by 2020, in the augmented reality - $ 120 billion, breakdown by spheres - lower in the scheme[8].

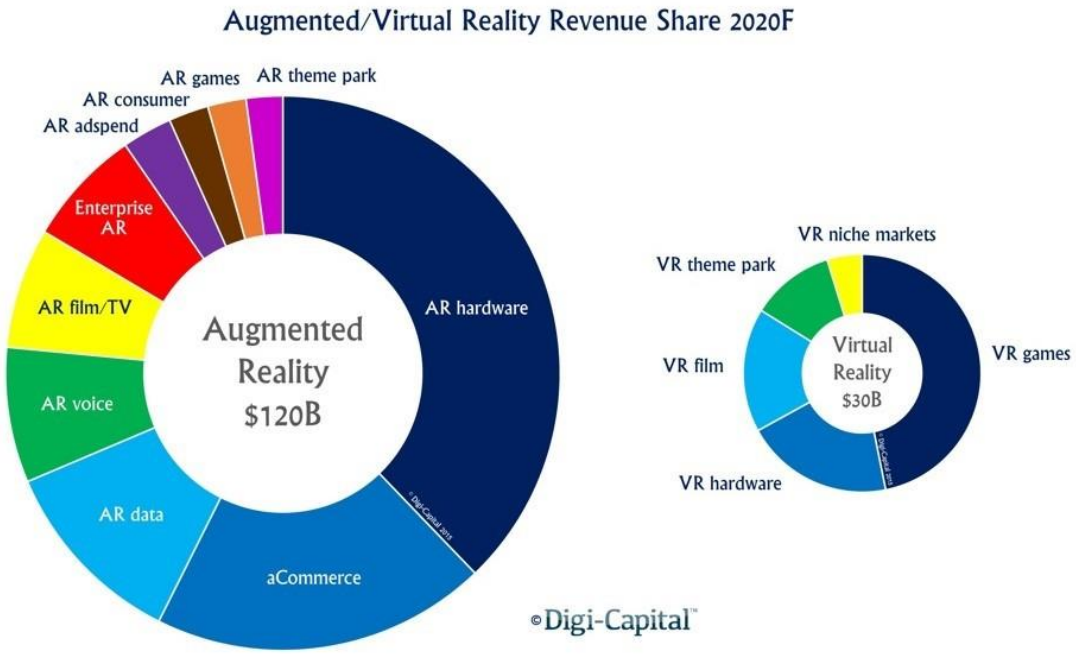


Figure 1.10. Digi-Capital Argument Reality and Virtual Reality Revenue Share 2020

There are already outlets from start-ups in this area - by buying a stake in companies by other players. Below - examples of large outputs.

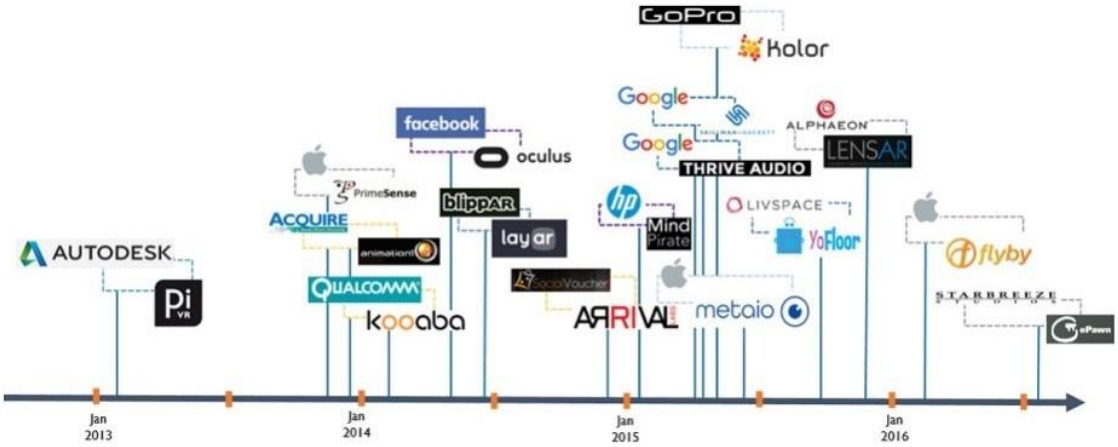


Figure 1.11. Development project on virtual reality

The virtual reality started to become interesting in market gradually. At first it was used mostly in entertainment such as computer games now it is active in different areas such military aviation or training. US and European schools made efforts to introduce virtual reality in classroom which creates potential future technology. Despite the fact that accurate virtual reality statistics in the classroom are not easily available, unconfirmed information states that there was an honest influx of companies providing virtual reality services with support for educational programs. Comenius project is the most popular model of virtual reality in teaching. This project was a biology lesson for the school in the Czech Republic, which used the controller leap Motion and the individual Oculus Rift DK2 headset to facilitate innovative scientific studies.

Despite the fact that the concept of virtual reality into the classroom, seemed ideally suited to provide an exciting experience for students to facilitate the learning process, the reality is that this technology had a very high overhead. gadgets, gear and training required to implement this technology in the classroom were very high. Get this exciting experience for students, educational institutions, then-still-expensive smartphones, tablets for teachers and, of course, glasses.

Another requirement was the high-bandwidth Internet connection, without which this experience could not be affected. All of these variables were some of

the main reasons why this amazing technology does not capture the whole world of classes.

2. VIRTUAL REALITY IN THE EDUCATIONAL PROCESS

2.1. Integration of pedagogical methodology and virtual reality

There are many companies that provide e-learning services. Creating a custom is not the most complex virtual simulation costing institution or a small company in a decent amount. Therefore, an excellent opportunity for them is the independent creation of electronic textbooks and simulations, the organization of events and meetings in virtual environments. Now all this can be done without having special skills in design or programming. The main thing is to have a fantasy and know the peculiarities of the method of presenting information using modern technology of virtual worlds.

Let's first consider the relationship between such concepts as virtual worlds, serious games and simulations. There is an opinion that all these are points of the same continuum. Virtual worlds, serious games and simulations belong to highly interactive virtual environments (Highly Interactive Virtual Environments, HIVE), but each with its own characteristics. Despite the fact that they are all alike, we can distinguish some features.

Educational simulations are strictly structured, structured scenarios with proven rules, tasks and strategies that are carefully designed to develop specific user competencies. The competences obtained in the simulations can be transferred by the user to the real world.

Games are involving activities, usually used for entertainment, but which can also be used to learn and practice something: a set of tools, ideas or actions. Games are implemented in a synthetic (or virtual) world, structured by certain rules, feedback mechanisms, and tools or support methods. Games are not simulations.

Virtual worlds are multi-user 3D environments, environments or genres of the Internet community. Being in such an environment, users can interact with each other, use the pre-created computer objects, their actions are not subject to

any specified destination, such as the transition to the next level or the successful completion of a script.

Figure 2.1 presents a continuum of virtual worlds, simulations and “serious games”.

Figure 2.1 - Continuum of virtual worlds, simulations and "serious games"

Clark Aldrich (Clark Aldrich), the famous Western researcher of serious games and training simulations, explains the differences between these three types of educational activity as follows:

“The virtual world will not work the same as simulation, if you need simulation, the virtual world is useless”. The virtual world offers only context without content, it provides a set of tools that both offers new opportunities and limits possible applications. "Educational simulation can be implemented in the virtual world, but for this, it must be created and "implemented" in the virtual world. Companies very often cannot use all the potential inherent in virtual

worlds, since they are sure that by purchasing virtual They will receive a ready simulation, similarly, the game is also not an educational simulation.

Playing SimCity will not make the mayor of your city work better. Some of the World of Warcraft players may have leadership skills, but not all of those who play the game will. The game does not provide training infrastructure and does not provide training guarantees. The fact that some players have developed their leadership skills in the game does not mean that leadership skills will be developed for any player playing this game and that the game should be used in serious leadership development programs. A completely educational simulation may not be too exciting. The program can have three-dimensional graphics and computer game animations, but the content can be frustrating.

Educational simulations are created to develop certain competencies and students' experience, with the assumption that educational simulations will be as interesting to them as games. "

However, there is another theory that training based on the game includes elements of the game, simulations and training in an almost equal way, as shown in Figure 2.2.

Without the inclusion of learning goals (pedagogy), games are simply simulations. If there is no simulation, then the games are a mixed form of entertainment and learning, often in a primitive format. And if we neglect the game mechanisms, we get a training simulation.

In turn, there is an opinion that serious games appear through the addition of pedagogy to the three main elements of the computer game - the plot, image and software. Pedagogy in this system should rather be subject to other plot and gameplay, rather than playing an equal or leading role.

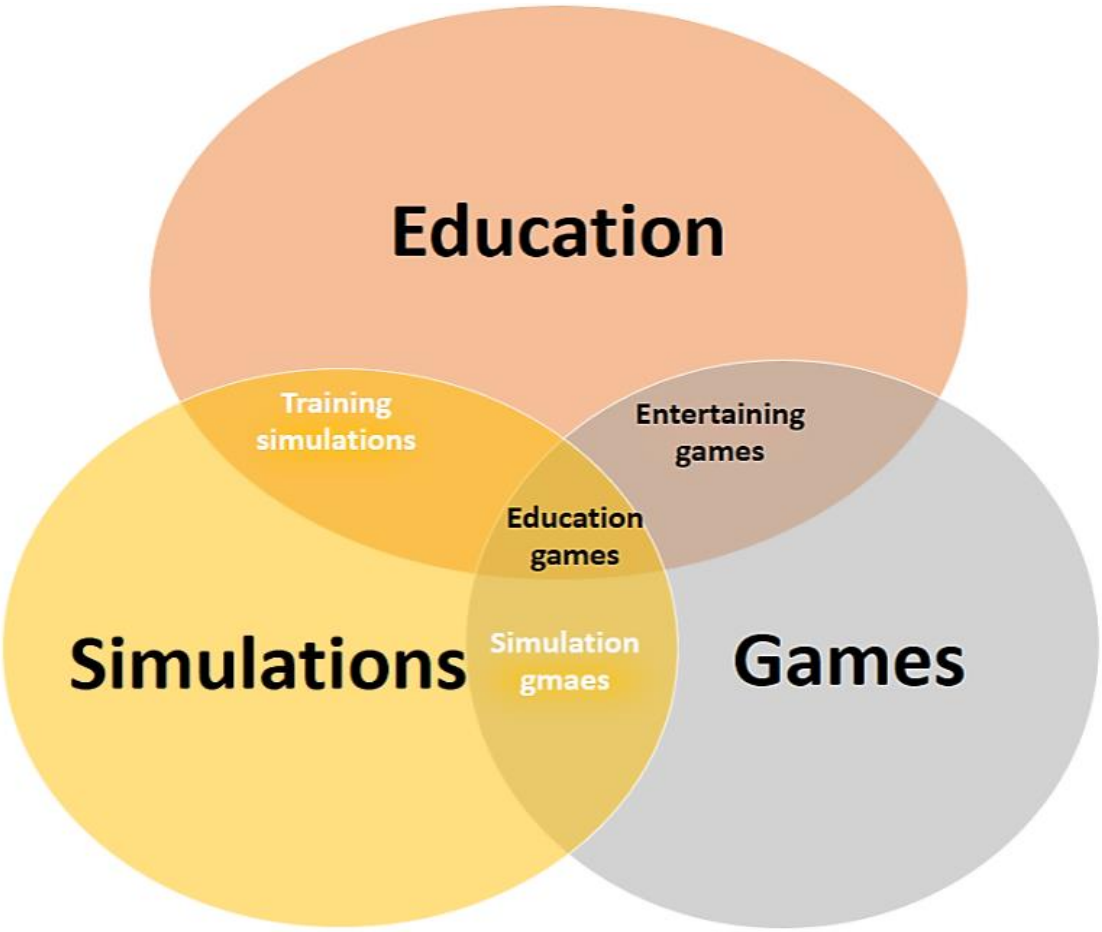


Figure 2.2. - pedagogy relation, computer technology and games

In this paper, the concept of "virtual world", based on the points of view discussed above, will be understood as a technology for creating Involving Learning Simulations, which combine virtual trainings, elements of games, and their construction takes place using pedagogical methods. The main thing is that further the virtual world will be considered not only as a genre of the Internet community, but also as a tool for creating simulations and serious games, besides the environment in such trainings can be presented not only in a three-dimensional environment, but also in a two-dimensional, for example, using multimedia content.

2.2. Learning methods using virtual reality

The possibilities of the "Virtual Reality" system through the implementation and implementation of special techniques for "embedding" learning technologies in subject-oriented learning environments, carry out a pedagogical impact of a long-term nature, providing:

• development of visual-figurative, visual-effective, intuitive, creative, theoretical thinking;

• the formation of aesthetic tastes, evaluations, which contributes to aesthetic education.

There is a problem: to what category of didactics and upbringing does this kind of virtual reality belong? Probably, BP in training is, first of all, methods and means of teaching.

As you know, in its most general form, the method is a method of achieving any goal, solving a specific problem, more specifically, it is a set of techniques or operations of practical or theoretical assimilation (cognition) of reality. We will not discuss the interrelation between the method and methodology of science, pedagogy, but we will focus on the more applied meaning of the concept method, on its relationship with such components of modern didactics as the means, form, types of education.

Most definitions of teaching methods emphasize that this category includes the activities of the teacher and the activity of the learner: "The method of instruction is a system of consistent interrelated actions of the teacher and students ensuring the assimilation of the content of education". I. Lerner, MD Skatkin, three types of signs of learning methods are distinguished: the designation of the goal of instruction, the reflection of the method of assimilation, the expression of the nature of the interaction of subjects of instruction. Most teachers talk about the method of teaching as a method of transfer, assimilation of knowledge, which is closely related to the actions of subjects of the educational process, with methods and means of teaching. The method is often understood simply as a set of coordinated, generalized methods of teaching, as a logical way

of mastering knowledge, mastering skills and skills, as a concrete way of the joint interrelated activity of educators and pupils, aimed at solution of educational tasks. The received scientific knowledge, especially new ones, is accessible only to the chosen ones, they are complex, abstract, intuitive, etc. The task of didactics is to transform such knowledge, make it accessible, understandable for the student. The method of teaching is closely related to understanding students' scientific knowledge or mode of action, it is designed to provide this understanding. Due to what understanding is achieved? By transforming the very knowledge or content of education. The method of teaching, therefore, is closely related to the content of education. The content of education is produced by the teacher, through him he translates to the student a system of meanings (connotation) and meanings (denotative meanings). The student must perform certain mental actions, thought processes, in order to understand the translated meanings and meanings. The criterion of understanding is the correct reproduction of knowledge. In addition, the method of instruction is aimed at memorizing certain information, on the development of thinking and personality, on practicing practical actions (skills). These tasks are realized through certain methods of constructing the educational material (cognitive impact), ways and means of its transfer, ways and means of forming a relationship to information (emotional impact). In general, the method of teaching is a systemic phenomenon, which includes at least three components:

- Teacher's actions;
- the actions of the student;
- a certain structured content of education.

The systematic nature of the didactic method predetermines many classifications of teaching methods. Depending on the chosen basis, the appropriate teaching methods are also highlighted. According to the primary source of knowledge, there are verbal, visual, and practical; By the logical method of teaching - inductive, deductive, analytical, synthetic; By the method of pedagogical guidance - methods of explaining the teacher, methods of

independent work, etc. However, often these classifications of methods are built on non-essential, secondary characteristics, they are useful only for the implementation of private didactic tasks. We agree with J. Lerner, MD Skatkin, which consists in the fact that "teaching methods reflect the purpose and content, the psychological (taking into account the laws of assimilation), epistemological (organization of students' cognitive activity) aspects of learning. In accordance with the nature of cognitive activity, they were justified explanatory-illustrative, instructive-reproductive, problematic presentation, heuristic, research method. This classification reflects many goals of developmental learning and systematically represents the content of teaching methods. But it is invariant to the features and structure of the educational material.

In our opinion, modern information means for submitting educational material are so specific and developed that they produce qualitatively new properties of the content of education, which were not contained in traditional methods. For example, the same BP radically transforms the principle of visibility, 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, olfactory perception, in the implementation of actions, as well as in real interaction with similar situations. In this respect, we are close to the position of the American didact K. Carr, who singled out four revolutions in the field of teaching methods:

1) the change of parents-teachers by professional teachers;

2) the replacement of the spoken word with writing;

3) introduction of a printed word;

4) the introduction of automation and computerization of training.

These revolutions reflect not so much a change in the means of instruction, but also a transformation of the quality of the educational material, the content of education. Virtual reality is one of the vertices of computerized learning. In it, "over stimulation" of human sense organs is achieved (similar to obtaining real perceptual experience), which is the basis of learning, including intellectual

learning. In addition, radically changing: the way of interaction between the teacher and the student, the content of education (which becomes informational), the actions of the learner and the learner, the way in which the material is learned. Thus, most of the essential features of the learning method are specific when it comes to VR. This allows us to talk about VR methods as training methods. These methods are implemented in a new kind of training (which, probably, it is necessary to allocate) - conditionally it can be called software and information.

Today, the specificity of human interaction with the information models of reality is obvious. In education, through the use of information systems, the subjectivity of both the teacher and the student sharply increases, the boundaries of the implementation of the principles of visibility and accessibility, the inclusion of learning, the connection of learning with life, and the potential for emotional impact on the learner expand. These and other features of VR methods and training software and information allow to speak about them as landmarks in the implementation of the subject of pedagogy. The essence of subject pedagogy is that the teaching and upbringing process is seen as the interaction of two subjects - the teacher and the student. The main object of pedagogical activity is the subject. The objective of subject pedagogy is the formation of a subject in cognition, learning, objective activity, experience, interpersonal and social relations, etc. In subject pedagogy, the task is to form a student as a full-fledged subject of life with his self-regulation, self-determination, self-determination, self-education at all stages of the life path.

Virtual reality as a means and technology of learning

VR, in our opinion, applies to the means of instruction. In the classical sense, teaching aids are didactic instruments of teacher and student activity, educational equipment, visual aids. These tools are the carriers of information that implement the learning objectives. In this regard, VR involves rather complicated equipment, special equipment, so that the device for implementing VR is considered as a means. Unfortunately, up to now training programs in this virtual environment are few. This reason predetermines the position that formally

virtual reality has not yet become a means of learning in the full sense of the word. According to the classification of schools S. Shapovalenko (natural objects, images and displays, descriptions and TLT - technical training tools), VR, obviously, is included in TLT. These provisions relate to the narrow meaning of the concept of "learning tool".

At present, in pedagogy, especially in the theory of education, an original approach is widespread, where the means of education are interpreted in a broad sense. For example, the work can serve as a means of forming personality, i.e. education. This occurs when labor activity is used not so much for the production of consumer goods, but primarily as a means of education, influence on the individual: this involves analyzing the results of labor, determining ways to correct mistakes made by students in labor, reflecting on ways to create better products. In this approach, education funds (respectively, training) - a variety of activities (game, learning, work, communication), which is impossible to form certain personal qualities of the pupil acting subject of the educational process. Therefore, the remedy is not so much in itself a material object used in the process of education, but the activity of the pupil, which includes the subject. It is the nature of the student's activities with a particular object ("tool") causes certain experiences, feelings and relationships These experiences and relationships, generalize and become the basis of character traits, will, personal and subjective qualities. It turns out that the activities of the pupil is the means of the other, more general activities - educational.

With this understanding of the means of education, VR also refers to the means of instruction. Work in VR can be considered as a certain type of activity, the subject of this activity is precisely information or information models of real situations. Such activity is not identical with the activity of the student with real objects. Probably the greatest didactic effects will be achieved using the most sophisticated equipment. These rooms VR-CAVE, consisting of several screens located in the form of a cube, on which images are projected, the student, in special glasses enters the room and sees nothing but the surrounding virtual

objects, which creates the effect of maximum presence. Interpretation of VR as an activity that realizes didactic goals, involves and training programs for creating avatars - information models in the human body VR or its parts, with which he identifies and can manage them. In teaching, this is still inefficient, for example, in distance education, learning environments for joint communication are created, like lecture audiences, where each student has his own avatar, which can be set to perform commands - raising his hand, going to the answer board or nodding his head. Such training VR-systems are still naive.

Thus, it is advisable to classify the various types of activities (game, educational, labor, etc.) on the one hand, and on the other hand, the totality of objects and works of material and spiritual culture that are involved in pedagogical work. The VR didactic programs act as teaching aids in both hypostases and senses.

There are several didactic possibilities of virtual technologies in education:

- the possibility of intensification of the educational process;
- activation of cognitive activity of students;
- a significant increase in the level of independent activity;
- development of creative abilities, logical thinking, memory;
- Virtual technologies allow realizing the ideas of individual and differential approach in the learning process;
- contribute to the fundamentalization of substantive training, due to the formal and logical reflection of cause-effect relationships of the functioning of objects in virtual models;
- develop procedural knowledge, which involves not only theoretical knowledge, but also to use it in practice;
- are an effective tool for training skills in various situations that are possible in future professional activities.

VR, used for pedagogical purposes, is also an educational technology. Educational technology is a system, a sequence of actions aimed at realizing the goals and objectives of educational concepts.

We agree with the opinion of V. Zagvyazinsky that in contrast to the methodology, educational technology built into a rigid algorithm of actions, prescriptions, providing a guaranteed effect, the implementation of the target. The actions inside the training programs that we have created in the genuine VR have a strictly defined sequence, are aimed at assimilating the content of education, and are guaranteed to lead to concrete results. However, VR-training programs have not yet been designed into a full-fledged technology. If we take into account all the main criteria of educational technologies: systematic, reproducible and guaranteed results, feedback, the last of the signs has not yet been implemented in didactic VR-systems. In particular, there is not enough control algorithm. This disadvantage, however, is quite easy to overcome, and in VR it can be realized at the highest instrumental level.

2.3. Psychological effects of virtual reality

Earlier, we obtained experimental data that the images of VR, when included as content, component of the task, significantly affect the increase in creativity (the number of collaterals), stimulate the procedural characteristics of thinking. Between the figurative and cognitive sphere of intelligence there are both direct and indirect forms of interaction, the mediating process in this interaction is the thought processes of analysis, synthesis, generalization.

Recently under our supervision was created a number of training programs in this virtual Wednesday in biology and geometry for students in upper secondary general schools. In these programs, the VR-images has become much more dynamic, the ability to animate expanded significantly.

All the objects in these tutorials are done in 3D, for animation a multi-platform tool was used to develop 3D applications "Unity". The programmer, Titov, was one of the first to use Unity not to create games, but to implement didactic programs. Two rather complicated topics on biology were taken for

pupils of secondary general education schools of the senior classes - "Synthesis of Protein", "Gene Inheritance». Students could zoom in and out of the objects during the action, stop the scene, receive sound comments to the biological processes that occurred on the screen, and so on. They completely immersed in the processes that occur inside the cell during the synthesis of protein and when inheriting the characteristics and could influence them. Viewing such a software product takes 8-15 minutes of time (see Figures 2.1 and 2.2).

VR images probably occupy an intermediate position among other species in the traditional classification of images. They refer primarily to images of perception, pepper there, at the same time, these images are close to eidetic, they have their own specifics.

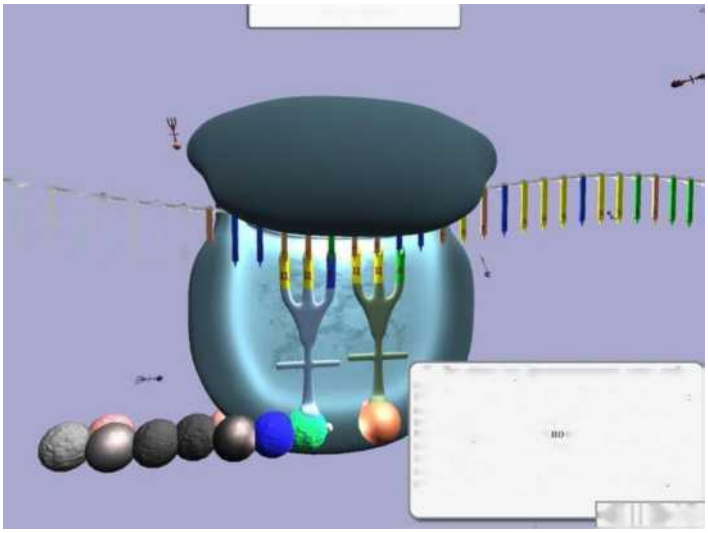


Figure. 2.3. "Synthesis of protein". In the ribosome, there is a combination of amino acids delivered by transport RNA

The problem of research. We were faced with the task of tracing the nature of the influence of training virtual programs on the thinking and mental states of the subject, determining the measure of the effectiveness of these software products in training.

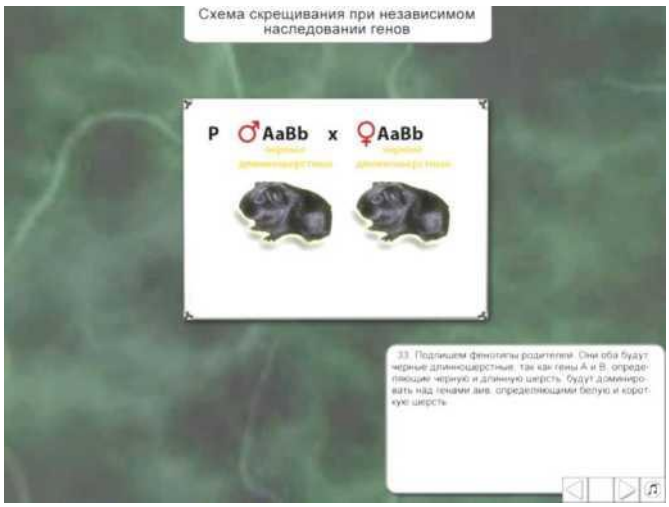


Figure 2.4. Shot from the program "Gene Inheritance"

Procedure and methods of research. The connection between virtual images and thinking was realized through the synthesis of systemic and subjective approaches, from the positions of the system-subject approach. At the same time, thinking acts as a complex formation, including thought processes, operations, forms, meanings of the cognizable object, generalized personal and subject characteristics. The dynamics of mental activity was recorded using the method of microsemantic analysis of the test subjects' protocols.

The content parameters of mental states are analyzed in the framework of the system-structural approach to states.

The sample consists of students in the upper grades of general education schools (45 people).

Results of the study. In the beginning, we will briefly present the data on the influence on the psychic training programs in biology. Prior to viewing the training program, the subjects decided a biology test for content on the topic. After viewing, the second test, similar in complexity to the first test, was also solved.

Both tests were specific questions, problems diagnosed by means of which the level of functioning and the process of thinking. The minor part of the experiments with the pupils used head-mounted display.

In general, training programs significantly influenced the growth of cognitive motivation and interest among students (98%). The main results were that the training programs in VR improve the answers on the tests for the relevant topics in poorly achievable pupils by 40-50%, for the excellent students and the talented ones - 2 and more times (100%).

A significant increase in the euphoric state was observed during the experiments. Judging by the feedback of the test subjects, the program causes considerable interest and admiration due to the quality of the objects and processes performed in the virtual environment and the general background of the environment as a whole, which may, in turn, indicate the reasons for increasing the euphoric state.

According to Sorochinsky's data, microsemantic analysis of the subject's thinking in performing complex tasks before and after work with the program showed that the analysis process through synthesis was not directed to the program and led to incorrect results, and after working with the program, a mixed 43% or 57% And led to correct results with 1 -2 prompts. At the same time, the level of predictions of the required solution of the problem before working with the program was empirical, often not in accordance with the objective laws of the subject matter of the problem, but after working with the program - already theoretical, generalized, with the correct use of scientific terminology and objective knowledge.Prior to working with the program, the subjects could not find the correct solution of the problem, they also did not accept the hints. Hypotheses were unscientific in nature and showed a significant misunderstanding of scientific laws. After working with the program, some of the subjects who were at the level of directed analysis through synthesis found the correct solution of the problem independently, without prompts, and the other part, with mixed analysis through synthesis, solved the problem with 1 -2 successfully accepted hints. When accepting hints, the insight effect ("Aga" reaction) was often observed. Concerning the reflection in the minds of the subjects of the relationship between the conditions and the requirements of the

problem, it should be noted that prior to working with the program, there was often a complete lack of connections between these components of the problem, or hopeless in terms of solving the conjecture (hypothesis) about these links. After working with the program in solving the problem, the subjects found the desired connections more successfully, while they reproduced in memory (consciousness) the images of the studied VR, corresponding to the condition and the requirement of the task. These images served as a support, a means for finding a solution, they gave the necessary information to find the correct relationship between the conditions and requirements of the problem. Particularly it should be emphasized that changes in the indicators of biological tests, students before and after the usual lessons on these topics were significantly lower - an improvement of only 10-15%.

When carrying out our experiments with adults and elderly people, the data are similar (in all cases the BP helmet was used, the sample was 48 people). It is interesting that the subjects were not related in the profession with biological topics, as a rule, they did not remember much about the synthesis of protein or the inheritance of genes at the beginning of the experiment. After working in a virtual biological environment, the indicators for solving the biological test increased 3.2 times. In thinking, 76.4% of the subjects passed from the level of non-directional analysis through synthesis to directed and mixed. This indicates a significant development of the procedural characteristics of thinking.

Briefly, we present data on the effect on the thinking characteristics of training programs in geometry (Figures 2.3, 2.4). The sample - pupils of 10-11 classes, 50 people. Before using the training program, the subjects decided the stereometrictest for content on the topic. After viewing, the second test, similar in complexity to the first test, was also solved.The tests included questions, problems, with the help of which the level and process of functioning of thinking were fixed. In a small part of the experiments a helmet VR was used. According Pobokina P.[6], training programs have significantly influenced the growth of cognitive motivation and interest to the students. The main results were that the

mathematical training programs in VR improve the answers for the tests on the relevant topics in schoolchildren by an average of 1.5 times, with an improvement of 90% 10% of pupils, in particular, 18% of pupils increased their answers by 1 point, 44% of pupils by 2 points, 22% of pupils by 3 points, 4% of pupils by 4 points and 2% of pupils by 5 points (each point corresponds to the correctly solved problem).The calculated empirical value of the Student's criterion (t = 11.74712) turned out to be much larger than the critical value of this criterion (t = 2.05), which leads to the conclusion that the improvement of the correct answers after the application of virtual mathematical training programs is reliable. In addition, according to a separate sample of 20 people. The number of correct answers by tests from the primary to the second diagnosis increased by 2 times. However, the effectiveness of the influence on the thinking processes and the effectiveness of solving problems in the training programs in BP by geometry is slightly lower than for biology programs[6].

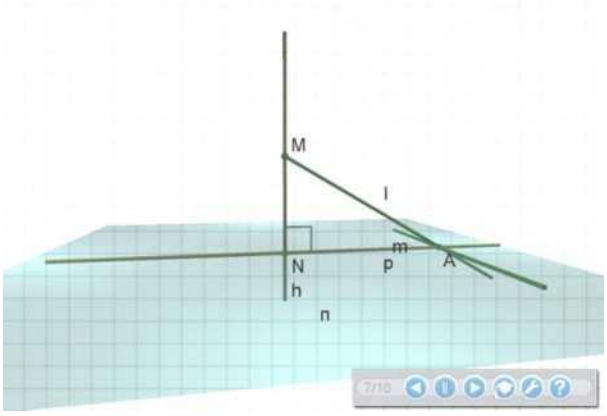


Figure. 2.5. Shot from the program "The theorem of three perpendiculars"

Figure. 2.6. Fragment of the program "Volumes of bodies"

During the experiments, changes in the mental states of the pupils were revealed. Activation and positive state of health after watching the program increased by 8%, calmness increased by 5%, but working with the program more significantly increases the excitement by 10%. Based on observations of students, it can be concluded that such methods of work are of considerable interest to children in comparison with traditional methods of teaching.

A microsemantic analysis of the protocols of solving problems showed that after using the mathematical training program in VR, students who were at the level of directed analysis through synthesis found the correct solutions of the problems themselves, they did not need hints (46% of the subjects or 23 people), students with mixed analysis through Synthesis (22% of subjects or 11 people) required a small amount of hints to solve mathematical problems, but the share of schoolchildren with non-directional analysis through synthesis decreased significantly (32% Subjects or 16 people).At the same time, the students had a sudden understanding of the existing relations and the structure of the whole situation, through insight, although before the use of virtual programs the students had a significant misunderstanding of scientific laws. After working with the program in solving the problem, the subjects found the desired connections more successfully, while they reproduced in memory (consciousness) the images of the studied VR, corresponding to the conditions and requirements of the task.

In the personal aspect of the functioning of thinking, the students' motivation was analyzed. If non-specific motivation prevailed before the use of virtual mathematical programs, then after the application of VR-programs - specifically cognitive. After the application of virtual mathematical programs, the interest and orientation of schoolchildren in studying these complex topics were noted.

Conclusions. The conducted experiments show that the training programs in this virtual environment are an effective means of shaping thinking and, in

general, teaching the personality, contribute to the formation of cognitive motivation and optimal mental states of the individual.

Educational virtual programs can not completely replace teaching in educational institutions (because in the end they represent an imitation of real actions and objects in the information space), it is advisable to use them widely when studying the most complex subjects of various subjects, as well as for training professional skills in various activities.

3. THE INTRODUCTION OF VIRTUAL REALITY TECHNOLOGIES IN EDUCATION

3.1. VRML

The three-dimensional image of the object known, the wide possibility of actions with objects (animation), immersive, and interactive situation, the implementation of abstract visualization models and others determined by Developing effect didactic programs VR.

The concept of VRML

VRML, Virtual Reality Modeling Language - the virtual reality modeling language, the standard file format for showing three-dimensional interactive vector graphics, is most usual in web technologies.

VRML is designed to describe the three-dimensional images and handles objects that describe geometrical figures and their arrangement in space.

The VRML file is an ordinary text file interpreted by the browser. Since many browsers do not have built-in support for VRML, for viewing VRML-documents it is necessary to connect a helper program - VRML-browser, for example, Live3D or Cosmo Player.

As with HTML, the same VRML document can look different in different browsers VRML. In addition, many developers are VRML-browsers add non-standard extensions to the VRML your browser.

There are many VRML-editors make the process of creating VRML-documents more convenient and faster, but the simple model discussed in this article can be created using a simple text editor [3, 9].

VRML - is the fruit of sustained interest in the idea of virtual reality and three-dimensional modeling technology. The transfer of virtual reality on the Web was considered a daunting task. At the end of 1993, while members of the Internet community enthusiastically copied the Mosaic package from the network and were heading for two-dimensional cyberspace, a group of progressive

ideologists were already thinking about how the Web would transform under the influence of virtual reality technologies. In March 1994, they gathered for a meeting. The purpose of the meeting was to start work on creating a virtual reality modeling language for the Web.

As is the case with HTML, the same-the VRML document can look different in different browsers, the VRML. In addition, many developers of VRML-browsers add non-standard VRML extensions to their browser.

VRML 2.0 is a file format for describing 3-dimensional interactive worlds and objects. It can be used in combination with the Worldwide Web network. Also, this language may be used to create 3-dimensional representations of complex scenes such as:

- Illustrations;
- description of the goods and services;
- video presentation;
- etc.

VRML 2.0 standard.

The release of the Virtual Reality Modeling Language (VRML) stimulated the growth of the popularity of virtual reality technology. VRML is a three-dimensional graphic analog of the Hypertext Markup Language (HTML), which is used in the Internet-based hypertext World Wide Web system. It allows you to create and send large images via the Web, like HTML allows you to build, link and forward Internet text and graphics. Taking into account the growth of the number of users of the Web system, it can be assumed that VRML will be the means that will allow virtual reality technologies to leave the laboratory premises and become widespread in the modern computer world. Currently, VRML is developing around the world hundreds of voluminous virtual reality systems for the Web, starting with simple three-dimensional graphical environments that are oriented to conventional computers, and ending with products that completely immerse the user in cyberspace, which require electronic goggles and gloves.

The Internet already uses a lot of voluminous games, systems for visualizing scientific developments, educational programs and interactive catalogs, most of which are developed with the help of specialized tools. VRML allows not only standardize the way to create such three-dimensional environments, but also expand them with additional features, such as multi-user mode. VRML - is the first step towards an inclusive cyberspace - said Gavin Bell (Gavin Bell), Engineer, Silicon Graphics (Mountain View, Calif.), Who was involved in creating the technology that underlies the VRML, a file-based format Open Inventor File Format (OIFF) by Silicon Graphics - One day, VRML will become more common than HTML, and HTML documents will be just part of the virtual environments created with VRML.

In fact, VRML is simply a description language, equipped with Bell's additional tools for creating a virtual reality. Like other programming languages, it implements a method for determining the interaction of objects with each other. Despite using a simple ASCII file format, VRML makes it possible to describe complex graphic objects such as cubes and polygons, lighting methods, materials and various special effects that give the image a reality and are provided in the OIFF.

The objects of VRML are:

- JPEG picture files,
- MPEG video files,
- MIDI format audio files
- and text documents in HTML format.

Characteristics of VRML 2.0.

VRML can represent static and moving objects that can have hyperlinks to other media objects, such as:

- sound;
- video;
- Static image;
- etc.

VRML 2.0 interpreters should be available for different computer platforms along with authoring tools for creating VRML 2.0 files.

VRML 2.0 supports an extensible model that allows you to create and register new objects based on the existing language standard. There is a mapping between the elements of VRML 2.0 and used in applications for working with 3D objects API.

Mechanisms and elements of VRML 2.0

VRML has the following mechanisms and elements:

- A mechanism for storing and transmitting 2D and 3D data over networks;
- Elements for presenting information about 2D and 3D primitives;
- Elements to determine the characteristics of these primitives;
- Elements for viewing and modeling 2D and 3D information;
- A container mechanism for including data from other metafiles;
- Mechanism for defining new elements that extend the capabilities of VRML metafiles to the definition of new types and forms of information.

Example for VRML

In VRML, the following units of measurement are accepted:

- Distance and size: meters
- Angles: radians
- The remaining values are expressed as part of 1.
- The coordinates are taken in a three-dimensional Cartesian coordinate system (see.)

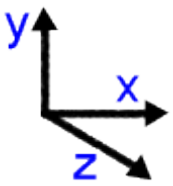


Figure 3.1. The coordinates are taken in a three-dimensional Cartesian coordinate system

VRML file header

As already mentioned, VRML-document is a normal test file.

So as for the VRML browser to find out the VRML-code file, a special header is placed at the beginning of the file - file header:

#VRML V1.0 ascii

The first line of the file should header , as well as, there must not be any spaces before the sharp notation.

VRML primitives

Four basic figures are defined in VRML: a cube (more correctly not a cube, and a rectangular parallelepiped), a sphere, a cylinder and a cone.

The figures are named as primitives. A set of primitives is small, however combining them, you can build fairly complex three-dimensional images. For example, here are these:

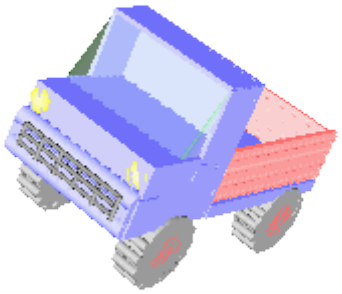


Figure 3.2. Three-dimensional image

Every primitives will considered in detail.

Cube

Possible parameters: width, height, depth.

```
Cube {
  width 4
  height 5
  depth 3
   }
```

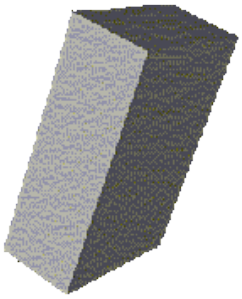


Figure 3.3. Cube

Sphere

The parameter for the sphere is only one, this is radius.

```
Sphere {
        radius 7
          }
```

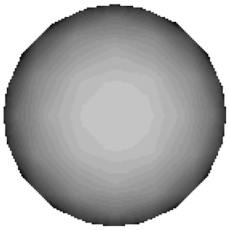


Figure 3.4. Sphere

Cylinder

For a cylinder, you can set the radius and height parameters. In addition, using the part parameter for the cylinder, you can determine whether the base cylinder and its side surface will be displayed. The parts parameter can be set to ALL, SIDES, BOTTOM, or TOP.

```
        Cylinder {
Parts ALL
radius 1
          height 2
}
```

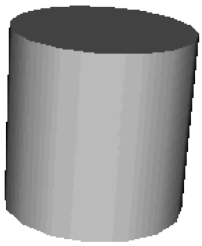


Figure 3.5. Cylinder

To simulate different surfaces in VRML, there is a Texture2 object.

As a texture, it's easiest to use a regular graphic file, for example, in GIF-format. In this case, to "stretch" the texture onto a three-dimensional image, you only need to specify the path to the file in the filename parameter of the Texture2 object.

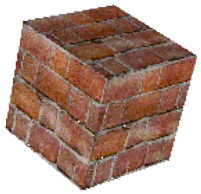


Figure 3.6. Three-dimensional image

3.2. Learning in three-dimensional interactive virtual reality

The researchers found that students remember 20 percent of what they hear, 30 percent of what they see, and up to 90 percent of what they do or imitate. Virtual reality gives the last scenario impeccable; Students can interact with a virtual environment in a person and manipulate various objects in it. This supports "learning by doing", as well as the results of creativity, constructivism.

Using virtual reality as an educational environment is the best benefit and an exciting experience, it brings to the table. Fresh and fuzzy subjects like history

and the cosmos, along with experiment-oriented disciplines like physics, chemistry and biology will be completely dependent on virtual reality. This will be so, because students will be exposed to sensory stimuli; Maybe testing concepts and experiencing the events that lead to them. You can see that virtual reality will lead to fun learning and better remembering using these methods.

Traditional distance learning for many may seem boring and not interesting. Our company radically changes this attitude, offering a new approach to distance learning, based on interactive interaction with the 3D virtual world, game situations in it, communication in the virtual space of many users.

The training complex is usually a three-dimensional multi-user virtual space in which a cluster of classes is deployed for each training course. Each class, depending on the content of a course, has its own appearance and means of presenting materials, such as screens, interactive whiteboards, etc.

Figure 3.7. Video is an example of a virtual class for MTC: (click on the image to start)

In accordance with the scenario and methodology of each course, classes in virtual reality can take place both in the form of self-training - the trainee independently studies didactic materials, video presentations, graphics, tables, etc. And subsequently passes the tests (traditional SDO - classes), and with the participation of the teacher in a virtual classroom, which is analogous to the usual face-to-face classes. Thus, it is possible to implement the most effective - blended learning.

The created virtual classes are distinguished by the highest interactivity of objects in them. Depending on the methodology of the course in a virtual environment, you can beat different game situations in which objects and objects in the environment react or change depending on the user's actions. For example, the simplest: the door to the next class will open only after the student has correctly answered the test. More complex versions of interactive interaction are usually limited only by the customer's imagination, because you can "revitalize" even the most insignificant part of the interior of the virtual classroom.

Figure 3.8. Video example of interactive interaction in a virtual environment (training of aviation security personnel)

The virtual spaces created by our Company are almost an ideal place for "immersion training", that is, learning immersing in an environment with access for students regardless of their location.

Distance learning in virtual reality often becomes not only a convenient tool for obtaining the necessary knowledge, but also a vital necessity, for example, for persons with disabilities.

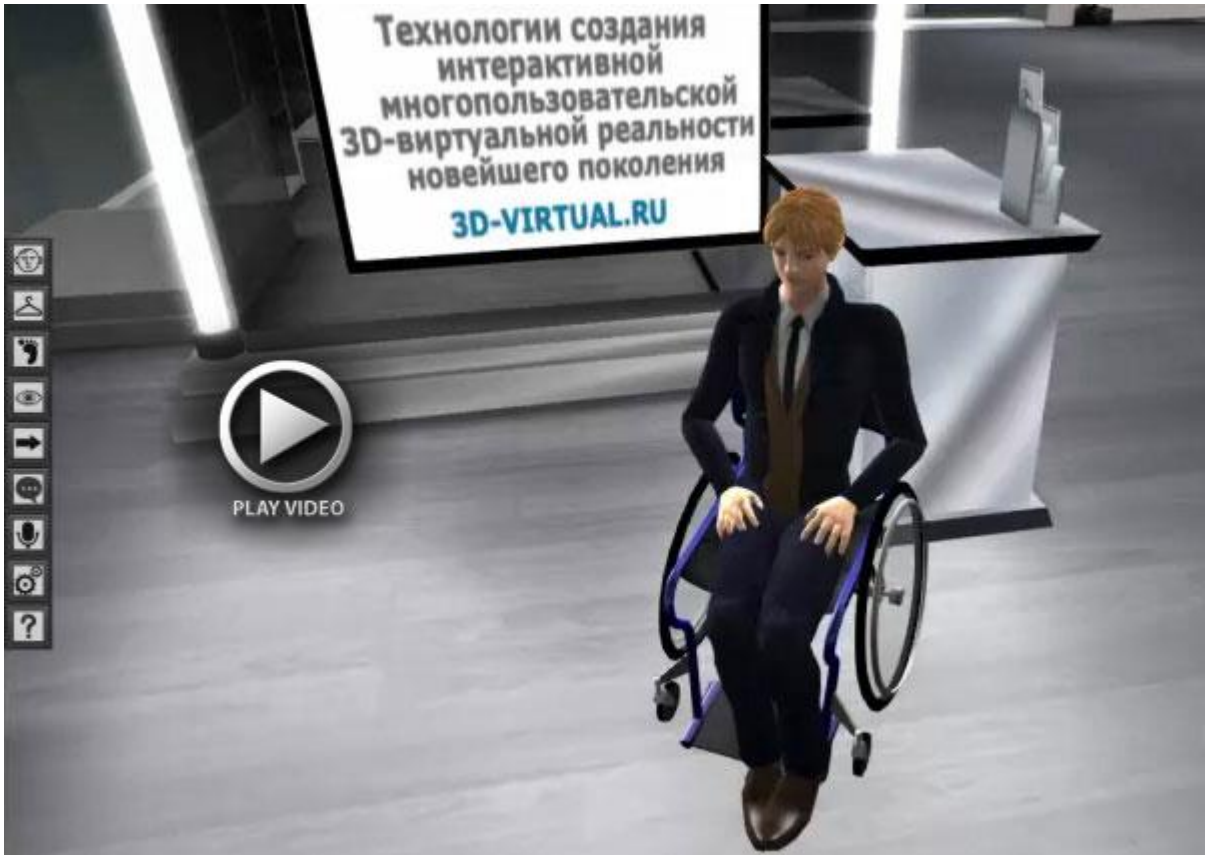


Figure 3.9. Video example of a visit by a wheelchair virtual exhibition: (click on the image to start)

Virtual Reality in education offers us a range of limitless possibilities. Virtual spaces can provide a wide range of types of training, for example, we can:

- Become a participant in historical events;
- To see the rarest physical phenomena;

• Conduct manipulations with various objects of the physical world;

• Participate in chemical experiments;

• Analyze large amounts of data ...

In the simplest case, our virtual space provides an ubiquitous computer environment where students can meet to discuss a variety of issues among themselves and with a teacher or counselor. Studies have shown that the use of avatars (three-dimensional characters used to personalize the user in virtual space) allows to increase the share of participation of even the most inactive students, and the possibility of text dialogue (chat) helps to prevent the capture of the initiative by more "talkative" students.

In more complex cases, our virtual spaces allow us to model an interactive environment that reproduces real world fragments used in the learning process. Such an environment can vary from geographical and historical installations to the layouts of institutions, streets, houses, shops, etc.

Figure 3.10. Video example of training through the thematic installation "Borodino": (click on the image to start)

In different educational scenarios, our virtual spaces allow us to reproduce situations in the office, situations related to buying / selling, household, emergency situations, health-related situations, etc.

The possibility of virtual communication and simulation of various situations is especially useful in teaching the language, where conversation is one of the main activities. The virtual environment makes it possible to implement language training in a communicative, intensive and, of course, classical methodology for distance learning. The ability to use role-playing games in virtual space makes learning more effective and attractive.

The teacher has the same capabilities as the student, plus the ability to use virtual class tools (a whiteboard for displaying training materials, a remote control for the display process), and the ability to develop lessons using the interface with work with the lesson base (including audio, video and presentation Materials in the scenario of the lesson).

The virtual environment makes it easy and relatively cheap to use the latest approaches to distance learning - such as blended learning, constructivism and connectivity. Correct development of the courses allows using the potential of the so-called hidden knowledge, that is, knowledge that arises from personal experience and is transmitted exclusively from person to person in personal communication.

Progress does not stand still, and virtual reality becomes more and more like the reality surrounding us.

3.3. Virtual Reality in practice

From the beginning, analyzing the information received, the authors came to the conclusion that BP is more likely to inspire a person with fear, despite all the attractiveness and affection. It feels a very definite threat to the uniqueness of man and some of his previously uncontested features. This new fear, along with

the traditional - the fear of dissolving in an artificial, they created reality.The phenomenon of virtual reality is certainly interesting. It is impossible to unequivocally answer the question about the usefulness or harm for humanity of BP! Of course, BP for Man opens new horizons. And how a person will use these opportunities, depends only on the person himself.

And then, on this subject, a full information review of both the library material and the Internet materials was made. The achievements and prospects were studied. The most interesting aspects, from our point of view, are presented in a multimedia teaching aid.

A tutorial in the form of a multimedia disk on the theme "Virtual Reality" was created in the Power Point program using the capabilities of this program: the introduction of sound, multimedia clips, pictures. This manual can be used in the lessons of the MHC, informatics, physics, and also the disk can be used by class teachers for holding thematic classroom hours.

First: A web-site was created on the topic "Virtual Reality". This site consists of 8 pages:

1. On the first web-page is placed the presentation of the site in the form of a poem and a video.

2. On the second web-site provides information about the concept of virtual reality (v_r1).

3. The third web page talks about the perception of BP man (v_r2).

4. The fourth web-page tells about the influence of BP on a person (v_r3).

5. The fifth web page presents the application of BP (v_r4).

6. On the sixth page, devices simulating BP (v_r5) are placed and described.

7. The seventh page tells about virtual glasses, a helmet and modern controllers and manipulators (v_r6).

8. On the eighth page, the steps of creating a virtual school model (v_r8) are proposed.

Second: The stages of creating a virtual school.

The virtual environment is an ideal learning environment. In the not too distant future, virtual schools will appear in each school. Imagine a virtual class of geography - a unique opportunity to move to any point of the globe in a matter of seconds. Study of landscapes, nature, acquaintance with the local population ... And now let's visit the lesson of history. Change of events, eras, cultures ... Perhaps the most interesting lesson is astronomy. Traveling on a spaceship beyond the solar system ...

Education using a virtual environment allows you to visually conduct lectures and seminars, conduct trainings, show students all aspects of a real object or process, which as a whole gives an enormous effect, improves the quality and speed of educational processes.

Stages of creating a virtual school

Now let's take a closer look at the process of creating the Virtual School Model. The whole process of creating a Virtual School can be divided into several stages:

1. Work with the engineering drawing of the school.

2. Creation of the main school details on VRML using drawings.

3. Creation of internal objects of the school (desks, chairs, cabinets) in digital format.

4. Reduction of all objects in a single virtual world.

5. Animating objects.

6. Final summary.

7. Viewing using the CyberStageprojection large-scale system.

At the moment, in the Blender environment, a virtual class model is created: a model of the room (walls, door, windows), desks, bookcases.

In such a school, first of all, it is possible to study those children who for one reason or another cannot attend regular school, for example, children with disabilities, children who have suffered serious injuries, as well as children living in remote villages and adults, wishing to continue their education. The main problem is providing the necessary equipment.

Currently, the distance education system is being actively developed, called e-learning desktop. Distance schools are often called virtual schools. The teacher and the author of educational materials with the help of this environment create and publish educational materials (text, multimedia, hypermedia, video, as well as experiments in virtual laboratories, etc.), assignments to students and certification work (including - with control of execution time, an adapted sequence of tasks, etc.).Students carry out assignments and send their results to the teacher (for example, they also upload them to a certain area of the school's website or (in exceptional cases) in the form of an e-mail). The teacher reviews the work: analyzes the results of the assignment and answers the student, communicates the results of the analysis, evaluation, comments, recommendations for further work, support tasks and links to information sources.

If distance school students provide equipment that creates a virtual reality, then we will bring the regular school closer to distance learning.

But, the use of VR in training obviously also has negative aspects. For example, "over-figurative," the visual presentation of the content of education (with incorrect construction) can reduce the development of abstract concepts, symbolic thinking.

3.4. Virtual reality technology in the education system of Uzbekistan

Virtual reality technologies are evolving rapidly and becoming more popular all over the world. The growth of interest in this sphere of entertainment is fueled by the release of all 3 main VR headsets: Oculus Rift, HTC Vive and PlayStation VR. Thanks to this, there are more and more articles about VR-games and applications appearing on the network, celebrities and cult developers say about virtual reality. So we wanted to know how fast growing audience interested in VR in Uzbekistan.

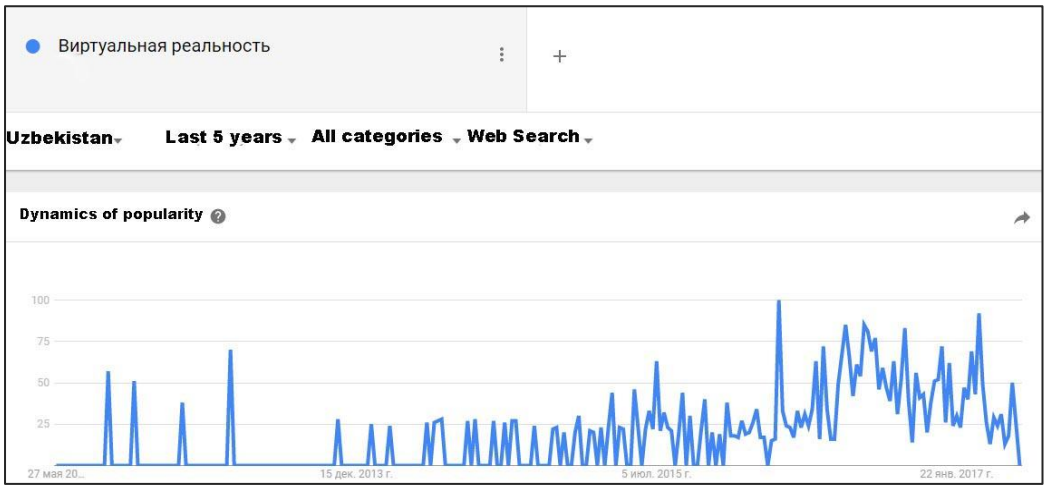


Figure 3.11. Google search. The dynamics of the popularity of the word virtual reality over the past 5 years in Uzbekistan

In 2015, the University of INHA in Tashkent announced the creation of a virtual reality club VR-Club.

VR-Club is open only for students of this university, who are interested in promoting the latest computer technologies, such as: games, animation, photography and video creation.

The main themes of the club:

• Virtual reality technologies using Oculus Rift and Google Cardboard platforms;

• Augmented Reality App Development (Augmented Reality App Development) applications;

• marketing and online business applications;

• Ninja Programming;

• 3D-modeling, design and animation;

• 3D and 360 Video Production;

• Interactive films.

Each member of the club must work on the VR / AR project, carry out market research, design, development, testing, publishing and marketing for their own applications.

Figure 3.12. Virtual reality for mobile phone

Weekly meetings of the members of the club (Meetups) are planned with presentations of projects and seminars on various topics. There will also be online discussions in a closed group.

Slamatization of INHA students in Tashkent

The helmets of virtual reality are becoming ever more firmly embedded in our real life. Recall that Facebook and Oculus VR are working on the project Rift, Sony PlayStation is preparing Project Morpheus, Google offers a cardboard solution - Cardboard. At the first meeting of the VR Club of INHA University in Tashkent, students actively studied the helmet of the virtual reality of Samsung Galaxy Gear VR.

The main task of VR-club is the development of our students' ability to create promising projects in these new directions. We involve the leading domestic specialists in cooperation with VR-club. A creative approach in such new directions as virtual and augmented reality will give our students even

greater impetus in becoming their specialists. As they say, from virtual reality to real knowledge.

Our first president I. A. Karimov stated this in his book to Toshkent Information Technology University professors

“We should give much attention to the issues such as high technologies which are essential for our lives, creating scientific works, preparing skilled specialists , to gain a suitable place in world information technology market, which are essential for spheres which specify our economic state such as car industry, electronics, air plain industry, radio connection, communication, bank branches

As well as we should take into consideration the role of creating and developing national information technology resources in which should be used possibilities of the Uzbek language in order to start the use of the Internet which is coming into our lives so fast in all spheres, to bring up the children in the spirit of Uzbekistan’s ancient and rich history, good traditions, high humanity quality”[1].

We can reach higher educational standards by promoting virtual reality technologies in our education system in our country. It requires specific methods to make these reformations to pre-school, general, secondary, high and other education levels. Because every level in our country’s education system has particular characteristics.

Now, using virtual reality technology in the education system in our country, can increase the quality of higher education. Such a reform school, middle school, secondary, higher and higher levels of education in new and different methodological approaches. The basis for each stage of education in the republic with its own characteristics.

The use of virtual reality in the education system of Uzbekistan, brings positive results when used in short sessions or in the form of simulators and simulators. It is inappropriate to apply BP for conducting lectures and seminars. When developing software solutions, you should focus on the latest BP

equipment, the most environmentally friendly and ergonomic for users. The interface of equipment and software should be as simple as possible for users, especially for teachers. It is necessary to integrate BP applications with the most common LMS (Moodle, BlackBoard, Edx, HyperMethod) in terms of authorization through the LMS account and transfer of data about user actions from BP to LMS. Recently, the system of user identification, including spacious, is becoming relevant and in demand in distance education. BP applications for education should be integrated with similar systems.

CONCLUSION

During the performance of the final qualifying paper the following results were achieved:

- Systematized the basic interpretation of the modern understanding of virtual reality and shows the possible changes of virtual reality, due to the influence of new computer technologies;
- Developed a methodology for using virtual reality in the learning process;
- Developed 3D-objects, information material and software;
- Tested in practical work;

The results of the study, we can formulate the following general provisions on the specifics of virtual reality as a method and means of training.

This is determined by the fact that the teaching VR-programs introduce a significant specificity in the activity of the teacher, the student, in the transformation of the content of education, provide the formation of a new, informational way of submission and assimilation of material, are high-tech didactic instruments and act as a relatively rigid algorithm of actions, prescriptions responsible for ensuring educational effect.

Educational virtual programs cannot replace teaching in schools, they should be widely used in the study of the most complex topics of various subjects, as well as for the training of professional skills in different areas.

REFERENCES