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METHODS OF CONDUCTING DEMONSTRATION EXPERIMENTS ON PHYSICS IN SECONDARY EDUCATION SCHOOLS

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ABOUT ARTICLE

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Abstract: The use of modern information technologies, which differs from the traditional way of teaching, provides an opportunity to achieve high efficiency. This article analyzes the effective methods and problems of forming the imagination of the model of theories in the minds of students, introducing them to phenomena and processes in the teaching of physics. The principles of applying computer technologies and using multimedia tools based on them to the teaching process of the electricity and magnetism course of the physics course are described.

INTRODUCTION

Currently, the priority task of higher education is the formation of modern innovative educational technologies. The relevance of this task is that, in accordance with the new generation of state education standards, the share of interactive presentation of material using computer technologies is increasing sharply. Fundamental changes in the field of higher education of Uzbekistan are related to the integration of Uzbekistan into the European and international educational community, taking into account the national characteristics and development needs. The priorities of the education policy are

reflected in the documents related to the Bologna process, "Concept of modernization of education of Uzbekistan until 2030". Currently, the society of Uzbekistan is moving to an innovative model of science, technology development in accordance with the Bologna agreement. At the same time, it was recognized as a priority that the direction of information and telecommunication technologies and electronics should have the highest place.

Information should cover all forms of the educational process, including such an important component as laboratory practice. Along with traditional educational methods, computer technologies help to present educational material more accurately and clearly, and form competencies necessary for further qualification. Modeling of laboratory work helps to better understand the processes that occur in real electronic devices. Experiments based on modeling, in contrast to traditional experiments, allow to slow down or accelerate the development of the studied processes, which allows for a deeper understanding of their nature. In measuring devices, there is no difference between real and virtual elements and devices in terms of assembly and connection of various circuits. This opens wide prospects for the use of electronic virtual laboratories. Wide use of virtual computer technologies in the educational process is a modern global trend of higher education.

Virtual laboratory practice is increasingly used in conducting laboratory work, the essence of which is to replace real research with mathematical modeling of the physical, chemical and other processes being studied, which significantly expands the possibilities of information provision of the computer education process. In general, a virtual laboratory is an information environment that allows conducting experiments without direct interaction with the object of research. Virtual laboratory work is an information system that interactively models a real technical object and its properties necessary for learning using computer visualization tools. Laboratory simulators make it possible to find optimal parameters for conducting experiments, acquire initial experience and skills at the preparatory stage, and facilitate and speed up work with real experimental devices and objects. With the help of modern information technology software tools, there are wide opportunities to create electronic resources on various forms of professional education. Power Point, Macromedia DreamWeaver, Microsoft FrontPage, HTML editors and software tools such as Microsoft Word, Adobe Photoshop, CorelDraw, Acrobat Reader, Director, Macromedia Flash are very useful in this. For example, the Macromedia Flash 8 animation program is an example of this. Using this program, animations of isomers of complex compounds were prepared.

Multimedia technology - allows the use of several methods of presenting information at the same time: text, graphics, animation, video, sound, etc. In recent years, many multimedia software products have

been created and are being created: encyclopedias, educational programs, computer presentations, and more. Multimedia product:

First, a software product that certainly provides interactivity to the user, that is, provides the exchange of commands and answers between a person and a computer, and creates a dialogue environment;

Second, the environment in which various video and audio effects are used.

Macromedia Director – serves to create presentations and multimedia products. This program allows you to work with MMX-technologies, as well as with buttons, slides, clips and animations.

Multimedia applications are divided into:

Crocodile Technology software

The Crocodile Technology program allows high school students and teachers, lyceum, college students to use the possibilities of modern information technologies for deeper mastery of the "electrical" part of physics. In addition, Crocodile Technology software can be used in electrical engineering and circuit theory courses. Figure 8. The program is an electronic designer that allows you to simulate the process of assembling electrical circuits on the monitor screen, as in real experience, and measure electrical quantities with a multimeter (3-dimensional), ammeter and voltmeter.

Crocodile Physics software.

Crocodile Physics is a powerful simulator that allows you to model physical processes and create and observe experiments related to mechanics, electrical circuits, optics, and wave phenomena. This program can be used in classes through an interactive board, and can also be used as an independent work on a personal computer. This powerful program allows you to observe physical phenomena, conduct experiments and model processes of various levels of complexity. For example, in the program:

Microprocessor programming and robotics models can be simulated in 3D.

The description of the details of the constructor and the measuring instruments are given in a schematic and real view;

If the value of the current flowing through the resistor exceeds the given nominal value, the resistor will burn (explode), which will be shown on the screen by changing its color in the form of a blackened detail;

Light bulbs and electric heaters light up at the nominal value of their power, if their power exceeds the working value - they burn out, and the device turns black on the screen.

Also, the change of physical quantities in other details is simulated on the screen;

many processes and their results are represented by sound effects.

All this allows the student to see his own mistakes, learn to identify the causes of unsuccessful experiments, and develop skills for analyzing electrical circuits before performing experiments on real devices. This program, regardless of the profession, teaches the user to be curious, think creatively, and analyze the results of work. The possibilities of the program are very wide, and it can be widely used in practical training (that is, in solving problems), especially in performing virtual laboratory work. By teaching students with the help of independently created experimental devices, the method of developing their physical thinking is improved, didactic goals, tasks, contents are integrated, and the development of one of the main elements of the person-oriented pedagogical process is achieved. The foundation of the teaching methods of physics, which is essentially an experimental science, is to achieve effective results with the help of innovative methods in studying the nature of physical phenomena based on experience. Currently, high school physics classrooms do not provide the necessary laboratory and demonstration equipment to teach in the full sense. In order to partially fill this gap, we proposed a creative way to demonstrate the movement of charges and their change under the influence of an external magnetic field in electrolytes. It is noteworthy that it was quickly noticed that the difference in interest in such a lesson was several times higher than in a lesson without a demonstration. Students enter the classroom and see the demonstration device in the middle, they concentrate their attention, anticipating that today's lesson will be interesting. And the fact that the device is made by hand from simple materials will start to interest the students even more. Some students begin to express a desire to independently prepare something similar, which means that the achievement elements of the lesson begin. The advantage of independently preparing physical devices together with students is that the students will have a deeper understanding of how the device works on the basis of physical laws and learn what purposes it can be used for. In addition, the process of creating experimental devices encourages students to develop their creative and personal abilities and to learn about the world independently.

Positive and negative charges separated in electrolytes attach polarized liquid molecules around them to form larger solvates, and their total charge changes and their mobility decreases, so they move slowly in the electric field . Using this, it is possible to find the coefficient of friction by determining the speed

of colored ions. It is also possible to see Faraday's laws for electrolysis by changing the electrodes, Ohm's law in liquids, electric current in electrolytes depending on temperature and concentration of ions. We see that it is possible to perform several experiments with the help of a single device. Finding device elements is not difficult today, because any old radio, television or other electronic device elements that have become unnecessary can be used. After each experience, the areas of their practical use are shown separately, which greatly helps the development of students' analytical thinking.

To the objections that the few hours allocated to physics do not allow such experiments to be taught, it should be said that after a lesson or two, which has been interesting with experiments, starting to prepare an experimental device with the students by inviting those interested in preparing the future training experience together plays a big role in increasing the students' activity and their Continuing the interest in the physics circle, which works regularly, will help to ensure that the number of exponents of the experiment is sufficient. Among the high-tech materials that are widely used in today's life, lasers, light-emitting diodes, and devices based on various semiconductors, the fundamental principles of their operation are related to the creation of methods for controlling the movement of charges in them, so conducting experiments aimed at studying the movement of charges in metals and semiconductors is of great importance. Since it is impossible to observe the movement of charges in them with the naked eye, they can be studied by conducting virtual experiments on a computer.

RESULTS AND DISCUSSIONS

A number of arguments can be made in favor of performing laboratory work in optional classes in the form of a physical workshop. Carrying out laboratory work of the physical workshop opens great opportunities for taking into account the individual interests and inclinations of students, and developing their creative abilities. At the workshop, you can put work that differs in the complexity and nature of the task. Various types of work were done in the optional courses in physical practice.

1) Subjects where the most important relations and laws of physics are established or verified experimentally. Performing this type of work, students experimentally verify Newton's second law, the law of conservation of mechanical energy, the laws of the photoeffect, establish the basic equation for the dynamics of rotational motion, the law of conservation of angular momentum, get from experience. The Stefan-Boltzmann law and the law of radioactive decay, Ohm's law for an alternating current circuit reveal the frequency dependence of the effective cross section for the interaction of photons with molecules of matter and the quantum nature of light absorption.

2) Work in which students get acquainted with the methods of measuring physical quantities. They measure speed and acceleration, mass and force, moments of inertia of bodies, kinetic energy of a rotating body, voltage, current, electric resistance, magnetic field induction, capacitor and alternating current coil resistance, determine the maximum energy. Perform qualitative spectral analysis of the gamma spectrum.

3) Work whose task is to study the physical properties of various natural objects of the world around us. These include work on determining the acceleration of free fall, the average speed of atmospheric air molecules, the induction of the Earth's magnetic field, the propagation speed of electromagnetic waves, the power of conduction, and studying the properties of space bodies.

4) Physical and technical characteristics and parameters of materials, tools and technical devices are checked in this type of laboratory work. Students determine the hardness of steel, operating parameters of an electromagnet, photoresistor, transistor, carry out testing of electrical measuring instruments, obtain a resonance curve in an alternating current circuit, study the operation of a three-phase current generator and asynchronous.

5) Work on physical and technical modeling. In the process of their implementation, they will acquire computing skills, design, assemble and test devices, study models of semiconductor devices. The use of modern methods of physics research with the use of high-precision classroom measuring instruments helps to increase the prestige of extracurricular activities in front of students, because it reduces the gap between "school" and "real" physics.

A magnetic field is not only created by permanent magnets, but electric current also creates a magnetic field. According to this aspect, the magnetic field is studied with special attention. The simplest case of a magnetic field is a uniform magnetic field, which does not change as it moves from point to point. Creating a homogeneous magnetic field over large areas is a rather difficult task. If the magnetic poles of a body generating a permanent magnetic field (permanent magnet) consist of a plane, it is possible to create a magnetic field close to a homogeneous magnetic field. Homogeneity is broken only at the edges of the permanent magnet. If the magnetic field lines are parallel to each other, the magnetic field is considered homogeneous. But one often encounters a magnetic field that changes as the magnetic field moves from point to point, that is, a non-homogeneous magnetic field. We will consider how to calculate the magnetic field induction vector in a few simple cases and the connections between the magnetic field and its sources. In 1820 Danish physicist G.H. Oersted (1777-1851) in experiments electricity to the magnetic arrow determined the effect.

Figure 1. Oersted's experiments on the formation of a magnetic field around a constant current.

of experiments as shown of vines mutually and to the magnetic arrow to the effect reason that is, any vine conductor a magnetic field of a special nature is formed around it and this is the magnetic field second vine to the conductor and to the magnetic arrow effect shows. Magnetic field check for , to the checked point of the field a closed contour is inserted and test it outline is called We also used virtual laboratory work for students in laboratory classes to improve their competence in information and communication technologies. In this case, the perception of objective existence with the help of natural senses is replaced by artificially created computer information with the help of a special interface, computer graphics and sound. Today, virtual existence is used in various fields of human cultural activity. The virtual entity is primarily used in the field in which it was created, in science, including physics, in modeling the dynamics of liquids and gases. In education, the digital literacy of teachers, who can freely use a personal computer, communicate with communities and students, plays an important role; in education, they update their resources using electronic technologies, in which a system of tasks performed by students in electronic form is implemented. At the end of the course, we re-administered the questionnaire to check the competence of students in information and communication technologies, the results of the study are given in Table 1.

Table 1. Indicators of use of information and communication technologies by students at the end of the electromagnetism course.

ICT name	Usage indicators			
	constant, %	often, %	rarely, %	familiar
Online classes	3	12	65	20
Virtual laboratory works	0	60	40	0
Power Point program	45	45	8.5	1.5

From the table, we can see that the use of electronic whiteboards, electronic textbooks during lectures, and use of virtual laboratories during laboratory work created an opportunity to increase the competence of students in information and communication technologies (Table 1). From Table 1, we can see that the students' use of Online Database and Power Point program increased. The reason is that during the course, students used the electronic database for independent work and the Power Point program for preparing presentations. The results of the research show that according to the survey taken at the beginning of the course, we can see that the students' use of ICT increased by 10-15% by the end of the course. Therefore, the use of electronic textbooks, electronic whiteboards and virtual laboratory programs during the course of the lesson plays a key role in improving students' information and communication skills. Modern information technologies accelerate all stages of educational processes. Based on the use of information technology, we can observe the increase in the quality and efficiency of the educational process, and the activation of students' cognitive activity.

CONCLUSION

Thus, we observe the increase in the quality and efficiency of the educational process, and the activation of students' cognitive activity. Having thoroughly studied the above laboratory work and the ability to conduct experiments, young students who can approach problems in all spheres of life with an innovative idea, believe in their own potential and, most importantly, are brought up in accordance with technical development. There is no doubt that with young people who have learned to independently carry out laboratory work, we will go boldly towards economic growth, master new technologies, and take a place among the developed countries with increased potential and opportunities of our people.

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