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THE IMPORTANCE OF STUDENT'S INDEPENDENT FRONTAL EXPERIMENTS IN PHYSICS

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Abstract

This article analyzes the problems of developing students' observation and thinking skills in teaching physics, as well as arousing interest in the problems of the world around them and their solutions. Physics during the lesson and the use of virtual laboratory programs in laboratory work plays a key role in improving students' information and communication skills. Modern information technologies accelerate all stages of educational processes. In this regard, based on the use of information technologies, we can observe an increase in the quality and efficiency of the educational process, as well as the activation of students' cognitive activity.

Keywords: Physics, modern information technologies, physical events, electricity and magnetism teaching, laboratory work, physics tools, experiment.

Introduction

When teaching physics in secondary school, experimental skills are developed through independent laboratory work. Teaching physics cannot be presented only in the form of theoretical classes, even if students are shown demonstration physical experiments in class. In addition to all types of sensory perception, it is necessary to add " hands-on work " in classes [1]. This is achieved when students perform laboratory physical experiments, when they assemble the setups themselves, measure physical quantities, and perform experiments. Laboratory work arouses great interest in students, which is quite natural, since in this case the student learns about the world around him based on his own experience and his own feelings. The importance of laboratory classes in physics is that students develop ideas about the role and place of experiments in cognition. When performing experiments, students develop experimental skills, which include both intellectual and practical skills. The first group includes the following skills: defining the purpose of an experiment, putting forward hypotheses, selecting devices, planning an experiment, calculating errors, analyzing results, and preparing a report on the work done. The second group includes the following skills: assembling an experimental setup, observing, measuring, and experimenting.

In addition, the significance of a laboratory experiment is that during its implementation, students develop such important personal qualities as accuracy in working with devices; maintaining cleanliness and order in the workplace, in the notes made during the experiment, organization, persistence in obtaining a result. They develop a certain culture of mental and physical labor [1-6].

In the practice of teaching physics at school, three types of laboratory classes have developed:

- frontal laboratory work in physics;
- physical workshop;
- home experimental work in physics.

2. Frontal laboratory work in physics and stages of their preparation

Frontal laboratory work is a type of practical work when all students in the class simultaneously perform the same type of experiment, using the same equipment. The idea of introducing them into the educational process was put forward quite a long time ago, but they were included in the physics course program only in 1927 and were not immediately implemented in practice. At the same time, both organizational and methodological problems, as well as technical, design and production problems arose [1-3]. Frontal laboratory work is most often performed by a group of students consisting of two people, sometimes there is an opportunity to organize individual work. Accordingly, the office should have 15-20 sets of devices for frontal laboratory work. In total, there are more than 1000 such devices. There are certain requirements for devices for frontal work: they must be light, cheap, easy to operate, have small dimensions, and may not have a high accuracy class. The names of the frontal laboratory works are given in the curricula. There are quite a lot of them, they are provided for almost every topic of the physics course. Frontal laboratory works are not very complex in content,

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are closely related chronologically to the material being studied and are usually designed for one lesson. Frontal laboratory work is very diverse, they can be classified and a group of works can be distinguished by :

➢ observation of physical phenomena (interaction of magnets, interference, etc.);

➢ familiarization with devices and performing direct measurements with their help (measuring current, voltage, body mass, etc.);

➢ performing indirect measurements of physical quantities (measuring the resistance of a conductor using an ammeter and voltmeter, measuring the EMF and internal resistance of a current source, etc.);

➢ establishing relationships between physical quantities describing some physical process (studying the relationship between current and voltage, between the parameters of the state of an ideal gas, etc.);

➢ assembly and familiarization with the operating principle of some technical installations and devices.

Depending on the didactic tasks that are solved with the help of frontal laboratory work, they can be divided into *illustrative* (testing) and *research* (heuristic). Illustrative works are performed with the purpose of "verifying" the studied patterns or the obtained deductive conclusion. Research work is carried out with the aim of testing hypotheses and obtaining new knowledge, which can serve as the basis for inductive inference [7].

For example, laboratory work on studying the laws of series connection of conductors as an illustrative one is carried out after the teacher explains and performs the corresponding demonstration experiment. If it is carried out as research work, then the students themselves, in the course of its implementation, come to the laws of series connection of conductors. In this case, the teacher organizes the students' activities in such a way that they go through all the stages of the research process: setting the task - putting forward a hypothesis - choosing experimental means (devices) - planning the experiment - performing the experiment - analyzing the results - conclusions. Instructions for completing laboratory work are contained in physics textbooks, but depending on the didactic purpose of their completion , the students' preparedness, and the level of skills being developed in them, the teacher either suggests using ready-made instructions, or develops a plan for completing the work together with the students, or suggests that they do it independently [8-12].

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3. Method a conducting frontal laboratory classes

The classification of laboratory work can be varied depending on the characteristics that form its basis. Thus, a distinction is made between short-term work and work designed for a whole lesson; qualitative work, associated with the observation of physical phenomena, and quantitative work, in which not only observations are made, but also And measurements; work carried out according to a pre-proposed plan, and work in which students are given greater independence (elements of creativity), etc. However, all these features are insufficient to cover the diversity of frontal laboratory work. Of greatest interest from a methodological point of view is the classification of work according to the tasks and goals that the teacher pursues when organizing frontal laboratory classes. According to these characteristics, the following types of work can be identified, for example:

Observation and study of physical phenomena

- Familiarization with the structure and operation of various physical devices, installations and techniques for handling them.
- Introduction to measuring instruments and measurement of physical quantities.
- Identification or verification of quantitative patterns between physical quantities.
- Definition of physical constants and familiarity with various methods of such determinations.

A clear example of the first type is the following type of work: students observe the expansion of solids, liquids, and gases from heating in simple experiments. They are convinced that gases expand more than others, and in the process they become familiar with methods for detecting minor expansion. Many other works also belong to this type, in which Students are convinced of the heating of bodies as a result of work performed; observe the thermal conductivity of various metals; convection in water and in air; the chemical action of current; examine crystalline and amorphous bodies, sound recording on a gramophone record, etc. The second type includes, for example, works where students become familiar with the details of the structure and operation of ball and roller bearings, with the structure and operation of a galvanic cell. In them, students become familiar with the operation of a battery, with the structure and application of an electromagnet, an

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electromagnetic relay, a simple electric motor, a mirror periscope, etc. The third type of work can be illustrated by the following works: they introduce students to the structure and use of a number of common measuring instruments: balance scales, dynamometers, hydrometers, thermometers, ammeters, voltmeters, etc. An example of the fourth type of work, where quantitative regularities between physical quantities are revealed or verified, can be a work revealing Ohm's law for a section of a circuit, or a work in which the formula for the work of an electric current is verified. In addition, this includes work: determining the efficiency when lifting a body on an inclined plane , the law of conservation of momentum, clarifying the condition of equilibrium of a lever, as well as work related to constructing graphs of the melting of naphthalene and the boiling of water [12].
Finally, the last, fifth type of work concerning the determination of certain physical constants includes works in which the following are determined: the densities of various solid and liquid bodies, specific heat capacity , specific heat of fusion of ice, specific resistance of a conductor , coefficient of sliding friction , surface tension of water, etc. Depending on the set goal (type of work), its content is determined, the necessary equipment is selected , and possible techniques and methods of implementation are chosen that are most suitable for the given conditions. All this as a whole determines the successful conduct of frontal laboratory classes.

4. Modern educational and methodological complex (EMC) for teaching physics.

A personal computer and the corresponding teaching aids for teaching physics do not replace traditional teaching aids, but rather complement them and together with them form a system of teaching aids oriented towards the use of new information technologies, the use of which creates conditions for teaching physics in the educational and information environment. Such a system of teaching aids, together with educational and methodological literature, software for the physics course and means of scientific organization of the work of the teacher and his students, constitutes an educational and methodological complex (EMC) using SNIT. The physics course software is oriented towards - firstly, to support the study of the course - study of theoretical issues, development of skills in solving physical problems, etc., secondly, to ensure the management of the educational process, automation of control, in - thirdly, to support the educational physical

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experiment - processing information received from physical quantity sensors, ensuring the operation of control elements, in - fourthly, to work with information and search systems.

Computer models demonstrating physical phenomena are also considered to be tools supporting physical experiments. This makes it easier for students to study phenomena whose implementation in school conditions is difficult or impossible (for example, experiments in nuclear or quantum physics). The necessity of using so-called traditional teaching aids is determined by their specific functions, which are either impossible or inappropriate to transfer to a computer from a pedagogical or hygienic point of view. For example, the demonstration of static information presented to students to memorize theoretical positions, as well as systematized information, reference data that the student must memorize, should be presented in the form of educational tables, diagrams, posters, which are printed aids.

A promising direction in the gradual replacement of these traditional means is the introduction of multimedia systems. By integrating the capabilities of a computer and various modern means of transmitting audiovisual information, these systems enrich the educational process in physics with the following possibilities:

- providing a variety of ways to access a library of moving and still images with or without sound;
- selection in any sequence from the database of audiovisual information required at a given stage;
- contamination (mixing, rearrangement) of information, including text, graphics, moving diagrams, animations with or without sound.

Naturally, the use of multimedia systems presupposes a fundamentally new level of organization of the educational process in physics in an educational environment that ensures the use of a wide range of new information technology tools. This level should be achieved gradually, therefore, the teaching and methodological kit retains traditional means of presenting educational information.

The training aids for conducting a physical experiment are divided into training equipment and, as has already been said above, into software that simulates or supports the physical experiment. The training equipment is divided by the type of experiment: demonstration, laboratory for practical work, and laboratory for frontal work. The training equipment includes various auxiliary equipment that helps in conducting the educational physical experiment: clamps, background screens, tripods, lifting tables, etc. Among the modern means of new information technologies, auxiliary training equipment in physics includes sensors of physical quantities and video equipment.

Conclusion

The use of modern auxiliary equipment allows students to create models of the processes being studied, to play out the behavior and development of the model under various conditions; to predict the development of processes and to check the reliability of the forecast using a computer. It becomes possible to automate school physics experiments; to conduct laboratory and demonstration experiments at the research level; to study the development of processes occurring in nature. Thus, with the help of SNIT, it is possible to introduce a fundamentally new educational experiment into the process of teaching physics, which provides the teacher and students with the following opportunities: to control objects of real life with the help of a computer; to visualize physical laws on the computer screen, using physical quantity sensors connected to the computer; to demonstrate computer information and microprojections to a large audience, using video projection equipment for this purpose.

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