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Methods of Laboratory Work in Physics

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Annotation. This article discusses pedagogical aspects and features of laboratory work in physics. This is reflected in the presence of specific characteristics of teaching to various units of physics.

Key words: pedagogy, pedagogical methods, lectures, laboratory classes, lessons, teaching methods, effectiveness, evaluation, laboratory classes.

The ability of students to theoretically discuss a certain system of action does not yet provide the ability to perform the same actions. The final stage in the development of mental operations of students is not the formation of mental action, but the implementation of this action in practical activity. Therefore, physics training provides for involving students to such activities that allow us to use acquired knowledge in practice, for example, to carry out students of laboratory work.

In accordance with the requirements of the educational standard, the regional component and the requests of employers to the maintenance and level of training, the forestry specialist must have general competencies that include the ability:

- to understand the essence and social significance of their future profession, to show steady interest in it;
- organize your own activity, choose typical methods and methods of performing professional tasks, evaluate their effectiveness and quality;
- make decisions in standard and non -standard situations and bear responsibility for them;
- to search and use the information necessary for the effective performance of professional tasks, professional and personal development;
- use information and communication technologies in professional activities;
- work in a team and in a team, effectively communicate with colleagues, management, consumers;
- take responsibility for the work of team members (subordinates), for the result of the completion of tasks;
- independently determine the tasks of professional and personal development, engage in self -education, consciously plan advanced training;
- navigate in the context of a frequent change in technology in professional activities.

The educational standard also provides for the formation of professional competencies corresponding to the main types of professional activities:

- choose rational methods of technology and technological modes;
- draw up a technological sequence and labor pattern;
- conduct documentation of the established sample;
- organize the work of the team;
- carry out technical quality control.

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Physics studies the general properties of the material world around us. This is a fundamental science: its concepts and laws underlie not only any sections of natural science, but also the disciplines of the professional cycle.

The discipline “Physics” can be distinguished by material that includes professionally significant knowledge that can be applied when mastering specific specialties, that is, both in the process of studying objects of the general professional cycle, and in industrial training.

Laboratory work is understood as such an organization of a educational physical experiment in which each student works with devices or installations.

The didactic role of laboratory work is extremely great. Perceptions during laboratory work are based on a larger and more diverse number of sensory impressions and become deeper and more complete compared to perceptions when observing a demonstration experiment. When performing laboratory work, students learn to use physical devices as tools for experimental knowledge, acquire practical skills. In some cases, the scientific interpretation of the concept becomes possible only after the direct familiarization of students with phenomena, which requires the reconstruction of experiments by students themselves, including during laboratory work. The implementation of laboratory work contributes to the deepening of the knowledge of students in a certain section of physics, the acquisition of new knowledge, familiarization with modern experimental technology, and the development of logical thinking.

Laboratory work also has important educational significance, since they discipline students, accustom them to independent work, instill laboratory culture skills.

Laboratory work in physics is classified according to various signs:

- in content - in mechanics, molecular physics, electrodynamics, optics, etc.;
- according to the methods of performing and processing results - observation, qualitative experiments, measuring work, quantitative studies of functional dependencies of quantities;
- a measure of students' independence during execution - verification, heuristic, creative;
- the didactic goal - the study of the new, repetition, consolidation, observation and study of physical phenomena, familiarization with physical devices and measurement of physical quantities, familiarization with the structure and principle of operation of physical instruments and technical installations, identifying or testing quantitative laws, determination of physical constants;
- According to organizational characteristics - frontal laboratory work, physical workshops, home experiment.

The last classification is the most common and most common. It makes it possible to consider the experiment from the point of view of studies of study, correctly determine the place of each experiment in the system of training in physics, and rationally select educational equipment.

Front laboratory work is such classes in which students themselves reproduce and observe physical phenomena or measure physical quantities, using special (laboratory) equipment. The word "frontal" means that in this case, all students of the class conduct the same experiment, using the same equipment. If the duration of frontal laboratory work does not exceed 10 -15 minutes, then they are often called frontal experiments. Front laboratory work is carried out during the study of the corresponding material.

A physical workshop is called this form of laboratory work, in which all links or groups of the links of students receive different tasks of complicated content. The workshop is carried out after studying a certain section of the physics course or most often at the end of the school year. His tasks cover large topics of the course and require complex physical equipment and experimental attitudes for their implementation.

Home experiment - laboratory work that is performed by students at home on the instructions of the teacher. At the same time, students use household items or independently manufactured by the simplest devices.

Laboratory work can be performed by one of the methods: reproductive, partial-search (heuristic) or research.

The reproductive method of laboratory work lies in the fact that in this case independent obtaining new knowledge is not provided, but only well -known facts and truths are confirmed or theoretically established statements are illustrated.

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The implementation of laboratory work with a reproductive method provides for the actualization of students' knowledge, a repetition of the method of measuring the necessary physical quantities, and clarifying the fundamental installation scheme. After that, students are invited to collect the installation circuit, measure, process the results of the experience and draw the appropriate conclusions.

This method of laboratory work is the most common in the practice of teaching physics, but it has significant drawbacks: it is designed for students reproducing the activities of students and requires actions on the model.

It is advisable to use the partial and search method in cases where all the actions that students should perform, already learned or are easily performed. This method can be used in works devoted to either the observation of phenomena or the establishment of functional dependencies between certain physical quantities.

During the research method, students receive only the task, and they seek the ways to fulfill it themselves and independently carry out all the stages of the study - they collect the installation, measure, process results, etc.

The research method in pure form can only be used in individual work with strong students. But the elements of this method need to teach all students. To do this, on the eve of laboratory work, it is advisable to invite students to think over possible methods of indirect measurement of any size, indicate the necessary devices and methods of measurement. Students' proposals are discussed in the group and the only approach to the work is made. All subsequent work is performed completely independently. The role of the teacher is only in monitoring the actions of students.

The use of computer technology at different stages of this work gives wide possibilities in performing a laboratory experiment. Using a computer allows you to graphically set some mathematical function (dependence between certain physical quantities), model physical processes, complex physical and technological installations, and consider physical processes in dynamics. The use of analog-digital converters makes it possible to use a computer during laboratory work to measure physical quantities and graphic interpretation of physical processes. The use of electronic computing technology during the processing of the experimental results allows you to avoid large expenses of educational time to perform monotonous calculations and increase the particle of students' creative work.

At the same time, using a computer in a laboratory experiment, it should be remembered that the modeling of physical processes on a computer poorly contributes to the formation of students' skills in students. After all, the computer only models the physical experiment, and the model can never submit comprehensive information about the phenomenon. Therefore, the use of a computer in a laboratory experiment should supplement, but not replace it. Students should be able to work with real physical devices, collect experimental installations, use measuring devices. Modeling of various situations, for example, during operation by "designers of electrical circuits" and other similar computer programs, will only only quickly know the patterns of certain processes and phenomena.

The purpose of laboratory classes is to teach, educate and develop a competent person who can conduct an independent search for information, choose methods and methods of performing professional tasks, evaluate their effectiveness and quality, and apply the knowledge gained in practical activities.

When planning laboratory work, it should be borne in mind that along with a leading didactic purpose - confirmation of theoretical provisions during the completion of tasks among students, practical skills of handling various devices, installations, laboratory equipment, equipment, which can be part of professional practical training, as well as Research skills (observe, compare, analyze, establish dependencies, draw conclusions and generalizations, independently conduct research, draw up results).

Methodology for conducting frontal laboratory work in physics

Front laboratory work can be in time from 10-15 minutes to 1-2 hours. One device should work no more than 2 people, i.e. Devices should be in significant quantities.

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Methodology for conducting frontal laboratory work:

1. Introductory conversation: the purpose of the work is indicated, the work plan is worked out, the necessary instructions on the records, calculations and the treatment of devices are given. Preparation for the implementation of frontal laboratory work begins with the creation of the relevant material base - the selection of the necessary for the performance of the devices. The implementation of frontal laboratory work is carried out in pairs, which are formed in such a way as to ensure the high efficiency of each student. On the eve of the execution of frontal laboratory work, the teacher informs students of the topic of work and the volume of material that must be repeated for its implementation.

The lesson begins with the introductory word of the teacher and the corresponding briefing regarding the performance of the work. The teacher also conducts a short training in safety students when performing this work and makes appropriate entries in the "Security Instruction Journal", which is located in the physics office.

Students write down the date, number and theme of laboratory work, a list of devices and materials, draw a table of measurement and calculation results.

2. The performance of work: depending on the nature of the work, the devices can be in advance on the desktop of students or are distributed by a laboratory assistant, teacher, students themselves after the conversation. Students perform the experimental part of the task independently under the control of the teacher. The teacher bypasses the tables of students, monitors their work, so that in each group everyone participates in the work. If necessary, it provides students with assistance, draws their attention to the methods of proper work with devices, notes a violation of safety rules. The teacher also records the quality and independence of the work of each student. If a hitch is obtained in the work of students, the teacher attracts the attention of all students and gives the necessary explanations to the group.

3. Final work: at the end of laboratory work, conclusions and results are subjected to collective discussion. Numerical results of various groups are discussed on the board. The causes of erroneous results are analyzed. The results of the work are entered in the notebook, where their processing is carried out and the corresponding conclusion is recorded (the obtained value of the physical value). Assessment for frontal laboratory work is set on the basis of a teacher's notes and checking a student's report. This assessment is entered in the learning journal.

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