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PHYSICAL PRACTICE IN A TECHNICAL HIGHER EDUCATIONAL INSTITUTION**ФИЗИЧЕСКИЙ ПРАКТИКУМ В ТЕХНИЧЕСКОМ ВУЗЕ**

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Abstract. *The article analyzes the role and tasks of a physical workshop in a course in general physics for students of natural and technical specialties of universities. A characteristic feature of modern education is the rapid growth in the amount of incoming information and, as a consequence, the urgent need to increase the rate of assimilation by students. It is especially important to improve the physical workshop as an effective form of cognitive activity for first-year students. Attention is paid to the formation of skills of creative independent work of students. The effectiveness of the development of a physical workshop by the methods of information and communication technologies is considered.*

Key words: *physical workshop, full-scale and virtual experiments, independent work of students.*

Introduction. The concept of physics and its laws are at the heart of all science, so physics is an essential part of professional education in most areas of human activity.

Fundamental training in physics is one of the most important areas of higher education, especially technical.

Physics is not only a basic component of engineering education, but also a worldview discipline that shapes the scientific thinking of the future specialist. Like all natural sciences, physics is an experimental science.

But in physics, as in basic science, the theory not only explains and generalizes, organizes the results of experiments, but is also a method of research that puts forward and considers assumptions that can only be confirmed by experiment.

The experimental work of the physical practicum is both an illustration and a direct proof of the manifestation and application of the laws, phenomena and processes studied in the theoretical general physics lecture course.

Physical laboratory practicum is an integral part of the course of physics and plays a major role in introducing students to the experiments underlying the laws of physics, gives the skills and conduct of physical experiment, shows the connection between science and practice.

The rapid growth of scientific information, which doubles every 10 years, requires that, in accordance with the National Doctrine of Educational Development of Ukraine in the 21st Century, the state standard of basic and complete education [1], provide graduates of higher education with knowledge, creativity, competence, allowing us to be in demand in the face of ever-changing technologies and industries.

The decisive role of physical experiment as a source of knowledge and the criterion of truth of theoretical research determines the place and importance of the



laboratory practicum in the course of general physics.

The peculiarities of conducting a modern experiment should be adequately reflected in conducting a laboratory workshop in physics at a higher education institution.

However, despite the efforts of teachers and scientists, the gap between the educational and scientific experiment is not narrowing.

There is another significant reason for reforming, improving physical education at universities (especially in pedagogical ones), and in general educational institutions - recently the interest of students and students to study physics has sharply decreased, and the prestige of physical education has decreased.

This is evidenced by the decrease in the number of specialties in which the study of physics is envisaged, as well as the number of EIT participants who choose physics as a competitive subject and a record low proportion of those who successfully passed EIT. In addition, when entering a technical specialty, the entrant chooses one competitive subject from two possible ones (Ukrainian language and literature, mathematics required) and, unfortunately, the preference is most often given not to physics, but to a simpler study of the subject.

For example, for entry to the specialty "Earth Sciences", "Hydraulic Engineering, Aeronautical Engineering and Aquatic Technology" the entrant chooses between physics and geography, for the specialty "Civil Engineering and Civil Engineering" - between physics and a foreign language.

It is interesting that in 2015-2019, Ukraine has the fifth largest geographic area and has the lowest percentage of those who did not overcome the 100 point threshold.

On the contrary, the largest proportion of FES participants in physics failed to overcome the threshold of 100 points. So, in 2017 they were 22, 61%.

Note also that in 2019 at one of the universities, geography is a competitive subject for 10 different specialties from 24.

Insufficient knowledge of the basics of first-year student physics is a serious obstacle in the formation of basic competencies of future specialists.

To raise the importance of physical education, to stimulate the formation of general and professional competences of students, to increase their interest in the results of educational activities, it is necessary to modernize the educational process from the first days of studying physics and conducting a physical workshop [3, 5].

The problem of increasing the efficiency of professional competence of graduates of natural sciences, especially technical, is closely related to the improvement of methods of studying physics and conducting a laboratory workshop in the course of general physics.

Fundamentals of the methodology of teaching physics in high school and conducting experiments in the educational process are considered in the studies of L.Antsiferov, O.Bugayov, G.Bushko, S.Velichko, S.Goncharenko, E.Korshak, L.Osadchuk and others.

The analysis of scientific literature shows that the greatest role in the development of students' creative activity belongs to the physical experiment, during which students observe phenomena, qualitatively and quantitatively evaluate these phenomena, find connections between them [2, 4].



The introduction of computer technologies provides ample opportunities for the development of a physical workshop and methods of its implementation in the course of general physics.

The content, structure, technical capabilities of the physical workshop should change according to the requirements of time, constant development of physics and other sciences, technology.

Laboratory practicum plays an important role in the course of general physics and provides the first-year students with the necessary physical knowledge, the ability to conduct physical experiments, directly influences the formation of professional competence of future specialists.

The use of information and communication technologies gives the student considerable opportunities for research creative activity, makes the acquired knowledge deeper and stronger.

Improving the organization and methods of conducting a physical workshop helps to increase the efficiency of training high-quality specialists who are able to work effectively and learn throughout their lives.

Main part. The need for physical knowledge for specialists in higher education in the natural and technical sciences is obvious and undeniable.

Qualification of a specialist, his professional competence are determined by the knowledge, scientific thinking skills, outlook, which is why the course of general physics is an important place in the training of specialists and should be conducted during the first two or three semesters.

Physical practicum - an integral part of the general physics course, the most effective form of student's cognitive activity, plays a major role in familiarizing students with the experimental bases of laws, phenomena and processes, in instilling the skills of independent preparation and conducting physical experiments.

Physical practicum gives students an understanding of the connection between theoretical knowledge and practice, develops research abilities, ability to apply the acquired knowledge when performing laboratory work [2, 4, 9].

The successes of basic research in physics achieved in recent years, the needs of production and new technological capabilities make it necessary to modernize educational processes, in particular, the physical workshop.

However, at present, teachers of technical and other non-physical specialties face a lack of basic physical knowledge of first-year students, which becomes a serious obstacle in the formation of basic competencies of future specialists [8].

The low level of knowledge of the basic fundamental discipline of physics leads to the fact that the study of special disciplines is the accumulation of knowledge without a deep understanding of the physical nature of the processes.

The situation is further complicated by the fact that in recent years the time spent studying general physics at many universities in Ukraine has decreased significantly.

About 50% of this time is spent in class, the rest - outside of the classroom, independent work.

However, neither the amount of basic material that students need to assimilate, nor the depth and quality of knowledge, skills and skills that need to be formed can not be changed for the worse.



Approximately 35% of class work is performed in the laboratory practicum [6, 7].

Limited time of practicum imposes rigorous requirements for the choice of laboratory works and methods of their implementation.

The topics of laboratory work should correspond to the most important and difficult sections of the theoretical course, to promote their strong assimilation.

At the same time, it is possible to distinguish 1-2 laboratory works for better understanding and understanding of theoretical material, which is studied independently. Naturally, in this case, the instructions should take into account the features of such work.

For effective use of class time it is necessary to distribute the program material from the course of general physics optimally into lectures, laboratory and practical classes.

Unfortunately, even in the engineering specialties, the curricula do not provide practical lessons in the study of some sections of the course in physics.

In this case, the theoretical part of the laboratory work should be strengthened by including the tasks in the control questions in this work.

The task of forming the general and professional competences of students requires that knowledge, skills and skills be formed in the conditions of educational activity as close as possible to the professional one. Therefore, a special place in the physical practicum should occupy laboratory work related to the profile of the faculty, specialization of students.

In such works, future specialists will become familiar with some of the research methods specific to the field of science and technology, and may study the devices and methods that they will continue to use.

Experience shows that students are more interested in performing such laboratory work.

Thus, in Kherson State Agrarian University, a separate set of laboratory works is organized for each specialty.

The modern General Physics course program includes a number of very difficult to understand questions. The most convincing way to address such issues is to demonstrate physical phenomena on real physical equipment, both during lectures [6, 7] and when conducting a laboratory workshop.

Laboratory works of this kind has until recently been the majority in various workshops.

The value and benefits of such work are obvious. But, unfortunately, in most universities the equipment of full-time laboratory work and lecture demonstrations is morally and physically outdated. The university's weak material and technical base makes it impossible to organize laboratory experiments in full, thus hindering the formation of general and professional competences.

In addition, the technical capabilities of such equipment are significantly limited. For example, when the processes under study are very transient or long-lasting, too small or large-scale processes, it is fundamentally impossible to observe the phenomena.

Exploring the surrounding world in all its diversity and incredible complexity is



impossible.

Therefore, there was a need to isolate, isolate the essential in the object and take for the study not the object itself, but its model.

Model - mentally imagined or materially implemented system that reflects (or reproduces) the basic properties of an object so that the study of the model gives new information about the object.

Some models are very useful and are widely used in explaining a wide range of phenomena, such as material point, absolutely solid, perfect gas, harmonic oscillator, etc.

Especially effective was the use of models using computer technology. Computer models have a high heuristic ability, allow to obtain significant results when performing virtual experiments. (For example, the study of electrical circuits using a public electronic circuit stimulator Electronics Workbench V5.12.)

Educational computer modeling of physical processes, implemented in the form of virtual physical experiments, plays an increasing role in the teaching of physics [3, 8].

A virtual experiment has several advantages that make it relevant:

- as a replacement for a real experiment in case of difficulties in its application;
- use of part-time and, in particular, distance learning courses in physical education for students;
- for students to work independently and prepare them for work on a real installation;
- possibility of virtual experiments in the after hours, independently, on the home computer.

It should also be noted the low cost of virtual experiments - all experiments are performed on the same computers; simplicity of organization of frontal laboratory work - only computer class is required; possibility of repeated researches with change of initial conditions that allows to solve difficult problems by the method of simulation modeling. However, virtual experiments have significant drawbacks that limit their wider use in the educational process.

Real objects, real measuring devices are much more complex and richer in their properties than virtual counterparts. When performing virtual experiments in virtual laboratory work, students do not develop practical skills of using real devices and equipment for measuring physical quantities, skills for conducting experiments, drawing electrical circuits, etc. Obviously, it is unacceptable to train professionals who are unable to work with real objects.

These features, advantages and disadvantages of virtual experiments determine the role and importance of virtual laboratory work in the physical workshop. Today, online resources offer a wide selection of virtual works in a variety of topics.

The development of the physical workshop by the methods of information and communication technologies, especially the organization of educational and cognitive activity of students in the process of preparation and execution of virtually oriented laboratory work in the course of general physics are considered by many researchers, in particular [3, 8].

An analysis of these works shows that a rational combination of traditional and



information-based learning technologies is most acceptable.

A computer experiment cannot completely replace a real one. Virtual laboratory work should only be performed when, for some reason, the necessary experiments cannot be performed using real equipment [8]. The rapid growth of scientific information, the need for university graduates to work in the context of high innovative technologies make the main task of teaching students the development of students' skills to acquire knowledge and put them into practice.

It is believed that a specialist with higher education should constantly, throughout his life, independently improve their knowledge, which is consistent with the concept of continuing education.

Therefore, the student, while studying at the university, must acquire the skills, ability to self-acquire knowledge, their continuous updating and updating.

In the context of a significant reduction in classroom hours at Ukrainian universities, a very important factor in the effectiveness of teaching is a clear organization of students' independent work.

Important creative reworking, the transformation of students' educational information obtained in the classroom, in the work on textbooks, from the Internet, in knowledge, skills, beliefs. This requires systematic independent work of students. A special role in acquiring the skills of independent work belongs to the physical workshop.

Laboratory practicum, unlike other training sessions, requires students from the very beginning to study independent, active and conscious work not only in the laboratory, but also at home in preparation for the performance of laboratory work, in processing the results of the experiment and the preparation of the report [2, 4, 8].

Particular attention should be paid to introductory classes, during which first-year students will be introduced to the tasks of the physical workshop, the organization of laboratory classes, the rules of work in the physical laboratory, the rules of safety.

The student should be aware that when performing each laboratory work, he or she must be able to:

- to explain the physical essence of the phenomenon studied in this work;
- to characterize the features of the object of research; - explain the physical basics of the measurement methodology used in this work;
- use measuring devices;
- to make measurements, to record correctly the results of measurements;
- to estimate the measurement error; - analyze the results of the experiment, draw conclusions, report on the work.

All these skills can only be acquired as a result of the student's purposeful independent work.

Note that virtual laboratory work in physics can be used as elements of student's independent work in preparation for the actual laboratory work.

Conclusions.

Studying the basic fundamental course of general physics is an important condition for the formation of the general and professional competence of a university graduate - specialist in natural science and technology.



The physical practicum provides students with experimental skills and the ability to effectively address the integration of theoretical knowledge and practical problems.

Particularly important is the role of the physical practicum - the development of students' ability to acquire knowledge, skills and abilities to work independently, self-education and self-improvement during life.

The development of the physical workshop and methods of its implementation are due to the widespread introduction of information and communication technologies, virtual laboratory work.

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Аннотация. В статье анализируются вопросы роли и задачи физического практикума в курсе общей физики для студентов естественных и технических специальностей вузов. Характерной чертой современного образования является быстрый рост объема поступающей информации и, как следствие, острая необходимость повышения скорости усвоения ее студентами. Особенно важно усовершенствование физического практикума как эффективной формы познавательной деятельности для студентов-первокурсников. Уделено внимание формированию умений и навыков творческой самостоятельной работы студентов. Рассмотрена эффективность развития физического практикума методами информационно-коммуникационных технологий.

Ключевые слова: физический практикум, натурные и виртуальные эксперименты, самостоятельная работа студентов.

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