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ON SOME ISSUES OF LEARNING PHYSICS IN HIGH SCHOOL

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Abstract
This article discusses the technical and methodological problems of teaching physics, which are associated with the fact that the majority of modern graduates, and then first-year students, do not have sufficient knowledge of the physics course. Students are not sufficiently prepared for independent work, especially if they choose technical areas of future professional activity. However, changes in the teaching of natural sciences in schools and universities do not always lead to sufficient results in improving quality. It is noted that the level of knowledge of schoolchildren entering the university has not increased even after the abolition of the mandatory unified state exam in physics at school, and the authors of this article believe that: the educational process should be organized in such a way that the bulk of students master the fundamental knowledge necessary for work in the specialty. And at the same time, the educational process must be organized so that gifted students have the opportunity to develop their abilities, that is, the educational process must be differentiated, which involves individual work with students. When teaching physics, it is necessary to use classical traditional methods (lecture material, laboratory course, practical exercises with analysis and problem solving, seminar classes, etc.) and modern computer software methods.

Keywords: natural sciences, fundamental knowledge, classical traditional methods.

Introduction

Among general education subjects, the university course of general physics occupies an important place in the training of specialists, because their qualifications are determined not only by the amount of knowledge acquired, but also by the level of understanding of the general laws of the development of science and technology, scientific thinking skills, and worldview. Of all the higher school courses, physics is perhaps the most difficult subject [1]. In addition to the introduction of complex concepts, generalizing ideas and specific patterns, it requires knowledge of a serious mathematical apparatus and a constant close connection between physics and mathematics. Unfortunately, interest in the exact sciences (including physics) and technology has declined in recent years. In many countries, the proportion of young

people choosing these subjects is declining. In recent years, serious difficulties have arisen in teaching physics due to the fact that the bulk of modern graduates, and later first-year students, do not have sufficient knowledge of physics. However, changes in the teaching of natural sciences in schools and universities do not always lead to improved quality. For example, after the abolition of the mandatory Unified State Exam in physics at school, the level of knowledge of schoolchildren entering university did not increase, because many school graduates, until the "last" moment, doubt the correctness of their choice of their future path, and therefore, the choice of the mandatory Unified State Exam, and therefore miss opportunities for in-depth study of the subject. The result of the above is the fact that students enter the university with poor knowledge of physics and who need additional independent work in physics under the supervision of a teacher [2].

As mentioned above, many graduates of modern schools do not have sufficient knowledge of physics. Currently, higher education institutions are deprived of the right to conduct entrance exams, and because of this, universities are forced to accept applicants with a low level of preparation. A logical question arises if we assume that universities cannot influence the quality of admission of freshmen, but are forced to accept applicants with poor preparation in subjects such as physics and mathematics. "What level of specialists can be prepared from modern applicants?" The following answers are possible:

1) the university follows the lead imposed on it by the modern school system of preparing applicants, and trains specialists, to put it mildly, of a very low level. And this, in turn, will affect the general level of technical training throughout the country;

2) the university must use all opportunities to train specialists of a sufficiently high level. To do this, it is necessary, firstly, to raise the level of training of freshmen to the level at which they can master the university program. TPU provides adaptation classes in physics for such students. Students are given additional lectures on physics, and under the supervision of the teacher, students solve problems. Students who have attended the adaptation course learn new material better and their performance in physics exams improves.

Methods

Currently, universities are required to graduate physicists at various levels (bachelors, masters) who meet certain professional standards. Bachelor's training does not imply an in-depth study of physics. At the same time, life shows that knowledge of physics provides in-depth training for people who can easily adapt to any situation. During the period of rapid development of science and technology, there is a rapid growth in

the volume of knowledge and, accordingly, the aging of information to be assimilated. This necessitates the inclusion in the course of general physics of many important issues related to the modern progress of physical science and technology, which leads to hypertrophy of individual sections and the course as a whole. Certain difficulties arise associated with the selection of material for study. In this regard, Academician V.A. Fabrikant proposed a model according to which every fundamental science, including physics, has a core that changes relatively slowly over time, and a rapidly deforming shell. The core includes a number of basic principles and factors. There may be sharp leaps in development, but they occur rarely. The shell consists of those sections of physics that are most important for the work of specialists in modern conditions. Depending on the profile of the university, the program identifies a range of basic knowledge, skills and abilities that a university graduate must master [3]. It is difficult to predict what a university graduate will encounter in practice, and what branch of physics he will be dealing with in practical use. It is unacceptable to replace a course of general physics with the study of its individual chapters in relation to the narrow specialty of this course. The process of teaching physics should consist of the consistent formation of physical concepts and theories that are new to the student on the basis of a few fundamental principles. Depending on the profile of the university, the program identifies a range of basic knowledge, skills and abilities that a university graduate must master. If at a given university the course of general physics is studied in a compressed volume, then the course should be shortened not by excluding fundamental provisions, but by reducing the detail of their provisions [4]. In teaching physics, it is necessary to use both classical traditional methods (lecture material, laboratory course, practical exercises with analysis and solution of problems, seminars, etc.), and modern computer methods. The art of teaching physics is to find a presentation of the material in which, with the help of sequential logical operations and rationally selected experiments, one could formulate the basic physical concepts and give an idea of the basic physical laws and theories.

Modern universities are characterized by a very large amount of information. One of the methods of teaching physics can be considered the process of developing the ability to work with information. Forming the ability to build an information model is one of the generalized skills. One of the criteria for this skill is the student's high efficiency in solving problems of systematization and generalization of educational material and his own knowledge. The basis for assimilation of information can be the detailed and systematic application of generalized methods, general methodological principles, extremely general concepts, etc. in the educational process.

Results and Discussion

The emergence of new computer-based educational programs poses the challenge of modernizing traditional education systems and developing new teaching methods. Currently, educational computer programs are widely used to conduct practical classes, which allows one teacher to conduct classes with large groups of students. Students can study independently using this program. The use of computers improves the quality of practical and laboratory classes in physics. Despite the objectivity and efficiency of this method, its capabilities cannot be absolutized or exaggerated. The disadvantage of this technique is that a successful lesson can only be carried out with a high-quality training program, but the software often has a rigid script, which, for example, is not able to evaluate an original solution to a problem not provided for by the program [5]. Experience using computer technology in the educational process showed that in solving problems in physics this approach was implemented by B.S. Belikov. His approach is based on a system of the most general concepts of physics as applied to solving any physical problem. Solving physical problems is a necessary basis for studying physics, since it is associated with independent work, which, in turn, teaches the analysis of the phenomenon being studied. As a result, solving any simple problem contributes to the development of a scientific worldview and approaches the model of scientific physical research. Solving a physical problem is a real school for a student's mental activity. The process of solving a given problem can be divided into three stages: physical (it ends if a closed system of equations is compiled), mathematical (its goal is to obtain a solution to the problem in general and numerical form) and the stage of analysis of the solution. In order to successfully solve problems in physics, according to B.S. Belikov, it is necessary, in addition to specific knowledge, to master so-called generalized knowledge. The basis of generalized knowledge is the fundamental concepts of physics, which are methodological in nature. There are relatively few fundamental methodological concepts in physics. This is a physical system, a physical quantity, a physical law, the state of a physical system, interaction, a physical phenomenon, ideal objects and ideal processes, a physical model, etc. The connection of a physical phenomenon with all other fundamental concepts is of particular importance. The use of a system of fundamental concepts allows us to formulate the most important definition of a theoretical physical problem as a physical phenomenon in which any connections and quantities are unknown. Solving a physical problem means restoring unknown connections and determining the required physical quantities. Involving them in active work during practical classes helps to train students in the skills of solving problems in physics [6]. Problem situations are created by setting a cognitive

task that would be understandable to students and captivating in its content. The nature of the problem situation is determined by the specific content of the educational material.

The solution to each complex physical problem can be a solution to a problem situation if this problem is solved independently by students and not passively written off from the board. Ways to create a problematic situation can be: emphasizing the practical significance of the topic for solving the most pressing problems of physics, 2) putting forward controversial hypotheses, 3) setting a research problem, 4) deriving a formula, etc. In general, the ability to independently find algorithms for solving problems of unfamiliar types, i.e. the ability to think physically and physical intuition are developed in the course of solving many problems of different types, equipping students with knowledge of various solution techniques. Consideration of elementary problems is useless, because during it, students do not receive new information and do not train their thinking abilities. However, problem-based learning cannot be considered universal. It must be combined with other teaching methods. Regardless of the methods used to study new material, the starting point in teaching physics should be the emergence of research interest. In this case, it is necessary to accurately assess the possibility and feasibility of using one or another method in given conditions.

In practical physics classes, we do not allow students to find basic physical laws and formulas on the Internet. Students who rush to fill their knowledge base from the Internet during classes often write down a formula without delving into its physical meaning, and understand the material worse than those students who analyzed it in a textbook. This can be explained by the fact that it is more difficult to find a law among similar formulas in a textbook without reading the explanations for them. Another problem is that some students can copy solutions to problems on the Internet.

One of the main tasks of modern higher education is to increase the efficiency of the educational process. Assessing students' knowledge throughout the semester makes it possible to control and adjust (if necessary) the learning process. The currently accepted rating system for assessing students' knowledge is as follows: all work during the semester, as well as exam results, are assessed by a certain number of points. The final grade is given according to the overall system of points received during the semester and during the session. The advantages of the adopted rating system include the fact that with such a control system, students work systematically during the semester, independent work improves, class attendance improves, etc. However, the rating system for assessing students' knowledge also has disadvantages. The rating system involves the use of a large number of tests, the correct answers to which do not

always correspond to a high level of knowledge. For example, some of the answers may simply be guessed. Some students are more interested in scores than knowledge. According to the rating system, a student can receive admission to exams without fully completing the curriculum, which negatively affects the overall level of training. The result of such a system for assessing student knowledge is a discrepancy between the student's real knowledge and the grade obtained on the exam, which, in turn, leads to the student's loss of interest in the subject being studied.

How, in modern conditions, can we prepare a competent engineer who has the necessary knowledge and is capable of creative problem solving? Many teachers believe that the solution to the problem lies not in filling the student's head with knowledge of all sciences, but in involving him in independent creative work, which will develop his ability in the future to independently obtain the necessary knowledge. It is believed that in modern conditions a specialist should obtain the necessary information, mainly with the help of information technology, and not keep it in memory.

Conclusion

Education at a university must meet the modern level of scientific and technological progress. To work in the field of high technology, universities must be able to use expensive laboratory equipment, which is difficult to achieve in modern economic conditions. The solution to these problems is possible with a closer connection between education, scientific laboratories of universities and high-tech production. The educational process should be organized so that the majority of students acquire the fundamental knowledge necessary to work in their specialty. And at the same time, the educational process should be organized so that gifted students have the opportunity to develop their abilities, i.e. the educational process must be differentiated, which involves individual work with students. It is necessary to pay great attention to the formation and development of creative abilities, which in the future will help a specialist in solving scientific and technical problems.

Given the current pace and characteristics of technology development, it is impossible to predict in advance which branches of physics will become of primary importance for technology in the future. Therefore, the physics course should be such that students receive solid systematic knowledge of all its main sections. The general physics course should be structured as a consistent unified course [7]. Modern science and technology are developing very quickly. In the first place when forming a future specialist, one must put his ability for professional self-renewal and self-education,

the desire for constant generalization of acquired knowledge, for orientation in the modern world of knowledge.

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