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IMPROVING METHODS FOR SOLVING PROBLEMS IN TEACHING PHYSICS IN TECHNICAL COLLEGES

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Abstract

The article discusses the importance of using experimental problems in the methodology of teaching physics at a technical university.

At the beginning of the 21st century, the well-being and further prosperity of the republic depend on scientific and technological progress and the intellectual potential of the country. In this regard, from the first day the Republic of Uzbekistan gained independence, the President and the country's leadership put the issue of education among the highest priorities.

Introduction

It is generally accepted that studying physics not only provides factual knowledge but also develops personality. Physical education is undoubtedly an area of intellectual development. The latter, as is known, manifests itself in both mental and objective activity of a person.

The task set before education is not only to give a person the comprehensive knowledge necessary to become a full-fledged citizen, but also to develop in him the independence of thinking necessary for the development of creative abilities. This is facilitated by the systematic solution of problems in physics lessons, which in turn prepares a person for rationalization, instills in him hard work, perseverance, determination, acts as a controlling link for knowledge, skills and abilities, and provides an opportunity to practice the ability to apply theoretical knowledge in practice. Based on various particular methods, the following definition of a "physical learning task" can be given. A physical educational task is a situation that requires students to think and practice based on the use of laws and methods in physics, the ability to apply them in practice and the development of thinking. Solving problems is a mandatory element of the educational process in physics. For a teacher, a student's ability to solve problems is one of the important criteria for mastering knowledge. Often there is a situation when a student knows the usual theory of a physics course, but does not know how to solve physical problems; after reading the conditions of some problems, he sometimes does not even know where to start solving them. Teaching a student to solve problems is one of the most difficult pedagogical problems.

In this regard, experimental problem solving, which necessarily involves both types of activity, acquires special importance. Like any type of problem solving, it has a structure and patterns common to the thinking process. The experimental approach opens up opportunities for the development of imaginative thinking. Experimental solution of physical problems, due to their content and solution methodology, can become an important means of developing universal research skills and abilities: setting up an experiment based on certain research models, experimentation itself, the ability to identify and formulate the most significant results, put forward a hypothesis adequate to the subject being studied , and on its basis build a physical and mathematical model, and involve computer technology in the analysis. The novelty of the content of physical problems for students, the variability in the choice of experimental methods and means, the necessary independence of thinking in the development and analysis of physical and mathematical models create the prerequisites for the formation of creative abilities.

Consequently, it is very important what method of teaching problem solving the teacher uses: one that equips the student with a generalized method, or one in which each problem is solved using a specific method. This is true to a certain extent when solving problems of any complexity. Question: “What type of task is this?” leads to the next question: “What can be done to solve this type of problem?” Asking these questions can be beneficial because... If it is possible to classify the problem under consideration to a certain class and establish its type, then we can recall a method for solving problems of this type. Similar questions can be successfully asked even in very serious studies. Thus, when solving problems, it is useful to classify them, distinguishing between problems according to their types. A good classification involves dividing problems into such types that the type of problem predetermines the method for solving it. Many scientists have dealt with the issue of classification of physical problems, including Belenok I.L., Belikov B.S., Velichko A.N., Znamensky P.A., Usova N.V., Tulkibaeva N.N., and a lot others. For example, Tulkibaeva N.N. [6] consider classification based on consideration of the adopted problem. In this case, the basis for classification may be the characteristics of either the task system or the decision system, or the relationship of the environment to them. She distinguishes the following types of tasks: a) by content: textual, graphic, experimental, drawing tasks; b) by the nature of the content: abstract, concrete; c) by degree of complexity: simple, complex; d) by method of solution: quantitative, qualitative, graphical, experimental, etc. Belikov B.S. identifies, in addition to the types already mentioned, posed and unposed tasks.[7]

Solving problems, of course, requires active mental activity. Therefore, using the material of the problems, the teacher can impart new knowledge to the students, and even material studied theoretically can be explained “on the problem.”

According to one of the axioms of the methodology, knowledge is considered acquired only when the learner can apply it in practice. Problem solving is a practical activity. This means that the task also plays the role of a criterion for acquiring knowledge. Based on the ability to solve a problem, we can judge whether the student understands this law, whether he can see the manifestation of any physical law in the phenomenon under consideration. And this can be taught – again – through problem solving. Practice shows that the physical meaning of various definitions, rules, and laws becomes truly understandable to students only after repeated application of them to specific individual example problems.[1]

The problem of improving the quality of students' knowledge in physics is resolved in the learning process in various ways, in particular, by strengthening the experimental side of teaching and organizing students' independent work. These goals are perfectly served by experimental problems, the solution of which is found experimentally.

Particularly valuable should be recognized such experimental problems, the data for the solutions of which are taken from experience taking place before the eyes of the students, and the correctness of the solution is verified by experience or a control device. In this case, the theoretical principles studied in a physics course acquire special vitality and significance in the eyes of the students. Solving experimental problems helps students to deeply and more fully comprehend and understand the studied pattern, since it shows it in action in a very specific situation, where each of the quantities included in the pattern appears to them quite realistically and in real-life relationships.[2]

Experimental problems can be solved in the following way:

1. Students become familiar with the experimental setup. If necessary, a drawing is made, the conditions of the problem are written down, and, if necessary, additional questions to it.
2. The physical essence of the phenomenon of the law to which it obeys is established. A path to experimentally solving the problem is outlined.
3. An experimental solution to the problem is carried out and the necessary calculations are made, if they are provided for by the given task.
4. The results obtained are discussed by all participants in solving the problem.[3]

In the teaching process, it is important to teach students to apply the basic principles of science to independently explain physical phenomena, experimental results, and the operation of instruments and installations. Highlighting the main material in each section of a physics course helps the teacher draw students' attention to those issues that they must deeply and firmly understand. Physical experiment is an organic part of the physics course at a technical university, an important teaching method.

The modern organization of educational activities requires that students make theoretical generalizations based on the results of their own activities. For the academic subject "physics" is an educational experiment. Experience shows that students show especially great activity and independence when solving experimental problems. Data for solving experimental problems are obtained from experience directly on the teacher's demonstration table or through physical measurements made by the students themselves.[4]

Let's consider an example of solving the following experimental problem that can be offered to students:

Determine the unknown resistance using a Wheatstone bridge circuit. To do this, it is proposed to assemble a bridge circuit "Wheatstone bridge" - a circuit first developed in 1844 by Charles Wheatstone (1802 - 75) for measuring resistance (Figure 1).

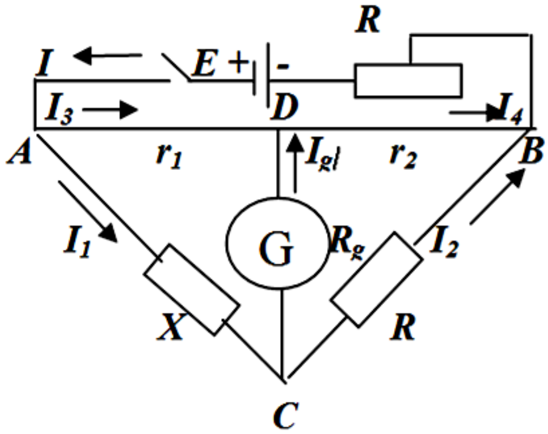

Fig. 1.

ext, students are offered the procedure for performing and taking measurements:

1. To start working with the equipment, the demonstration bridge circuit (hereinafter referred to as the module) must be connected using a DC power source in a 220 V network.
2. Set the position counter of the rheochord resistor (7) to the middle position equal to 50% (5 revolutions).
3. Install any sample resistance measuring resistor Rrev (10 Ohm, 100 Ohm, 1 kOhm) into terminals (6). The sample resistance value must be within 10 times the RX resistance value being determined.
4. Connect a resistance store to the terminals (4) using connecting cables (as the desired resistance).
5. Turn on the power supply to the module using the ON toggle switch (1), and the Upit indicator light (2) will light up.
6. Use the rotary knob of the rheochord resistance (7) to set the position of the galvanometer needle (3) to zero.
7. Read the readings of the rheochord Rr and calculate the unknown resistance RX according to the equation:

$$\frac{R_x}{R_{обр}} = \frac{R_r}{100 - R_r} \qquad (3)$$

8. For a more accurate measurement of the resistance being determined, press the “FINE MEASUREMENT” button (5). While holding the non-locking button (5), repeat steps 6-7. Fill in the readings in the table.

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Table No. 1

№	R, (Om)	l_1, (sm)	l_2, (sm)	l_1/l_2	X (Om)	$\Delta X = X_{av} - X$	ε, %
1							
2							
3							
					$X_{av}=$	$\Delta X_{av}=$	
1							
2							
3							
					$X_{av}=$	$\Delta X_{av}=$	
1							
2							
3							
					$X_{av}=$	$\Delta X_{av}=$	
1							
2							
3							
					$X_{av}=$	$\Delta X_{av}=$	

9. Carry out similar measurements for other unknown resistances with other resistance samples.
10. Turn off the power using the ON toggle switch (1), the Upit indicator light will go out. Disconnect the equipment from the network.

The correctness of the solution found is checked by operations with the names of the quantities included in the formula.

The results of solving the problem are collectively discussed, and a conclusion is made about the reliability of the assumption underlying its solution.

The advantage of experimental problems over text ones lies, first of all, in the fact that experimental problems cannot be solved formally, without sufficient understanding of the physical process. Cognitive interest is exploratory in nature. Under its influence, a person constantly has questions, the answers to which he himself is constantly and actively looking for. Cognitive interest has a positive effect not only on the process and result of activity, but also on the course of mental processes - thinking, imagination, memory, attention, which, under the influence of cognitive interest, acquire special activity and direction.[5]

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