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PROJECT-RESEARCH ACTIVITIES OF STUDENTS IN THE STUDY OF PHYSICS

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ABSTRACT

The article argues that, given the complex and abstract nature of physics, providing students with opportunities for practical experience and collaborative problem-solving is crucial for improving the effectiveness of physics education. Furthermore, the authors provide recommendations for integrating project-based learning within modern educational methodologies to increase the engagement and success of students in the study of physics.

KEYWORDS

Project-based learning, research activities, physics education, independent learning, scientific thinking, problem-solving skills, experimental methods, collaborative learning, critical thinking, hands-on projects, physics curriculum, educational methodologies, student engagement, teamwork, practical experience, concept mastery.

Introduction

In the modern world, the process of emergence of new knowledge is constantly accelerating, there is a need for new professions, for continuous improvement of the level of education.

Therefore, education today solves a very important task – preparing the younger generation for life in a rapidly changing information society. Nowadays, it is no longer enough to provide students with a certain amount of knowledge; it is more important to teach them to acquire knowledge independently.

But recently there has been a decline in students' interest in learning in general, which leads to a decline in the quality of knowledge. Studying is hard work, requiring willpower, persistence, patience, diligence, and special skills from students.

Another important reason for the decline in the quality of knowledge is the monotony and uniformity of classes, the absence of vivid impressions, and changes in events. The learning process turns into loading the students' memory with a large number of rules, formulas, and terms. The student does not learn to think, but gets used to everything being given in a ready-made form.

Therefore, it is necessary to widely introduce alternative forms and methods of conducting educational activities into the educational process. One of such forms is educational research activity. Research activity forms students' skills and abilities in the practical application of theoretical knowledge, develops thinking, logic, teaches setting goals, tasks and finding ways to achieve them, requires mastering various

methods. Since this is acquired on the basis of one's own experience, it leads to a deeper understanding of the knowledge gained.

Physics is an experimental science. It is based on observations and experiments, and the organization of research activities in the study of physics is a necessary factor that allows increasing the interest of students in physical science, making it exciting, entertaining and useful, and realizing that physics is not scary, physics is interesting.

For successful research activities, it is necessary to develop basic research skills in students and to arouse interest in research work.

The research activities of students are multifaceted and can be organized at any stage of training: when studying theory; solving problems; conducting a demonstration experiment; performing laboratory work. Since students come to the first year of technical school with a certain amount of knowledge in physics, the teacher gives a research task at the introductory lesson. Students are asked to create a crossword puzzle in which the key word will be the student's surname. Students must not only correctly formulate the crossword questions, but also know the answers to them. The search for answers to such questions forces students to turn to the textbook, additional literature, and the Internet.

Experimental work of students also belongs to project-research activities. Computer technology makes teaching physics more visual and more interesting. In addition, such sciences as physics, chemistry, biology cannot be studied well without an experiment. Therefore, the teacher devotes a significant part of the lesson time to experiments. This is, first of all, a frontal experiment, where research work is planned in pairs or groups. Such work can be carried out according to the following plan:

1. The students are presented with a problem for which an experiment is being conducted.
2. Knowledge is not communicated to students, since students acquire it independently in the process of research.
3. Students choose the means to achieve results themselves, i.e. they become active researchers.
4. The teacher manages the research process.

For example, when studying the topic "Work and heat as forms of energy transfer" the question is asked: how can you change the temperature of a body without transferring heat? A set of equipment is offered: aluminum wire, a test tube with water. The problem is solved quickly with the wire: as a result of repeated bending and unbending, the wire heats up. They conclude that it is possible to change the temperature of a body by doing work. Next, the issue of heating water is solved. For this, a research laboratory work "Heating water by doing work" is conducted. They receive further evidence that the internal energy of a body can be changed by doing work.

Using the research method when studying new material. During a research lesson, all stages characteristic of the implementation of any research project are present:

1. During the conversation, a problematic question is formulated, the knowledge necessary for further research is updated, and the goals and objectives of the work are set.

(Evaporation and condensation. Problem: what quantities determine the evaporation rate. Accordingly, the problem sets a goal and objectives)

2. A research hypothesis is put forward through brainstorming. *(The rate of evaporation may depend on: the area of the free surface, the temperature, the type of liquid, the wind speed)*
3. The research method is selected. This choice can be made during a frontal conversation, an independent discussion of the problem and hypothesis in a group, or formulated by the teacher. *(Observation of the evaporation of different liquids, evaporation of the same liquid at different temperatures, etc.)*

4. Students, working in groups, search for a solution to the problem. Then they analyze the results and draw conclusions about their work. *(Each group conducts its own research, generalizes, and draws a conclusion)*
5. Each group presents the results of its work in the form of an oral report.
6. The results of the work are summed up and the activities of each group are assessed.

Research can be conducted even when solving problems. For example, solving a problem on the law of conservation of momentum. *A boy weighing 50 kg dives from a boat weighing 200 kg, moving at a speed of 1 m/s, moving horizontally. What will be the speed of the boat after the boy's jump, if he jumps at a speed of 2 m/s?*

The condition is analyzed in advance, the main elements are identified, the law is repeated, a solution plan is drawn up, with the solution methods correctly selected. The tasks on the ZSI assume the presence of a drawing, which will depict the velocity vectors of the bodies before and after the interaction. A problem arises: first, where does the boy jump from: from the stern or from the bow of the boat? Second, where will the boat's velocity be directed after the jump? Then we predict the result.

Any task should have an element of novelty, so as not to weaken the developmental side of problem solving. It is necessary to teach students to solve problems using different methods, both standard and those not often used in practice. It is useful to solve the same problem in different ways, this teaches students to see different sides of any physical phenomenon, develops creative thinking. And if the task is slightly changed, then students, not finding a scheme or algorithm, will solve the problem using a research approach. Knowledge acquired as a result of one's own search becomes the basis for obtaining new knowledge.

The main general didactic techniques used in solving problems are: analysis, comparison, generalization and systematization, hypotheses, transfer of knowledge to a new situation, search for an analog for a new solution to a problem, proof or refutation of a hypothesis, research planning, and presentation of research results.

The teacher must teach students to identify elements of the research approach in the structure of the solution of any physical problem, using the method of heuristic questions, comparisons, observations, versions and conclusions; teach students to draw an analogy between the elements of the solution to the problem and the elements of research activity.

But laboratory work, of course, provides the greatest opportunity to apply research methods. Traditional laboratory work involves following a specific instruction or algorithm. However, each such work contains elements of research, which contributes to the development of students' intellectual and thinking abilities. After all, when performing laboratory work, students must not only make the necessary observations, measurements, calculations, but also make certain conclusions, comparisons, build graphs, etc. In addition, students must find answers to professionally oriented test questions.

Many educational tasks are solved during laboratory classes:

- confirmation of the validity of the laws being studied (for example, verification of Ohm's law for a complete circuit);
- mastering methods of measuring physical quantities (measuring the power of a light bulb, the efficiency of an electric kettle);
- instilling skills in the use of measuring instruments (dynamometer, scales, ammeter, voltmeter);
- study of the structure and operating principle of physical devices (models of an electric motor, electromagnet);

• developing the ability to read electrical diagrams.

Participation of students in the work of the scientific research society is another means of increasing interest in the study of physics. The scope of activities of the NISO is to provide support to students in scientific research work, self-education and raising the level of professional knowledge; assistance in expanding the range of students' scientific research activities; improving the quality of education.

When carrying out project-research work, students study scientific publications, monographs, search for new developments in science and technology, i.e. serious work with literature takes place. By joining scientific research, students learn to navigate the vast world of scientific books, magazines, and manuals. They learn to classify the collected material, process, analyze it, generalize, and draw conclusions. Students learn the ability to express their thoughts on paper, conduct a public discussion, and defend their own conclusions. All this work leads to a rethinking, enrichment, and deepening of the knowledge gained in physics lessons.

Studying physics through the organization of research activities helps students gain invaluable experience, master the methods of scientific knowledge, contributes to the formation of conscious and quickly used knowledge, and forms the need for self-development.

Practice shows that project-research activities really contribute to the formation of a new type of student who has a set of skills and abilities for independent and constructive work, knows the methods of purposeful activity, is ready for cooperation and interaction, and has experience in self-education. Young people who are able to make adequate, quick, thoughtful decisions can ensure a decent life and a high level of socialization.

References

1. Artamonova I.I. General provisions for organizing research activities of students. // Research activities of students and teachers. Collection of articles. / Ed. by M.A. Bulavina. – Omsk: OOIPKRO, 2004.
2. Savenkov A.I. Research-based learning and design in education. – Research work of schoolchildren, 2004, No. 1.
3. Leontovich A.V. On the basic concepts of the concept of development of research and project activities of students. – Research work of schoolchildren, 2003, No. 4.
4. Alekseev N. G., Leontovich A. V. Criteria for the effectiveness of teaching students research activities Development of students' research activities: Methodological collection. Moscow: Public education, 2001. 272 p.
5. Lebedeva O. V. Principles of organizing research activities in the educational process in physics in secondary school / O. V. Lebedeva // Science and School. 2012. N4, pp. 113–116.
6. Lerner I. Ya. Problem-based learning - M.: Knowledge. 1974. 64 p.
7. Obukhov A. S. Research position and research activity: what and how to develop. Research activity of schoolchildren, 2013.N4, pp.18–23
8. Alnikova T. V. Organization of project-research activities in teaching physics // Bulletin of TSPU. Issue . 6 (57) series: natural and exact sciences. - TSPU Publishing House, 2016.