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THE ROLE OF PEDAGOGICAL INNOVATION IN THE PROBLEM-BASED TEACHING OF PHYSICS IN GENERAL SECONDARY SCHOOLS

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Abstract:

In the goals and principles of organizing the learning process between problem and traditional teaching, the purpose of problem-based learning is to not only assimilate the basics of science, develop students' knowledge and creative abilities in the process of obtaining knowledge and scientific evidence. The basis of the organization of problem-based learning is the basic principles of research, learning and cognitive activity of the student that is, teaching him scientific facts, events, laws, research methods and methods of applying knowledge in practice.

Keywords: Model, universe, assimilation, concept, axiological, methodological, equivalent, principle, system. Charge, resistor, frontal, cognitive, flat capacitor, electric field, Ohm's law, network, resistor.

Knowledge required for the formation and development of students' scientific outlook, logical thinking, intellectual development, self-awareness through the teaching of physics in general secondary schools, to continue their education using pedagogical technologies of problem-based learning in the formation of national and universal values is given. Through the study of physics, students become acquainted with a series of phenomena in nature and at the same time with their scientific substantiation; they are convinced of the materiality of the world. By being acquainted with the history of the development of physics, they are convinced that man is studying nature more deeply, finding ways to use it. All of this will shape students 'worldviews correctly. Through the study of physical laws and theories, the connections between them, the application of theories in solving physical problems, students develop logical thinking and cognitive abilities.

The main tasks of physics education in general secondary schools:

- To acquaint students with physical phenomena, concepts, quantities, models, laws, measurements, practical applications of physics, knowledge of the physical landscape of the universe;
- To acquaint students with the development of science and technology, the practical application of the laws of physics;
- Development of a scientific worldview by imparting knowledge about the structure of the universe and its phenomena;
- consciously direct students to the profession by linking the content of education with the development of social life and technology, and prepare the ground for them to continue their studies;
- The formation of skills in the use of physical equipment, performing simple measurements and experiments, drawing conclusions based on their results, compliance with safety regulations.

Knowing a person's values in life, knowing how to relate to the world of values, appreciating this world so much, a developing person pays attention to the values around them every minute and helps to establish them in real life. The essence of education is reflected in the relationship to the world provided by the ability to learn about the world and interact with the world. Based on the concept of modern education, we highlight some methodological foundations of the new education:

- The attitude approach reveals the main content of the attitude to education and worldly life;
- The activity approach shows the only possible way of shaping the personality, is the activity of the student;

The axiological basis determines the value direction of the specified content - the formation of relations to the highest values of life. Their formation involves students 'knowledge of a particular world and their ability to interact with the outside world. As a meaningful component of the learning process, 'knowledge', 'skill' and 'relationship' are not a sum of equivalent components; they are processes that are subject to a particular relationship.

The main difference between problem and traditional teaching is reflected in the goals and principles of organizing the learning process. The purpose of problem-based learning is not only to assimilate the basics of science (as in a defined type of learning), but also the process of acquiring knowledge and scientific evidence, developing the

student's knowledge and creative abilities. The basis of the organization of problem-based learning is the principle of "discovering" the student's research, learning and cognitive activity, that is, the ways in which he applies scientific evidence, phenomena, laws, research methods and knowledge in practice.

However, problem reading cannot be imagined as a continuous chain of independent "discoveries" by the requirements of new laws and events. It includes a system of scientific concepts and research methods, an optimal combination of students 'reproductive and creative activities in mastering logical thinking techniques. In the case of problematic lessons, the teacher's explanations and the students 'learning assignments and exercises to develop the necessary skills are not excluded. Problem-based learning, like any other teaching method, is not universal, but is an important part of a modern teaching system.

As a type of education, problem-based learning leads to an evolving group, the development of students 'creative abilities and cognitive independence, the transformation of their knowledge into beliefs, and their widespread use in physics lessons. In case of problem-solving, the physics teacher identifies the material, explains the most complex concepts, regularly creates problem situations in the classroom, and organizes the learning and cognitive activities of the students so that they are independent based on evidence analysis, event observation (during observation or demonstration). Draw conclusions, generalized concepts, and have the ability to formulate rules, concepts, and laws, apply their knowledge in new situations. Based on this, problem-based learning begins with the creation of the main means of activating the problem-solving mental activity of school students and then goes through the main stages and such as problem formation, finding ways to solve it, problem solving, and drawing conclusions.

The essence of a problem situation is the inconsistency between the facts and events that have already been learned, the skills, and the explanation that need to be explained. Not every problem situation always becomes a learning problem, but there is a new situation in every problem situation. For example, to a teacher's question: "What does the law of conservation of charge explain?" to the question

Assignment to 7^{th} graders creates a problematic situation where they still cannot find an answer, and it only goes into a learning problem that can be solved in 10th grade. The difficulties of analyzing a problem situation should be appropriate for the learner and should be overcome, while solving the problems is not immediately available to all learners.

An important and crucial stage of problem-based learning is the creation of a problem-solving situation. The main tools for this are problem solving, but in physics classes we can use demonstration and thought experience, frontal experiments, experimental problems, and more for this purpose. To solve problems successfully, it must include cognitive difficulty and the visible boundaries of the known and the unknown. The problematic issue must include the inconsistency of the data, give rise to the need, and desire to compare, consider, analyze, generalize the data, i.e. to search for the data. For example, a flat capacitor has a capacitance of 0.1μF and a potential difference of 200V. Determine the electric field energy in the capacitor. This task is more complicated because it is not immediately apparent how the electric field energy is found - this is the beginning of a problematic situation. In similar types of tasks, basic characters are required. In solving the problem, they themselves put forward hypotheses, prove them, and test them.

The problematic situation in pedagogy, unlike psychology, is not as a state of intellectual stress associated with an unexpected "train of thought" but a state of mental stress that occurs in a particular learning environment, a lack of objective approach by students to previously acquired knowledge and mental or practical methods. The question is, does this unexpected difficulty always amaze, excite, and stimulate mental inquiry.

Problems are problems that help create problems. A problematic question, like a problematic task, is a specific feature of the object of thinking. It can be studied and solved as a relatively independent form of thought as a separate problem statement that performs its function, is included in problem tasks, and requires an answer. The problematic question differs from the information in that it focuses on the opposite situation and encourages the search for unknown, new knowledge.

We give an example of a theoretical question posed after studying Ohm's law for the series and parallel connection of conductors.

Question: Determine how the current in a parallel connection network changes if the resistance of one of its networks decreases (if there is a resistor in the undamaged part of the circuit of the contacts)?

To answer this question, students go through several stages. Note these steps:

1. First, learn how to change the resistance of a parallel connection and the resistance that leads to corrosion of all contacts.
2. Determine how the current in the constant part of the circuit has changed.

The main goal of problem-based learning is to achieve maximum efficiency in developing students' thinking and creative skills with a minimum of time, so the issue of selecting the necessary (most valuable) interrelated problems in a single system cannot be solved separately from the structure and content of the material.

The following should be considered when choosing to perform problematic tasks independently:

- Independent performance of problem-solving tasks leads to a deeper understanding of the relevant questions of the course and contributes to the rapid intellectual development of students;
- More time is required to complete these tasks.

Therefore, it is recommended to apply the problematic tasks required for the whole class, especially when it is necessary to ensure deep and long assimilation of the material. It is clear that we are talking about the most important and fundamental questions of the physics course: basic concepts and phenomena, laws. In such cases, extra time is worth it. A sequence of actions is needed to build a system of key problems. In the process of teaching physics, we can identify and implement the main idea of this part, which stems from the general goals and objectives of teaching and learning, taking into account the teaching materials.

Due to limited time for problem-based homework, examples of problem situations, and learning problems, not all types of problem-based tasks can be used in lessons, such as designing and manufacturing physical instruments, setting up experiments that require long-term observation or multiple inspections, and other problems open up great opportunities for student development. Simple and challenging individual assignments are useful for some low-achieving students, but their purpose is different: it is important to stimulate students 'interest in physics by convincing them

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