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RESEARCH ARTICLE

Development of Students' Research Activity Through Problem-Based Learning Technologies in Physics Lessons

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Abstract

This article discusses the issues of developing students' research skills through the use of problem-based learning technologies in the process of teaching physics in professional educational institutions. The use of innovative pedagogical approaches in physics education plays an important role in developing students' independent thinking, increasing their interest in scientific inquiry, and forming their ability to solve problem situations. During the research process, the methodology of developing students' research competencies was analyzed through activities such as creating problem situations, proposing scientific hypotheses, conducting experiments, and drawing conclusions. The results showed that the use of problem-based learning technologies ensures the development of students' analytical thinking, scientific reasoning, and deeper understanding of physical phenomena. This approach serves as an important pedagogical tool for improving the effectiveness of physics education.

KEYWORDS

Physics education, problem-based learning, innovative approaches, research skills, scientific thinking, professional educational institutions, problem situation, pedagogical technologies.

INTRODUCTION

In the modern education system, developing students' independent thinking and their ability to conduct scientific research is considered one of the most important tasks. Particularly in the process of teaching physics, it is essential to form students' scientific worldview by integrating theoretical knowledge with practical activities. According to modern educational requirements, students should not only acquire ready-made knowledge but also learn how to independently search for information, analyze it, and apply it in practice.

The use of innovative pedagogical approaches in teaching physics in professional educational institutions contributes to the activation of students' learning activities. Innovative approaches increase students' engagement in the learning process, encourage independent thinking, and promote deeper knowledge acquisition. In particular, the use of interactive methods, experiment-based learning, and problem situations in physics teaching allows the learning process to be organized more effectively. Through such approaches, students not only acquire theoretical knowledge but also learn to apply it in real-life situations.

Physics is one of the fundamental sciences that explains natural phenomena on a scientific basis. Therefore, this subject provides great opportunities for forming students' scientific worldview, understanding cause-and-effect relationships between phenomena, and developing scientific thinking. However, in traditional teaching methods, students often participate as passive recipients of ready-made knowledge. Modern education, on the other hand, requires

students' active participation, independent inquiry, and research activities. In this regard, problem-based learning technology is considered one of the important methods for activating the educational process.

Problem-based learning activates students' thinking activities by creating problem situations during the learning process and encourages them to engage in independent inquiry. Problem situations stimulate students' curiosity and motivate them to find solutions. In such situations, students analyze their existing knowledge, search for new information, and formulate their own conclusions. As a result, students do not receive knowledge in a ready-made form but actively participate in the process of discovering it independently.

The main goal of problem-based learning technology is to develop students' scientific research activities. In this process, students go through several stages, such as identifying a problem, analyzing its causes, proposing scientific hypotheses, and verifying them through experiments or theoretical analysis. This process develops students' skills of independent thinking, logical analysis, and drawing scientific conclusions. During this process, students acquire new knowledge by answering problem questions, proposing scientific hypotheses, and conducting experiments.

The use of problem-based learning technologies in physics lessons is an important factor in developing students' research skills. Research skills reflect students' readiness for scientific activity. These skills include identifying problems, proposing hypotheses, conducting experiments, analyzing results, and drawing scientific conclusions. Organizing such activities in physics lessons not only develops students' scientific thinking but also fosters their creative thinking.

For example, while studying electrical phenomena, students can be asked problem questions about the relationship between electric current, voltage, and resistance. In this process, students are given opportunities to conduct small experiments, observe the results, and analyze the obtained data. Experimental activities allow students to directly observe physical laws and understand them in practice. As a result, students gain a deeper understanding of physical phenomena and learn to explain them scientifically.

Students attempt to determine the relationships between these quantities through various experiments. Similarly, while studying topics such as energy transformation or electromagnetic phenomena, problem situations can be created to involve students in scientific inquiry. Such tasks help students connect theoretical knowledge with practical experiments.

When organizing problem situations, the teacher does not simply provide ready-made information but directs students to analyze the problem independently. For example, when studying topics such as electromagnetic phenomena, energy transformation, or electrical circuits, students' scientific thinking can be developed by posing problem questions.

In the process of problem-based learning, students acquire knowledge through several stages. First, they develop interest in the problem situation. In the next stage, students attempt to determine the causes of the problem and propose various hypotheses. After that, the hypotheses are tested through experiments or theoretical analysis. As a result, students find solutions to the problem and draw appropriate scientific conclusions.

The use of problem-based learning technologies in physics lessons not only improves students' level of knowledge but also develops their analytical thinking. For example, when studying electrical phenomena, students can be asked problem questions about the relationship between electric current, voltage, and resistance. Through experiments, students attempt to determine the relationship between these quantities. Likewise, creating problem situations in topics such as energy transformation or electromagnetic phenomena helps engage students in scientific inquiry. Such tasks help students connect theoretical knowledge with practical experiments.

Students develop the ability to analyze complex physical phenomena, identify cause-and-effect relationships, and draw scientific conclusions. This is very important for their future professional activities.

Furthermore, problem-based learning technology increases students' activity during the lesson. In traditional teaching methods, students often remain passive listeners. In problem-based learning, however, students become active participants in the educational process. They have the opportunity to express their opinions, participate in discussions, and draw scientifically grounded conclusions while solving problems. This increases students' interest in the lesson and helps them acquire knowledge more deeply.

The use of problem-based learning technologies also allows the content of physics to be mastered more deeply. Students

study theoretical knowledge in connection with practical experiments, which makes it easier to understand physical laws and ensures stronger knowledge acquisition. In addition, the use of problem-based learning technologies enriches the content of physics lessons and makes the educational process more engaging. Students actively participate in learning complex physical phenomena and develop the ability to conduct scientific research. This plays an important role in forming research competencies necessary for their future professional activities.

CONCLUSION

In conclusion, the use of problem-based learning technologies in teaching physics in professional educational institutions plays an important role in developing students' research activities. This approach helps form students' scientific thinking, develop independent reasoning, and promote deeper understanding of physical phenomena. In modern education, developing students' research activities not only improves their level of knowledge but also plays an important role in their future professional careers. The use of innovative methods in teaching physics broadens students' scientific worldview and encourages them to engage in independent inquiry. Therefore, the wide application of problem-based learning technologies in physics education is considered one of the important directions of modern education.

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