

THE PEDAGOGICAL SIGNIFICANCE OF THE STEAM APPROACH IN TEACHING PROBLEMS RELATED TO PLATES

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In the modern education system, the process of teaching physics is becoming increasingly complex, requiring students not only to apply ready-made formulas but also to deeply analyze physical phenomena, understand their essence, and relate them to real-world processes. In particular, topics related to electric fields, including physical processes occurring between parallel plates, play a significant role in the development of students' abstract thinking. However, practical experience shows that problems related to plates are often solved using a traditional approach based solely on formulas, which hinders students' deep understanding of the subject.

From this perspective, the introduction of the STEAM approach in teaching problems related to plates emerges as a pressing pedagogical issue. The STEAM approach is based on interdisciplinary integration, in which scientific knowledge is closely connected with technological tools, engineering thinking, visual representation, and mathematical modeling [1]. This approach elevates the problem-solving process in physics education beyond mere calculation, transforming it into a deeply analytical and creative activity.

When teaching problems related to plates using the STEAM approach, the scientific essence of the concept of the electric field is first revealed [2]. The characteristics of the uniform electric field formed between parallel plates, the direction and density of field lines, the potential difference, and the effect of electric force are theoretically justified and explained. At this stage, students begin to comprehend the cause-and-effect relationships of physical processes.

At the next stage, these concepts are reinforced through technological components. Using digital simulations and virtual models, the distribution of the electric field between the plates is visually demonstrated [3]. As a result, students gain the opportunity to directly observe the parallel arrangement of electric field lines, the dependence of their density on voltage, and how the field changes when the distance between the plates is varied. This significantly enhances the clarity and comprehensibility of the topic.

Within the STEAM approach, engineering thinking also plays an important role and is manifested in teaching problems related to plates through the analysis of various parameters. For example, discussions focus on how the physical state of the system

changes when the distance between the plates, the voltage, or the charge values are modified. Such analyses help develop students' skills in evaluating problem situations, formulating hypotheses, and testing them.

In this process, visual and aesthetic representation is of paramount importance. Electric field lines, force vectors, and particle motion trajectories are expressed through drawings, graphs, and schematic diagrams. Through visual representations, students begin to form clear and concrete mental images of abstract concepts, which contributes to reducing the number of errors during problem-solving.

In the final stage of the STEAM approach, mathematical tools are applied. Precise calculations are performed based on formulas, and the obtained results are compared with the previous visual and theoretical analyses. In this process, special emphasis is placed on the origin of the formulas and their physical meaning. As a result, mathematics is presented not merely as a computational tool, but as an essential element for understanding physical phenomena.

Teaching problems related to plates based on the STEAM approach develops students' logical and critical thinking, fosters independent decision-making skills, and strengthens interdisciplinary connections. Through this approach, students begin to perceive the phenomenon of the electric field not merely as a theoretical concept, but as a real physical process.

In conclusion, the STEAM approach in teaching problems related to plates represents an important pedagogical factor that enhances the effectiveness of physics education. This approach transforms the problem-solving process from mechanical calculation into a level of scientific inquiry and creative activity. As a result, students acquire knowledge deeply and consciously and become well prepared to apply it in practical contexts.

References

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