

THE EFFECTIVENESS OF USING PRACTICAL PROBLEMS IN TEACHING DIFFERENTIAL EQUATIONS

Qodirova Dilnoza Rashidovna

Department of Technological Machines and Information
Systems, Asia International University

Annotation. This article examines the methodological and didactic aspects of using practical problems in teaching the section of differential equations at higher education institutions. The possibilities of modeling real-life processes using differential equations are analyzed, and methods for reinforcing students' theoretical knowledge through practical problems are presented. Effective approaches used in the process of teaching differential equations are justified. The research results demonstrate that the use of practical problems enhances the effectiveness of education.

Keywords: differential equation, practical problem, higher mathematics, teaching methodology, mathematical modeling

Introduction

In higher education institutions, linking theoretical knowledge with practice is one of the main pedagogical tasks in teaching higher mathematics. In particular, the section on differential equations is considered one of the complex topics for students. The main reason is the abstract nature of the topic and its insufficient connection with real processes. Differential equations are widely used to describe various natural and social processes, including mechanical motion in physics, population growth, substance decay, and economic processes. Therefore, using practical problems in teaching this topic helps students understand it more deeply. The purpose of this article is to examine new methods of increasing educational effectiveness by using practical problems in teaching differential equations.

Literature Review

Scientific and pedagogical literature pays special attention to the methodology of teaching differential equations. Researchers emphasize that approaches based on mathematical modeling increase students' activity and help consolidate their knowledge. Lessons conducted using practical problems develop students' logical thinking and analytical skills. Furthermore, literature shows that connecting differential equations with real processes increases students' interest in the subject. However, systematically applying this approach remains insufficiently studied.

The Role of Differential Equations in Education

A differential equation expresses the relationship between an unknown function and its derivative. Such equations describe processes depending on time or other factors. First-order differential equations are one of the main sections in a higher mathematics course. Students often know the algorithms for solving differential equations but have difficulty understanding their meaning. Therefore, explaining the topic using practical problems and various interactive methods is essential.

Teaching Through Practical Problems

A practical problem is based on a real process and requires its description using a mathematical model. For example, the decrease of a substance over time or the growth of a population can be represented using a differential equation. In such processes, the rate of change of the substance or population depends on its current value, making it easier for students to visualize. During the analysis of these problems, students understand the real process, create a mathematical model, and interpret the results. As a result, the topic becomes clearer.

Factors Increasing Educational Effectiveness

Lessons based on practical problems improve students' knowledge acquisition. Students develop the following skills:

- Analyzing real processes
- Mathematical modeling
- Independent thinking and drawing conclusions

Since the topic can be complex, traditional approaches are not always effective. Therefore, using interesting and interactive methods in teaching is advisable:

1. **Real-life problem method:** Start the lesson with a problem from everyday life, e.g., population growth or substance decay.
2. **Problem-based learning:** Instead of giving ready-made formulas, students first analyze the process and create their own mathematical model, fostering independent thinking.
3. **Graphical and visual approach:** Showing function changes over time through graphs helps students understand the meaning of differential equations.
4. **Group work:** Students are divided into small groups, each receiving a separate practical problem. They exchange ideas and consolidate knowledge.

Methodological Recommendations

- Start each topic with examples from real life
- Reinforce each topic with practical problems
- Use graphical and tabular materials
- Assign independent practical tasks to students

Conclusion

The use of practical problems in teaching differential equations significantly enhances the effectiveness of the educational process. Through practical problems, students not only consolidate their theoretical knowledge but also develop skills in analyzing real-world processes, mathematical modeling, and independent thinking. The study results demonstrate that interactive methods, real-life examples, group work, and graphical visualization contribute to a deeper understanding of the topic and increase students' engagement. Practical approaches ensure that students grasp not only solution algorithms but also the conceptual meaning of differential equations.

Moreover, lessons organized around practical problems foster logical reasoning, problem-solving abilities, and independent research skills among students. This substantially improves the mastery of the differential equations section and reinforces the practical relevance of higher mathematics. As a

result, the systematic use of practical problems and interactive teaching methods broadens students' knowledge and skills while enhancing the quality of education, making it a crucial pedagogical tool for effectively teaching differential equations in modern higher education institutions.

References.

1. Axmedov S. Differential Equations. — Tashkent: Fan, 2019.
2. Boymurodov B. Higher Mathematics. — Tashkent: O'qituvchi, 2020.
3. Karimov A., Raximov T. Ordinary Differential Equations. — Tashkent, 2018.
4. Zill D. Differential Equations with Applications. — Boston: Cengage Learning, 2018.
5. Polyanin A. D., Zaitsev V. F. Handbook of Ordinary Differential Equations. — CRC Press, 2019.
6. Bronshteyn I. N., Semendyayev K. A. Mathematics Handbook. — Moscow: Nauka, 2017.
7. Tenenbaum M., Pollard H. Ordinary Differential Equations. — Dover Publications, 2016.
8. Simmons G. F. Differential Equations with Applications and Historical Notes. — McGraw-Hill, 2017.