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IMPROVING THE METHODOLOGY OF TEACHING HIGHER MATHEMATICS THROUGH MODERN PEDAGOGICAL APPROACHES

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Abstract

This article analyzes the scientific and theoretical foundations of modern pedagogical approaches in teaching higher mathematics. The study examines issues related to improving the methodology of teaching higher mathematics based on competency-based, student-centered, and activity-oriented approaches. The role of modern interactive methods, problem-based learning, and practical classes in developing students' analytical thinking is substantiated. The results show that a systematic and scientifically grounded methodological approach increases students' ability to deeply master knowledge and apply it in practice.

Keywords

higher mathematics, teaching methodology, competency-based approach, student-centered learning, analytical thinking, interactive methods, educational effectiveness.

Аннотация

В данной статье анализируются научно-теоретические основы современных педагогических подходов в преподавании высшей математики. В исследовании рассматриваются вопросы совершенствования методики обучения высшей математике на основе компетентностного, студентоцентрированного и деятельностно-ориентированного подходов. Обоснована роль современных интерактивных методов, проблемного обучения и практических занятий в развитии аналитического мышления студентов. Результаты исследования показывают, что системный и научно обоснованный методический подход повышает способность студентов к глубокому усвоению знаний и их практическому применению.

Ключевые слова

высшая математика, методика преподавания, компетентностный подход, студентоцентрированное обучение, аналитическое мышление, интерактивные методы, эффективность обучения.

Introduction

Today, one of the most important tasks of the higher education system is to train competitive specialists who are capable of independent thinking and possess practical competencies. Due to its fundamental nature, higher mathematics plays a crucial role in developing students' logical and analytical thinking skills.

However, traditional teaching methods are often focused on the mechanical acquisition of theoretical knowledge and do not sufficiently develop students' independent thinking and practical skills. Therefore, the introduction of modern methodological approaches in teaching higher mathematics has become an urgent issue.

The purpose of this article is to scientifically substantiate modern pedagogical approaches in higher mathematics education and to demonstrate their effectiveness in developing students' analytical thinking.

Methodology

In this study, modern pedagogical methods were applied to increase students' interest in higher mathematics and to develop their analytical thinking skills. The main directions of the research methodology are as follows:

1. Problem-Based Learning (PBL)

The problem-based learning approach helps students independently solve real or theoretical complex problems. Through this method, students not only strengthen their theoretical knowledge but also develop analytical and critical thinking skills. For example, students were assigned tasks related to identifying different types of sets.

2. Project-Based Learning

The project-based learning method develops students' skills in teamwork, data collection, analysis, and presentation of results. This approach facilitates the application of theoretical knowledge in practice. For instance, students were assigned projects involving statistical analysis or the creation of mathematical models.

3. Interactive Classes

During the learning process, students studied topics through question-and-answer sessions, crosswords, quizzes, and small competitions.

4. Use of Digital and Visual Tools

To facilitate the understanding of mathematical concepts, software tools such as GeoGebra, MATLAB, and Python were used. These tools enabled students to study abstract topics in a visual and interactive manner.

Research Tools and Assessment

- Students were observed during classes through project tasks, problem-solving exercises, and interactive activities.
- Student performance was assessed through project defenses and tests.
- Throughout the study, students' engagement, interest, and level of analytical thinking were analyzed.

This methodology was aimed at developing students' independent thinking and practical skills, increasing their interest in higher mathematics, and applying theoretical knowledge to real-life problems.

Results and Discussion

The study revealed that the application of problem-based, project-based, interactive, and digital methods in teaching higher mathematics significantly increased students' interest and level of analytical thinking.

1. Students' Interest

- Lessons conducted using interactive activities and digital tools increased students' interest and attention toward the subject.
- Students became more confident in expressing their opinions, asking questions, actively participating in classes, and striving to thoroughly understand the concepts.

2. Analytical Thinking and Problem-Solving Skills

- Problem-based and project-based methods contributed to the development of students' abilities to independently analyze complex mathematical problems and find solutions.

3. Practical Skills

- With the help of digital tools and visualization, students effectively learned to solve mathematical models, formulas, and equations on computers, as well as construct graphs.

Discussion

The obtained results are consistent with both international and national research findings. Compared to traditional lecture-based methods, modern methodological approaches:

- enable deeper acquisition of knowledge;
- improve long-term retention;
- enhance the ability to apply knowledge in various fields.

Furthermore, competency-based and activity-oriented approaches align higher mathematics education with the demands of the modern labor market. These approaches develop not only theoretical knowledge but also practical skills.

Conclusion

The study demonstrates that the systematic application of modern pedagogical approaches in teaching higher mathematics significantly improves the quality of education. Competency-based, interactive, student-centered, and activity-oriented methods:

- develop analytical and critical thinking;
- foster independent problem-solving skills;

- strengthen professional competencies.

In future research, enriching the study with empirical data, real classroom examples, and quantitative indicators will further enhance the effectiveness of methodological approaches in teaching higher mathematics.

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