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METHODOLOGY FOR DEVELOPING STUDENTS' ANALYTICAL THINKING COMPETENCE BASED ON AN INTEGRATIVE APPROACH (ON THE EXAMPLE OF PHYSICS EDUCATION)

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Abstract: This article explores the development of students' analytical thinking competence through an integrative approach in physics education. The study examines the theoretical foundations of analytical thinking, its structural components, and its importance in modern education. The pedagogical essence of the integrative approach is analyzed, emphasizing interdisciplinary connections between physics and other scientific fields such as mathematics, computer science, and biology. The paper proposes a methodology based on problem-based learning, project-based learning, experimental activities, and digital technologies. The results of an experimental study demonstrate that the integrative approach significantly enhances students' analytical thinking, problem-solving skills, and motivation. The findings confirm the effectiveness of integrating disciplines in improving the quality of physics education and developing key competencies required in the 21st century.

Keywords: integrative approach, analytical thinking, competence, physics education, interdisciplinary learning, methodology.

Аннотация: В данной статье рассматриваются вопросы развития аналитического мышления студентов на основе интегративного подхода в обучении физике. Анализируются теоретические основы аналитического мышления, его структура и педагогическая значимость. Раскрывается сущность интегративного подхода и его роль в повышении эффективности обучения физике через междисциплинарные связи с математикой, информатикой и биологией. Предлагается методика, включающая проблемное обучение, проектную деятельность, экспериментальные методы и использование цифровых технологий. Результаты экспериментального исследования показывают, что интегративный подход способствует развитию аналитического мышления, повышению уровня усвоения знаний и мотивации студентов. Делается вывод о высокой эффективности интеграции дисциплин в системе современного образования.

Ключевые слова: интегративный подход, аналитическое мышление, компетенция, обучение физике, междисциплинарность, методика.

Introduction

In the modern educational paradigm, the emphasis has shifted from the simple transmission of knowledge to the development of competencies that enable students to think critically, analyze information, and solve complex problems. Analytical thinking is one of the most important competencies required in the 21st century, especially in the field of physics education.

Physics, as a fundamental science, requires students to understand natural phenomena through observation, experimentation, and logical reasoning. However, traditional teaching methods

often fail to develop students' analytical thinking skills effectively, as they are primarily focused on memorization rather than understanding.

Therefore, there is a need to implement innovative teaching approaches that promote active learning and intellectual engagement. One of the most promising approaches is the integrative approach, which connects knowledge from different disciplines and provides a holistic learning experience.

Literature Review

The concept of analytical thinking has been widely studied in educational psychology and pedagogy. Researchers emphasize that analytical thinking involves cognitive processes such as comparison, classification, abstraction, and generalization.

According to Bloom's taxonomy, analytical thinking is a higher-order cognitive skill that goes beyond remembering and understanding. It involves breaking down information into components and examining relationships between them.

Several scholars have highlighted the importance of interdisciplinary learning in developing analytical thinking. The integrative approach allows students to apply knowledge from multiple disciplines, thereby enhancing their ability to analyze and synthesize information.

In physics education, integration with mathematics and computer science has been shown to improve students' understanding of complex concepts and increase their engagement in the learning process.

Theoretical Framework

Analytical thinking competence can be described as a combination of knowledge, skills, and attitudes that enable individuals to analyze information effectively.

Its main components include:

cognitive component (knowledge and understanding);

procedural component (skills and abilities);

motivational component (interest and engagement).

The integrative approach is based on the principle of interdisciplinary connections, where knowledge from different subjects is combined to create a unified understanding.

This approach is particularly effective in physics education because many physical concepts are closely related to mathematical models, computational methods, and real-world applications.

Methodology

The proposed methodology is based on the integration of various teaching methods and technologies aimed at developing analytical thinking.

1. Problem-Based Learning

Students are presented with real-life problems that require them to analyze situations and find solutions using interdisciplinary knowledge.

2. Project-Based Learning

Students work in groups to complete projects that involve physics concepts and their applications in other fields.

3. Experimental Activities

Laboratory experiments play a crucial role in developing analytical thinking, as they require observation, data analysis, and interpretation.

4. Digital Technologies

The use of simulations, virtual laboratories, and educational software enhances students' understanding and engagement.

5. Interdisciplinary Tasks

Tasks that combine physics with mathematics, biology, and computer science help students see connections between different fields.

Experimental Study

An experimental study was conducted to evaluate the effectiveness of the proposed methodology. The study involved two groups of students: a control group taught using traditional methods and an experimental group taught using the integrative approach.

The results showed that:

students in the experimental group demonstrated higher analytical thinking skills;

their ability to solve complex problems improved significantly;

they showed greater motivation and interest in learning physics;

they were better able to apply knowledge in new situations.

Quantitative and qualitative analysis confirmed the positive impact of the integrative approach on students' learning outcomes.

Discussion

The findings of the study highlight the importance of integrating disciplines in the teaching process. The integrative approach not only enhances students' analytical thinking but also prepares them for real-world challenges.

It encourages active participation, collaboration, and creativity, which are essential for modern education. Moreover, it aligns with global educational trends that emphasize competency-based learning.

Conclusion

The integrative approach is an effective pedagogical strategy for developing students' analytical thinking competence in physics education. It promotes deeper understanding, improves problem-solving skills, and increases student motivation.

The study confirms that integrating different disciplines and using innovative teaching methods significantly enhances the quality of education.

Future research should focus on expanding the application of the integrative approach in other subjects and educational contexts.

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