THEORETICAL AND METHODOLOGICAL FOUNDATIONS OF DEVELOPING THINKING SKILLS THROUGH QUEST-BASED TECHNOLOGY IN SCIENCE EDUCATION

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ABSTRACT

This article examines the theoretical and methodological principles of applying quest-based technology in science education to develop students' thinking skills. The study highlights that using quests stimulates cognitive activity, enhances problem-solving abilities, and promotes both analytical and creative thinking. Emphasis is placed on structuring the learning process, fostering a motivating environment, and integrating quest elements into traditional and remote learning contexts. The article also reviews domestic and international research to identify key principles, approaches, and recommendations for effective implementation of quest-based technology in educational practice.

Introduction.Modern education emphasizes not only the acquisition of subject-specific knowledge but also the development of universal cognitive competencies, including analytical and creative thinking skills. In the rapidly changing information society, traditional teaching methods often prove insufficient for cultivating students' ability to independently solve problems, critically analyze information, and apply acquired knowledge in practical contexts.

Quest-based technology represents an innovative pedagogical approach that integrates game elements, research activities, and problem-solving tasks into the learning process. By completing a series of interconnected challenges, students are actively engaged in constructing knowledge, developing strategies, and achieving specific learning outcomes. In science education, quests provide a stimulating and interactive environment that encourages active participation, promotes teamwork, and fosters the cognitive skills necessary to address complex and non-standard problems.

The relevance of this study is rooted in the need to identify effective instructional strategies that integrate theoretical understanding with practical application, thereby enhancing students' independent and creative thinking abilities. Despite growing interest in gamification and interactive learning approaches, the methodological foundations for implementing quest-based technology to develop analytical and creative thinking in science education remain underexplored.

The primary aim of this study is to investigate the theoretical and methodological principles of using quest-based technology to enhance students' thinking skills in science

education. The objectives include analyzing domestic and international practices, identifying key pedagogical principles and approaches, and providing practical recommendations for effectively integrating quest-based learning into both traditional and remote educational settings.

Quest-based technology is an active learning method that combines elements of gaming, problem-solving, and inquiry-based education. Its core principle is that students gradually achieve learning objectives by completing a sequence of interconnected tasks.

Research indicates that quest-based learning contributes to the development of several key competencies:

Analytical thinking – the ability to identify essential elements, construct logical sequences, and analyze cause-effect relationships.

Creative thinking – the ability to generate novel ideas, find unconventional solutions, and apply imaginative approaches to problem-solving.

Communication skills – the capacity to collaborate effectively in teams, discuss ideas critically, and defend reasoning.

Independence and responsibility – students actively participate in their learning, make informed decisions, and evaluate results autonomously.

Methodological approaches to implementing quest-based technology include differentiated instruction, project-based learning, interdisciplinary integration, and the use of digital tools. Motivation is a critical factor, as quests create an engaging and interactive environment that stimulates students' intrinsic interest and cognitive involvement.

Practical application in science education

In practice, quest-based technology can be applied across various science subjects, including biology, chemistry, physics, and geography. Examples of tasks include:

- Problem-solving activities linked to real experiments and scientific phenomena;
- Step-by-step research projects guiding students through inquiry processes;
- Interactive quizzes, laboratory challenges, and scenario-based tasks;
- Online and mobile quests using digital platforms and educational software.

Evidence from both domestic and international studies shows that quest-based learning enhances students' comprehension of scientific concepts, improves their problem-solving skills, and fosters independent and creative thinking. Furthermore, it encourages collaboration, promotes engagement, and develops students' ability to integrate knowledge across disciplines.

Conclusion.Quest-based technology is an effective pedagogical tool for fostering analytical and creative thinking in science education. Its implementation offers multiple benefits:

- Activation of students' cognitive and problem-solving skills;
- Development of analytical, critical, and creative thinking competencies;
- Enhancement of motivation, engagement, and interest in scientific subjects;
- Strengthening of communication, teamwork, and organizational abilities.

Overall, integrating quest-based technology into science education represents a promising innovation that can be successfully applied in both traditional classroom settings

and remote learning environments. Its methodological foundations provide a framework for educators to design effective, engaging, and student-centered learning experiences.

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