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INTERACTIVE PEDAGOGICAL METHODS IN CREATIVE TEACHING OF THE DISCIPLINE “MATERIALS SCIENCE” IN TECHNICAL HIGHER EDUCATION INSTITUTIONS

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Abstract

This article analyzes modern interactive pedagogical methods aimed at creative teaching of the discipline Materials Science in technical higher education institutions. The role of the teacher as a moderator who applies problem-based learning, the case method, project-based activities, and digital technologies is determined. Results of a pedagogical experiment indicate increased student learning motivation, improved quality of knowledge acquisition, and the formation of professional competencies. The study highlights the importance of implementing interactive methods in modernizing technical education.

Keywords: interactive learning, creative learning, materials science, technical education, pedagogical technologies, project-based learning, problem-based learning

1. Introduction

Interactive teaching methods in higher education institutions are aimed at actively engaging students in the learning process. These methods facilitate deep understanding of material and the development of critical and collaborative thinking skills. Such methods include discussions (round tables, debates), game-based techniques (business games, role-playing, simulations), brainstorming, the case method (analysis of specific situations), and project-based activities. Interactive technologies, including interactive whiteboards, virtual reality (VR), and online platforms, are widely used.

Modern engineering education systems should focus not only on theoretical knowledge but also on practical, creative, and research competencies. From this perspective, Materials Science is strategically significant in training engineers. Traditional teaching methods, however, often emphasize passive information reproduction and cannot fully engage students' active cognitive abilities.

Hence, the introduction of interactive pedagogical methods is essential. These methods ensure students' active participation, foster creative thinking, and develop the ability to solve engineering problems independently.

2. Interactive Learning Concept

In interactive learning, the teacher's activity gives way to students' active participation, while the teacher's role is to create conditions that encourage student initiative. The term “interactive” implies the ability to interact with an object (e.g., a computer) or a person in a dialogue mode. Interactive learning is fundamentally dialogical, facilitating collaboration and communication.

During dialogical instruction, students analyze information critically, solve complex problems, evaluate alternative viewpoints, make reasoned decisions, participate in discussions, and communicate effectively. Pair and group work, research projects, role-playing exercises, document analysis, and creative assignments are commonly employed.

Students become full participants in the learning process, and their personal experience contributes to knowledge construction. Teachers act as facilitators, supporting and guiding students rather than transmitting ready-made knowledge.

Key benefits of interactive learning include:

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- Enhancing student interest and cognitive activity
- Stimulating active participation
- Supporting critical thinking and problem-solving
- Encouraging independent knowledge acquisition
- Providing feedback and formative assessment
- Developing life and professional skills
- Positively influencing behavior and collaboration

Interactive teaching shifts the focus from theory-to-practice to experience-based learning, promoting understanding through application. It ensures active engagement, supports skill development, and prepares students for future professional challenges.

3. Forms of Interactive Learning

Interactive learning can take the following forms:

1. **Passive:** The student listens and observes as an “object” of instruction.
2. **Active:** The student engages independently through tasks, creative assignments, course projects, etc.
3. **Interactive:** Learners engage collaboratively as equal partners, with the teacher facilitating the process.

The teacher’s role includes supporting collaborative research, encouraging initiative, and providing guidance while allowing students to solve problems and reach consensus independently. Lessons are carefully planned with tasks for group discussion, promoting active student interaction and problem-solving.

4. Theoretical Foundations

Interactive learning emphasizes collaborative knowledge construction, while creative learning develops non-standard thinking, idea generation, and systematic analysis. In pedagogical theory, these methods align with competence-based education models. In Materials Science, interactive and creative approaches enable students to understand material properties theoretically and apply them in engineering problem-solving.

5. Interactive Methods in “Materials Science”

Effective interactive methods in teaching Materials Science include:

- **Problem-based learning:** Enhances analytical and research skills by presenting specific engineering problems.
- **Case method:** Develops decision-making skills through the analysis of industrial and scientific scenarios.
- **Project-based learning:** Implements individual and group projects for practical knowledge application.
- **Digital simulations and virtual laboratories:** Expand experimental opportunities through modeling of material structures and properties.
- **Gamification:** Increases motivation and promotes teamwork.

6. Teacher’s Role

In interactive learning, the teacher functions as an information provider, facilitator, and guide. By supporting student creativity and initiative, the teacher enhances learning outcomes. Teachers must adapt content to student readiness and combine traditional instruction with interactive methods.

Research confirms that interactive and creative pedagogical methods are highly effective in technical higher education, fostering professional competencies and creative potential in future engineers. The teacher’s active guidance is a key factor in enhancing educational quality. Further

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research should focus on refining interactive methods and improving engineering education outcomes.

Interactive learning also drives systemic changes in educational institutions, encouraging teachers to act as moderators rather than sole knowledge providers. This requires continuous professional development, readiness for innovation, and the integration of interaction, collaboration, and sustainable development into the learning process.

7. Conclusion

Interactive and creative methods are crucial for modern technical education. They promote active engagement, critical thinking, problem-solving, and professional competence development. Implementing these methods aligns teaching with global academic standards and prepares students for practical engineering challenges.

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