

“INTERACTIVE MASTERING OF THE TEACHER IN CREATIVE TEACHING OF THE DISCIPLINE “MATERIALS SCIENCE” AT HIGHER EDUCATIONAL INSTITUTIONS OF TECHNICAL DIRECTION”

J.K. Davletmuratov

Karakalpak State University

Abstract: *The article examines the importance of teaching the course “Materials Science” in technical higher education institutions using interactive and creative methods. Interactive teaching techniques make it possible to activate the educational process, enhance students’ creative thinking skills, and deepen their professional preparation. The author analyzes the structural elements of the teacher’s interactive mastery, presents creative teaching methods (project method, case analysis, flipped classroom, virtual laboratories, etc.), and tests their effectiveness with practical examples. Alongside this, the difficulties encountered in the teaching process and ways to resolve them are considered in detail. The article emphasizes the significance of interactive teaching methods in preparing future engineers.*

Keywords: *interactive teaching, creative methods, materials science, teacher mastery, flipped classroom, engineering education, innovative technologies, project method, case analysis*

1. Introduction In higher education institutions with a technical orientation, the course “Materials Science” aims not only to teach students through theoretical knowledge but also to prepare them with practical, research, and creative thinking abilities through the foundational science of engineering, technology, and materials. Innovative pedagogical technologies, in particular the methods of “interactive teaching,” provide opportunities to increase student engagement, promote deeper understanding of knowledge, and consolidate it. From this viewpoint, the necessity arises to enhance teachers’ interactive mastery and to adopt creative teaching approaches.

The purpose of the article is to identify the interactive mastery of the teacher in the creative instruction of the “Materials Science” course, to select its structural elements, to present effective methods, and to develop guidelines for their application in the educational process.

Interactive teaching methods are among the significant tools for improving students’ professional readiness in higher education. At present, it is insufficient for an instructor to be merely competent in their subject and to deliver theoretical lectures in the classroom. A modern perspective in the

teaching process is required. The interactive methods (from English interaction — mutual interaction, mutual influence) are teaching techniques focused on interaction among students. Interactive teaching is a form of directed activation: a teaching method implemented through students' joint activity.

All participants work together, exchange information, jointly solve problems, analyze situations through modeling, evaluate others' and their own actions, and immerse themselves in an atmosphere directed toward solving issues through businesslike collaboration.

One of the goals of interactive teaching is to create the necessary conditions for instruction such that students sense their achievements and intellectual potential, and thereby make the educational process effective.

Interactive teaching methods enable the transformation of the teaching process into an active interaction between teacher and students. As a result of this interaction, the core competencies of the 21st century emerge: critical thinking, communicative competence, teamwork, the ability to work in groups, creativity, and digital literacy. These traits are no longer viewed as additional skills, but as essential prerequisites for successful integration into society and for self-realization from a professional standpoint.

Implementing interactive methods requires a complex effort: methodological readiness of teachers, adaptation of curricula, development of digital infrastructure, and promotion of active participation of students in the learning process.

Importantly, interactive teaching is not merely a set of methods — it is the pedagogical philosophy of interaction centered on subjectivity, collaboration, and reflection.

Interactive methods not only involve the traditional interaction between teacher and students, but also active interaction among students themselves or between students and computer programs. There are various classifications of interactive teaching methods associated with models such as student–teacher, student–student, student–computer, and student–computer–teacher. Over time, such methods have increasingly taken root in teaching students. By employing interactive teaching methods, lesson design in technical higher education becomes very favorable for students, because it corresponds to their age differences: it enables them to express themselves in peer groups, increases interest in the material, and intensifies their interest in information-communication technologies. Such teaching not only facilitates the acquisition of new knowledge but also develops their potential and raises cooperation and joint work to a high level.

2. Theoretical Foundations

2.1. The concept of interactive teaching The term “interactive” denotes mutual action, collaboration, and connection between student and teacher. In interactive teaching, a student is not a passive listener, but an active participant: solving problem-based issues, debates, group work, projects, etc.

2.2. Creative teaching and its meaning Creativity implies the generation of new ideas, intuitive and holistic thinking, and the use of creative methods in problem solving. In technical fields and in the subject of materials science, creativity is especially important for students in analyzing materials, their properties and techniques, producing new materials, or optimizing existing ones.

2.3. Teacher mastery and its components Teacher’s interactive mastery consists of the following structural elements:

- Deep subject knowledge: materials science, properties and structure of materials, metallurgy, composite materials, etc.
- Knowledge and internalization of pedagogical methods: group work, case method, flipped classroom, laboratory work, virtual and interactive laboratories.
- Communication and motivation: open communication with students, asking questions, engaging in discourse.
- Use of information-communication technologies: utilizing presentations, simulations, visualizations, and electronic tools.
- Reflection and evaluation: analyzing lessons afterward, identifying errors and deficiencies, and implementing improvement strategies.

3. Interactive creative teaching methods in materials science Effective interactive and creative teaching methods include:

3.1. Case study method Provide students with concrete engineering or materials production-related examples and propose problem-solving tasks. For example, class discussions on which alloy materials to select or how to modify materials in specific cases.

3.2. Project-based instruction Students work individually or in groups on projects. These may include creating new materials, modeling (chemical, physical, mechanical), or evaluating the effectiveness of composite materials or technological processes.

3.3. Flipped classroom Students study theoretical materials at home (via video lectures, articles, presentations), and class time is devoted to questions, problem solving, laboratory work, and group discussions to deepen their knowledge.

3.4. Virtual and interactive laboratories Using simulation software and virtual labs to conduct experiments, work with models, and visualize material structures.

3.5. Problem-based and creative thinking methods Brainstorming, analogical comparison, creative tasks in class — e.g. students think about material properties so that they meet aesthetic and mechanical requirements.

4. Practical Examples and Experience

4.1. Applied studies In practical classes on “Technology and Materials Science,” the role and significance of interactive teaching pedagogies are discussed. Innovative methods of knowledge delivery are considered in teaching “Materials Science and Structural Materials” to engineering students.

4.2. Sample lesson structure Lesson topic: Properties of elements in alloy structure and criteria for material selection

Lesson plan:

1. Homework: students read an article or watch a video about the topic.

2. At the beginning: check preparation by questions and hear student opinions.

3. Group work: each group is assigned to choose elements in alloy compositions; based on available data, they select the most efficient combination.

4. Laboratory or virtual simulation work: model, experiment, and compare results of chosen combinations.

5. Discussion and reflection: groups discuss results, determine which elements were suitable or not, and analyze reasons.

6. Evaluation: grading, self-assessment by students and peer assessment.

5. Challenges and Solutions

5.1. Challenges

- Students’ passivity and unfamiliarity with interactive methods.
- Insufficient methodological readiness of teachers.
- Limited resources: lack of technological tools, virtual labs, simulators.
- Constraints of class time and credit hours, making it difficult to implement all interactive elements.

- Lack of integration between courses and disciplines.

5.2. Proposed solutions

- Conduct regular seminars and training in interactive and creative teaching for educators.

- Expand resources in higher education institutions — virtual and interactive labs, simulation tools, online platforms.

- Plan lessons in advance and incorporate interactive elements into lesson design.

- Use tasks and evaluation methods that stimulate creative thinking.

- Strengthen interdisciplinary connections — ensure the “Materials Science” course is integrated with other technical disciplines.

6. Conclusion Teaching the discipline of “Materials Science” using creative and interactive methods allows the teacher to engage students, deepen their mastery of knowledge, and foster independent thinking and a creative perspective. Teacher’s interactive mastery is not only about knowing methods and technologies but also about productive interaction with students, motivation, reflection, and the use of information-communication technologies. If this mastery is developed, the training of future engineers through the course of materials science will reach a high level.

7. Recommendations

1. Organize dedicated training and seminars on interactive and creative teaching for educators in higher education institutions.

2. Use instructional tools and methodological guidelines, electronic resources, simulation tools, and virtual laboratories broadly.

3. Revise lesson plans by linking them with interactive and creative elements.

4. Systematically collect student feedback and suggestions to introduce clear changes into the teaching process.

5. Through pedagogical research, evaluate the effectiveness of interactive methods and publish the findings.

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