

# DEVELOPING THE PROFESSIONAL COMPETENCIES OF FUTURE ENGINEERS THROUGH MODERN APPROACHES

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## Abstract

The article explores effective ways to develop professional competencies in preparing graduates of technical higher education and the application of innovative pedagogical methods. Developing professional competencies of graduates in technical higher education and implementing modern pedagogical approaches are of great importance for making them competitive in the labor market. This topic is aimed at improving the quality of the educational process in technical higher education, equipping students with practical skills, and developing their creative and analytical thinking abilities.

**Keywords:** Engineering education, innovative methods, modern approaches, interactive teaching, digital technologies, professional competence.

## Introduction

The study, mastery, and effective use of modern technologies and techniques is an urgent issue in all developed countries of the world. Today, due to the rapid update of knowledge and skills in the field of technology, it is necessary to organize the educational process in higher education institutions based on modern methods and to implement innovative teaching techniques. Innovative methods and modern approaches play a crucial role in enhancing the professional qualifications of engineering graduates, fostering the development of their creative ideas, and shaping their logical and independent thinking abilities.

Professional competencies in engineering refer to the ability of engineers to effectively apply their theoretical knowledge in practice. This includes not only technical expertise but also problem-solving skills, creativity, teamwork, communication, and adaptability. In today's global and rapidly changing world, engineers must be capable of addressing increasingly complex and multidisciplinary problems, which often require collaboration among experts from various fields.

In order to succeed in the modern field of technology, graduates of higher education institutions must have high professional competencies. Technical higher education not only provides students with theoretical knowledge but also places great emphasis on developing their practical skills.



## DISCUSSION

Today, specialists in the field of technology must be highly adaptable, possess innovative thinking, and be able to quickly master and effectively apply new technologies. Therefore, the development of professional competencies and the introduction of modern approaches in technical higher education have become one of the most important aspects of the educational process.

The key professional competencies that future engineers must acquire include the following:

- developing and applying technological processes in mechanical engineering production;
- bringing technological processes in mechanical engineering production to the required performance standards and mastering them;
- learning to apply international and professional standards of information technology, modern paradigms and methodologies, and tools and computational devices according to the preparation specialty in practice;
- modeling production processes and using methods to reorganize production processes in the practical activities of organizations;
- developing technical documentation (work schedules, instructions, plans, estimates, and orders for materials and equipment) when preparing technological processes and equipment for mechanical engineering production;
- planning and carrying out the installation and adjustment of technological equipment in mechanical engineering production, including automated, digitally controlled, flexible production systems, and non-standard equipment.

The educational process for the “Mechanical technology, equipment and automation of mechanical engineering” field of study is carried out in four stages: acquiring knowledge, developing abilities, enhancing skills, and developing competencies.

Modern approaches to teaching future engineers aim to make the educational process effective and interactive through the use of modern technologies, methodologies, and pedagogical styles.

Modern approaches include the following:

**Project-based learning** in this approach, students work on projects to solve real-world problems. In the field of engineering, this approach introduces students to practical experience, allowing them to apply theoretical knowledge in practice. For example, students form small project groups to solve engineering problems (such as mechanical engineering, energy efficiency, automation).

**Interactive and multi-stage teaching (Flipped classroom):** in this approach, students study online materials at home (videos, articles), and in class, discussions, problem-solving, and group work are conducted under the guidance of the instructor based on these materials. This method encourages students to deepen and analyze their knowledge, as well as teaches them to be active and think independently.

**Computer-aided learning and simulation:** In engineering, using computer programs and simulations is crucial for understanding complex systems and processes. For example, students create, analyze, and test their projects using software such as 3D modeling, MATLAB, AutoCAD, and SolidWorks. This approach helps students develop technical skills.



**Integration of innovative and advanced technologies:** in teaching future engineers, it is important to integrate new technologies, such as artificial intelligence (AI), robotics, the Internet of Things (IoT), and 3D printing. By studying these technologies, students will be able to find innovative solutions to modern engineering problems.

**Blended learning:** in this approach, traditional classes are combined with online learning resources. Students engage with video lessons, interactive materials, and online tests to reinforce their knowledge. Additionally, during class sessions, students participate in practical exercises in groups. This approach makes the learning process more flexible and effective.

**Developing creative and systematic thinking:** modern teaching methods not only focus on technical knowledge but also aim to develop creative and systematic thinking in students. For example, students learn to approach complex engineering problems in a systematic way and develop innovative ideas and new solutions.

**Collaboration and teamwork:** modern engineering often requires teamwork, which is why it is essential to teach students how to work effectively in groups. It is important to teach skills such as leading a team, collaborating to solve problems, and working together to achieve common goals.

**Open and research-based learning:** students learn through scientific research. This approach encourages students to engage in scientific inquiry, develop independent thinking, and generate new ideas. In the field of engineering, this approach teaches students to apply the knowledge they have acquired to solve new problems.

**Problem-solving and critical thinking:** in engineering, analyzing problems, solving them, and finding new solutions are essential. In modern educational approaches, students learn to view each issue from multiple perspectives and develop critical thinking skills.

## RESULTS

These modern approaches not only teach students theoretical knowledge but also practical skills and creative thinking, which help them become successful engineers in the future.

Modern approaches significantly contribute to enhancing the quality of technical higher education. These approaches allow students to master not only theoretical knowledge but also practical skills. The influence of modernity on education is evident in the following directions. The innovations introduced by modernity in technical higher education aim to improve students' learning processes and enhance their professional readiness. Today, the following innovations are being implemented in technical higher education:

The application of innovative technologies helps students learn modern engineering methods. The use of modern equipment from the technopark established at Bukhara engineering – technological institute plays a significant role in enhancing the professional competencies of students in the “Fundamentals of technology of mechanical engineering” course, which serves



as a driver for the Bachelor's degree program in mechanical engineering technology, machine tool equipment, and automation.

## CONCLUSION

The development of professional competencies and the implementation of modern approaches in training future engineers helps to improve the effectiveness of the educational process. This process aids in enhancing students' professional skills, fostering creative thinking, and shaping practical competencies. Additionally, applying modern technologies can improve the effectiveness of teaching. Innovative approaches play a crucial role in improving the quality of education and shaping professional competencies. They assist students in developing creative thinking, independent analysis, and practical skills. Innovative methods make the teaching process more effective, interactive, and engaging, which increases students' interest in learning. As the field of engineering continues to evolve, teaching approaches for future engineers must also adapt.

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