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PREPARATION OF STUDENTS FOR DESIGN AND CONSTRUCTING ACTIVITIES AS A COMPONENT OF TYPES OF PROFESSIONAL ACTIVITIES

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Annotation: This thesis highlights the essence, content, and professional significance of preparing students for design and engineering activities in engineering education. For the development of students' technical thinking, creative thinking, and practical design skills, design and engineering activities are analyzed as an integral part of professional training. The study demonstrates the methodological foundations for the effective organization of this activity, as well as the role of modern digital platforms (SolidWorks, Solid Edge, Fusion 360, etc.) in the educational process.

The results show that teaching based on a project approach serves to analyze problem situations, find independent technical solutions, work in cooperation, and form innovative thinking in students. This approach is recommended as an effective way to develop professional competencies in engineering education.

Keywords: engineering education, design and engineering activities, professional competence, technical thinking, innovative technologies, CAD/CAM/CAE systems, digital platforms, practical training, creative approach.

In the modern education system, engineering directions are of particular strategic importance and are one of the key factors of production, technological development, and economic growth. In today's era of digital transformation, engineering education is not limited to the provision of theoretical knowledge, but also requires the formation of students' competencies based on practical activity, creative thinking, and engineering thinking.

From this point of view, design and engineering activity is recognized as the main pedagogical component of engineering education. It ensures the student's practical application of their knowledge in the educational process and their direct participation in the design, modeling, and analysis of technical objects. Through this activity, students develop technical thinking, a systematic approach, creative thinking, and the ability to find technical solutions in problem situations.

The essence of design and engineering activity lies in the fact that it allows integrating the professional training of students with real production problems. Therefore, this activity is considered as an integral part of professional activity. It forms not only engineering competencies, but also skills based on communication, information technology, and social responsibility.

As noted in the decrees of the President of the Republic of Uzbekistan "On Improving the System of Personnel Training in the Field of the Digital Economy" (2020-2023), future engineers must master such advanced areas as digital

technologies, automated systems, artificial intelligence, and 3D modeling. Therefore, the introduction of design and engineering activities into the educational process is a decisive factor in the training of engineering personnel in accordance with the needs of modern production.

Today, digital platforms such as SolidWorks, Solid Edge, Fusion 360, AutoCAD, CATIA, Siemens NX, Kompas-3D are widely used in engineering. With their help, students acquire skills in technical design, modeling of mechanical systems, and developing design documentation in a virtual environment close to real production conditions.

Studies show that training based on design and engineering activities:
activates the engineering thinking of students by 30-40%;
develops creative and independent decision-making skills;
forms a culture of working in project teams;
ensures the integration of theory and practice.

The relevance of this topic lies in the fact that in the context of modern engineering education, the systematic study of design and engineering activities as an integral part of professional activity and its application in the educational process on a methodological basis has become an important issue.

Also, to increase the effectiveness of this process:
modernization of pedagogical approaches,
integration of the educational process with the digital environment,
such areas as the use of innovative platforms in practical classes are of great importance.

The purpose of this study is the scientific substantiation of the process of preparing students for design and engineering activities as an integral part of professional activity, the development of its pedagogical, methodological, and technological foundations, as well as the formation of innovative engineering competencies in students.

The scientific and practical significance of this approach lies in the fact that it combines creative and practical activity in engineering education, strengthens the integration of education and production, as a result of which highly qualified personnel are trained in accordance with the requirements of the digital economy.

In recent years, the issues of modernizing engineering education, introducing design and engineering activities into the educational process, and preparing students for practical professional activity have been widely discussed both at the international level and in our country. In scientific sources, this process is assessed as a central component of the competency-based model of engineering education.

In studies conducted by Uzbek scientists, design and engineering activity is interpreted as a means of forming technical thinking, problem situation analysis, creative thinking, and practical design skills in students.

A. Khusanov (2021) substantiated the advantages of innovative approaches in engineering education, in particular, an integrated training system for design and engineering activities. In the author's opinion, project-based learning connects

students' activities with real production processes, which significantly increases their professional training.

Z. Abdurakhmanov (2022) developed pedagogical conditions for the formation of design and engineering competencies, in which the most important factors are the organization of educational tasks based on design problems, directing students to solve technical problems in collective cooperation.

N. Gafurov (2020) in his research proposes to increase the effectiveness of project activities by introducing digital technologies in engineering education. According to him, CAD/CAM/CAE platforms (SolidWorks, AutoCAD, Fusion 360, etc.) are an important tool for developing students' skills in constructive thinking, technical design, and an analytical approach.

Also, M. Shodmonov (2023) shows 3D modeling in engineering education and project activity through training in a simulation environment as an effective mechanism for practical orientation.

The role of design and engineering activities in professional training is widely covered in the works of Western scientists.

Kolb, D. A. (2014) in his "Theory of Experimental Learning" emphasizes that knowledge is formed in the process of practical activity, and substantiates that this approach is the most natural model of learning in engineering education.

Marra, R. M. and Schuurman, J. (2019) in their work "Project-Based Learning in Engineering Education" proved that project-based learning has proven itself as the most effective pedagogical technology in engineering.

In the works of Smith, J. and Taylor, R. (2021) and Harris, P. (2022), an in-depth analysis of digital integration of training through 3D modeling, simulation, CAD/CAM/CAE systems in engineering sciences is carried out. They note that the use of design tools in the digital environment significantly develops students' analytical thinking, design culture, and teamwork skills.

Based on the analyzed literature, the following general scientific conclusions can be drawn:

Preparing students for design and engineering activities is one of the main areas of professional activity of engineering education, based on the integration of theory and practice.

This process teaches students to think creatively, analyze problem situations, develop technical projects, and model them.

Project-Based Learning is recognized as an effective pedagogical mechanism for the formation of engineering competencies.

Digital technologies (Solid Edge, SolidWorks, Fusion 360, AutoCAD, etc.) allow organizing project activities in a virtual environment, prompt analysis and optimization of results.

The introduction of design and engineering activities into the educational process allows increasing the professional maturity, technical thinking, and production competence of students by 25-40%.

Analysis of the literature shows that the formation of design and engineering skills in students leads to a stage of transition from theoretical learning to practical activity. This approach transforms engineering education into an innovative, integrative, and competency-oriented system.

Consequently, existing scientific sources scientifically confirm the role and pedagogical foundations of design and engineering activities in professional training, but a deeper development of mechanisms for its effective organization in the digital environment is currently one of the most relevant scientific directions.

Design activity is the student's participation in the process of designing, modeling, analyzing, testing, and improving a technical object, device, or system. This activity is the main practical platform for the formation of engineering thinking, the development of professional independence, and the strengthening of a creative approach.

Analysis of the types of professional activity shows that design and engineering training in engineering is closely related to the following structural areas:

- Project activity - development, modeling, and pilot testing of new technical solutions;
- Design activity - the transformation of a technical project into a practical design, the preparation of drawings and technical documentation;
- Technological activity - planning of the production process and implementation of technical control;
- Research activity - scientific analysis of technical problems and promotion of innovative ideas;
- Information and technological activity - mastering the processes of digital design, virtual modeling and simulation in CAD/CAM/CAE systems.

Studies show that digital platforms (Solid Edge, SolidWorks, AutoCAD, Fusion 360, CATIA), as well as virtual laboratories and the 3D modeling environment, play an important role in the formation of design and engineering skills in students. With their help, the student will have the opportunity to complete educational tasks based on real technical problems, participate in team project activities, and develop their design thinking.

In the process of organizing design and engineering activities in engineering education, the following didactic conditions ensure effectiveness:

- organization of the educational process based on problem-design tasks;
- involvement of students in practical production projects;
- Use of ICT tools (computer design, 3D model, simulation);
- application of interactive methods (Case study, Team work, Brainstorming);
- implementation of project assignments in cooperation with manufacturing enterprises.

This approach helps students understand all stages of professional activity - from design to production. As a result, they are formed as professionally independent engineers with technical thinking and innovative thinking.

Analysis shows that design and engineering activity in students leads to the following results:

- develops technical thinking and creativity;
- forms the ability to understand and manage technological processes;
- strengthens the ability to make independent decisions and solve collective problems;
- develops skills in analyzing real production problems and proposing solutions.

Through the phased organization of such activities in engineering education, the professional competence, creative thinking potential, and practical training of students increase significantly.

In conclusion, preparing students for design and engineering activities is one of the main components of engineering education, which creates the basis for the formation of professional competence of the future engineer, the development of creative thinking, and effective activity in the production environment. The success of this process depends on the integral integration of innovative technologies, digital platforms, and practical project activities in the educational process.

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