

Methodological Support For The Development Of Professional Competencies Of Future Engineers

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Abstract: The development of professional competencies in future engineers is a critical component of modern engineering education. This study examines the methodological support necessary to enhance the professional skills, practical abilities, and personal qualities of engineering students. The research identifies key pedagogical conditions organizational, methodological, psychological, digital, and assessment-based that collectively contribute to the formation of professional and transversal competencies. Special attention is given to strategic, content-integrative, and methodological frameworks that align educational objectives with labor market demands and real-world engineering challenges.

Keywords: Law on education, hierarchical approach, personal abilities, communicative culture, Socio-psychological environment, digital economy, pedagogical conditions, case-study, startup projects, development of professional competence, organizational, methodological, psychological, social, and material factors, pedagogical system, parget–strategic conditions, pigital conditions, assessment-based conditions, methodologically-oriented conditions.

Introduction: Today, significant positive and scientific changes are being implemented in the field of pedagogical conditions in Uzbekistan. Systematic reforms are being carried out to develop and modernize the education system, improve teachers' working conditions, and enhance their scientific skills and professional qualifications.

In particular, in accordance with Order No. 311 of July 16, 2021, issued by the Ministry of Higher and Secondary Specialized Education of the Republic of Uzbekistan, the documents entitled "State Educational Standard of Higher Education. General Provisions" and "State Educational Standard of Higher Education. Classifier of Higher Education Fields and Specialties" were approved. These documents were registered by the Ministry of Justice on October 20, 2021. Furthermore, amendments and additions were introduced in accordance with the Law of the Republic of Uzbekistan "On Education" and the Presidential Decree No. F–31 dated June 15, 2023, "On the Parameters of the State Order for Admission to State

Higher Education Institutions for the 2023/2024 Academic Year" [1].

A. M. Qodirov notes, an engineer should be able to set goals and achieve them, plan their work, develop and implement problem-solving strategies, continuously improve their professional level, and monitor scientific and technological advancements in their field. All of these aspects are directly related to pedagogical conditions. The necessary qualities are not only the result of university education and training outcomes, but also the result of practical skills accumulated through solving problems in professional activities [2].

N. Ergashev, in his research, demonstrates the advantages of a hierarchical approach to improving the effectiveness of engineering education in a digital environment. The author substantiates a step-by-step instructional model, comprehensive use of digital resources, and the creation of conditions that support students' independent and collaborative activities [3].

S. Ruzmetova highlights the role of psychological competence in engineering practice. According to the

author, the development of communicative culture, stress resilience, a positive socio-psychological climate, and the application of self-development-oriented teaching methods are essential conditions for the professional success of future engineers [4].

K. Axadova argues that preparing engineers for professional activity in the era of the digital economy requires new approaches. She identifies the integration of digital technologies into the educational process, effective use of virtual and distance learning formats, the development of students' digital culture, and the formation of competencies aligned with modern labor market demands as key pedagogical conditions [5].

M. Aralov considers the educational and methodological complex as a tool for improving the quality of students' graphic training. He emphasizes that such complexes function as specialized knowledge bases, which are widely used today for processing significant volumes of information. Essential requirements include structural adequacy and systematic enrichment of the knowledge base with relevant subject content [6].

T. Shoymardonov, summarizing research on pedagogical conditions and their influence on the educational process, refers to M. Potashnik's ideas on defining organizational and pedagogical conditions aimed at organizing the learning process and expressing the core research concept [7].

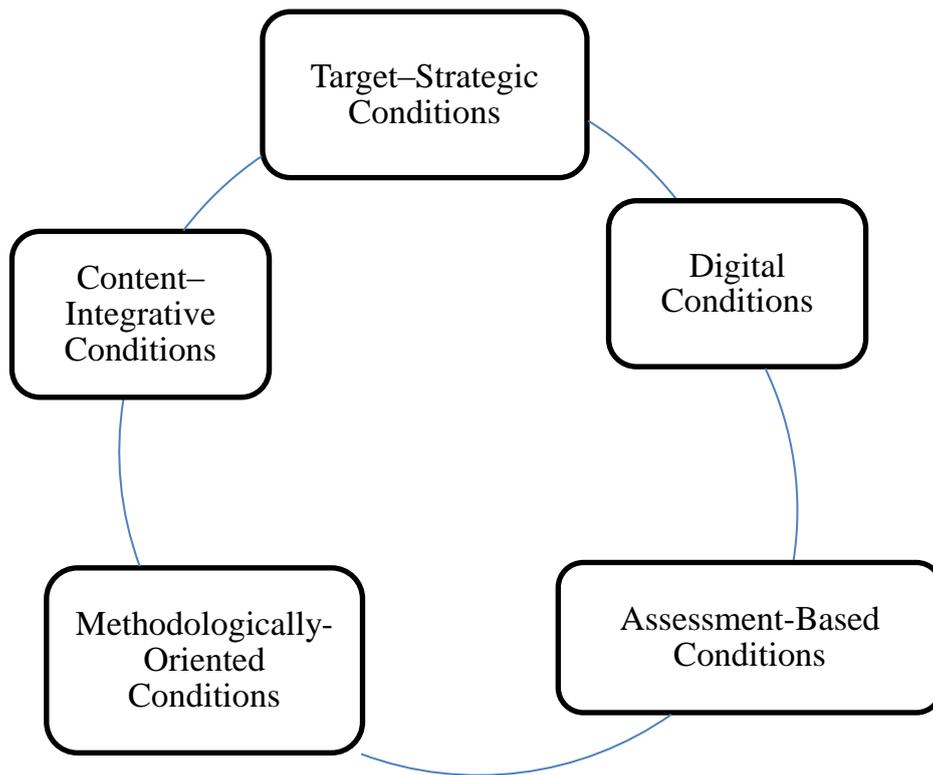
B. Rahmatova highlights continuous professional development as a crucial pedagogical condition for

enhancing engineers' professional competence. She stresses the importance of retraining courses for engineering teachers to master new technologies, creating a competitive environment through practical trials, olympiads, and contests, implementing internships and dual education systems, and regularly updating curricula according to labor market demands [8].

V. Baydenko distinguishes between organizational conditions such as proper lesson planning, balanced workload distribution, and effective time management and methodological conditions, including the use of modern educational technologies, software tools, and didactic materials to ensure deep knowledge acquisition [9].

Researchers such as R. S. Bondarevskaya, B. S. Gershunskiy, and A. L. Galinovskiy note that pedagogical conditions represent a set of measures implemented through appropriate pedagogical technologies, taking into account the capabilities of the educational environment, organizational forms, tools, and methods.

Finally, determining the level of competence formation requires the introduction of comprehensive assessment systems. Alongside traditional control methods, the use of portfolios, project outcomes, practical assignments, and diagnostic tests allows for objective and continuous evaluation of future engineers' professional competencies.



The Most Important Types of Pedagogical Conditions for Developing the Professional Competence of Future Engineers

Target-Strategic Conditions involve defining educational goals based on engineering education development strategies and a competency-based approach. All other pedagogical conditions are built upon this foundation. Within this framework, competence outcomes are clearly specified, answering the fundamental question of engineering education: "Why do we teach?" In the context of globalization and digital transformation, target-strategic conditions act as a key methodological basis in the training of future engineers. They ensure clear identification of educational objectives, alignment of curriculum content with modern labor market demands, and guaranteed learning outcomes expressed through professional competencies.

The significance of target-strategic conditions in engineering training is primarily explained by the strategic orientation of the educational process. Rather than focusing solely on knowledge transmission, priority is given to developing students' competencies in analyzing professional problems, making technical decisions, working with digital technologies, and demonstrating innovative thinking. This shift facilitates the transition from a traditional knowledge-based model of engineering education to a competency-

based model.

Furthermore, target-strategic conditions enable the integration of the educational process with labor market needs, national development strategies, and international standards. As a result, the professional preparation of future engineers is enriched not only with theoretical knowledge but also with practical skills applicable in real industrial environments.

Considering that modern engineering activity is multidisciplinary, interdisciplinary, and digital in nature, target-strategic conditions create a pedagogical environment necessary for the development of transversal competencies such as communication, teamwork, critical thinking, responsibility, and adaptability. This significantly enhances graduates' professional competitiveness.

Thus, target-strategic conditions function as a system-forming factor in the development of future engineers' professional competence. They direct the content, structure, and outcomes of the educational process toward a unified strategic goal. The implementation of these conditions in engineering education serves as an essential pedagogical guarantee for preparing engineers who meet the demands of modern society—professionally competent, innovative in thinking, and

capable of operating effectively within a digital environment.

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