

Integrative Approaches to the Construction of the Methodological System for Teaching Technical Mechanics

Khujamov Abbos Bazarovich

Independent Researcher at Bukhara State University

Annotation

This article analyzes the scientific and methodological foundations of applying integrative approaches in constructing a methodological system for teaching technical mechanics. The essence of integration principles is revealed, and the possibilities of employing innovative pedagogical technologies to enhance the efficiency of the educational process are examined. Special attention is given to the didactic foundations of the methodological system and the interconnection of components within the teaching process of technical disciplines. The significance of integrative approaches in shaping the professional training of future engineers is substantiated.

Keywords: technical mechanics, methodological system, integrative approach, innovative pedagogical technologies, didactic principles, educational process, professional training, technical disciplines.



This is an open-access article under the [CC-BY 4.0](https://creativecommons.org/licenses/by/4.0/) license

Introduction. Improving the effectiveness of teaching technical mechanics in modern engineering education is considered one of the pressing scientific and methodological challenges. In the process of training engineering personnel, the development of students' theoretical knowledge and practical competencies, the application of innovative pedagogical technologies, and the effective organization of the educational process represent key components of the methodological system. The integrative approach in teaching technical mechanics serves to cohesively link educational materials, reinforce logical connections between different subjects, and foster the development of students' engineering thinking. The practical implementation of this approach contributes to enhancing the quality of engineering education, deepening students' knowledge, and developing their independent thinking skills throughout their professional training. This article analyzes the scientific and methodological foundations of integrative approaches in the construction of a methodological system for teaching technical mechanics. Additionally, it highlights the integration of innovative pedagogical technologies into the educational process, the interrelation among technical disciplines, didactic principles, and issues related to professional training. The research findings aim to contribute to the development of new methodological approaches for improving the quality of teaching technical mechanics in engineering education [1].

Literature Review. Scientific studies conducted on the development of a methodological system for teaching technical mechanics are aimed at improving the effectiveness of engineering

education. Research findings indicate that, alongside traditional approaches, the application of innovative pedagogical technologies plays a crucial role in teaching technical subjects. For instance, S.N. Abramov (2018), in his research, explored the principles of forming modern methodological systems for teaching technical disciplines and emphasized the significance of integrated approaches in engineering education. Various theoretical and practical models of the role of integrative approaches in the educational process have been developed by researchers[3].

Scientific studies indicate that the application of integrative approaches in teaching technical mechanics serves as an effective means of developing students' professional competencies, fostering their independent research activities, and enhancing their skills in solving real-world engineering problems. Therefore, the formation of an integrative methodological system has a significant impact on the advancement of engineering education[4,5].

Research methodology. This study is aimed at evaluating the effectiveness of integrative approaches in constructing a methodological system for teaching the subject of technical mechanics. The research employed methods such as theoretical analysis, experimental investigation, surveys, and statistical analysis.

The study was carried out in three stages: **Theoretical stage** – existing methods of teaching technical mechanics were analyzed; **Experimental stage** – classes were conducted using integrative approaches in technical higher education institutions, and the outcomes were observed; **Data analysis stage** – the collected data were processed using statistical methods to assess effectiveness.

The study evaluated a methodological system designed to develop students' knowledge, practical competencies, and independent thinking skills in technical higher education institutions. The findings demonstrated that integrative approaches are effective in teaching technical mechanics [6].

Analysis and results. The research findings provide important conclusions for assessing the effectiveness of integrative approaches and developing a methodological system for teaching technical mechanics. The study was conducted based on analyses and statistical data obtained during the experimental phase.

1. **Changes in students' academic performance.** During the study, experimental and control groups were formed. The students in the experimental group, who were taught using an integrative approach, achieved significantly better results than those in the control group who were taught using traditional methods. In the experimental group, the learning performance increased by 15–20%, and the ability to complete practical tasks improved by 25%.
2. **Effectiveness of innovative pedagogical technologies.** The use of digital technologies and virtual laboratories contributed to increasing the interactivity of the educational process. According to survey results, students emphasized the effectiveness of visualization and modeling methods in understanding the subject of technical mechanics.
3. **Development of professional competencies.** The results showed that the methodological system based on integrative approaches was effective in preparing students to solve real engineering problems. Analytical thinking and problem-solving skills improved, and students developed the ability to apply the subject in practice.
4. **Survey and analysis results.** 85% of students stated that the integrative approach plays an important role in effectively organizing the learning process. Additionally, 78% of instructors confirmed the necessity of widely applying this approach in teaching technical mechanics. The findings demonstrate that using integrative approaches and innovative technologies in teaching technical mechanics ensures high efficiency in deepening students' theoretical knowledge and developing their practical skills [7,8].

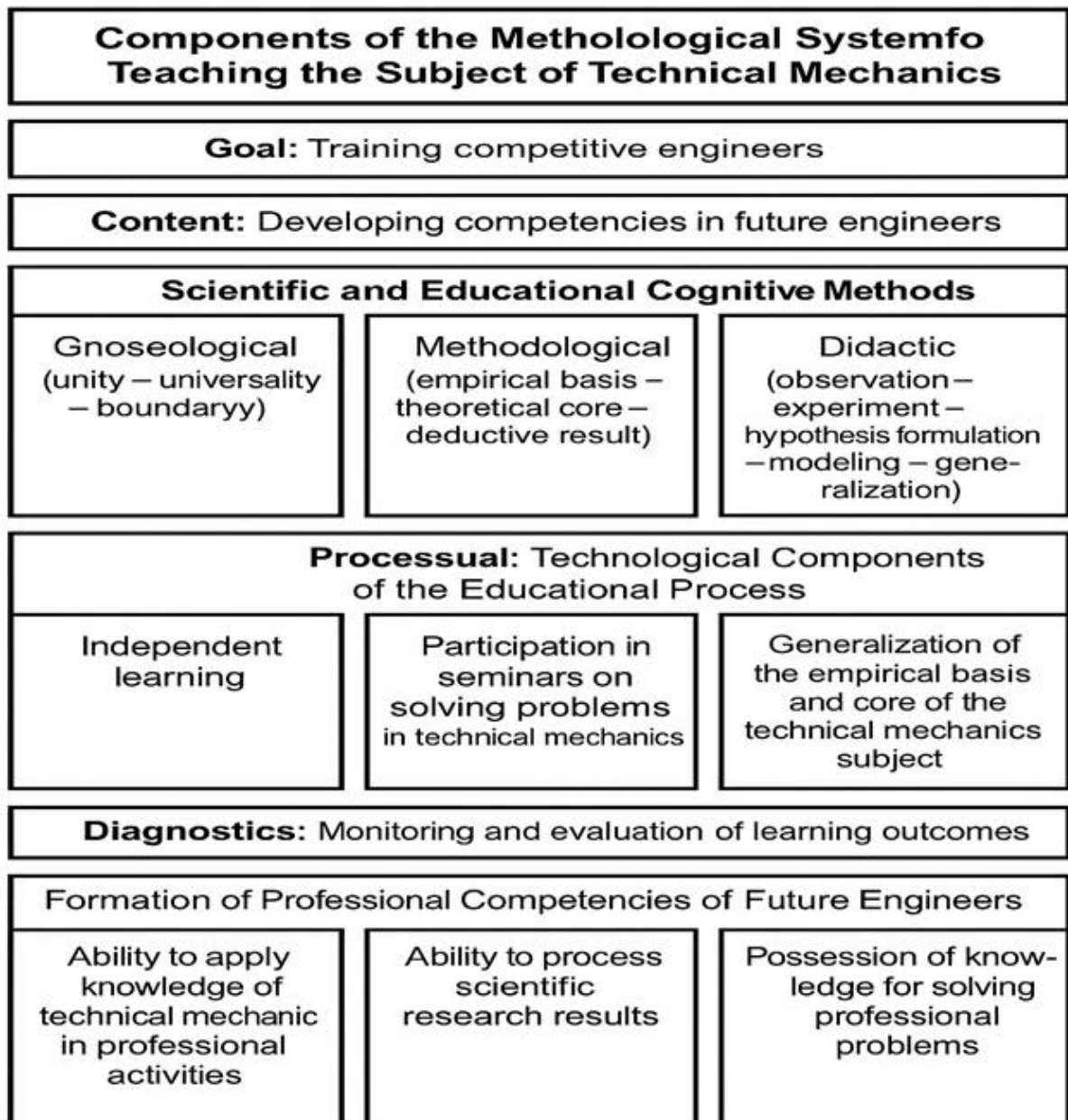


Figure 1. Structural and Functional Model of the Methodological System for Teaching Technical Mechanics to Future Engineers

Thus, based on the principles of systemic, methodological, and competency-based approaches, as well as scientific and educational cognitive methods, it is possible to construct an organizational-structural-functional model of the methodological system for teaching technical mechanics as a fundamental engineering discipline in technical higher education institutions (see Figure 1). This model fully meets the above-mentioned requirements and clearly reflects the logical interrelations between its components, the scientific and educational cognitive methods, types of learning-based cognitive activities, and the outcomes of the formation of professional competencies in future engineers [9,10].

Conclusion and Recommendations. This study was aimed at determining the effectiveness of integrative approaches in teaching the subject of technical mechanics. The results revealed that the integrative methodological system plays a significant role in deepening students' theoretical knowledge, developing their practical skills, and enhancing their level of professional training. During the research, the effectiveness of innovative pedagogical technologies, virtual laboratories, and interactive teaching methods was thoroughly analyzed. The findings of the experimental

studies confirmed that students' knowledge acquisition levels and technical thinking abilities had significantly improved. Therefore, the necessity of applying integrative approaches in teaching technical mechanics was substantiated. This methodology contributes to improving the quality of modern engineering education, organizing the educational process more effectively, and preparing students for practical professional activity.

References

1. Абрамов С. Н. Методология и технологии обучения техническим дисциплинам в инженерном образовании. – М.: Наука, 2018.
2. Петров В. А. Интегративные подходы в инженерном образовании. – СПб.: Изд-во Политехнического университета, 2019.
3. Джонсон Д., Браун М. Integrative Teaching Methods in Engineering Mechanics. – Journal of Engineering Education, 2020.
4. Савельев А. Н. Дидактические принципы обучения техническим наукам. – Казань: Университетское издательство, 2017.
5. O‘zbekiston respublikasi Farmoni “ O‘zbekiston Respublikasi oliy ta’lim tizimini 2030 yilgacha rivojlantirish konsepsiyasi “2019 yil 8 oktabr, PF-5847-son .
6. Abduqodirov A.A., Tursunov S.Q. Ta’limda axborot texnologiyalari. Darslik. T.: “Adabiyot uchqunlari”, 2019 y
7. Baydenko V.I. «Bolonskiy protsess: rezultati obucheniya i kompetentnostniy podxod. - M.: Issledovatel’skiy sentr problem kachestva podgotovki spetsialistov. 2009. – S. 482-492.
8. Bepalko V.P. Bumajnaya versiya elektronogo uchebnika. Shkolniye texnologii. -M.: «Narodnoye obrazovaniye», 2007. -№ 2. - C.54-55.
9. Turaev S.J. Methods of the using of software program Microsoft Excel in practical and laboratory occupation on physics, *Scientific Bulletin of Namangan State University*: 2019. Available at: <https://uzjournals.edu.uz/namdu/vol1/iss10/55>.
10. Ismoilov D.M. <http://www.idpublications.org/wpcontent/uploads/2020/06/Full-Paper.METHODS-OF-SCIENTIFIC KNOWLEDGE-AND-RESEARCH-IN-THE CONTENT OF SECONDARY EDUCATION.pdf>.