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CONDITIONS FOR IMPLEMENTING TUTORIAL TECHNOLOGY IN TEACHING CONSTRUCTION MECHANICS

K.I. Pochka,
Doctor of Science in Technology, Professor

Yu.V. Maksymiuk,
Doctor of Science in Technology, Professor

Yu.S. Krasylnyk,
Candidate of Pedagogic Science, Associate Professor

H.L. Korchova,
Candidate of Pedagogic Science, Associate Professor

M.V. Rudenko,
Candidate of Pedagogic Science, Associate Professor

Kyiv National University of Construction and Architecture, Kyiv

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The conditions for implementing tutoring technology in teaching construction mechanics have been established: pedagogical, organizational, material and technical, and psychological. The structural components of tutoring technology for teaching construction mechanics have been revealed: target, content, technological, activity-based, and result-based. The key determinants of the effectiveness of tutoring support for students are substantiated, and the main approaches to personalizing learning are identified.

Keywords: tutor, tutoring, tutor functions, tutoring technology, conditions for implementing tutoring technology, individual educational trajectory, student-centered learning, structural mechanics.

Introduction. In the context of training professionals in the construction field, the implementation of innovative approaches allows not only to develop relevant competencies in construction mechanics, but also to develop creativity, which is a necessary quality for solving complex engineering projects. Construction mechanics is a key educational component of educational programs for training engineers for the construction industry. It covers the principles and methods of calculation necessary to ensure the reliability and safety of structures, and also develops critical thinking and analytical skills, which are the basis for the professional activity of an engineer [1, 2, 3, 8, 10, 14, 15 and 17].

Problem statement. For modern educational theory and practice, it is particularly important to find innovative approaches to teaching engineering disciplines that can ensure the continuity and quality of the educational process even in crisis situations, such as during war or a pandemic. In conditions of forced remote interaction, tutoring technology plays a decisive role, as it combines individual guidance, mentoring, and support for the professional development of higher education students. It helps not only to overcome barriers in the assimilation of complex theoretical and practical provisions of construction mechanics, but also to maintain motivation, a sense of involvement, and confidence in conditions of instability. Thus, the introduction of tutoring technology in teaching structural mechanics is not only relevant but also strategically necessary for the development of higher education pedagogy. However, an analysis of the works of researchers specializing in this particular issue has not revealed any scientific developments in tutoring technology in teaching structural mechanics. Nevertheless, there are studies on the implementation of modern educational technologies in higher education institutions that reveal various aspects of the application of tutoring technology in teaching academic disciplines. In particular, A. Suchana, studying aspects of training future teachers for tutoring, emphasizes the need to create an educational environment based on the integration of modern information, digital, and pedagogical technologies. The scholar emphasizes the importance of combining traditional approaches to teaching with innovative methods and forms that meet the standards and practices of the European higher education area. [18].

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Опір матеріалів і теорія споруд/Strength of Materials and Theory of Structures. 2025. № 115

Analysis of recent research and publications. The scientific basis for addressing this issue has been laid in the research of a number of domestic and foreign scientists: N. Demyanenko [9], O. Shershnova [22], S. Boiko [5], V. Mizyuk, A. Khizhnyak, V. Khrenova [11], O. Papach, O. Gorozhankina, G. Rizak [13], L. Sydorenko [16], V. Babaev, I. Biletsky, V. Voronko, Yu.Garyunova, I. Glazkova, T. Gura, O. Dolgopol, Yu. Zavalevsky, T. Krekhno, A. Krokhmal, K. Kuznetsova, M. Marusinets, A. Prykhodko, O. Rezvan, O. Romanovskaya, P. Saukh, S. Khatuntseva, I. Khomyuk, O. Cherkas, M. Shlenova [7], T. Shvets [21], M. Bray [24], D. Lochtie, E. McIntosh, A. Stork, B. Walker [30], D. Palfreyman [32], L. Phiri, C. Meinel, H. Suleman [33], D. Mejia, V. Castillo, M. Fong, R. Guerrero, L. Siero [31], F. Ahmed, K.Shubeck, L. Zhang, L. Wang, X. Hu [23], and others.

Various aspects of the formation of theoretical and methodological foundations for the professional training of engineers in the construction industry, in particular the issue of teaching construction mechanics, are reflected in the works of: O. Protsenko, V. Sopov [14], V. Kolokhov [10], P. Balduk, N. Surianinov [3], V. Bazhenov, O. Shishov [2], O. Svirgun, V. Savchenko, V. Svirgun, A. Chornonog [15], O. Alferov, O. Svirgun, V. Savchenko, A. Chornonog [1], V. Gryshchenko, O. Svirgun, E. Kalinin, V. Savchenko [8], and others. Our research is based on the competence-based approach and student-centred educational paradigm, the need to combine fundamental knowledge with practice-oriented tasks, individualisation of educational trajectories, and activation of personal participation of students in the organisation of their own learning [6, 25, 26].

Despite the significant contribution of Ukrainian and foreign scientists to the study of tutoring technologies, aspects of their analysis aimed at creating conditions for the implementation of tutoring technology in teaching construction mechanics remain insufficiently researched. It is this scientific gap that determined the relevance and conceptual basis of our research.

The aim of the article analyse and characterise modern tutoring technologies, justify the conditions for the implementation of tutoring technology in teaching construction mechanics that contribute to the development of professional competencies of higher education students.

Presentation of the main research material. In order to analyse and identify the characteristics of tutoring technologies, it is necessary to examine the terminology used. The relevant educational technology emerges in response to new social needs or goals that are shaped by scientific discoveries or research. This is due to the growing relevance of issues related to the personalisation and individualisation of the educational process.

An analysis of the historical origins of tutoring should begin with a consideration of the original meaning of the term, which derives from several Latin words: ‘tutor,’ ‘tueri,’ ‘tute,’ ‘tutus,’ and ‘tutela.’ In Latin, the word ‘tutorem’ meant “protector” or ‘guardian’ and covered activities such as provision, protection, preservation, support, shelter, as well as the ability to cope with tasks or defend against external threats [29]. The concept of tutor (from English ‘tutor’ and Latin ‘tueor’) in the New English-Ukrainian Dictionary is interpreted as a tutor, educator, student group leader, teacher-mentor, assistant, student advocate, etc. [12].

The UNESCO International Bureau of Education thesaurus provides a definition of tutoring that, in our opinion, is the most comprehensive and accurate, taking into account current global practices in this field. Tutoring is defined as any form of activity aimed at providing an education seeker with guidance, advice or supervision from an experienced and competent educator. The mentor supports the learner in the educational process, regardless of whether it takes place in an educational institution, training centre or workplace. Tutoring covers the following areas: academic support to improve educational outcomes; career counselling to facilitate a successful transition from education to professional activity; personal development to help learners make informed decisions [28]. This definition emphasises the universality and versatility of tutoring as an educational phenomenon.

K. Chaika-Helminska considers tutoring to be a purposeful process of personal development, which is carried out with the support of a tutor. The main goal of this process is to reveal the potential of the individual and guide them on the path of self-development. [27, p. 38].

S. Tolochko characterises tutoring as a special type of pedagogical activity integrated into an organised educational system. This activity is implemented in various formats, including classroom, distance, individual, pair or group formats. [19, p. 237].

A. Boiko defines tutoring as a form of individual interaction between a student and a teacher, aimed at developing motivation and interest in the chosen profession, as well as stimulating the process

of independent personal development of future specialists [4]. S. Boikocharacterises tutoring as a process of tutoring support that not only covers the sphere of learning, but also touches on other components of the educational process and even beyond. Tutoring involves cooperation between an adult and a mentee (pupil/student) through individual meetings (tutorials) [5, p. 25]. In particular, tutoring is seen as a pedagogical phenomenon, a special type of pedagogical activity aimed at supporting and accompanying an individual in the process of obtaining an education. [5, c. 25].

According to T. Shvets, tutoring is a process of supporting personal development aimed at unlocking an individual's potential. It is a special form of educational activity that covers both academic and educational aspects. The main goal of tutoring is to promote self-development and self-realisation. This approach can be implemented both in a one-on-one format and in small groups. Tutoring is based on subject-subject relationships and the principles of personalisation: the learner becomes the author of their own educational and life path, actively participates in planning their activities and pursues individual development with the support of a tutor. [21].

S. Tolochko defines a tutor as an educator who provides academic support in the process of creating and implementing an individual educational trajectory for a student, supporting them on the path to independent development [19, p. 237].

A. Boikoemphasises that a tutor is an educator who focuses on observation, listening and analysis. For him, it is not so much important to speak himself as to thoughtfully perceive and understand his interlocutor and the situation. This approach allows the tutor to make informed conclusions about the development and formation of each personality. A. Boiko considers the main functions of tutoring to be: organisational management of the educational and cognitive activities of the student; identification of their abilities and interests; recommendations for personal development, self-education, formation of a value system, lifestyle, and identification of personal prospects; providing assistance in the correct and effective use of scientific and methodological support in a particular academic discipline; organising independent work; ensuring the equalisation of knowledge among students and pupils; justifying the means and assisting in achieving a high rating for the student; providing information and facilitating the exchange of additional literature between subjects [4]. S. Boiko clarifies the meaning of the term ‘tutor’ as a person who provides individual systematic support to a student, helps them to reveal and realise their potential, encourages them to reflect on their own development and supports them with their own experience. A tutor is proficient in modern educational technologies, is a specialist in the field of pedagogy, and can support the student's research and scientific activities [5, p. 25].

According to N. Demyanenko, a tutor is a universal educator whose professional activity is aimed at implementing the idea of individualisation of education at any stage. A tutor acts as a companion in the educational and professional development of a student, helping to identify individual educational needs, shape a personal educational trajectory, and develop, methodically support, and implement an individual educational programme in various formats. In addition, tutors play a key role in analysing and reflecting on the results of individual educational programmes, ensuring that they meet the needs and goals of students [9, p. 9].

In English-language scientific literature, the term ‘tutor’ is mostly interpreted as the role of a teacher associated with supporting and assisting students in their studies. In particular, the following definitions can be distinguished:

a tutor is a private teacher or tutor who provides an individual approach to the learning process [24];

a tutor contributes to improving the academic performance and overall well-being of students through personalised comprehensive support, acting as a personal mentor who advises, informs, provides feedback, helps to set and achieve educational goals, unlock the potential of students, and supports them on their path to independence [30];

a tutor is a mentor who encourages learners to think independently. In this model, learners take an active role in their learning, and tutoring is conducted in a one-on-one format. At the same time, tutoring does not replace lectures or seminars, but harmoniously complements them, ensuring the deepening and individualisation of the educational process [32].

Taking into account the results of studies [4, 9, 21, 22, 24, 30, 32], let us define the concept of a ‘tutor’. A tutor is a teacher (mentor) who provides individual support and guidance to students in their educational activities, aimed at the conscious acquisition of knowledge, the development of professional and personal competencies, independence in learning, and the formation of critical

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thinking. The concept includes the following key aspects: educational and advisory function – helping students understand complex material and choose the best ways to learn; motivational support – stimulating internal motivation for learning and self-development; organisational function – planning an individual learning path, coordinating independent work; developmental function – developing analytical thinking, skills for independent problem solving, creativity and responsibility; feedback – systematic assessment of progress, providing recommendations for improving educational outcomes.

Since the implementation of educational programmes requires technologies that provide for the diagnosis of educational needs of learners, individual counselling, coordination of educational activities and motivational support, it is precisely the above-mentioned systematisation of tutor functions that, in our opinion, can ensure the holistic formation and development of learners' professional competences. Thus, tutoring technology can serve not only as a tool for individual support, but also as a comprehensive system whose main goal is to implement educational programmes that take into account the individual educational trajectories of learners.

A. Boiko defines the main concepts of tutoring technology as transformational processes that have become an integral reality of modernity, aimed at affirming the uniqueness of each person, changing the profound meaning of their existence, axiological guidelines and the nature of relationships; in the context of postmodernism, globalisation and integration processes, a deep understanding of the theory of education and didactics becomes particularly important; tutoring technology is based on subject-subject, moral and aesthetic relationships based on the principles of creativity, electivity and personalisation; at the centre of interaction is an optimistic assessment, formed on the basis of dialogical interaction, conversation and mutual respect between two equal subjects [4]. This approach creates a stable need for independent, individual, personality-oriented work between two equal partners – the student and the tutor who supports their individual educational trajectory. Within the framework of this study, an individual educational trajectory is considered as a personality-oriented model of the organisation of the educational process, based on the requirements of the educational programme and curriculum. According to H. Shaparenko, an individual educational trajectory ensures the gradual acquisition of professional competencies, contributes to the development of the learner's individual style of self-education, its further improvement and gradual transition to their own style of professional activity [20, p. 461].

For teaching practice, tutoring technology is timely due to its potential to improve students' assimilation of educational material. It allows for a personalised approach to each higher education student, taking into account their level of preparation and pace of learning, as well as providing timely support in mastering the content of complex topics in construction mechanics. As a result, this improves the quality of training for future professionals in the construction industry, reducing the gap between their theoretical and practical training, and serves as an important way to overcome a number of contradictions in the teaching of construction mechanics.

A review of teaching practices in structural mechanics shows that students need to master both the theoretical foundations and practical methods of structural design. At the same time, an increased focus on theoretical aspects reduces the practical value of the content, as students are not always able to apply their knowledge to solving engineering problems. On the other hand, insufficient theoretical training of students complicates the understanding of basic principles and limits the possibilities of applying knowledge to solve non-standard problems. In a frontal form of teaching, scientific and pedagogical workers do not always fully take into account the level of training and characteristics of each higher education applicant. At the same time, every teacher is aware of the importance of taking into account that different students need different approaches for effective assimilation of educational material. However, the individualisation of the educational process requires additional resources and time.

Traditional teaching methods often do not meet the modern requirements of engineering education. However, modern technologies allow the use of software for modelling and calculations, which significantly increases the effectiveness of training. Structural mechanics is a complex educational component that covers a significant amount of both theoretical and practical content. The content of structural mechanics is quite complex, requiring students to concentrate intensely and put considerable effort into their studies. This has a negative impact on the motivation of some students, especially those who do not have a clear understanding of the importance of this discipline for their future professional activities.

The focus of teaching on traditional, 'knowledge-based' methods also limits opportunities for the development of critical thinking and analytical skills in students. The modern construction industry requires future professionals to have not only technical and technological knowledge, but also the ability to make non-standard decisions and adapt to rapidly changing conditions and technologies in their professional activities. Therefore, overcoming these contradictions requires a comprehensive approach to the organisation of the educational process, the improvement of teaching methods and the integration of modern technologies to ensure a deep understanding of both theory and the mechanisms of professional competence development in higher education students.

We have established that the experience of teaching construction mechanics at the Kyiv National University of Construction and Architecture (KNUCA) encompasses many years of practice and innovative achievements, which meets the modern requirements of engineering education methodology. The main components of this experience can be summarised in the following aspects:

theoretical training based on fundamental principles: teachers emphasise thorough teaching of the basics of structural mechanics, in particular the theory of elasticity, statics, dynamics and stability of structures. Students learn the basics of structural calculation and design, which is the basis for solving more complex engineering problems. Lectures contain clearly structured theoretical explanations, as well as examples of their practical application;

Practical classes and laboratory work: students learn how to apply theoretical knowledge to solve specific engineering problems. KNUCA widely uses laboratory work to model various situations that may arise in the design process. This helps students consolidate their knowledge and acquire the skills to calculate relevant structures;

use of software: the university actively implements modern software that is widely used in the construction industry, such as AutoCAD, Autodesk Revit, Tekla Structures, LIRA, SCAD, etc. This allows students to familiarise themselves with advanced technologies for designing and modelling building structures, developing skills in working with tools that will be useful in their future professional activities;

Student-centred learning: the university practises a student-centred approach to learning, which allows for the level of preparation and needs of each student to be taken into account. Teachers provide individual consultations on solving real professional problems, which is especially important when teaching complex topics in structural mechanics.

Research activities: teachers actively involve students in research activities in the field of structural mechanics. This contributes to the development of scientific and analytical skills, and also allows students to participate in the development of new methods and approaches to structural design, which is important for the innovative development of the industry.

Preparation for practical activities and internships: KNUCA works closely with construction companies, allowing students to undergo practical training and internships at real construction sites. This promotes a better understanding of the practical aspects of construction mechanics, familiarises students with the specifics of working on real projects, and prepares them for professional activities.

use of case methods and solving real-life problems: university education includes the use of case methods, where students solve real engineering problems and work on specific projects, which increases student motivation and allows them to apply theoretical knowledge in the context of real professional tasks.

It is worth noting the peculiarities of teaching construction mechanics at KNUCA in the context of distance (blended) learning, which determined the active search for new approaches by teachers to ensure high-quality training of students. The main aspects of this experience can be summarised according to the following criteria:

use of digital platforms for conducting classes: teachers use video conferencing platforms such as Zoom, Microsoft Teams, Google Meet, etc. to conduct lectures, practical and laboratory classes. These platforms allow teachers to teach complex topics in construction mechanics and maintain constant communication with students. The Moodle and Google Classroom learning platforms are also used to access materials, where students can obtain lecture notes, learning materials and class recordings;

Interactive lectures and practical classes: An interactive format has become important in the teaching process, helping students to actively engage in learning. Teachers use real-time

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demonstrations of problem solving, allowing students to observe the entire calculation process and clarify any questions they may have.

use of software for modelling and calculations: distance learning has led to wider use of calculation and modelling software, allowing students to work on practical tasks independently. Teachers provide instruction on how to use these programmes during online meetings, and students complete tasks with the help of video tutorials and detailed methodological recommendations;

development of educational videos and lecture recordings: teachers have created a library of videos that include lectures, explanations of tasks, and examples of solutions to specific types of tasks. Class recordings are an important part of learning, as students can review educational materials at their convenience;

online testing and practical tasks: distance learning requires the adaptation of knowledge assessment methods. To this end, the university uses online tests and practical tasks that are completed by students and then submitted for review. These tests are conducted on the Moodle or Google Forms platforms and include both theoretical questions and calculation tasks;

project work: in a remote format, students are actively involved in working on projects that reflect real situations in the construction industry;

monitoring and feedback: teachers organise regular monitoring of academic performance, check students' assignments, provide feedback on results and recommendations for improving students' academic performance;

Online consultations and tutoring support for the educational process: video consultations have become an important means of supporting students who have difficulty mastering the content of construction mechanics. Teachers conduct regular online consultations, allowing students to receive help on specific issues related to theory and practice. Thus, summarising the practice of distance learning in construction mechanics at KNUBA allows us to establish effective online (offline) learning mechanisms that can be combined with traditional formats, increase students' independence, expand their digital competencies, and ensure adaptation to the modern requirements of the educational process.

Taking into account the results of theoretical research [1, 2, 3, 5, 7, 8, 15, 20, 22, 25, 30] and the study of the practice of teaching construction mechanics, we can justify a model of tutoring technology that specifies the methodology of teaching higher education students. Tutor technology for teaching structural mechanics is an organised system of pedagogical methods, techniques and procedures aimed at providing individualised support to higher education students in the process of developing professional competencies in the field of structural mechanics, based on the principles of active learning, a personalised approach, the encouragement of independent work and systematic feedback. It takes into account modern requirements for engineering training, a focus on the individual and personal development of students, the integration of digital technologies and the increased role of the teacher as a mentor and tutor.

The main components of the model are (Fig. 1):

1. Target component – ensuring the professional training of future engineers through individualised learning, the development of independence and research skills.
2. Content component – integration of fundamental knowledge of construction mechanics with practical tasks, case studies and project-based work.
3. Technological component – use of tutoring technologies: individual educational paths, counselling, facilitation of group work, online tools (Google Forms, LMS, virtual simulators, etc.).
4. Activity component – interaction between the teacher-tutor and the student in a ‘subject-subject’ format, with an emphasis on partnership, mentoring and support in learning activities.
5. The results component – improving professional competencies, developing critical thinking, engineering analysis skills, independent decision-making and readiness for professional activity in changing conditions.

Thus, the proposed model of tutoring technology creates conditions for the transition from a traditional knowledge-oriented approach to an individually-oriented one, which will contribute to the effective training of technical students.

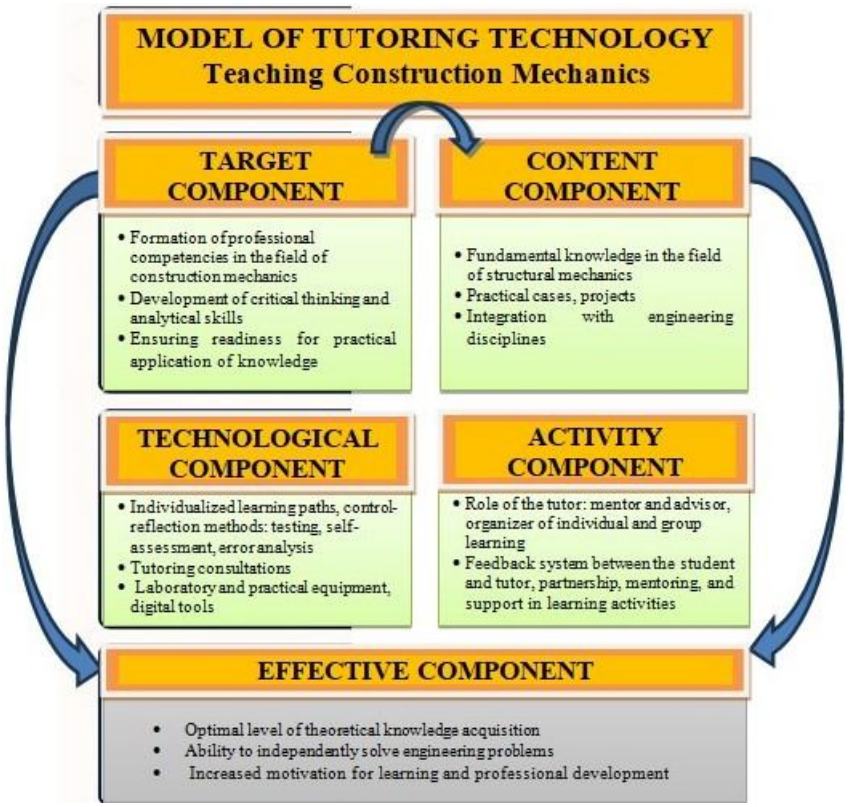

Fig. 1. Model of tutorial technology for teaching construction mechanics

To determine the conditions for the implementation of tutoring technology in the teaching of construction mechanics, a survey was conducted among teachers (n=38) and third-level (educational and scientific) higher education students (n=50) at KNUCA. The survey was conducted using the online tool Google Forms (https://forms.office.com/e/hMfkSnH034). Based on the results of the study, a number of criteria were identified that characterise the effectiveness of the implementation of tutoring technology in teaching educational components of construction mechanics. Respondents provided the following answers:

1. The ability of a teacher-tutor to set promising educational goals (Fig. 2). Among teachers, the answers were distributed as follows: 14 respondents (34%) are aware of the prospects for professional development and growth; 11 respondents (29%) are aware of the need to improve their tutoring skills; 14 respondents (37%) focus on immediate educational goals and ways to achieve them. Among the applicants, the answers were distributed as follows: 18 respondents (36%) are aware of the prospects for professional growth and development; 15 respondents (30%) are aware of the need to improve their tutoring skills; 17 respondents (34%) identify their immediate educational goals and ways to achieve them.

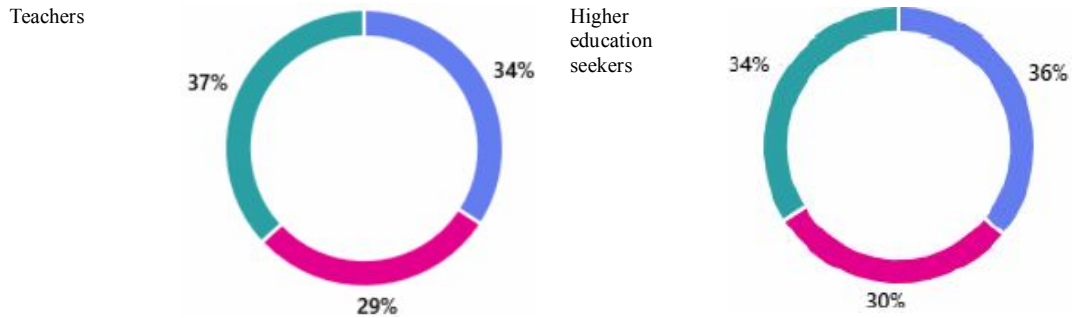

Fig. 2. The ability of a tutor to set promising educational goals

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2. Ability to implement tutoring tasks as a teacher (Fig. 3). Among teachers, the answers were distributed as follows: 4 respondents (11%) try to study the characteristics of students and the factors that influence their behaviour; 12 respondents (32%) choose methods to improve communication with students; 22 respondents (58%) discuss with students the problems that arise during the learning process and look for possible ways to solve them. Among the students, the answers to this question were distributed as follows: teachers perform specific educational tasks of tutoring – 17 respondents (34%); teachers prepare for the main activities of tutoring – 9 respondents (18%); teachers perform educational tasks as tutors – 24 (48%) respondents.

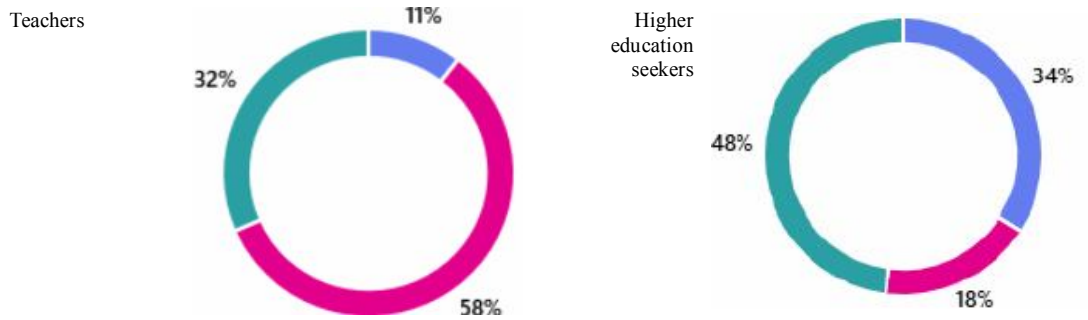

Fig. 3. Ability to implement tutoring tasks as a teacher

3. The ability of educational actors to focus on novelty (Fig. 4). Among teachers, the answers to the question were distributed as follows: 17 respondents (45%) are aware of the need to pay attention to the originality of students' presentation of the results of educational tasks; 5 respondents (13%) independently plan the stages of their own professional growth; 16 respondents (42%) emphasise the need to improve their individual style of professional activity. Among the applicants, the distribution of answers was as follows: it was found that 5 respondents (10%) prefer non-standard, original presentation of the results of educational tasks; 19 respondents (38%) expressed a desire for dynamic change in behaviour in the new conditions of educational activity; 26 respondents (52%) focused on the need to improve their individual professional style.

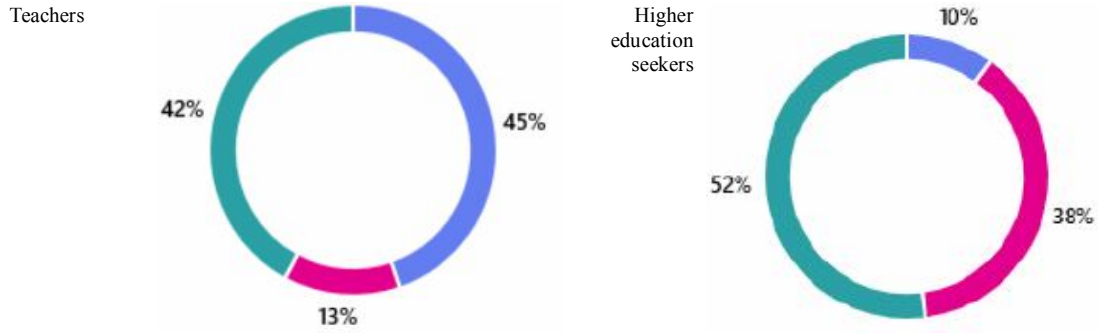

Fig. 4. Ability of educational entities to focus on innovation

4. The ability of educational actors to demonstrate creativity (Fig. 5).

Among teachers, responses regarding a creative approach to teaching educational components of construction mechanics were distributed as follows: 7 respondents (18%) focus on developing fundamentally new approaches to teaching; 22 respondents (58%) indicated that they dynamically change their behaviour in new educational conditions; 9 respondents (24%) believe that the attitude of the audience is the decisive factor for successful educational activity. Among the applicants, the survey results were distributed as follows: 21 respondents (42%) focus on developing fundamentally new approaches to teaching, education and development; 19 respondents (38%) demonstrate the ability to dynamically change their behaviour in new conditions of educational activity; 10 respondents (20%) emphasise that the decisive factor for successful educational activities is the attitude of the audience.

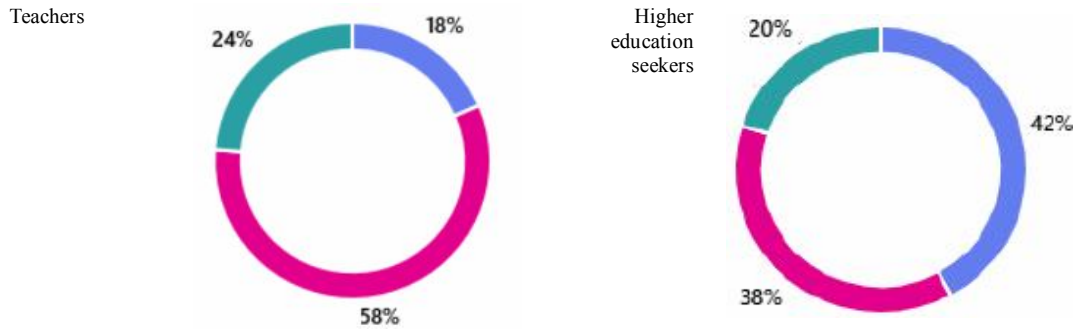

Fig. 5. Ability of educational entities to demonstrate creativity

5. Introduction of an individual-oriented approach in educational activities (Fig. 6). Among teachers, responses to questions regarding an individual-oriented approach to educational activities were distributed as follows: 13 respondents (34%) focus on the individual psychological characteristics of students; 1 respondent (5%) takes into account the age characteristics of students in carrying out educational activities; 22 respondents (58%) adjust educational technologies depending on the individual learning and cognitive abilities of each student; 1 respondent (5%) believes that they adjust their teaching activities depending on the initiative of students. Among the respondents, the answers to the question regarding the implementation of an individual-oriented approach to educational activities by teachers were distributed as follows: 15 respondents (30%) are focused on taking into account the individual mental characteristics of students; 6 respondents (12%) indicate the need to take into account the age characteristics of students in teaching activities; 29 respondents (58%) believe that educational technologies should be tailored to the individual learning and cognitive abilities of each student.

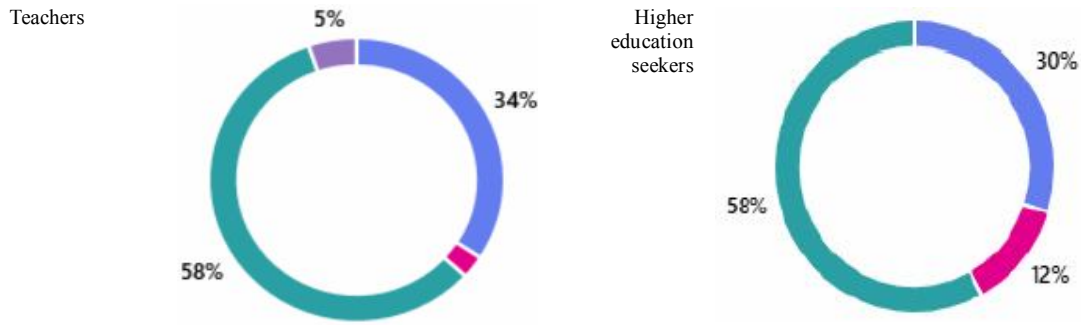

Fig. 6. Implementation of an individual-oriented approach in educational activities

Analysis of the results obtained allows us to identify a number of prerequisites that determine the effectiveness of the implementation of tutoring technology.

Firstly, both teachers and students emphasised the importance of the tutor's ability to identify both long-term and short-term educational goals and ways to achieve them, which indicates an awareness of the need to combine strategic and tactical approaches in teaching.

Secondly, respondents emphasised the importance of the teacher's ability to carry out tutoring tasks: from establishing communication with students to finding common ways to overcome educational problems. This indicates an expansion of the teacher's functions towards mentoring and support.

Thirdly, both teachers and students consider it important to focus on innovation: original presentation of learning outcomes, dynamic adaptation of behaviour to new conditions, and improvement of individual professional style.

Fourthly, creativity is an important indicator of the effectiveness of tutoring technology. A significant proportion of respondents demonstrated a focus on finding fundamentally new approaches to teaching and a willingness to change educational practices in line with contemporary challenges, while emphasising the importance of audience engagement.

Fifth, the implementation of an individual-oriented approach is recognised as a key factor. Both teachers and students emphasise the need to take into account the individual psychological characteristics, age characteristics and educational and cognitive abilities of each student, which underlines the role of the tutor as a facilitator of individual educational trajectories. Thus, the results of the empirical study confirm that the effectiveness of implementing tutoring technology in teaching construction mechanics directly depends on the teacher's ability to combine a strategic vision of educational goals, mentoring support, creativity, and individualisation of the educational process. Contemporary transformational processes in society and its transition from the industrial to the post-industrial stage of development are shaping a fundamentally new content of the conditions for the implementation of tutoring technology in teaching structural mechanics, focused on the competence and readiness of students for professional activity [1, 2, 5, 7, 10, 11, 13, 14, 15, 16, 20, 22, 23, 26 and 33] and confirmed by empirical research.

In our opinion, the conditions for implementing tutorial technology in teaching structural mechanics are a combination of organisational, methodological, pedagogical and technical factors that ensure the effective application of an individualised approach to higher education students and the achievement of learning objectives in the field of structural mechanics. These conditions include:

pedagogical conditions – a high level of professional and methodological competence of the tutor, a clear definition of learning goals and objectives, a system of motivation and incentives for independent work by students.

organisational conditions – planning of individual and group work, development of learning trajectories and educational programmes, provision of time and resources for consultations and practical classes;

material and technical conditions – availability of laboratories, computer equipment, software for modelling building structures, access to modern information resources and databases;

psychological conditions – creation of an atmosphere of trust and mutual respect, support for students' internal motivation, development of independence and critical thinking.

Conclusions. The article covers:

1. Key determinants that influence the application of tutoring technology in teaching construction mechanics at higher education institutions specialising in construction.

2. Approaches to the formation of the content of training and structural components of interactive tutoring technology, focused on personality-oriented learning and the implementation of individual educational goals of students, are clarified: target, content, technological, activity-based, and result-based.

3. It has been established that ensuring the relevance of teaching structural mechanics to the needs of the labour market requires the implementation of tutoring technology conditions: pedagogical, organisational, material and technical, and psychological.

The results of the study can be used in the future to optimise the conditions for the implementation of tutoring technology in the teaching of technical disciplines.

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Почка К.І., Максим’юк Ю.В., Красильник Ю.С., Корчова Г.Л., Руденко М.В.

УМОВИ ВПРОВАДЖЕННЯ ТЬЮТОРСЬКОЇ ТЕХНОЛОГІЇ ВИКЛАДАННЯ БУДІВЕЛЬНОЇ МЕХАНІКИ

Встановлено умови впровадження тьюторської технології у викладанні будівельної механіки, які охоплюють педагогічні, організаційні, матеріально-технічні та психологічні аспекти освітнього процесу. Педагогічні умови передбачають підготовку викладачів як тьюторів, формування методичних стратегій індивідуального та групового супроводу студентів, а також створення навчально-методичного забезпечення, що сприяє розвитку компетентностей майбутніх професіоналів. Організаційні умови включають оптимізацію структури освітнього процесу, визначення режиму взаємодії викладача як тьютора зі здобувачами освіти, планування навчальних модулів та координацію роботи між кафедрами та лабораторіями. Матеріально-технічні умови забезпечують доступ до сучасних засобів навчання, цифрових платформ, лабораторного обладнання та електронних ресурсів, що дозволяє реалізувати персоналізоване навчання та активну практичну діяльність. Психологічні умови полягають у створенні атмосфери довіри, мотивації, підтримки самостійності та відповідальності студентів, що формує їхню готовність до професійного розвитку та самовдосконалення. Розкрито структурні компоненти тьюторської технології викладання будівельної механіки, серед яких виділяються цільовий, змістовий, технологічний, діяльнісний та результативний блоки. Цільовий компонент визначає напрями підготовки та програмні результати навчання, змістовий − формує зміст освітнього процесу відповідно до стандартів та компетентнісних вимог. Технологічний компонент включає методи, прийоми та інструменти тьюторського супроводу, діяльнісний − передбачає конкретну активність студентів та тьютора, а результативний − оцінює ефективність навчання та досягнення освітніх цілей. Обґрунтовано ключові детермінанти ефективності тьюторської підтримки студентів, серед яких виділяються рівень педагогічної компетентності тьютора, ступінь індивідуалізації навчання, мотиваційний потенціал студентів та інтеграція технологій цифрового навчання. Визначено основні підходи до персоналізації навчання, що передбачають побудову індивідуальної освітньої траєкторії, адаптацію навчального матеріалу до потреб та можливостей студентів, систематичне оцінювання результатів та корекцію освітнього процесу.

Ключові слова: тьютор, тьюторинг, функції тьютора, тьюторська технологія, умови впровадження тьюторської технології, індивідуальна освітня траєкторія, студентоцентроване навчання, будівельна механіка.

Pochka K.I, Maksymiuk Yu.V., Krasylnyk Yu.S., Korchova H.L., Rudenko M.V.

CONDITIONS FOR IMPLEMENTING TUTORIAL TECHNOLOGY IN TEACHING CONSTRUCTION MECHANICS

The conditions for implementing tutoring technology in teaching construction mechanics have been established, covering pedagogical, organisational, material, technical and psychological aspects of the educational process. Pedagogical conditions include training teachers as tutors, developing methodological strategies for individual and group support of students, and creating teaching and methodological support that promotes the development of competencies of future professionals.

Organisational conditions include optimising the structure of the educational process, determining the mode of interaction between the teacher as a tutor and students, planning training modules, and coordinating work between departments and laboratories. Material and technical conditions provide access to modern teaching aids, digital platforms, laboratory equipment and electronic resources, enabling personalised learning and active practical activities. Psychological conditions consist of creating an atmosphere of trust, motivation, support for independence and responsibility among students, which shapes their readiness for professional development and self-improvement. The structural components of the tutorial technology for teaching construction mechanics are revealed, among which the target, content, technological, activity and result blocks are distinguished. The target component determines the directions of training and program learning outcomes, while the content component shapes the content of the educational process in accordance with standards and competency requirements. The technological component includes methods, techniques and tools of tutoring support, the activity component involves specific activities of students and tutors, and the result component evaluates the effectiveness of learning and the achievement of educational goals. The key determinants of the effectiveness of tutoring support for students are substantiated, among which the level of pedagogical competence of the tutor, the degree of individualisation of learning, the motivational potential of students and the integration of digital learning technologies are highlighted. The main approaches to personalising learning are identified, which involve building an individual educational trajectory, adapting learning material to the needs and abilities of students, systematic assessment of results, and correction of the educational process.

Keywords: tutor, tutoring, tutor functions, tutoring technology, conditions for implementing tutoring technology, individual educational trajectory, student-centred learning, structural mechanics.

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У контексті реалізації компетентнісного підходу та студентоцентрованої парадигми освіти визначено умови впровадження тьюторської технології у викладанні будівельної механіки, що охоплюють педагогічний, організаційний, матеріально-технічний і психологічний аспекти. Систематизовано структурні компоненти тьюторської технології – цільовий, змістовий, технологічний, діяльнісний і результативний, які забезпечують формування професійних компетентностей здобувачів вищої освіти. Обґрунтовано детермінанти ефективності тьюторського супроводу студентів, серед яких провідними є педагогічна майстерність викладача, індивідуалізація освітніх траєкторій, мотиваційний потенціал здобувачів та інтеграція цифрових технологій в освітній процес.
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In the context of implementing a competency-based approach and a student-centred paradigm of education, the conditions for introducing tutoring technology in teaching construction mechanics have been defined, covering pedagogical, organisational, material, technical and psychological aspects. The structural components of tutoring technology – target, content, technological, activity and result – have been systematised, ensuring the formation of professional competencies in higher education students. The determinants of the effectiveness of tutoring support for students are substantiated, among which the leading ones are the pedagogical skills of the teacher, the individualisation of educational trajectories, the motivational potential of students and the integration of digital technologies into the educational process.
Fig. 6. Refs. 33.

Автор (науковий ступінь, вчене звання, посада): доктор технічних наук, професор, член-кореспондент НАПН України, завідувач кафедри професійної освіти КНУБА ПОЧКА Костянтин Іванович
Адреса: 03037, Україна, м. Київ, проспект Повітряних Сил, 31, Київський національний університет будівництва і архітектури, кафедра професійної освіти, ПОЧЦІ Костянтину Івановичу
Тел.: +38(044) 241-55-28
E-mail: pochka.ki@knuba.edu.ua
ORCID ID: https://orcid.org/0000-0002-0355-002X

Автор (науковий ступінь, вчене звання, посада): доктор технічних наук, професор, професор кафедри будівельної механіки КНУБА МАКСИМ'ЮК Юрій Всеволодович
Адреса: 03037, Україна, м. Київ, проспект Повітряних Сил, 31, Київський національний університет будівництва і архітектури, кафедра будівельної механіки, МАКСИМ'ЮКУ Юрію Всеволодовичу
Тел.: +38(044) 241-55-38
E-mail: maksymiuk.iuv@knuba.edu.ua
ORCID ID: https://orcid.org/0000-0002-5814-6227

Автор (науковий ступінь, вчене звання, посада): доцент кафедри професійної освіти КНУБА КРАСИЛЬНИК Юрій Семенович
Адреса: 03037, Україна, м. Київ, проспект Повітряних Сил, 31, Київський національний університет будівництва і архітектури, кафедра професійної освіти, КРАСИЛЬНИКУ Юрію Семеновичу
E-mail: krasulnyk.yus@knuba.edu.ua
ORCID ID: https://orcid.org/0000-0003-0358-0066

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Автор (науковий ступінь, вчене звання, посада): доцент кафедри професійної освіти КНУБА КОРЧОВА Галина Леонідівна
Адреса: 03037, Україна, м. Київ, проспект Повітряних Сил, 31, Київський національний університет будівництва і архітектури, кафедра професійної освіти, КОРЧОВІЙ Галині Леонідівні
Тел.: +38(044) 241-55-28
E-mail: korchova.gl@knuba.edu.ua
ORCID ID: https://orcid.org/0000-0002-9082-0146

Автор (науковий ступінь, вчене звання, посада): доцент кафедри професійної освіти КНУБА Руденко Микола Васильович
Адреса: 03037, Україна, м. Київ, проспект Повітряних Сил, 31, Київський національний університет будівництва і архітектури, кафедра професійної освіти, РУДЕНКУ Миколі Васильовичу
Тел.: +38(067) 401-46-50
E-mail: rudenko.mv@knuba.edu.ua
ORCID ID: https://orcid.org/0000-0003-2069-0566