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PROFESSIONAL TRAINING OF FUTURE BACHELOR'S DEGREE HOLDERS IN TRANSPORT TECHNOLOGIES: TERMINOLOGICAL DISCOURSE

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Abstract

Relevance. The need to unify the terminological apparatus of bachelor's training in transport technologies stems from the necessity of consistent interpretation of key concepts and the modernization of educational standards and programs in line with the European Qualifications Framework (EQF) and the National Qualifications Framework (NQF).

Purpose – to theoretically justify and unify the basic concepts of the terminological field of professional training («vocational training» «professional competence», «methodological system», «engineering pedagogy», «digital education», «transport technologies») and to identify gaps between normative requirements and educational practice in technical higher education institutions (HEIs).

Methods: interpretive and content analysis of normative documents, comparative analysis of dictionary and encyclopedic sources, semi-structured interviews with students, faculty, and employers.

Results. A structured scheme of the terminological field has been developed, with a central core of «vocational training» and related concepts. A gap has been identified between the competence requirements of EQF/NQF (knowledge – skills – communication – responsibility – autonomy) and the reduced perceptions of stakeholders («knowledge + skills»). Harmonized working definitions of key terms, aligned with European and national approaches, have been proposed.

Conclusions. The need to unify the terminological field for bachelor's training in specialty 275 Transport Technologies (by mode of transport) and harmonize it with EQF/NQF has been substantiated. The identified gaps between normative requirements and stakeholders' perceptions confirm the need to strengthen components of autonomy, responsibility, professional communication, and transversal skills in educational programs.

Keywords: *vocational training; professional competence; methodological system; engineering pedagogy; digital education; technical education; transport technologies.*

Introduction. Modern training of bachelors in the field of transport technologies is carried out under conditions of intensive transformation of higher technical education, digitalization of the educational process, and growing requirements for the effectiveness of graduates' professional activity. In accordance with European and national guidelines for the development of educational systems—specifically the European Qualifications Framework (EQF) and the updated National Qualifications Framework (NQF)—key learning outcomes at the bachelor's level are described by the dimensions of "knowledge – skills – communication – responsibility and autonomy," which sets a new conceptual configuration for the professional training of technical specialists. In this context, the issue of terminological consistency acquires particular weight, as it is precisely this that determines the accuracy of scientific conclusions, the validity of educational programs, and the

correctness of assessing competency-based results. However, an analysis of modern discourse demonstrates that in the interdisciplinary field of "pedagogy – engineering – logistics – digitalization," significant semantic fragmentation of key concepts is observed, which complicates scientific communication and reduces the comparability of research results.

The implementation of digital transformation technologies, the growing role of engineering pedagogy, and requirements for the integration of professional, technical, and transversal competencies actualize the need to form a unified terminological field that will rely on modern methodological approaches and respond to the challenges of technical education. Interaction with various groups of stakeholders attests to the presence of substantial gaps between regulatory requirements and the practices of their implementation. In particular, the EQF for the sixth level insists on results covering responsibility, autonomy, and professional communication alongside knowledge and skills (Council of the European Union, 2017), whereas in real descriptions of educational-professional programs (EPP) and in the perceptions of some subjects of the educational process, results are often narrowed to the formula "knowledge + skills" without a clear definition of the components of autonomy, responsibility, and communication. A similar gap is also traced between the state standards for specialty 275 Transport Technologies (by modes of transport) (which set competencies regarding the planning and organization of transportation processes, ITS/data integration, safety, and ecological sustainability) and the assessment practices of academic disciplines, where test instruments for checking knowledge predominate without authentic tasks that measure managerial decisions, work with data, or indicators of safety and sustainability (Ministry of Education and Science of Ukraine, 2018, 2024). Additionally, in the digital education block, international frameworks (OECD, UNESCO) offer an ecosystemic human-centric perspective and a requirement for evidence of the impact of digital tools on results, yet in the practice of technical HEIs, digitalization is often reduced to the instrumental use of platforms without integration into the design of competency-based results and substantiated criteria for their measurement (OECD, 2023; UNESCO, 2024). This, in turn, points to insufficient consistency of educational process components, for example, learning goals and outcomes with the

content of disciplines (syllabuses do not always reflect requirements for responsibility, autonomy, and professional communication), which determines the necessity of theoretical rethinking of the content and functions of main concepts.

Thus, the problem lies in the absence of a holistic and scientifically grounded terminological apparatus that would ensure unified approaches to the interpretation of key concepts and serve as a foundation for the modernization of the professional training of future specialists in transport technologies. The relevance of solving this problem is conditioned both by scientific tasks—the construction of correct theoretical models, methodological bases, and conceptual schemes—and by practical ones—updating the content of educational programs, improving the quality of training, and increasing the conformity of graduates to labor market demands. Comprehensive systematization of terms in the context of engineering pedagogy and the digital transformation of education provides opportunities for increasing the consistency of standards, ensuring the transparency of professional qualifications, and forming an effective methodical system in technical higher education institutions.

Therefore, the problem of the terminological discourse of professional training in the technical field is determining for ensuring the effectiveness and modernity of the educational process. Its solution is directly connected with the formation of a competent, responsible, and mobile specialist capable of acting under conditions of uncertainty, technological dynamics, and the growing digitalization of transport systems.

Sources. The theoretical basis of the research is constituted by four complementary blocks of sources, which include: normative-framework documents (European and national), state standards of specialty 275 Transport Technologies (by modes of transport), terminological and encyclopedic reference books of the transport sphere, as well as policies on the digital transformation of education. Their synthesis ensures a unified conceptual field that makes it possible to compare framework expectations with the current educational practice of technical HEIs.

The European Qualifications Framework (EQF) defines learning outcomes in the categories of knowledge, skills, and competence, concretized through responsibility and autonomy. The National Qualifications Framework, compatible with the EQF, additionally singles out the dimension of

communication, which influences the interpretation of the competencies of a bachelor graduate of a technical profile.

State standards of specialty 275 "Transport Technologies" for the first (bachelor's) and third (educational-scientific) levels of higher education concretize learning outcomes through a system of professional competencies, thereby setting the engineering-organizational-digital character of the concept "transport technologies" (MES of Ukraine, 2018; MES of Ukraine, 2024).

Terminological and encyclopedic sources of the transport sphere in this research served to unify terms, for example, the Glossary for Transport Statistics (UNECE–ITF–Eurostat), which ensures the consistency of statistical definitions between countries and modes of transport (Eurostat, ITF (OECD), & UNECE, 2019). Leading encyclopedic publications reflect the evolution of transport technologies from a material basis to digital platforms and automation (Britannica Editors, 2026; Vickerman, 2021).

International documents (OECD Digital Education Outlook 2023; UNESCO Six Pillars) and the JRC DigCompEdu framework set a pedagogically grounded approach to the integration of technologies into learning, teaching, management, and assessment (OECD, 2023; UNESCO, 2024; Redecker & Punie, 2017). The National Concept for the Development of Digital Competencies concretizes requirements for the digital literacy of instructors and learners and supports institutional initiatives for mass access to learning (Decree of the Cabinet of Ministers of Ukraine, 2021).

Collectively, these sources outline the boundaries of key definitions ("professional training," "professional competence," "methodical system," "transport technologies," "digital education") and serve as a foundation for building the author's terminological framework and further harmonization with the EQF/NQF and standards of specialty 275 Transport Technologies (by modes of transport) (Council of the European Union, 2017; Resolution of the Cabinet of Ministers of Ukraine, 2011; MES of Ukraine, 2018, 2024; Eurostat et al., 2019; OECD, 2023; UNESCO, 2024; Redecker & Punie, 2017).

The goal of the article lies in the theoretical substantiation and unification of key concepts of the terminological field of professional training of future bachelors in transport technologies (specifically: "professional training," "professional competence," "methodical system," "engineering pedagogy," "digital education," "transport technologies") in accordance with the requirements of the EQF/NQF and higher education standards for specialty 275 Transport Technologies (by modes of transport), as well as in identifying and explaining gaps between framework normative prescriptions and practices of their implementation in technical HEIs, with the subsequent formulation of methodical guidelines for the harmonization of educational design.

Methods. Interpretative analysis of scientific and normative sources was applied; content analysis of standards and frameworks (EQF/NQF); semi-structured interviews with learners (n=31), instructors of professionally oriented specialized disciplines (n=16), and stakeholders (n=7), aimed at identifying the meanings they invest in key concepts ("professional training," "professional competence," "methodical system," "engineering pedagogy," "digitalization of education").

Results and Discussion. The terminological field of the research is outlined by the issues of professional training of future bachelors in specialty 275 "Transport Technologies" (by modes) in institutions of higher technical education; its structural representation is presented in Fig. 1.

Fig. 1. Structural scheme of the terminological field with visualization of key concepts of the research topic and their interconnections (Source: developed by the author)

In accordance with the aim of the research, an interpretative review of normative sources was carried out, which makes it possible to define the categorical-conceptual apparatus of the study. The focus of our attention was centered on a number of definitions, namely: professional competence, methodical system, educational process, engineering pedagogy, digital education, technical education, transport technologies. Basing on the results of the analysis of normative documents, we note that within the framework of the EQF and the updated NQF, these connections are logically organized around learning outcomes in the dimensions of "knowledge – skills – communication – responsibility – autonomy," where the sixth level (bachelor's) sets the requirement for managing complex types of activities (projects) and making decisions under conditions of uncertainty (Council of the European Union, 2017; Resolution of the Cabinet of Ministers of Ukraine, 2011).

Let us examine the essence of the aforementioned definitions that align with qualifications frameworks and higher education standards for the specialty. Thus, the term "professional training" is formulated as a systemically organized process of achieving learning outcomes of the sixth (bachelor's) level of the EQF/NQF in the field of "Transport," which ensures the ability for independent decision-making, professional communication, and responsibility in

typical and atypical production-transport situations. The definition "professional competence" is an integral ability to act effectively under conditions of uncertainty on the basis of a combination of knowledge, skills, communication, responsibility, and autonomy (Council of the European Union, 2017; Resolution of the Cabinet of Ministers of Ukraine, 2011).

Effective formation and reliable assessment of the components of professional competence of bachelors in transport technologies is ensured by the methodical system, which translates expected results into a managed educational process – from goals and content to mechanisms, methods, and tools; it is holistic and algorithmized to the specifics of the specialty. N. Nychkalo (2000) defines a methodical system as a constituent part of the methodology of a certain academic subject, which covers: methodology of research, methodology of the academic subject; general methodology of a complex of interconnected subjects (various foreign languages; natural science disciplines, etc.); methodology of educational work, methodology of training teacher personnel, etc. (Nychkalo, 2000, p.183). 275 (MES of Ukraine, 2018; MES of Ukraine, 2024).

Besides this, the methodical system must align with EQF/NQF descriptors, and therefore a need arises for an instrument that ensures the transfer of these framework requirements into

concrete educational designs, methods, and tools. Such a function in our research is performed by engineering pedagogy as a conceptual and technological "bridge" between the provisions of the EQF/NQF and content-methodical practices of training bachelors of specialty 275 "Transport Technologies (by modes)." It ensures pedagogical design and algorithmization of the methodical system (goals → content → mechanisms → methods → tools → assessment) for measurable results required by the EQF/NQF and concretized in state standards for the indicated specialty (MES of Ukraine, 2018; MES of Ukraine, 2024). Substantively, engineering pedagogy integrates engineering content, didactics, and work-based learning (WBL), translating the engineering-organizational-digital character of "transport technologies" (ITS/data, safety, sustainability, efficiency) into authentic educational situations (cases, projects, production tasks), by means of which the competencies of graduates are verified. In this way, engineering pedagogy: firstly, ensures the unification of terms and requirements (from EQF/NQF frameworks to courses and syllabuses); secondly, strengthens the evidence base of digitalization (selection of impact tools according to OECD/UNESCO, DigCompEdu); thirdly, guarantees the transfer of learning results into typical and atypical production-transport situations where the graduate demonstrates independent decision-making and professional communication at a high level of responsibility and autonomy (OECD, 2023; UNESCO, 2024; Redecker & Punie, 2017). Thus, engineering pedagogy is a methodological and technological platform for designing and implementing the professional training of bachelors in transport technologies, converting framework EQF/NQF requirements and standards into managed educational design and verifiable results in WBL and case formats.

The next step in scientific explorations is defining and comprehending the digital component of educational design. If engineering pedagogy sets methodological and technological principles for transferring framework requirements into practice, the concept "digital education" defines the ecosystem conditions and tools for their implementation and evidence-based verification: from data management and impact indicators on specialist training, as well as professional development of instructors. In this context, international frameworks serve as guidelines on data management and system design (OECD, 2023);

UNESCO Six Pillars (UNESCO, 2024) – coordination, infrastructure, sustainability, capacity, content/solutions, data/evidence, and JRC DigCompEdu (Redecker & Punie, 2017) – digital competencies. Their coordinated application allows translating WBL and case formats from the level of instrumental use of platforms to the level of pedagogically motivated, data-confirmed digital transformation for expected results in training bachelors in specialty 275 Transport Technologies (by modes of transport).

We believe that precisely on this foundation it is appropriate to clarify the base subject of professional training – "transport technologies" – as an object of learning and assessment, relying on unified terminology and statistical standards of transport to avoid semantic discrepancies between subsystems of the field and educational programs. In this research, transport technologies are defined as an engineering-organizational-digital complex of technical means, infrastructure, processes, and ITS/data aimed at efficient and safe transportation of passengers and cargo (Eurostat, ITF (OECD), & UNECE, 2019).

As a next step, we must clarify the essence of the concept "technical education" as a system of training specialists for engineering-rich spheres (specifically transport) combining fundamental natural science and engineering training with applied technological components, methodology of design and operation of technical systems, as well as modern digital tools for analysis, modeling, and management. In other words, technical education sets a framework for competence formation and assessment in which "transport technologies" act as the subject core of content, and engineering pedagogy and digital education ensure didactic mechanisms and substantiated assessment of results.

Thus, a common language for describing phenomena and results is outlined. It is here that terminological discourse acquires a system-forming role: a) it consolidates the conceptual apparatus; b) it cultivates flexible, context-sensitive scientific thinking necessary for solving complex theoretical and practical tasks of the methodology of organizing the educational process for training bachelors in transport technologies. At the same time, such discourse encompasses the ordering of conceptual series reflecting the specifics of the transport field as a multi-level scientific-technical system integrated from engineering, logistics, managerial, and digital components.

Given the applied nature of professional training and its orientation toward satisfying labor market needs, we believe that the interpretation of the categorical-conceptual apparatus of the research cannot be limited only to normative interpretations of the essence of outlined concepts. Therefore, to achieve the aim of the research, theoretical generalizations and studies of subjective perceptions and professional experience of key stakeholders – employers, instructors, and learners, who comprehend the essence and results of professional training differently – are necessary. This, in turn, determines the choice of such qualitative research methods that ensure depth, flexibility, and contextual sensitivity of the data obtained. In this context, it is expedient, from our point of view, to use the semi-structured interview as a method of collecting empirical data for the interpretative analysis of concepts.

If we compare domestic and international normative-conceptual documents with the empirical perceptions of educational process participants, one can see a gap between the formally established competency model of professional training and its perception in the practice of higher technical education. Thus, formulated normative definitions often fixate on the program-procedural side of training, whereas the EQF and NQF (for the sixth level) describe a qualification through results, among which emphasis is placed on the ability to manage complex types of activities and make decisions autonomously with an appropriate measure of responsibility. This expands the traditional pair "knowledge – skills" to at least "knowledge – skills – responsibility – autonomy" supplemented by communication.

Consequently, the concept "professional training" is a complex, multidimensional phenomenon. Its content and functional substance are formed at the intersection of normative-legal requirements, international educational guidelines, and practical meanings attributed to it by participants of the educational process.

In the understanding of employers, professional training implies possession of theoretical knowledge, the ability to apply it in practice, and readiness for independent solving of professional tasks (42.9%). The same proportion of respondents (42.9%) reduces professional training primarily to practical application of knowledge, and 14.3% emphasize only readiness for independent solving of professional tasks. The majority of learners (87.1%) interpret professional training as a combination of theoretical knowledge and practical skills necessary for the future profession. Among instructors of professionally oriented disciplines, 68.8% invest primarily theoretical knowledge into the content of the concept; 18.8% – practical skills and ability for self-learning; 6.3% – social and communicative skills, while another 6.3% found it difficult to answer.

Thus, stakeholder perceptions regarding the essence of professional training generally align around a combination of theoretical knowledge and practical skills, however, they differ in emphasis: employers orient primarily on practicality and autonomy in performing professional tasks, learners – on integration of theory and practice, and instructors – on the dominance of the theoretical component with gradual recognition of the role of practical and social competencies. This attests to the need for a balanced model of training combining knowledge, practical, and activity components. In this model, it is necessary to consider transversal skills as an obligatory content component of professional training. It is communication, teamwork, and the ability to present and argue results that ensure the transfer of acquired knowledge and skills into real professional contexts, reinforcing the autonomy and responsibility of the future specialist. This dimension is clearly articulated in the "Dublin Descriptors" (Bologna Working Group on Qualifications Frameworks [BWGQF], 2005), where among expected training results at different cycles of higher education, the ability to communicate effectively with professional and non-professional audiences, cooperate, and make substantiated decisions in a team is defined. In a situation of increasing interdisciplinarity, precisely these competencies become the "connective tissue" between theory, practice, and innovations. At the same time, results of our surveys indicate that this component often remains out of focus for educational process participants.

Results of interviewing higher education learners attested to a predominantly practice-oriented interpretation of professional competence, understanding it as the ability to apply knowledge, abilities, and skills in practice (81.7%), whereas a part of respondents (12.9%) limits it to the sphere of professional knowledge. Instructors also adhere to a pragmatic approach, yet often interpret professional competence within the traditional didactic paradigm, emphasizing primarily content mastery. The positions of employers are more varied: 42.9% view competence as a complex of knowledge, skills,

and readiness for independent decisions; the same amount – as the ability to apply knowledge in practice; 14.3% focus primarily on autonomy in professional activity. Overall, empirical perceptions of all groups confirm the dominance of an activity-based, practice-oriented vision of professional competence.

Thus, summarizing the results of interviewing different groups of respondents gives grounds to assert that professional competence in the consciousness of educational process participants and stakeholders is predominantly associated with practical ability to act in the professional sphere, whereas such components as responsibility, autonomy, reflexivity, and value-motivational orientation remain insufficiently articulated, especially in the views of learners and instructors. At the same time, it is the position of employers that most closely approaches the modern competence-based understanding of professional competence as an integral characteristic of personality that goes beyond possession of knowledge and skills and reflects the specialist's readiness for independent, responsible professional activity.

Regarding the concept "engineering pedagogy," we note that according to the data of the National Repository of Academic Texts database for the last quarter of the 21st century, close to 30 dissertation works have been identified in which it acts as a theoretical basis of research or an independent object of scientific analysis. Generalization of results of studying dissertations and professional publications makes it possible to single out four leading approaches to its interpretation. Specifically, within the disciplinary approach, it is viewed as an integration of pedagogy, psychology of learning, and engineering sciences, serving as a theoretical basis for forming professional and pedagogical competencies of future engineers and engineer-pedagogues (Tymkiv, 2020). The integrative-competency approach, which dominates in recent research, defines engineering pedagogy as a system of integrating engineering and pedagogical knowledge aimed at developing professional, didactic, and social-communicative competencies (Ivanushko, 2022). In the activity-methodological approach, it appears as a methodology of designing the educational process in technical education and a totality of principles and technologies of training engineers, which is characteristic primarily for works in the sphere of vocational and professional pre-higher education (Ivanushko, 2022). The sociocultural and international approach interprets engineering pedagogy as an instrument for developing human capital and ensuring the quality of engineering education in accordance with IGIP standards and requirements of the European Higher Education Area (Tymkiv, 2020). Consequently, the modern understanding of engineering pedagogy is characterized by a plurality of interpretations, among which the leading one is the integrative-competency approach, since it corresponds most to current tendencies of development of technical education and training of engineering personnel.

Analysis of stakeholder views on the essence and role of engineering pedagogy in training future specialists revealed significant differences between groups. Thus, employers demonstrate a fragmented understanding: part of them (28.6%) acknowledge engineering pedagogy as an important source of modern approaches to learning, whereas the same proportion assigns it a secondary place, prioritizing production experience. Another 14.3% do not consider it significant, and the rest either hesitate or do not identify the concept, which attests to uneven awareness regarding its potential. The position of instructors is more consistent: 56.3% grant engineering pedagogy key significance in forming the methodical system of learning, whereas 31.3% view it as secondary to the content filling of disciplines. This reflects the tension characteristic of technical education between methodology ("how to teach") and subject content ("what to teach"). Among learners, a positive and practice-oriented attitude dominates: 51.6% consider engineering pedagogy a source of modern techniques and development of engineering thinking, 35.5% emphasize its role in understandable and structured teaching of technical disciplines. The obtained empirical data make it possible to generalize results: 1) within the academic environment (instructors, students) there is a consensus regarding the importance of engineering pedagogy; among employers – a fragmented and partially insufficiently informed vision; 3) common to all groups remains the need for practice-oriented, accessible, and technologically modern methodologies capable of developing engineering thinking and being effective in production conditions.

The study of scientific sources made it possible to single out several approaches to interpreting the concept "methodical system." Within the systemic-didactic approach, this phenomenon is defined as a holistic unity of goals,

content, internal mechanisms, methods, and tools of a specific way of learning; herein methods act as instruments of realizing goals and content taking into account psychological mechanisms of learning (Malafiiik, 2005). According to the integrative-linguodidactic approach, the methodical system is interpreted as an integrative category combining theoretical modeling and practical implementation of interconnected elements aimed at achieving high results of professional training (Druzhenenko, 2016). In classical didactics, a methodical system is viewed as a way of constructing learning – a coordinated complex of methods selected according to principles, goals, content, capabilities of learners, and conditions of learning; such a system ensures predictable sequencing of method application according to leading psychological mechanisms of learning. Generalizing these approaches allows defining the essence of the concept "methodical system" as a holistically designed organization of the educational process that integrates the goal and content of learning, psycho-didactic mechanisms, methods, and tools into an interconnected structure oriented toward theoretical modeling and practical implementation of educational activity. Such a system implies algorithmized, context-conditioned selection and combination of methods according to principles of learning, conditions, resources, and characteristics of learners (Druzhenenko, 2016; Concept of methodical systems, n.d.; Yahupov, n.d.).

Survey results allowed outlining perceptions of different respondent groups about the essence of the methodical system. Learners mostly perceive it as clearly structured and modern (64.5%), ensuring conformity of training to labor market requirements. At the same time, 22.6% point to the need for its updating, and 9.7% are not familiar with the concept itself, which reflects a certain terminological inconsistency in the student environment. In turn, instructors of professionally oriented disciplines demonstrate a predominantly situational-contextual approach to organizing the methodical system: 75% combine methods depending on the learning situation, and 25% purposefully use modern methods and digital tools. This indicates dominance of constructive logic of building learning – not as a set of methods, but as their thoughtful combination according to goals, content, and conditions.

Interesting, in our opinion, is the understanding of this concept by employers, who emphasize practical utility of methodical system elements. The predominant proportion (71.4%)

simultaneously defines three priorities: practical training at enterprises, use of modern technologies, and systemic cooperation of HEIs with employers; in smaller subgroups (14.3% each) a focus only on practice or only on partnership is singled out. This reflects expectations of a holistic and coordinated configuration of elements ensuring transition from learning to professional activity. Summarizing results, we must attest to gradual convergence of respondent perceptions toward understanding the methodical system as a structured, context-conditioned, and practice-oriented way of organizing learning. At the same time, among learners and part of instructors a tendency is recorded to simplify this concept to "modernity" or "a set of methods," without taking into account internal psycho-didactic mechanisms and algorithmized design.

Thus, empirical assessments show concentration of interview participants on structuredness, modernity, practice, digital tools, and cooperation with employers. They partially align with scientific approaches but require supplementation with systemic components: a clear model of goals and content, defined internal mechanisms, and context-sensitive combination of methods ensuring reproducibility and guaranteed nature of training results.

In accordance with the Law of Ukraine "On Education" (2017), the educational process is understood as a "system of scientific-methodical and pedagogical measures aimed at development of personality through formation and application of its competencies." In our research, this definition is used as a conceptual basis. Simultaneously, results of interviewing different groups of respondents attested that employers are unambiguously oriented toward practical direction of the educational process: 71.4% emphasize necessity of forming practical skills, using flexible programs, and close cooperation with business, whereas 28.6% focus only on practical component of training without accent on institutional interaction. In our view, such assessments reflect labor market demand for an applied educational process approximated to real conditions of professional activity. Instructors of higher technical education institutions predominantly support integration of theoretical and practical components of training (68.8%), which corresponds to academic traditions. Another 25% indicate importance of using modern technical and laboratory equipment, and individual respondents emphasize significance of independent work of

learners, connecting it with development of autonomy and responsibility. In survey results of learners two dominant interpretations of the educational process can be distinguished: for 64.5% it is purposeful interaction of students and instructors aimed at forming professional competencies, whereas 35.5% identify it with totality of lectures, practical and laboratory classes. The latter testifies to prevalence of formally organizational, rather than competence-based vision of the educational process.

Summarizing obtained empirical data, it is necessary to pay attention to notable differences between groups: employers emphasize practicality and flexibility of the educational process; instructors – integration of theory and practice and resource provision; learners – predominantly its organizational forms. This confirms necessity of updating content and methods of organizing the educational process to ensure its competence orientation and balance expectations of all stakeholders.

Quite debatable is the essence of the concept "technical education," which in Ukrainian tradition of its comprehension is defined as component of professional, technological, and engineering-pedagogical training. Such a point of view is presented in works of domestic scholars O. Abramov et al. (2024); L. Potapiuk (2018); Yu. Rashkevych and T. Semyhina (2025). It should be noted that despite absence of normatively fixed definition, in these studies concept "technical education" functions within stable conceptual field. Basing on results of studying essence of technical education, one can conclude that in scientific works this term is presented as: a) component of professional education aimed at training specialists of technical and technological profile; b) competence-oriented educational process resulting in formed integral, general, and professional competencies relevant to dynamic technological environment; c) integrative system combining engineering-technical, psycho-pedagogical, and sociocultural components of training; d) resource for development of human capital and innovative economy. In such vision technical education appears as holistic, multidimensional process of professional direction oriented toward combining technical knowledge, competencies, and values necessary for activity in sphere of technique and technologies and for sustainable development of society.

Generalizing cited approaches, one can state that modern Ukrainian interpretations of category "technical education" are gradually converging with European ones according to logic of competence orientation and integrativity of training. At the same time domestic definitions remain mostly generalized and oriented toward procedural character of educational activity, whereas European approaches are distinguished by greater normative structuredness and clear result orientation within TVET and Engineering Education frameworks. In these approaches technical education is viewed as means of developing professional, social, and personal capability of specialist (Rashkevych & Semyhina, 2025; UNESCO UNEVOC, 2008; Rauner & Maclean, 2008).

The revealed conceptual discrepancies in defining the social function of technical education— the economocentric accent in domestic discourse and the human-centric orientation of European approaches—require empirical verification at the level of attitudes of different respondent groups. With this aim, a survey of employers, instructors, and learners was conducted, the results of which made it possible to assess the degree of consistency of their perceptions with modern conceptual approaches. It was found that the majority of learners (83.9%) understand technical education as an integration of theory, practice, and innovations, which testifies to an integrative vision of its essence formed in the student environment. Another 12.9% interpret it as a system of knowledge in technical disciplines, whereas other representatives of this surveyed group found it difficult to answer. Among instructors, a complex assessment of challenges and prospects for the development of technical education dominates. The multiple choice of the majority of respondents (68.8%) outlines three coordinated priorities: updating content, digitalization, and increasing the motivation of learners. At the same time, other positions were also revealed: 18.8% emphasize exclusively motivation, and 6.3% each – only digital technologies or only content updating. The totality of answers attests to a consensus regarding key directions of technical education modernization.

Thus, the obtained data demonstrate consistency between the student interpretation of technical education as a combination of theory, practice, and innovations and the instructor vision of its development through content modernization, implementation of EdTech tools, and strengthening of motivational strategies. This confirms the relevance of the human-centric and competency-practical trajectory of technical education

development and concretizes directions for its updating – curriculum redesign, integration of digital technologies, and formation of a motivational educational environment. Employers were proposed to assess the level of technical education of bachelor graduates in specialty 275 Transport Technologies. Almost unanimously critical assessments were obtained: 42.9% believe that training requires improvement, another 42.9% – that it does not meet labor market requirements, and only 14.3% assess it as corresponding to modern requirements. These results confirm the employers' demand for strengthening the practical component, updating content, and broader integration with the production environment.

Relying on the analysis of policies and scientific-analytical sources, it was established that in international discourse the concept "digital education" is interpreted ecosystemically and human-centrically: from frameworks of digital competencies and pedagogically grounded integration of technologies to systemic policies of digital transformation and indicator models of assessment (OECD; UNESCO). The Ukrainian approach, instead, gravitates toward an institutional-environmental definition, with an emphasis on the development of digital competencies of citizens and educators and the expansion of access through national platforms and programs (Concept of Digital Competence Development; "Diia.Osvita").

Within the limits of this research, digital education is viewed as a systemic transformation of the educational process and its management based on digital technologies and data, which creates criteria for assessing effectiveness in the dimensions of quality, personalization, inclusivity, and evidence-based practice. Further analysis is directed at the empirical identification of how these guidelines are perceived by the main subjects of the educational process.

Survey results of learners demonstrate a predominantly positive attitude toward digitalization: 83.9% believe that it improves the quality of training thanks to access to modern resources and technologies. At the same time, 9.7% point to information overload, and 6.5% do not note a substantial influence of digitalization. This makes it possible to outline both dominant perceptions of positive effects and risk zones requiring methodical correction.

The positions of other groups align with these tendencies, yet have their own emphases. Among instructors, 87.5% note that digitalization reinforces the innovativeness and flexibility of learning. Among employers, 71.4% share a positive attitude, whereas 14.3% express reservations, linking excessive use of digital tools with risks of formal learning and a decrease in the level of critical thinking.

Consequently, empirical data attest to a generally positive perception of the digital transformation of education by all respondent groups, which confirms its potential as a factor in improving the quality and flexibility of professional training. At the same time, the revealed reservations actualize the need for managed and methodically substantiated digitalization aimed at reducing information overload, developing critical thinking, and ensuring a balanced combination of digital and traditional educational practices.

Within the limits of this research, it is important to clarify the content of the concept "transport technologies," which in professional dictionaries and sectoral glossaries is interpreted as a set of technical means, infrastructure, operational processes, and digital systems ensuring the movement of passengers and cargo. International terminological frameworks emphasize the integrated character of this concept, within which transport technologies cover not only the material component but also standards, algorithms, rules, and information systems ensuring the efficiency and safety of transport processes (UNECE, ITF & Eurostat).

Encyclopedic sources supplement this understanding with a systemic and evolutionary vision: from historical technical solutions to modern high-speed and digital mobility systems. In Britannica, transport technologies are represented as a dynamic complex of means and modes of movement, whereas the International Encyclopedia of Transportation emphasizes their interdisciplinarity, integration with logistics, safety, traffic management, modeling, and the influence of new technologies – AI, automation, big data. At the level of European standardization, ITS is defined as the application of ICT to transport, which is a key subsystem of transport technologies in the digital dimension.

In Ukrainian standards of specialty 275 "Transport Technologies (by modes)," the concept is disclosed through competency-based results connected with planning and organizing the transportation process, managing flows, safety, using ITS and digital systems, as well as the logistic interaction of transport modes. Typical educational-

professional programs detail it as applied engineering-organizational activity aimed at optimizing transportation processes with the help of engineering methods and digital tools.

Scientific sources interpret transport technologies as mechanisms of technical and organizational improvement of transport systems – reducing time, cost, and risks through the implementation of alternative energy types, intelligent transport systems, automation, digital platforms, and logistic integration (Button & Hensher, 2001; Annema, 2023). Regional frameworks of UN ESCAP supplement this vision with an emphasis on transport digitalization, smart solutions, ITS, big data, and automated network management (UN ESCAP, 2019; UN ESCAP, 2024).

Generalization of the researched literature confirms that the term "transport technologies" in modern approaches means the innovative contour of the transport system combining technique, infrastructure, digital solutions, and logistic algorithms for the purpose of increasing the efficiency, safety, and sustainability of transport networks (Annema, 2023; UN ESCAP et al., 2019).

Thus, within the limits of this research, it is expedient to use the definition of the concept "transport technologies" as an integrated totality of technical means, infrastructure, organizational methods, and digital solutions (ITS/data) ensuring efficient, safe, inclusive, and ecologically sustainable movement of passengers and cargo, aligned with international terminological frameworks and modern approaches to digitalization.

Conclusion. The research substantiates the necessity of unifying the terminological field of professional training of bachelors in specialty 275 "Transport Technologies" and its harmonization with the EQF/NQF, which ensures correct design of learning outcomes in the dimensions "knowledge – skills – communication – responsibility – autonomy." A gap was revealed between framework requirements and perceptions of stakeholders, who often reduce competence to the formula "knowledge+skills"; this requires strengthening components of autonomy, responsibility, professional communication, and transversal skills in the content of EPP. The methodical system must act as an instrument of transferring framework requirements into managed educational design (goals → content → mechanisms → methods → tools → assessment), while engineering pedagogy and digital education – ensure pedagogically motivated, data-confirmed solutions and authentic assessment. Empirical data attested to student support for the integration of theory, practice, and innovations, instructor consensus regarding content updating, digitalization, and motivation, as well as the employer demand for strengthening the practical component and integration with production. In connection with this, in the future practice of professional training of future bachelors, it is necessary to use authentic assessment more broadly, institutionalize the HEI – business dialogue, systemically develop transversal skills, and ensure the digitalization of the educational process.

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ПРОФЕСІЙНА ПІДГОТОВКА МАЙБУТНІХ БАКАЛАВРІВ З ТРАНСПОРТНИХ ТЕХНОЛОГІЙ: ТЕРМІНОЛОГІЧНИЙ ДИСКУРС

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Реферат:

Актуальність: потреба уніфікації термінологічного апарату професійної підготовки бакалаврів з транспортних технологій зумовлена необхідністю узгодженого тлумачення ключових понять і модернізації освітніх стандартів та програм відповідно до європейської (EQF) та Національної (НРК) рамок кваліфікацій.

Мета – теоретично обґрунтувати та уніфікувати базові поняття термінологічного поля професійної підготовки («фахова підготовка», «професійна компетентність», «методична система», «інженерна педагогіка», «цифрова освіта», «транспортні технології») та виявити розриви між нормативними вимогами й освітньою практикою у технічних ЗВО.

Методи: інтерпретаційний і контент-аналіз нормативних документів, порівняльний аналіз словникових та енциклопедичних джерел, напівструктуровані інтерв'ю зі здобувачами освіти, викладачами і роботодавцями.

Результати: сформовано структуровану схему термінологічного поля з центральним ядром «фахова підготовка» та пов'язаними поняттями; виявлено розрив між компетентнісними вимогами EQF/НРК (знання – уміння – комунікація – відповідальність – автономність) і редукованими уявленнями стейкголдерів («знання+навички»); запропоновано узгоджені з європейськими й національними підходами робочі дефініції ключових термінів.

Висновки: обґрунтовано необхідність уніфікації термінологічного поля підготовки бакалаврів зі спеціальності 275 Транспортні технології (за видами транспорту) та його гармонізації з EQF/НРК; виявлені розриви між нормативними вимогами та уявленнями стейкголдерів підтверджують потребу посилення в освітніх програмах компонентів автономності, відповідальності, професійної комунікації та трансверсальних умінь.

Ключові слова: *фахова підготовка, професійна компетентність, методична система, інженерна педагогіка, цифрова освіта, технічна освіта, транспортні технології.*