

МІНІСТЕРСТВО ОСВІТИ І НАУКИ УКРАЇНИ
УНІВЕРСИТЕТ ГРИГОРІЯ СКОВОРОДИ В ПЕРЕЯСЛАВІ

ПРОФЕСІЙНА ОСВІТА: МЕТОДОЛОГІЯ, ТЕОРІЯ ТА ТЕХНОЛОГІЇ

Том 11, № 1
2025

Науковий журнал



Переяслав
2025

MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE
HRYHORII SKOVORODA UNIVERSITY IN PEREIASLAV

PROFESSIONAL EDUCATION: METHODOLOGY, THEORY AND TECHNOLOGIES

Vol. 11, No. 1
2025

Scientific Journal



Pereiaslav
2025

Засновник:

Університет Григорія Сковороди в Переяславі

Рік заснування: 2015

Періодичність випуску: двічі на рік

*Рекомендовано до друку та поширення
через мережу Інтернет Вченою радою
Університету Григорія Сковороди в Переяславі
(протокол № 8 від 21 березня 2025 року)*

Ідентифікатор медіа: R30-04675

(Рішення Національної ради України з питань телебачення і радіомовлення
№ 1442, протокол № 14 від 25 квітня 2024 року)

Журнал включено до категорії «Б»

Переліку наукових фахових видань України. Спеціальності:

011 – Освітні, педагогічні науки; 012 – Дошкільна освіта; 013 – Початкова освіта;
014 – Середня освіта (за предметними спеціальностями);
015 – Професійна освіта (за спеціалізаціями); 016 – Спеціальна освіта; 231 – Соціальна робота
(Наказ Міністерства освіти і науки України № 409 від 17 березня 2020 року)

**Журнал представлено в таких міжнародних наукометричних базах даних,
репозитаріях та пошукових системах:**

Фахові видання України; Національна бібліотека України імені В.І. Вернадського;
Open Ukrainian Citation Index (OUCI); Google Академія; Crossref;
Dimensions; University of Oslo Library; OpenAlex, Litmaps; Ulrichsweb Global Serials Directory;
ERIH PLUS; Research4Life; GALE

Адреса редакції:

Університет Григорія Сковороди в Переяславі
08401, вул. Сухомлинського, 30, м. Переяслав, Україна
Тел.: +380 (44) 293-11-10
E-mail: info@profedu.com.ua
<https://profedu.com.ua/uk>

Founder:

Hryhorii Skovoroda University in Pereiaslav

Year of foundation: 2015

Frequency: semi-annual

*Recommended for printing and distribution
via the Internet by the Academic Council
of Hryhorii Skovoroda University in Pereiaslav
(Minutes No. 8 of March 21, 2025)*

Media identifier: R30-04675

(Decision of the National Council of Television and Radio Broadcasting of Ukraine
No. 1442, Minutes No. 14 of April 25, 2024)

**The journal is included in category “B”
of the List of scientific professional publications of Ukraine. Specialties:**

0111 – Education science; 0112 – Training for pre-school teachers;

0113 – Teacher training without subject specialisation;

0114 – Teacher training with subject specialisation; 0923 – Social work and counselling
(Order of the Ministry of Education and Science of Ukraine No. 409 dated March 17, 2020)

**The journal is presented in the following scientometric databases,
repositories and scientific systems:**

Professional Publications of Ukraine; Vernadsky National Library of Ukraine;
Open Ukrainian Citation Index (OUCI); Google Scholar; Crossref;
Dimensions; University of Oslo Library; OpenAlex, Litmaps; Ulrichsweb Global Serials Directory;
ERIH PLUS; Research4Life; GALE

Editorial office address:

Hryhorii Skovoroda University in Pereiaslav
08401, 30 Sukhomlynskyi Str., Pereiaslav, Ukraine
Tel.: +380 (44) 293-11-10
E-mail: info@profedu.com.ua
<https://profedu.com.ua/en>



Редакційна колегія

Головний редактор

Катерина Осадча

Доктор педагогічних наук, професор, провідний науковий співробітник Інституту цифровізації освіти Національної академії педагогічних наук України, Україна

Заступник головного редактора

Ірина Доброскок

Доктор педагогічних наук, професор, Університет Григорія Сковороди в Переяславі, Україна

Національні члени редколегії

Наталія Арістова

Доктор педагогічних наук, професор, Інститут педагогіки Національної академії педагогічних наук України, Україна

Роман Горбатюк

Доктор педагогічних наук, професор, Тернопільський національний педагогічний університет імені Володимира Гнатюка, Україна

Наталія Кушнір

Кандидат педагогічних наук, доцент, Херсонський державний університет, Україна

Ольга Набока

Доктор педагогічних наук, професор, Державний вищий навчальний заклад «Донбаський державний педагогічний університет», Україна

Наталія Пазюра

Доктор педагогічних наук, доцент, Національний авіаційний університет, Україна

Наталія Харченко

Доктор психологічних наук, професор, Університет Григорія Сковороди в Переяславі, Україна

Оксана Жерновнікова

Доктор педагогічних наук, професор, Харківський національний педагогічний університет імені Г.С. Сковороди, Україна

Олександр Коберник

Доктор педагогічних наук, професор, Уманський державний педагогічний університет імені Павла Тичини, Україна

Людмила Овсієнко

Доктор педагогічних наук, професор, Київський столичний університет імені Бориса Грінченка, Україна

Лариса Савченко

Доктор педагогічних наук, доцент, Криворізький державний педагогічний університет, Україна

Ольга Шапран

Доктор педагогічних наук, професор, Університет Григорія Сковороди в Переяславі, Україна

Міжнародні члени редколегії

Вінцентас Ламанаускас

Доктор соціологічних наук, професор, Шяуляйська академія Вільнюського університету, Литва

Марсел ван дер Клінк

Доктор філософії, викладач, Зюйдський університет прикладних наук, Маастрихт, Нідерланди

**Зелія Марія Джесус
Бреда**

Доктор філософії з туризму, доцент, Університет Авейру, Португалія



Міжнародні члени редколегії

Йоліта Ввайнхардт

Доктор соціальних наук, професор, Університет Вітовта Великого, Литва

Моніка Скура

Доктор філософії, доцент, Варшавський університет, Польща

Наталія Шяджувене

Доктор соціальних наук, професор, Шяуляйський державний університет прикладних наук, Литва



Editorial Board

Editor-In-Chief

Kateryna Osadcha | Doctor of Pedagogical Sciences, Professor, Leading Researcher at the Institute for Digitalisation of Education of the NAES of Ukraine, , Ukraine

Deputy Editor-in-Chief

Iryna Dobroskok | Doctor of Pedagogical Sciences, Professor, Hryhorii Skovoroda University in Pereiaslav, Ukraine

National Members of the Editorial Board

Nataliia Aristova | Doctor of Pedagogical Sciences, Professor, Institute of Pedagogy of National Academy of Educational Sciences of Ukraine, Ukraine

Roman Horbatiuk | Doctor of Pedagogical Sciences, Professor, Ternopil Volodymyr Hnatiuk National Pedagogical University, Ukraine

Nataliya Kushnir | PhD in Pedagogical Sciences, Associate Professor, Kherson State University, Ukraine

Olha Naboka | Doctor of Pedagogical Sciences, Professor, State Higher Educational Institution "Donbas State Pedagogical University", Ukraine

Nataliia Paziura | Doctor of Pedagogical Sciences, Associate Professor, National Aviation University, Ukraine

Nataliia Kharchenko | Doctor of Psychological Sciences, Professor, Hryhorii Skovoroda University in Pereiaslav, Ukraine

Oksana Zhernovnykova | Doctor of Pedagogical Sciences, Professor, H.S. Skovoroda Kharkiv National Pedagogical University, Ukraine

Oleksandr Kobernyk | Doctor of Pedagogical Sciences, Professor, Pavlo Tychyna Uman State Pedagogical University, Ukraine

Liudmyla Ovsiienko | Doctor of Pedagogical Sciences, Professor, Borys Grinchenko Kyiv Metropolitan University, Ukraine

Larysa Savchenko | Doctor of Pedagogical Sciences, Associate Professor, Kryvyi Rih State Pedagogical University, Ukraine

Olha Shapran | Doctor of Pedagogical Sciences, Professor, Hryhorii Skovoroda University in Pereiaslav, Ukraine

International Members of the Editorial Board

Vincentas Lamanuskas | Doctor of Sociological Sciences, Professor, Vilnius University Šiauliai Academy, Lithuania

Marcel van der Klink | PhD, Lecturer, Zuyd Hogeschool, Maastricht, Netherlands

Zélia Maria de Jesus Breda | PhD in Tourism, Associate Professor, University of Aveiro, Portugal



International Members of the Editorial Board

Jolita Vveinhardt	Doctor of Social Sciences, Professor, Vytautas Magnus University, Lithuania
Monika Skura	PhD, Associate Professor, University of Warsaw, Poland
Natalija Šedžiuvienė	Doctor of Social Sciences, Professor, Šiauliai State University of Applied Sciences, Lithuania

ЗМІСТ/CONTENTS

В. Лященко, І. Доброскок, А. Зарва

Вплив нейропедагогічних технік
на ефективність процесу навчання майбутніх менеджерів освіти 10

V. Lyashchenko, I. Dobroskok, A. Zarva

The impact of neuropedagogical teaching technologies
on the effectiveness of the learning process of future education managers 10

Т. Ковальчук, Г. Ткаченко

Методичні засади забезпечення якісної підготовки фахівців технічних спеціальностей
у закладах вищої освіти 22

T. Kovalchuk, H. Tkachenko

Methodological principles for ensuring high-quality training of technical specialists
in higher education institutions 22

Л. Філіпова, Д. Міллер

Особливості розвитку міжнародної академічної мобільності
українських студентів гуманітарного профілю в цифровому суспільстві 34

L. Filipova, D. Miller

Specific features of the development of international academic mobility
among Ukrainian humanities students in the digital society 34

О. Мкртічян, Н. Ржевська

Вплив міжнародного досвіду
на розвиток системи професійної освіти в Україні 46

O. Mkrtychian, N. Rzhevskya

The influence of international experience on the development
of the vocational education system in Ukraine 46

Є. Кузнєцов

Теоретичні засади розвитку цифрових навичок педагогів професійного навчання:
інноваційні інструменти, інтеграційні підходи 57

Ye. Kuznietsov

Theoretical foundations for the development of digital skills of vocational education teachers:
Innovative tools, integrative approaches 57

М. Вайнтрауб, І. Левченко, А. Литвин

Розвиток інформаційно-цифрових технологій в закладах вищої освіти 70

M. Vaintraub, I. Levchenko, A. Lytvyn

Development of information and digital technologies in higher education institutions 70

В. Різник, В. Носаченко

Філософія освіти як основа розробки інноваційних педагогічних технологій 80

V. Riznyk, V. Nosachenko

Philosophy of education as a basis for the development of innovative pedagogical technologies 80

Ю. Коваль

Адаптація навчальних програм до вимог ринку праці 93

Yu. Koval

Adaptation of curricula to labour market requirements 93



The impact of neuropedagogical teaching technologies on the effectiveness of the learning process of future education managers

Vira Lyashchenko*

PhD, Associate Professor

H.S. Skovoroda Kharkiv National Pedagogical University

61002, 29 Alchevskyyh Str., Kharkiv, Ukraine

<https://orcid.org/0000-0002-1698-8557>

Iryna Dobroskok

Doctor of Pedagogical Sciences, Professor

Hryhorii Skovoroda University in Pereiaslav

08401, 30 Sukhomlynskyi Str., Pereiaslav, Ukraine

<https://orcid.org/0000-0002-3937-8428>

Alina Zarva

Postgraduate Student

Hryhorii Skovoroda University in Pereiaslav

08401, 30 Sukhomlynskyi Str., Pereiaslav, Ukraine

<https://orcid.org/0009-0000-3542-4813>

■ **Abstract.** The purpose of the study was to determine the impact of neuropedagogical technologies on the effectiveness of the training process of future education managers. The research methodology included the use of the Emotional Intelligence Scale to assess the level of students' emotional intelligence before and after the introduction of neuropedagogical technologies, methods for assessing cognitive learning strategies, and a questionnaire for evaluating pedagogical effectiveness. The study involved 120 higher education students – future education managers and teachers. They were assessed on their ability to understand and manage their own emotions, as well as evaluated the impact of new pedagogical technologies on their learning process. The research focused on methods such as multimodal learning, action learning, emotional intelligence development, brainstorming with neuropedagogical techniques, as well as reflection and self-regulation techniques. The results of the study have shown that neuropedagogical technologies affect the cognitive development, emotional intelligence and motivation of students of vocational educational institutions. It was found that after their introduction into the educational process, there was a significant increase in the level of students' emotional intelligence. Teachers who used modern neuropedagogical technologies created favourable conditions for learning, which led to increased motivation, better learning and increased cognitive activity of students. It was noted that methods of reflection and self-regulation significantly improved students' ability to manage their own learning, reduced stress and increased their interest in learning. It has been found that teachers should use reflection, self-regulation and multimodal learning technologies to improve the learning process and manage students' emotions. It is also important to take into account individual characteristics and develop social and communication skills through teamwork. These findings emphasised the importance of integrating neuropedagogical techniques into the vocational education system to improve the effectiveness of the learning process

■ **Keywords:** professional training; vocational education; innovative technologies; emotional intelligence; cognitive activity; teaching strategies; educational practices

Suggested Citation:

Lyashchenko, V., Dobroskok, I., & Zarva, A. (2025). The impact of neuropedagogical teaching technologies on the effectiveness of the learning process of future education managers. *Professional Education: Methodology, Theory and Technologies*, 11(1), 10-21. doi: 10.69587/pemtt/1.2025.10.



Copyright © The Author(s). This is an open access article distributed under the terms of the Creative Commons Attribution License 4.0 (<https://creativecommons.org/licenses/by/4.0/>)

*Corresponding author

■ Introduction

Vocational education is undergoing constant change due to the rapid development of technology, changing labour market needs and new approaches to learning. There is a need to update teaching methods in vocational education to improve the quality of learning and adapt to the individual characteristics of students. Learning processes need to be more flexible and personalised. Neuropedagogy offers new approaches that promote the development of critical thinking, creativity and adaptability of students, which are important skills in professional life.

Teaching methods are based on outdated pedagogical approaches and do not take into account the latest scientific discoveries in the field of neuroscience. This leads to the fact that learning can be less effective than it could be if the individual cognitive characteristics of students were considered. Despite the growing popularity of neuropedagogy in the world, its implementation in the vocational education system remains insufficiently researched. Many teachers do not have a clear understanding of how to use neuroscientific data to improve teaching methods. Most vocational education institutions have not yet implemented the principles of neuropedagogy in practice, which reduces the effectiveness of learning processes. There is a need to study how neuropedagogy technologies can be adapted to improve teaching methods in vocational education. A significant number of researchers have studied neuropedagogy, revealing unique aspects of how the application of knowledge about brain function, cognitive functions and emotional development can improve learning experience and performance, in particular, H. Kravchenko *et al.* (2024) studied the relationship between neuropedagogy and learning processes. They explored how knowledge about the brain can be applied in educational practice to improve student outcomes. N. Rombaoa Tanaka *et al.* (2020) found that learning through play, using active attention, and stimulating different cognitive processes help students to better remember and absorb information. Their research highlighted how important it is to take into account the neuroplasticity of the brain in curricula.

A. Petter *et al.* (2021) specialised in the emotional and social aspects of neuroeducation. They proved that learning is related not only to cognitive processes, but also to the emotional state of participants in the educational process. Their research has shown that emotional stimuli play a key role in motivation and deep learning. The use of methods that promote the development of emotional intelligence can improve academic performance and satisfaction with learning. The role of neuropedagogy was studied by M. Fragkaki *et al.* (2022). This study was aimed at developing methods for teachers to help optimise the learning process, taking into account the cognitive characteristics of students. They found that the use of active learning, where

different sensory channels are involved, helps students better understand complex topics and increases overall learning performance. Z. Wen *et al.* (2023) studied the practical application of brain knowledge in schools and universities. Their research shows that an approach based on understanding cognitive processes increases student engagement in the learning process. They also found that methods that support emotional interaction between teacher and student help reduce stress during learning and facilitate learning.

Researchers O. Sviertniev & Y. Shostak (2022) noted that the process of training education managers should be targeted at developing managers of a new generation who can think and act methodically, make appropriate management decisions in crisis situations, and use existing resources efficiently. A. Hernández Fernández (2022) found that the use of neuroeducational approaches, such as alternating concentration and relaxation, can improve long-term memory and learning of complex concepts. This, in turn, helps students to reduce anxiety during learning and improve their academic performance. A. Alam & A. Mohanty (2024) have conducted research in the field of neuropedagogy and its impact on student motivation. Their work focused on how interactive technologies and methods of stimulating cognitive activity can help students with different types of learning abilities. Despite significant achievements in the study of neuropedagogy, the issue of its impact in the context of vocational education has not been sufficiently considered. Most of the research is related to general education or higher education, but the specifics of vocational education remain insufficiently researched. The aim of the study was to investigate the impact of neuropedagogical technologies on the cognitive development, emotional intelligence and motivation of vocational education students.

■ Materials and Methods

The study was conducted on the basis of a quantitative approach, which helped to assess the impact of modern pedagogical technologies and methods of neuropedagogy on the learning process of students of vocational education institutions in Ukraine. The sample consisted of 120 participants, including 60 women and 60 men, aged 19 to 21 years. All participants were students of vocational educational institutions from different regions of Ukraine and had previous experience with innovative pedagogical technologies. This sample ensured the representativeness of the study and made it possible to analyse the impact of neuropedagogical methods in different contexts and regions.

Three methods were used to collect data after the application of new neuropedagogical pedagogical technologies in the educational process among vocational education students: multimodal learning, action learning, development of emotional intelligence, application

of brainstorming technology using neuropedagogical techniques, technology of reflection and self-regulation. The first methodology was the emotional intelligence scale. This scale allowed to measure the level of students' emotional intelligence, namely their ability to understand and manage their own emotions before and after using neuropedagogical pedagogical technologies. The next methodology was to assess cognitive learning strategies. This tool allowed to assess the level of cognitive activity of students, their ability to learn independently, as well as their use of various strategies in solving educational tasks. The questionnaire included questions related to aspects such as organisation of learning activities, memorisation strategies, metacognitive skills and self-regulation:

1. How often do you use plans or task lists to organise your learning process?
2. What memorisation strategies do you use when preparing for exams or learning new material?
3. Do you analyse your mistakes after completing learning tasks to improve your understanding of the material?
4. To what extent can you control your attention and focus on a task even in the presence of distractions?

The data obtained from this questionnaire made it possible to assess the extent to which students are actively involved in the learning process and the extent to which they are able to organise their own learning. The last method used was the questionnaire for assessing pedagogical effectiveness, which is aimed at assessing the effectiveness of teachers' use of modern methods of neuropedagogy in their work and included the following questions: Does the teacher use different teaching methods (visual, auditory, kinetic) to stimulate different types of cognitive activity? To what extent does the teacher adapt teaching methods to the individual characteristics of students? Does the teacher use methods that promote the development of critical thinking (discussions, case studies, problem-based learning)? Does the teacher provide constructive feedback during the learning process? How do you assess the teacher's ability to maintain your attention and motivation during classes? Does the teacher use methods that take into account the principles of neuropedagogy (e.g., taking into account the peculiarities of brain functioning at different times of the day, working with students' emotions, etc.)? How do you assess the overall effectiveness of the teacher in using modern neuropedagogy methods?

The students evaluated the teachers according to various criteria, including their ability to adapt teaching materials to the needs of students, use of interactive technologies, emotional support and stimulation of cognitive activity. The data on the following questions helped to determine which teaching methods are most effective within the neuropedagogical approach. The study was organised in such a way that all students filled out the questionnaires in an electronic format.

This made it possible to attract participants from different regions of Ukraine, ensuring the geographical diversity of the sample. The participants were provided with an explanation of the purpose of the study, as well as guarantees of confidentiality and anonymity of their answers in accordance with the American Sociological Association's Code of Ethics (1997). The data collection procedure lasted about two weeks to ensure that all respondents had adequate time to participate. The data were analysed using statistical methods, including descriptive statistics. The analysis focused on the relationship between cognitive activity, emotional intelligence, and the effectiveness of neuroeducational methods. This comprehensive approach to data collection and analysis helped to gain a broad understanding of how neuropedagogy affects teaching methods in vocational education, as well as which aspects are most effective in improving the quality of learning.

■ Results

Theoretical foundations of neuropedagogy and analysis of the main pedagogical technologies in this field that affect the educational process in vocational education

Neuroeducation combines knowledge of neuroscience, psychology, and pedagogy to improve educational processes. This field helps to study how the brain works during learning, how cognitive processes occur, and how emotions affect the acquisition of new knowledge. By applying this scientific approach, educators can develop learning strategies that meet the individual developmental characteristics of students.

One of the main aspects of neuropedagogy is understanding how the brain processes information. It has been found that different areas of the brain are activated during different tasks, such as reading, solving maths problems or listening to music. Neuroeducation also takes into account the development of the brain at different stages of life. For example, younger learners have a different structure of cognitive processes than teenagers or adults, so teaching methods should be appropriate to these age-specific characteristics. Another important aspect of neuropedagogy is the role of emotions in the learning process. Scientific research shows that positive emotions can contribute to better learning, while stress or anxiety can block learning. It is important for teachers to create a positive emotional environment in the classroom where students feel safe and supported. The use of neuropedagogy allows teachers to use a variety of approaches that promote active engagement of students in the learning process. These can include methods that develop critical thinking, stimulate creativity, or improve memory. The use of multimedia, interactive tasks or game-based learning can stimulate the brain and make learning more effective.

The above science helps teachers to better understand how individual student characteristics affect

their learning. These may include differences in information processing speed, attention span, or learning style. Taking these factors into account, teachers can create differentiated tasks that meet the needs of each student. The main principles of neuropedagogy include active learning, individualisation, emotional engagement and metacognition. Taking into account different types of thinking, learning styles and learning rates allows to focus on each student individually. Use methods that stimulate cognitive activity, such as interactive technologies, problem-solving and practical tasks. This promotes better memorisation and deeper understanding of the material.

There are several different neuropedagogical technologies that are important to introduce to vocational students and apply in the learning process. Multimodal learning involves using different sensory perception channels, such as sight, hearing, and touch, to absorb information. This means combining audio and video materials, interactive simulations, and practical exercises to stimulate different areas of the brain, contributing to a deeper understanding of professional knowledge. Action learning is based on physical activity during training, which stimulates various parts of the brain and enhances memory and concentration. This can include coordination exercises while solving practical problems. The development of emotional intelligence involves incorporating emotional components into the learning process to help students improve their ability to interact and collaborate. Students can model real-life situations of professional communication, requiring them to show empathy, regulate emotions, and make decisions under pressure. The application of brainstorming technology with neuropedagogical techniques helps activate creative and analytical processes in the brain. This includes using interactive whiteboards or software to visualise thoughts and ideas during group discussions, stimulating both hemispheres of the brain and enhancing creativity. Reflection and self-regulation technology teach students these skills to improve their cognitive and emotional performance. Students can keep learning diaries, where they analyse their successes, challenges, and emotions during tasks and independently determine strategies for further learning.

Neuropedagogy emphasises the importance of emotions for learning, as positive emotions contribute to better memory and motivation. Creating a friendly and supportive environment helps students to engage more actively in the process. Developing self-reflection and self-regulation skills in learning allows students to better understand their own cognitive processes, which helps them to learn new knowledge more effectively. Applying the principles of neuropedagogy in education allows teachers to better understand how students learn information and create teaching methods that contribute not only to academic success but also to the development of cognitive and emotional skills.

Analysis of the research results after getting acquainted with new pedagogical technologies of neuropedagogy in the educational process of vocational education students

During the academic semester, teachers used a number of neuropedagogical technologies in the learning process. Students took part in classes that combined multimodal approaches, active learning, brainstorming and reflective practices. Students were encouraged to work with different formats of information – texts, audio and video materials, interactive presentations – which activated different sensory channels of information perception. This contributed to better knowledge acquisition and the development of skills related to emotional self-regulation, as students learned to manage their emotional state while processing large amounts of information. The curricula included many practical tasks that required students to actively participate, react quickly and solve real professional situations. This allowed students to experience their own emotions in stressful situations and learn how to manage them effectively. Students were also offered a series of special exercises to develop emotional self-awareness, empathy and emotional self-regulation. For example, exercises to determine the emotional state of themselves and other people, as well as techniques to control emotional reactions during conflicts or learning challenges.

Brainstorming sessions using neuropedagogical techniques helped to engage students in active idea generation in teamwork. It helped to develop communication and empathy skills as students learnt to express their thoughts, listen to others and respond to the emotions of their partners. Future education managers also regularly performed reflection exercises, which allowed them to analyse their emotional states after completing challenging tasks. This practice contributed to the development of self-regulation and self-control skills, which are important elements of emotional intelligence. At the initial stage of the study, students were tested using the Emotional Intelligence Scale, which allowed to assess their basic level of emotional competence. The average value of the level of emotional intelligence for all students was 62.4 points out of a possible 100, which indicates an average level of students' ability to manage emotions at the beginning of the educational process. At the start of the study, vocational education students with a higher level of emotional intelligence showed higher motivation to learn and a better understanding of their emotions when performing complex tasks. Students with a lower level of emotional intelligence more often had difficulty managing emotions during stressful situations and demonstrated lower performance.

After the introduction of pedagogical technologies during the academic semester, the Emotional Intelligence Scale was re-tested, which revealed significant changes in students' emotional competence. The majority

of students showed an increase in the level of emotional self-awareness. Students noted that they had become better able to understand their emotional reactions in stressful situations, especially when performing practical tasks requiring quick decision-making. It turned out that 65% of respondents showed a significant improvement in their emotional awareness, which is a key component of emotional intelligence. This improvement was attributed to the effectiveness of reflection and self-regulation, which helped students analyse their emotions after completing difficult tasks. During practical classes, students were encouraged to take notes on their emotional reactions and analyse their impact on the task. This allowed them to better control stress and maintain concentration during subsequent classes.

The ability to manage one's emotions, especially in times of stress or conflict, is an important aspect of emotional intelligence. After using brainstorming and active learning techniques, 70% of students showed significant improvement in managing their emotions. They became better able to control their reactions to difficulties and failures, particularly when working in teams or completing complex tasks. Students who participated in brainstorming sessions learned how to interact with others, listen better and understand the emotions of their classmates. This helped them to develop empathy and more successfully resolve conflicts that arose during teamwork.

55% of students said that after the introduction of neuropedagogical technologies, they became more sensitive to the emotions of other people. This was especially noticeable among students who worked in groups while completing their learning tasks. Teachers used multimodal learning methods, where students had to interact with different types of information and look for common solutions, taking into account the emotional state of each team member. This result suggests that the use of neuropedagogy contributes to the development of empathy, which is an important aspect for successful learning and professional activity. Students with a higher level of empathy adapted better to different learning environments and were able to interact more effectively with both teachers and classmates.

Improved emotional intelligence also had a positive impact on students' academic achievements. 80% of respondents reported that their motivation to learn had increased significantly after the introduction of neuropedagogical technologies. They felt more satisfied with the learning process and began to learn the material better. Emotional support from teachers, which became possible due to the development of emotional competence, allowed students to feel more confident when completing tasks. This increased their academic productivity and helped them to cope better with stressful situations that could have previously had a negative impact on their performance. The data analysis also showed a certain difference in the impact of pedagog-

ical technologies on men and women. Women showed a greater tendency to develop empathy and emotional awareness, while men showed better results in managing stress and emotions in stressful situations. This indicates that teachers should take into account gender peculiarities when implementing neuropedagogy methods in order to develop students' emotional intelligence as effectively as possible.

The results of the study using the Emotional Intelligence Scale methodology showed that the introduction of neuropedagogical technologies significantly improved the emotional and cognitive abilities of vocational education students. An important conclusion was that technologies aimed at developing emotional self-awareness, emotion management and empathy have a great impact on student performance. In particular, after the introduction of such technologies as multimodal learning, action learning, brainstorming using neuropedagogical techniques, and technologies for reflection and self-regulation, 80% of students showed an increase in motivation to learn, increased self-confidence, and reduced stress during academic tasks. The greatest impact was observed in students with initially average and low levels of emotional intelligence. They showed significant improvements in such aspects as emotional self-regulation, the ability to reflect and interact with other students during group tasks. This demonstrated the effectiveness of neuropedagogical pedagogical technologies in promoting the development of emotional competence even in students who initially had a low level of emotional intelligence.

The second methodology was aimed at studying the level of students' cognitive activity and their ability to learn independently using the methodology of assessing cognitive learning strategies. The study involved 120 students from different vocational education institutions, which allowed to collect a variety of data and draw objective conclusions about the use of cognitive strategies in learning. The level of cognitive activity of the respondents was assessed on a scale from low to high, which allowed to identify how effectively students use cognitive strategies to process information and assimilate it. Three main levels of cognitive activity were identified: high, medium and low (Fig. 1).

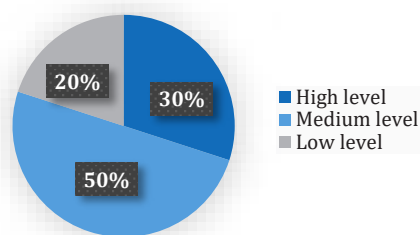


Figure 1. Assessment of the level of cognitive activity of students after familiarisation with pedagogical technologies of neuropedagogy

Source: compiled by the authors

The high-level group of students demonstrated positive indicators of the use of cognitive strategies aimed at deep understanding of the educational material. They actively used such strategies as analysis, synthesis, critical thinking, and also have the ability to systematise information. They did not just memorise the material, but understood it on a deeper level, which allowed them to apply knowledge in new situations. Students in this group were more likely to use reflection when necessary and to reflect on the results of their learning activities.

The largest group of students showed an average level of cognitive activity. They used basic cognitive strategies, such as memorisation and superficial understanding of the material, which allowed them to cope with the tasks provided that the teacher explained them properly. However, their strategies tended to be less systematic and less effective for learning complex concepts or solving problems. This group often used simple methods of memorisation, but did not often engage in critical thinking. The smallest group demonstrated a low level of cognitive activity. These students had difficulties in organising their learning and found it difficult to apply cognitive strategies for effective learning. They did not often use strategies such as analysis or critical thinking, and resorted to rote memorisation. This approach led to a superficial understanding of the material and limited opportunities for further use of knowledge in practical situations. The students' ability to learn independently was also divided into three levels, which allowed to assess how well students can organise their learning activities, plan tasks and effectively monitor their own progress (Fig. 2).

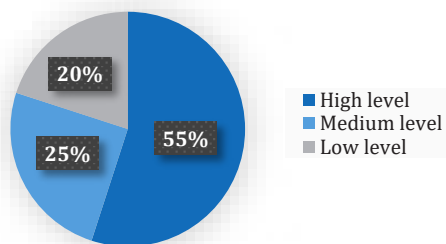


Figure 2. Assessment of the ability of vocational education students to learn independently

Source: compiled by the authors

The group of high-level students accounted for more than half of all those involved in the study, which was a positive indicator. These individuals are able to organise their learning independently. They plan time effectively, distribute tasks and are highly motivated to achieve their goals. These students used a variety of information sources and critically analysed the data. They can find solutions to problems independently. They have developed skills of self-organisation and self-control, which helps them to achieve significant academic success without constant support from teachers. A quarter of all participants have an average level of independent learning ability. They are able to complete learning tasks with instructions or guidance from teachers. They need some support in the form of clear guidance on how to organise their studies. Their ability to plan and control their own activities is not yet sufficiently developed, but they show potential for further development of these skills. The smallest group still has a low level of independent learning ability. These students demonstrated difficulties in organising the learning process and need constant guidance and assistance from teachers. They are usually unable to plan their own learning tasks or analyse their progress, which often leads to delays in completing tasks and poor academic performance.

The results of the analysis showed that there is a positive correlation between the level of cognitive activity and the ability to learn independently. This indicates that students with a higher level of cognitive activity also demonstrate a higher ability to learn independently. Students who use complex cognitive strategies, such as critical thinking, analysis and synthesis of information, are more likely to organise their learning effectively and achieve high results. At the same time, vocational students with low cognitive activity have significant difficulties in independent learning, as they do not have sufficiently developed strategies for processing information and planning their activities. They need additional support from teachers and clear instructions to complete tasks successfully. The survey participants assessed the effectiveness of teachers' use of neuropsychology technologies in the educational process. The results of the survey are presented in Table 1.

Table 1. Results of assessment by vocational education applicants of the effectiveness of teachers' use of modern neuropsychological technologies

Question number	% of participants	Results of the survey participants' responses
1	90%	It was noted that teachers actively use various forms of presenting material, stimulating different channels of perception (visual, auditory, kinetic).
	10%	It was believed that teachers mostly use one method without adapting it to different cognitive styles.
2	75%	Teachers' ability to change their teaching approach depending on the individual needs and level of training of students was positively assessed.
	25%	It was noted that adaptation of methods occurs infrequently, and the teachers' approach is more standard.
3	85%	Teachers noted the frequent use of critical thinking development methods, such as case analysis, discussions, and problem-based learning.
	15%	They pointed out the insufficient integration of such methods into the educational process.

Table 1. Continued

Question number	% of participants	Results of the survey participants' responses
4	80%	Teachers were believed to provide constructive feedback that helps to understand mistakes and improve subsequent results.
	20%	Feedback was felt to be insufficiently specific or infrequent.
5	70%	Teachers' ability to maintain attention and motivation was rated as high, noting the interesting nature of the material and interactive approaches.
	30%	It was pointed out that teachers do not always use motivational tools, and students' attention during classes decreases.
6	65%	Confirmed that teachers use methods that take into account the peculiarities of brain function, such as planning classes taking into account daily rhythms and working with the emotional state of students.
	35%	Teachers did not notice the active use of such approaches in the educational process.
7	90%	Teachers' effectiveness in applying modern neuropedagogical methods was highly appreciated.
	10%	It was noted that teachers could integrate more innovative approaches to improve the quality of teaching.

Source: compiled by the authors based on their own research

According to the above information, it was found that 55% of students rated the work of their teachers as very effective. These teachers actively use neuropedagogical approaches focused on stimulating students' cognitive activity, developing critical thinking and interactive teaching methods. Students noted that such teachers adapt teaching methods to meet individual student needs, apply multimodal approaches, and use various forms of feedback to enhance understanding of the material. At the same time, 35% of the survey participants rated their teachers as moderately effective. They found that teachers use some neuropedagogical methods, but their implementation is not always consistent or systematic. Students noted that these teachers introduce new methods, but often return to traditional teaching methods, such as lectures and tests, without integrating modern cognitive approaches. 15% of students assessed the work of their teachers as ineffective in terms of the use of neuropedagogical technologies. Students in this group noted that teachers mostly rely on traditional teaching methods that do not take into account the peculiarities of students' neurocognitive processes. These teachers rarely used active or interactive teaching methods and almost never apply approaches that would improve students' memory, attention or cognitive activity.

Vocational education students were quite positive about teachers who demonstrated an understanding of neuropedagogical approaches and the ability to adapt their teaching methods depending on the type of material or the needs of the group. Such teachers provided a variety of options for presenting information, using both visual and auditory teaching methods. However, 40% of respondents indicated that they did not always consider the individual cognitive characteristics of students. Teachers who effectively used neuropedagogical methods contributed to the improvement of students' academic results. Vocational students reported that such teachers helped them to better understand the material and stimulated the development of cognitive skills such as critical thinking

and problem-based learning. In groups with a low level of neuropedagogy, students often felt a decrease in motivation and interest in the subject. Active teachers, according to students, provided constructive feedback, which helped them to better understand their own mistakes and adjust their learning process. Students noted that regular and well-structured feedback had a positive impact on their understanding of the course material. The study showed that the introduction of neuropedagogy into the educational process can significantly improve learning efficiency and student motivation, but this requires providing teachers with the necessary knowledge and skills.

Neuropedagogy has a significant impact on teaching in vocational education and learning outcomes, as it considers the peculiarities of brain functioning to optimise the learning process. Its principles have helped teachers to better understand how students perceive, process and learn information, which is important for training specialists in various fields. It turned out that using knowledge of brain functions, teachers can better adapt curricula to the needs of individual students, taking into account their cognitive characteristics and level of training. Teachers who have developed an emotional connection with students are able to increase motivation and create a favourable learning environment. By understanding how students absorb information, neuropedagogy promotes interactive teaching methods that engage students in active learning through digital platforms, simulations, or game-based methods.

Teachers should actively use reflection and self-regulation technologies so that students can be aware of their emotional reactions during the learning process. This will help them to better manage emotions in stressful situations. It is also worth continuing to use various forms of multimodal learning, as it allows for the use of different sensory channels and promotes better absorption of information. Teamwork, which stimulates the development of empathy and communication skills, should be actively implemented, as it contributes to the development of students' social and emotional competences.

At the same time, it is important for teachers to take into account the individual characteristics of students, including gender differences in the development of emotional intelligence, to ensure the most effective learning for all groups of students. Since professional education is often associated with high levels of stress (especially in medical or technical specialities), neuro-education helps to develop methods to improve stress management, which contributes to a more effective learning process. Neuropedagogy provides scientifically based approaches to the development of teaching methods, which increases the effectiveness of learning in vocational education, making it more adapted to the needs of modern students.

■ Discussion

The results of the study showed that neuropedagogy is gaining widespread use in vocational education every year due to its ability to ensure more effective learning and development of students' cognitive abilities. The study of the brain and neuroscience allows teachers to better understand how learning affects neural processes and adapt teaching methods to improve learning outcomes. Research shows that neuropedagogical approaches contribute to the development of critical thinking, concentration and the ability to solve complex problems in students of professional educational institutions, as noted by L. Werner & D. Koering (2020), D.E. Nurmakhanova *et al.* (2021), S.-C. Kong & Y.-Q. Wang (2024). This study also found that the use of neuropedagogical techniques, such as adaptive learning strategies, content personalisation, and cognitive training, increased student achievement. These results are in line with the research of other authors, such as R. Shaw & B. Patra (2022), R. Shaw *et al.* (2023), where the emphasis is on the connection between emotions and the learning process, and this allows for a deeper understanding of how motivation and emotional states affect academic achievement. The study by S. Mystakidis *et al.* (2023) emphasises the importance of integrating emotions into learning processes, which contributes to the activation of certain neural pathways responsible for the storage and processing of information. This study also noted that the emotional engagement of students caused by teachers through the use of multimedia materials and interactive tools improved their understanding of complex material and its long-term retention. The findings on the importance of integrating emotional factors are consistent with previous research and highlight the need for emotional stimulation to improve learning outcomes.

It has been found that individualisation of educational processes based on neurobiological differences between students is considered one of the key topics of neuropedagogy. According to research by D. Marchak & I. Shvarts-Serebro (2021), I. Shvarts-Serebro *et al.* (2024), the adaptation of teaching methods to the

individual cognitive needs of the participants in the educational process is an important aspect to achieve maximum results. In this study, it was found that the use of adaptive methods, in particular testing the cognitive profile of students before the start of the educational process, allows teachers to select the most effective tools and approaches for each student. This makes it possible to adjust the learning process to consider the neuroplasticity of the brain, which further increases the level of knowledge acquisition. These results correlate with the findings of A. Rakhmetova *et al.* (2024), which emphasised that teachers should use teaching methods that correspond to the natural learning cycles of the brain. In particular, these results showed that the use of interactive simulators and simulations that take into account individual cognitive characteristics significantly increases the level of student interest and promotes deeper learning.

The findings also revealed that it is important to take into account the neuroplasticity of the brain, i.e., its ability to change its structure and functions in response to experience and learning. Studies have shown that techniques that stimulate neuroplasticity, such as practical application of knowledge, problem-based learning, and cognitive training, can significantly improve learning outcomes (Izaguirre *et al.*, 2023; Álvarez de Andrés, 2023). These studies confirmed that curricula based on the integration of practical tasks and simulation training help vocational students to better learn the material and develop professional skills. These results are also consistent with the study by V. Richard *et al.* (2018), which noted that practice and repetition are key factors that stimulate neuroplasticity. In the present study, students who went through intensive practical training and worked with simulation tools demonstrated significantly higher results on final tests, which confirms the importance of using practical methods for the development of neuroplasticity.

Innovative technologies such as virtual reality, augmented reality, and artificial intelligence are important tools in neuropedagogy, as they can provide unique opportunities for interactive learning and adaptation to the individual needs of students (Cobos Reina & Silva, 2022). In this study, it was noted that the use of such simulations and interactive platforms allows vocational students to immerse themselves in real-life situations that stimulate cognitive activity and promote more effective learning. This approach is consistent with the research of S. Ismail Adham & N. Al-Zuhairi (2022), which emphasised that multimedia learning promotes the active involvement of neural networks responsible for cognitive perception. The works by O.O. Adesope *et al.* (2019), S. Gates (2021), R. Recio (2024) also support the idea that technologies that allow students to interact with learning material contribute to better understanding and assimilation of knowledge. In the present study, it was noted that vocational students who used

interactive simulators and technology performed better on final tests and demonstrated a better understanding of professional skills. This once again underlines the importance of using the latest technologies to stimulate cognitive activity and develop neuroplasticity.

Neuropedagogy has demonstrated significant results in improving learning effectiveness, but its application in vocational education faces certain challenges and limitations. Researchers such as A. Kumar *et al.* (2021), B. Mohammadi Orangi *et al.* (2021) note that there is a risk of misinterpreting neuroscientific data and transferring untested concepts to practice. This can lead to ineffective use of methods, as incorrect interpretations may not be relevant to real-world learning environments. In this context, it has been found that some teachers have difficulty adapting the latest neuropedagogical methods due to a lack of training and resources, which limits their ability to implement new approaches effectively. An essential step in overcoming these difficulties is the development and implementation of systematic professional development programmes for teachers. Such programmes can help to better understand the foundations of neuroeducation and to use them appropriately in practice. This is in line with the work of E. Bottero (2022), who emphasised the need to prepare teachers to use neuroscientific knowledge to improve learning outcomes. The introduction of new technologies and methods can also require significant financial costs and resources. This can be a limitation for some educational institutions, especially those facing funding issues or insufficient technical equipment. The effective implementation of neuropedagogical approaches requires a comprehensive approach to training and resourcing.

The introduction of neuropedagogy in vocational education demonstrates significant potential for improving learning outcomes. This study confirms that the use of neuropedagogical techniques, such as adaptive learning strategies, interactive technologies and practical tasks, contributes to the improvement of learning outcomes and the development of professional skills. These results are consistent with previous research confirming the importance of integrating emotional and cognitive aspects into the learning process. The latest technologies that stimulate cognitive activity and neuroplasticity are proving to be effective in improving the quality of education. The implementation of neuropedagogical methods faces certain challenges. One of the main aspects is the need for additional resources and teacher training. Without sufficient teacher training and resources to implement the latest approaches, their implementation may be limited or ineffective. To further develop neuropedagogy in vocational education, it is important to continue research and develop effective strategies for integrating new methods into the learning process. This will help to achieve maximum results in learning and developing students'

professional skills. Thus, neuropedagogy is a powerful tool for transforming the system of training new generation education managers, but its successful implementation requires a comprehensive approach and continuous improvement of methods and technologies.

■ Conclusions

The results of the study of the importance of neuropedagogy in the educational process confirm the significant role of this interdisciplinary field in improving learning efficiency. One of the key technologies is that multimodal learning, which involves different sensory channels, contributes to better learning. Students who receive information through visual, auditory, and tactile channels demonstrate a deeper understanding and greater engagement in the learning process. This is supported by data showing the need to develop cognitive strategies such as critical thinking, information analysis and self-organisation. Technologies that support active learning through action also have a significant impact on the effectiveness of vocational education. Teachers who use brainstorming sessions and practical exercises help students better adapt theoretical knowledge to real-life professional situations. The use of neuropedagogical techniques during brainstorming sessions helps to develop students' ability to think critically and make quick decisions. An important aspect of this is also the development of emotional intelligence, which contributes not only to better socialisation of students, but also to their ability to work effectively in a team, manage emotions and resolve conflicts.

A significant part of the study was devoted to assessing the impact of reflection and self-regulation technologies on the cognitive activity of future education managers and the formation of their managerial competence. The results showed that students who are aware of their emotions and are able to control them in stressful situations demonstrate a higher level of independence in learning. 55% of the surveyed vocational students showed high results in terms of independent cognitive activity, which indicates the need to introduce additional training programmes aimed at developing these skills. This confirms the importance of neuropedagogy in shaping teaching methods that support the development of critical thinking and self-organisation skills. The latter methodology has shown that most teachers successfully use modern neuropedagogy methods, including multimodal approaches and critical thinking strategies. However, there is room for improvement in terms of individual adaptation of teaching methods, as well as in the wider use of neuropedagogical techniques to support students' emotional and cognitive activity. The majority of teachers actively use modern neuropedagogical approaches, and the need to individualise methods remains an important task. A wider range of neuropedagogical techniques aimed at supporting students' cognitive and emotional

engagement could lead to even greater learning gains, especially in the context of vocational education, where critical thinking and emotional intelligence skills are key to success. Prospects for further research are the development of new curricula that will take into account the cognitive characteristics of vocational education students and contribute to the personalisation of the educational process.

■ Acknowledgements

None.

■ Funding

None.

■ Conflict of Interest

None.

■ References

- [1] Adesope, O.O., Pour, N.B., Van Wie, B.J., & Thiessen, D.B. (2019). [Work in progress: Fostering cognitive engagement with hands-on learning pedagogy](#). In *Engineering library division papers American Society for Engineering Education conference*. Tampa: American Society for Engineering Education-ASEE.
- [2] Alam, A., & Mohanty, A. (2024). Framework of self-regulated cognitive engagement (FSRCE) for sustainable pedagogy: A model that integrates SRL and cognitive engagement for holistic development of students. *Cogent Education*, 11(1), article number 2363157. [doi: 10.1080/2331186X.2024.2363157](#).
- [3] Álvarez de Andrés, E. (2023). Promoting socio-spatial and cognitive justice through critical pedagogies. *Planning Theory*, 23(4), 300-323. [doi: 10.1177/14730952231214277](#).
- [4] Bottero, E. (2022). Freinet pedagogy: The challenges of cognitive psychology and institutional pedagogy. *Encyclopaideia*, 26(64), 107-113. [doi: 10.6092/issn.1825-8670/15551](#).
- [5] Cobos Reina, A.R., & Ledesma Silva, Y.E.L. (2022). Use of ICT and neuroeducation in higher education: Improvement of the teaching-learning process. *HUMAN Review*, 12(4). [doi: 10.37819/revhuman.v12i4.1065](#).
- [6] Fragkaki, M., Mystakidis, S., & Dimitropoulos, K. (2022). Higher education faculty perceptions and needs on neuroeducation in teaching and learning. *Education Sciences*, 12(10), article number 707. [doi: 10.3390/educsci12100707](#).
- [7] Gates, S. (2021). Developing musical imagery: Contributions from pedagogy and cognitive science. *Music Theory Online*, 27(2). [doi: 10.30535/mt0.27.2.3](#).
- [8] Hernández Fernández, A. (2022). Neuropedagogy and neuroimaging. *Texto Livre*, 15, article number e40453. [doi: 10.35699/1983-3652.2022.40453](#).
- [9] Ismail Adham, S., & Al-Zuhairi, N. (2022). Level of professional pressures during the use of e-learning teaching method among teachers of the Faculties of Physical Education and Sports Sciences in Baghdad. *SPORT TK-EuroAmerican Journal of Sport Sciences*, 11, article number 52. [doi: 10.6018/sportk.526721](#).
- [10] Izaguirre, M., Vera, M., Podestá, L., & Jaco, M. (2023). Perceived quality of distance education during the COVID-19 pandemic by postgraduate students of a school of medicine. *Anales de la Facultad de Medicina*, 84(4), 435-440. [doi: 10.15381/anales.v84i4.24529](#).
- [11] Kong, S.-C., & Wang, Y.-Q. (2024). The impact of school support for professional development on teachers' adoption of student-centered pedagogy, students' cognitive learning and abilities: A three-level analysis. *Computers & Education*, 215, article number 105016. [doi: 10.1016/j.compedu.2024.105016](#).
- [12] Kravchenko, H., Ryabova, Z., Kossova-Silina, H., Zamojskyj, S., & Holovko, D. (2024). Integration of information technologies into innovative teaching methods: Improving the quality of professional education in the digital age. *Data and Metadata*, 3, article number 431. [doi: 10.56294/dm2024431](#).
- [13] Kumar, A., Sarkar, M., Davis, E., Morphet, J., Maloney, S., Ilic, D., & Palermo, C. (2021). Impact of the COVID-19 pandemic on teaching and learning in health professional education: A mixed methods study protocol. *BMC Medical Education*, 21, article number 439. [doi: 10.1186/s12909-021-02871-w](#).
- [14] Marchak, D., & Shvarts-Serebro, I. (2021). The multidisciplinary learning grid: A conceptual space to develop neuropedagogy-based, arts-integrated chemistry activities. In L. Bigon & N. Shaked. (Eds.), *The arts of the grid* (pp. 204-224). Boston: De Gruyter. [doi: 10.1515/9783110733228-017](#).
- [15] Mohammadi Orangi, B., Yaali, R., Ghorbanzadeh, B., Loprinzi, P., & Abdalifar, A. (2021). The effect of aerobic exercise with nonlinear pedagogy on anxiety, depression, motor proficiency and cognitive ability of boys with attention deficit hyperactivity disorder. *Journal of Rehabilitation Sciences & Research*, 8(3), 144-150. [doi: 10.30476/jrsr.2021.91068.1163](#).
- [16] Mystakidis, S., Christopoulos, A., Fragkaki, M., & Dimitropoulos, K. (2023). Online professional development on educational neuroscience in higher education based on design thinking. *Information*, 14(7), article number 382. [doi: 10.3390/info14070382](#).
- [17] Nurmakhanova, D.E., Rakhmetova, A.K., Kassymbekova, D.A., Meirova, G., & Rakhimzhanova, G.M. (2021). Neuropedagogy for improving the educational process in universities. *Journal of Intellectual Disability – Diagnosis and Treatment*, 9(3), 321-328. [doi: 10.6000/2292-2598.2021.09.03.8](#).

- [18] Petter, A., Espinosa, T., & Araujo, I. (2021). Didactic innovation in physics education: A study on the adoption of the peer instruction method in the context of Brazilian programs of professional master in teaching. *Research in Physics Education*, 43. doi: [10.1590/1806-9126-RBEF-2021-0070](https://doi.org/10.1590/1806-9126-RBEF-2021-0070).
- [19] Rakhmetova, A., Meiirova, G., Balpanova, D., Baidullayeva, A., & Nurmakhanova, D. (2024). The use of elements of neuropedagogy in the creation of virtual simulators for in-depth study of chemistry in higher education. *Journal of Technology and Science Education*, 14(2), 473-483. doi: [10.3926/jotse.2532](https://doi.org/10.3926/jotse.2532).
- [20] Recio, R.V. (2024). A possible utopia for cognitive justice. In J.M. Paraskeva (Ed.), *Itinerant curriculum theory: A declaration of epistemological independence* (pp. 129-142). New York: Bloomsbury. doi: [10.5040/9781350293014.0015](https://doi.org/10.5040/9781350293014.0015).
- [21] Richard, V., Lebeau, J.-C., Becker, F., Boiangin, N., & Tenenbaum, G. (2018). Developing cognitive and motor creativity in children through an exercise program using nonlinear pedagogy principles. *Creativity Research Journal*, 30(4), 391-401. doi: [10.1080/10400419.2018.1530913](https://doi.org/10.1080/10400419.2018.1530913).
- [22] Rombaoa Tanaka, N., Boyce, L.K., Chinn, C.C., & Murphy, K.N. (2020). Improving early care and education professionals' teaching self-efficacy and well-being: A mixed methods exploratory study. *Early Education and Development*, 31(7), 1089-1111. doi: [10.1080/10409289.2020.1794246](https://doi.org/10.1080/10409289.2020.1794246).
- [23] Shaw, R., & Patra, B.K. (2022). Cognitive-aware lecture video recommendation system using brain signal in flipped learning pedagogy. *Expert Systems with Applications*, 207, article number 118057. doi: [10.1016/j.eswa.2022.118057](https://doi.org/10.1016/j.eswa.2022.118057).
- [24] Shaw, R., Mohanty, C., Patra, B., & Pradhan, A. (2023). 1D multi-point local ternary pattern: A novel feature extraction method for analyzing cognitive engagement of students in flipped learning pedagogy. *Cognitive Computation*, 15, 1243-1256. doi: [10.1007/s12559-022-10023-5](https://doi.org/10.1007/s12559-022-10023-5).
- [25] Shvarts-Serebro, I., Ben-Yehudah, G., Elgavi-Hershler, O., Grobgeld, E., Katzof, A., Luzzatto, E., Shalom, M., & Zohar-Harel, T. (2024). Agents of change: Integration of neuropedagogy in pre-service teacher education. *Frontiers in Education*, 9, article number 1369394. doi: [10.3389/educ.2024.1369394](https://doi.org/10.3389/educ.2024.1369394).
- [26] Sviertniev, O., & Shostak, Y. (2022). Terminological characteristics of the process of formation of managerial competence of the future education manager. *Pedagogical Sciences*, 5(1), 87-91. doi: [10.33989/2524-2474.2022.79.264556](https://doi.org/10.33989/2524-2474.2022.79.264556).
- [27] The American Sociological Association's Code of Ethics. (1997). Retrieved from <https://www.asanet.org/about/ethics/>.
- [28] Wen, Z., Sparks, R.L., Biedroń, A., & Teng, M.F. (2023). *Cognitive individual differences in second language acquisition: Theories, assessment and pedagogy*. Boston: De Gruyter Mouton. doi: [10.1515/9781614514749](https://doi.org/10.1515/9781614514749).
- [29] Werner, L.C., & Koering, D. (2020). Anthropologic – architecture and fabrication in the cognitive age. *Proceedings of the 38th eCAADe Conference*, 1, 685-692. doi: [10.14279/depositonce-10568](https://doi.org/10.14279/depositonce-10568).

Вплив нейропедагогічних технік на ефективність процесу навчання майбутніх менеджерів освіти

Віра Лященко

Доктор філософії, доцент

Харківський національний педагогічний університет імені Г.С. Сковороди

61002, вул. Алчевських, 29, м. Харків, Україна

<https://orcid.org/0000-0002-1698-8557>

Ірина Доброскок

Доктор педагогічних наук, професор

Університет Григорія Сковороди в Переяславі

08401, вул. Сухомлинського, 30, м. Переяслав, Україна

<https://orcid.org/0000-0002-3937-8428>

Аліна Зарва

Аспірант

Університет Григорія Сковороди в Переяславі

08401, вул. Сухомлинського, 30, м. Переяслав, Україна

<https://orcid.org/0009-0000-3542-4813>

■ **Анотація.** Метою дослідження було визначення впливу нейропедагогічних технологій на ефективність процесу навчання майбутніх менеджерів освіти. Методологія дослідження включала використання Шкали емоційного інтелекту для оцінки рівня емоційного інтелекту студентів до і після впровадження нейропедагогічних технологій, методики оцінювання когнітивних стратегій навчання та опитувальник оцінки педагогічної ефективності. Було залучено 120 здобувачів вищої освіти – майбутніх менеджерів освіти та викладачів. Вони проходили оцінювання на здатність розуміти та управляти власними емоціями, а також оцінювали вплив нових педагогічних технологій на свій навчальний процес. Дослідження зосереджувалося на вивченні таких методів, як мультимодальне навчання, навчання через дію, розвиток емоційного інтелекту, застосування технології мозкових штурмів із нейропедагогічними техніками, а також технології рефлексії та саморегуляції. Результати дослідження показали, що нейропедагогічні технології впливають на когнітивний розвиток, емоційний інтелект та мотивацію студентів професійних закладів освіти. Виявлено, що після їх впровадження у навчальний процес спостерігалось значне підвищення рівня емоційного інтелекту студентів. Викладачі, які використовували сучасні нейропедагогічні технології, створювали сприятливі умови для навчання, що призводило до підвищення мотивації, кращого засвоєння матеріалу та зростання когнітивної активності студентів. Було відзначено, що методи рефлексії та саморегуляції значно покращили здатність студентів самостійно керувати власним навчанням, зменшували стрес та підвищували їхню зацікавленість у навчанні. Виявлено, що викладачам слід використовувати технології рефлексії, саморегуляції та мультимодальне навчання для кращого засвоєння інформації та управління емоціями студентів. Важливо також враховувати індивідуальні особливості та розвивати соціальні й комунікативні навички через командну роботу. Ці результати підкреслили важливість інтеграції нейропедагогічних методик у систему професійної освіти для підвищення ефективності навчального процесу

■ **Ключові слова:** професійна підготовка; професійна освіта; інноваційні технології; емоційний інтелект; когнітивна активність; навчальні стратегії; освітні практики



Methodological principles for ensuring high-quality training of technical specialists in higher education institutions

Tetiana Kovalchuk*

PhD in Technical Sciences, Associate Professor
Kryvyi Rih National University
50027, 11 Vitaliy Matuselych Str., Kryvyi Rih, Ukraine
<https://orcid.org/0000-0001-8272-8465>

Halyna Tkachenko

PhD in Technical Sciences, Associate Professor
Kryvyi Rih National University
50027, 11 Vitaliy Matuselych Str., Kryvyi Rih, Ukraine
<https://orcid.org/0000-0003-2537-9195>

■ **Abstract.** The acquisition of competencies by higher education students faces problems of deterioration of basic school knowledge, as well as the unstructured and fragmented nature of higher mathematics teaching, which hinders the assimilation of professional disciplines. The aim of the study was to improve the methodological tools for forming a comprehensive system of quality knowledge and its conscious assimilation. The main directions for creating methodological and organisational conditions for ensuring the continuity of learning and building interdisciplinary links were developed. Methodologically, the study relied on the use of methods of analysis and generalisation in the creation of visual basic material. Statistical methods were used in the systematisation and processing of the results of testing students' residual knowledge and evaluating the results of testing as small samples. Testing the knowledge of the school course in mathematics and physics of students majoring in electrical engineering revealed shortcomings in their training that must be taken into account when teaching sections of higher mathematics. The correspondence between the volume of material in the discipline and the time required to master it was analysed, which made it possible to identify basic knowledge from the entire course of higher mathematics to ensure a differentiated approach to the acquisition of professional knowledge. The specifics of distance learning were considered, which led to the creation of visual reference notes with enhanced explanatory functions. In accordance with professional competencies, a classification of material was proposed, which ensured interdisciplinary links and expanded propaedeutic opportunities. The methodological approach created made it possible to systematise the teaching material in higher mathematics, which can be used by teaching staff, applicants and other participants in the educational process, as well as in the development of curricula and the compilation of working teaching programmes

■ **Keywords:** quality of education; methodology; knowledge system; higher mathematics; electrical engineering speciality; propaedeutics

■ Introduction

The problem of high-quality training of specialists in technical specialities in higher education institutions is mainly internal in nature, characterised by imperfect methodological tools and discrepancies between

the requirements for the acquisition of professional competences by applicants and the basic knowledge of higher mathematics that provides them. The training of highly qualified specialists for the needs of the

Suggested Citation:

Kovalchuk, T., & Tkachenko, H. (2025). Methodological principles for ensuring high-quality training of technical specialists in higher education institutions. *Professional Education: Methodology, Theory and Technologies*, 11(1), 22-33. doi: 10.69587/pemtt/1.2025.22.



country's industry and business faces dynamic processes of transformation in the external and internal environments in which they operate. Such changes require all participants in the educational process to improve its effectiveness, aimed at obtaining certain competencies in the relevant fields of knowledge. Given that the Kryvyi Rih iron ore basin is a powerful mining and metallurgical complex in the region, it needs to replenish energy-intensive enterprises with high-quality electrical engineering personnel. Staff training is based on ability to set and solve problematic tasks with in-depth adaptive knowledge of higher mathematics, which determined the relevance of the research topic.

In view of the above, O. Ivanashko *et al.* (2023) revealed their vision of essential issues regarding the effectiveness of educational activities, which they consider to be the main prevailing idea that determines the sustainability of the entire education system in the country. The authors conducted a comprehensive analysis of the Ukrainian experience in providing educational services in higher education. A distinctive feature of the study was the consideration of crisis phenomena inherent in the current conditions of education. Based on the assumption that the crisis will continue in the long term, the authors propose the development of algorithms to stimulate the efficiency and effectiveness of the higher education system, which will not only provide the labour market with qualified personnel, but also guarantee the development of science regardless of unfavourable conditions. An important condition for obtaining high-quality professional training is the ability to form stable and comprehensive knowledge, which is the basis for further learning. Many scholars have devoted their work to the level of training of applicants, which is determined by testing residual and current knowledge. The authors S. Vadzyuk *et al.* (2021) noted that the main aim of such a measure was to identify gaps that prevent students from fully realising their knowledge and skills. For the teacher, it provided an opportunity to adjust the educational process and led to the improvement of the teaching system. The authors presented a proposal to divide knowledge control into initial, final and performance indicators.

The researcher S. Yutkalo (2020) proposed that testing should be considered the main form of control. The aim of testing is not only to determine the level of mastery of the material, but also to identify shortcomings in the learning process that lead to poor mastery of the necessary practical skills and abilities. It was proposed to use testing to carry out various types of assessment depending on the volume of material being tested. The author, like most educational researchers, emphasised the importance of the assessment function of testing, but also considered it as a system of training tasks and a procedure for monitoring the quality of acquired knowledge. One of the reasons for the deterioration in the quality of education is the transition of the

majority of educational institutions to distance learning. A number of teachers, O. Afanasieva *et al.* (2021), pointed out the lack of standards for distance learning in Ukraine, which makes it difficult to unify the material even within one country. Therefore, higher education institutions are forced to independently seek opportunities to apply the most suitable information and educational technologies.

Full assimilation of knowledge, especially in distance learning, is impossible without technological knowledge. L. Mesarosh (2023) emphasised that after 2020, it is impossible to imagine a future specialist without an understanding of the importance of information processes and information and communication technologies. This allows for the processing of large amounts of information, without which it is impossible to function fully in a changing world and impossible to reach a new level of quality in education. The author proposed to create mathematical knowledge competencies that define a certain set of knowledge and boil down not only to the assimilation of typical algorithms for finding solutions, but also to the understanding and ability to practically implement mathematical research methods. In substantiating the importance of interdisciplinary connections, which are an integral part of learning, A. Didyk (2019) emphasised the importance of disciplines such as higher mathematics and physics. The researcher suggested that disciplinary connections should be considered as a reflection of interdisciplinary connections, which are inseparable from scientific knowledge. The author defined the features of the course "Electrical Engineering and Electronics" as interdisciplinary potential and the creation of conditions for self-improvement and self-development.

Scientists O. Strakh & T. Lukashova (2021) drew attention to the fact that interdisciplinary connections not only perform educational and upbringing functions, but also form a comprehensive vision of the surrounding environment. This makes it possible to solve real-life problems. In addition, it creates the possibility of developing a holistic approach to mathematical objects and the algorithms used to describe them, thereby contributing to the intellectual development of students. N. Honhalo (2022) proposed the same goal using MS Excel. The combination of the components of the problem and their relevance, as well as the analysis of the work of scientists on this issue, identified a number of issues that require the creation of a conceptual system for the provision and assimilation of quality knowledge, primarily for students of technical specialities. The aim of this article was to avoid fragmentation of knowledge and supplement it with specific propaedeutic material in mathematics that is unique to these specialities.

■ Materials and Methods

The validity of the selected research methods and tools was based on general scientific research methods.

These included empirical research methods for testing residual knowledge and the use of informational and explanatory reference notes. Methods of analysis and comparison were used in researching the work of scientists on the research topic, as well as general logical methods, in particular deduction in analysing the stages of the qualitative knowledge system, and generalisation in formulating interim and general conclusions of the research. This article developed methodological approaches for testing the quality of residual knowledge and evaluating its results. The research was conducted in accordance with the Declaration of Helsinki (2013), and the confidentiality of personal information was preserved and agreed upon with the applicants. The verification of residual knowledge was carried out using the example of speciality 141 "Electric Power Engineering, Electrical Engineering and Electromechanics"

at Kryvyi Rih National University on the Google Classroom platform, with 18 students participating in the writing of the work.

Stage 1. Determination of school education knowledge that is basic for this speciality and needs to be corrected. The mathematics tasks were designed to test the level of general theoretical training, the results of which would reveal shortcomings in performing calculations; finding solutions to various types of equations and inequalities; mastering algebraic and trigonometric transformations; composing and solving meaningful problems, etc. Applicants were given a mathematics test consisting of 15 tasks of medium and lower levels of knowledge in the main sections of elementary mathematics, which was assessed on a 100-point scale. They were given 80 minutes to complete the test. An example of a mathematics task is given in Table 1.

Table 1. Example of a mathematics test to check residual knowledge

No.	Task content
1.	Calculate $\frac{(2\frac{4}{5}-1,2)\frac{1}{2}}{4,2-3\frac{2}{5}}$.
2.	When processing oil, 40% petrol is obtained. How much oil is needed to obtain 12 tonnes of petrol?
3.	Solve the system of equations $\begin{cases} 3x + 7y = -17; \\ -x + 3y = -9 \end{cases}$ and find $z = x + y$.
4.	Simplify the expression $\frac{ab+b^2-b}{a^2-ab} \cdot \frac{a-b}{a^2+ab-a} : \frac{5b}{a^2}$.
5.	The first term of a geometric progression is 5, and the common ratio is 2. Find the 5th term of the geometric progression.
6.	Solve the equation $3^{\sqrt{x}} + 3^{\sqrt{x+2}} - 90 = 0$.
7.	A cyclist travelled from one inhabited locality to another at a speed of 15 km/h. On the return journey, he cycled at 12 km/h, so the return journey took 1 hour longer. Find the distance between the inhabited localities.
8.	Solve the equation $\sqrt{x+4} = 3$.
9.	Solve the equation $\log_3(x-3) = 1 + \log_3 3$.
10.	Given $\triangle ABC$, $\angle C = 90^\circ$, $ CA = 2$, $\text{ctg} \angle B = 9$. Calculate $ BC $.
11.	Solve the equation $\text{tg} \alpha$, where $\sin \alpha = 0.6$, $0^\circ < \alpha < 90^\circ$.
12.	Solve the equation $4\cos^2 x - 4\cos x + 1 = 0$, where $0^\circ < x < 90^\circ$.
13.	Find the lateral side of an isosceles trapezium if its bases are 8 cm and 14 cm, and the area is 44 cm^2 .
14.	The base of a pyramid is an equilateral triangle with a side of $2\sqrt{3}$ cm. Two lateral faces are perpendicular to the base plane, and the third forms an angle of 60° . Find the volume of the pyramid.
15.	Find the value of x , that satisfies the inequality $\frac{x-7}{3-x} \geq 1$.

Source: compiled by the authors

Stage 2. Assessment of residual knowledge test results. When assessing the results of empirical studies, statistical methods were used to find numerical estimates for small samples and to construct confidence intervals when the mean square deviation of the general population was unknown. Since standard (point) estimates do not fully assess the qualitative state of residual knowledge, it is proposed to extend them to interval estimates. The point estimate, which determined the average score, was found using the formula:

$$\bar{x} = \frac{\sum_{i=1}^n x_i}{n}, \quad (1)$$

where \bar{x} – average number of points; x_i – number of points for the work of the i -th student; n – number of

students. Since the number of students is not large, corrected grades were used. The corrected standard deviation S – deviation from the average number of points;

$$S = \sqrt{\frac{\sum_{i=1}^n (x_i - \bar{x})^2}{n-1}}. \quad (2)$$

The interval estimate of the average number of points (confidence interval) was calculated using the formula:

$$\left(\bar{x} - \frac{t_{\gamma} \cdot S}{\sqrt{n}} < a < \bar{x} + \frac{t_{\gamma} \cdot S}{\sqrt{n}}\right), \quad (3)$$

where γ – confidence probability (reliability), which determines the probability of error; $t_{\gamma}(n-1; 1-\gamma)$ – the value of the critical point according to the Student's

distribution. The methodology presented made it possible not only to identify gaps in knowledge, but also to understand the range of their assessment for the majority of students, which depends on the specified reliability.

Results and Discussion

Based on the above analysis of issues of interest to the educational community, a number of areas requiring further research can be identified. In doing so, it is necessary to take into account both the regional and professional specifics of training engineering specialists at each educational institution. The research conducted and its results are subject to certain stages, the essence of which lies in analysing the level of student training based on secondary education knowledge, comparing the volume of subject material and the number of hours required to master it, and selecting an appropriate form of training and ensuring that the content of the material corresponds to the professional competencies of future graduates. Practical issues that can be used to implement these stages of improving the quality of education depend on the specific technical speciality.

The importance of training engineering personnel, in particular in electrical engineering specialties, is due to the location of Kryvyi Rih National University in the Kryvyi Rih iron ore basin. The development of the basin's deposits requires an appropriate industrial base and qualified personnel for their operation. Based on this, the training of specialists capable of not only solving complex specialised tasks in the electrical engineering field is relevant (Bachelor's educational programme..., n.d.). At the same time, attention is drawn to the uncertainty of the conditions in which such specialists work and the complexity of the tasks they face. The main competencies that applicants for speciality 141 – “Electrical Power Engineering, Electrical Engineering and Electromechanics” (EEM) in the educational and professional programme of the specified speciality for the discipline of higher mathematics boil down to the formation of the ability to: analyse and think abstractly; independently search for and process information; solve practical problems using mathematical methods. The main stages of forming a comprehensive system of knowledge and its structural content are presented in the form of a diagram (Fig. 1).

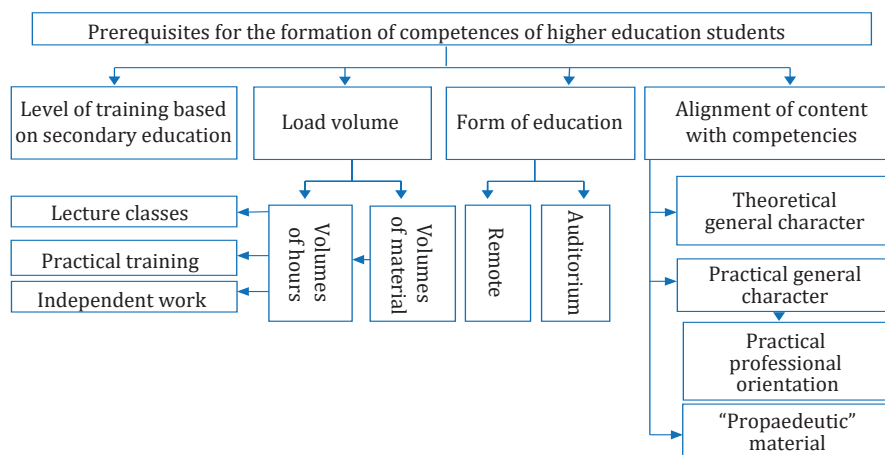


Figure 1. Scheme of forming a system of quality knowledge of future specialists

Source: compiled by the authors

The implementation of a quality education system (Fig. 1) begins with testing residual knowledge from

the school mathematics course. The results of the test for speciality 141 EEM are presented in Figure 2.

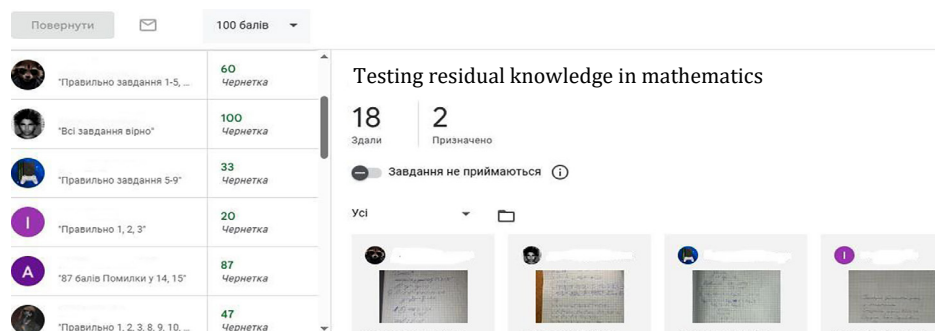


Figure 2. Form and results of the residual knowledge test on the Google Classroom platform

Source: compiled by the authors

When determining the numerical characteristics of this sample, which characterises the average number of points and the confidence interval for assessing

knowledge of the school course, methods for working with small samples were used. The results of the calculations are presented in Table 2.

Table 2. Results of calculations of the average score for residual knowledge in mathematics and physics

No.	Indicator	Results of calculations
1.	Average score	$\bar{x} = \frac{954}{18} = 53.$
2.	Corrected standard deviation	$S = \sqrt{601.53} = 24.53.$
3.	Confidence level (reliability)	$\gamma = 0.99$
4.	Critical point in the Student's distribution	$t_{\gamma}(17; 0.01) = 3.97.$
5.	Confidence interval	$a \in (30; 76)$

Source: compiled by the authors

Therefore, with a reliability of 0.99 (the margin of error is only 1%), it can be stated that the average score for the assessment of residual knowledge in mathematics for the EEM speciality falls within the interval $a \in (30; 76)$. An analysis of the research results for the sections of higher mathematics and physics for the 141 "Electrical Power Engineering, Electrical Engineering and Electromechanics" speciality is presented in Table 3.

The worst results in mathematics are related to the fact that applicants do not have developed spatial

thinking, and there is a negative impact from the absence of subjects such as drawing and descriptive geometry in the school curriculum and in higher education programmes. However, the most negative aspect is that the overall percentage of correct answers is lowest for trigonometry tasks (questions 10-12). This means that even at the secondary school level, basic knowledge of trigonometry has not been developed, which complicates the understanding of complex numbers, which are mainly used to describe processes related to electric current.

Table 3. Analysis of the results of the residual knowledge test

No.	Section of mathematics	Result		№	Section of mathematics	Result	
		number of correct answers	%			number of correct answers	%
1.	Actions with fractions	14	77.79	9.	Logarithmic equations	15	83.33
2.	Problems on percentages	15	83.33	10.	Trigonometric functions in a right triangle	7	38.89
3.	Systems of linear equations	12	66.67	11.	Basic formulas of trigonometry	10	55.56
4.	Algebraic transformations	7	38.89	12.	Trigonometric equations	3	16.67
5.	Arithmetic and geometric progression	7	38.89	13.	Planimetry	7	38.89
6.	Exponential equations	11	61.11	14.	Stereometry	4	22.22
7.	Problems on composing equations	11	61.11	15.	Inequalities	4	22.22
8.	Irrational equations	14	77.79				

Source: compiled by the authors

The main shortcomings of higher technical education include: a narrow worldview understanding of the interconnection of processes and phenomena; insufficient interdisciplinary links in teaching; a reduction in the volume of study; a decrease in student motivation; narrow specialisation, etc. All these problems are also inherent in the training of EEM students. Fourteen credits are allocated to the study of higher mathematics for this speciality over two semesters, of which 36% are classroom hours and 64% are independent study hours. Therefore, there is an urgent need to clearly divide the material for independent and classroom study. This division should continuously ensure the possibility of consistent study of the full scope of material in higher mathematics and help focus attention on the

material used in mastering specialised disciplines, reflecting interdisciplinary continuity.

The first section of higher mathematics is "Fundamentals of Linear Algebra", the main result of which is the ability to solve systems of linear algebraic equations using the Gauss method, determinants (Cramer's formula) and the inverse matrix. The theoretical material of this section is used in the study of: vector algebra (transition to a new basis, finding vector and mixed products in coordinate form); analytical geometry (equations of a plane through three points, finding the points of intersection of geometric objects; transition from a parametric equation of a straight line in space to a canonical one); functions of several variables (finding critical points when studying local and global extrema of functions,

Lagrange multiplier method); integration (method of undetermined coefficients); differential equations (finding solutions using the method of variation of arbitrary constants and linear homogeneous and non-homogeneous second-order differential equations with constant coefficients), etc. The mathematical apparatus for this topic is used in physics in calculations of branched electrical circuits and electrical circuits in Kirchhoff's laws.

It should be noted that the organisation of the educational process in Ukrainian universities differs from the similar process in the United States of America. G. Strimel *et al.* (2018) clarified that engineering programmes require additional study of higher-level mathematics, so they include several semesters for the formation of priority knowledge. They go beyond the study of algebra, trigonometry and applied calculus and should have greater practical value. The first year of study is the basis for writing term papers in mathematics, natural sciences and engineering design, which provides an opportunity to begin studying specialised disciplines. Unlike Ukrainian universities, the training of future engineers does not

include the study of special sections of higher mathematics and taking exams. The goal is to consolidate basic mathematical concepts and the ability to solve engineering problems. The applied part of higher mathematics is only studied in the second year of study.

In the current conditions of educational institutions, preference is given to distance learning during the semester, and the session is held in a mixed format. To improve the quality of knowledge, it is proposed to prepare basic reference material in electronic form for each topic, which is not only information-rich in terms of familiarisation with methodological approaches, theoretical knowledge and examples of their application to the topic, but also has explanatory functions, shows the strengths and weaknesses of each methodology, and the conditions for their use in each specific case. In addition, Google Classroom should provide extended material on the topic, which includes a component for independent study. An example of such a presentation of material on the topic "Integration of trigonometric functions" is given in Table 4.

Table 4. Form of presentation of basic material on the topic "Integration of trigonometric functions"

No.	Integral of the form	Substitution	Methodological recommendations
Objective: transition from trigonometric functions to algebraic functions $\int R(\cos x, \sin x) dx \rightarrow \int R(x) dx$.			
1	Universal trigonometric substitution $\int R(\cos x; \sin x) dx$	$tg \frac{x}{2} = t; \frac{x}{2} = \arctg t; x = 2 \arctg t;$ $dx = \frac{2dt}{1+t^2};$ $\cos x = \frac{\cos x}{1} = \frac{\cos^2 \frac{x}{2} - \sin^2 \frac{x}{2}}{\cos^2 \frac{x}{2} + \sin^2 \frac{x}{2}} =$ $= \left[: \cos^2 \frac{x}{2} \right] = \frac{1 - tg^2 \frac{x}{2}}{1 + tg^2 \frac{x}{2}} = \frac{1-t^2}{1+t^2};$ $\sin x = \frac{\sin x}{1} = \frac{2 \sin \frac{x}{2} \cos \frac{x}{2}}{\cos^2 \frac{x}{2} + \sin^2 \frac{x}{2}} =$ $= \left[: \cos^2 \frac{x}{2} \right] = \frac{2tg \frac{x}{2}}{1 + tg^2 \frac{x}{2}} = \frac{2t}{1+t^2}.$	<p>Despite its versatility, it requires significant algebraic transformations and can lead to the integration of overly complex rational fractions. Therefore, recommended to apply it after considering partial approaches to the integration of trigonometric expressions. For example:</p> $\int \frac{5+6 \sin x}{\sin x(4+3 \cos x)} dx = \int \frac{\left(5+\frac{6-2t}{1+t^2}\right) \frac{2dt}{1+t^2}}{\frac{2t}{1+t^2} \left(4+\frac{3(1-t^2)}{1+t^2}\right)} = \dots$
Partial substitutions			
2	$\int \cos m x \cdot \cos n x dx;$ $\int \sin m x \cdot \sin n x dx;$ $\int \sin m x \cdot \cos n x dx.$	$\cos m x \cdot \cos n x = \frac{1}{2}(\cos(m-n)x + \cos(m+n)x);$ $\sin m x \sin n x = \frac{1}{2}(\cos(m-n)x - \cos(m+n)x);$ $\sin m x \cos n x = \frac{1}{2}(\sin(m+n)x + \sin(m-n)x).$	When the integrand is the product of the functions $\sin n x$ and $\cos m x$, i.e., with multiple arguments. The transition from the product of trigonometric functions to their sum or difference, which will lead to the use of linear substitution.
3	$\int R(\sin x) \cos x dx;$ $\int R(\cos x) \sin x dx.$	$1. \int = \left[\begin{matrix} \cos x = t, \\ \sin x dx = -dt \end{matrix} \right] = -\int R(t) dt.$ $2. \int = \left[\begin{matrix} \sin x = t, \\ dt = \cos x dx \end{matrix} \right] = \int R(t) dt.$	When the integrand consists of a product of functions that contain only sines and the expression $\cos x dx$ or only cosines and the expression $\sin x dx$. In fact, this is a method of variable substitution in an indefinite integral.
4	$\int R(tg x) dx;$ $\int R(ctg x) dx.$	$1. \int = \left[\begin{matrix} tg x = t \\ x = \arctg t \\ dx = \frac{dt}{1+t^2} \end{matrix} \right] = \int R(t) dt.$ $2. \int = \left[\begin{matrix} ctg x = t \\ x = \text{arcctg} t \\ dx = -\frac{dt}{1+t^2} \end{matrix} \right] = \int R(t) dt.$	When substituting, incorrect rational fractions are usually obtained, which require the whole part to be separated. When converting the original, it is necessary to take into account that, $\text{arctg}(tg x) = x$, $\text{arcctg}(ctg x) = x$.

Table 4. Continued

No.	Integral of the form	Substitution	Methodological recommendations
5	$\int \cos^m x \cdot \sin^n x dx$ where m and n – even numbers	$\cos^2 x = \frac{1}{2}(1 + \cos 2x),$ $\sin^2 x = \frac{1}{2}(1 - \cos 2x).$	To transition to tabular integrals, use the formula for lowering the degree. For example: $\cos^4 x = (\cos^2 x)^2 = \left(\frac{1}{2}(1 + \cos 2x)\right)^2 = \frac{1}{4}(1 + 2\cos 2x + \cos^2 2x) = \frac{1}{4}(1 + 2\cos 2x + \frac{1}{2}(1 + \cos 4x)).$
6	$\int \cos^m x \cdot \sin^n x dx$ where at least one of the values m or n is an odd number	Transition to integrals of the form $\int R(\sin x)\cos x dx$ and $\int R(\cos x)\sin x dx$	An odd power is represented as the product of an even power and the first power. For example: $\cos^3 x = \cos^2 x \cdot \cos x$. The basic trigonometric identity is applied to even powers $\sin^2 x + \cos^2 x = 1$. For example: $\cos^2 x = 1 - \sin^2 x$.

Source: compiled by the authors

The use of such visual material allows applicants to form clear algorithms of actions for each specific case of integration, which leads to a conscious approach to the use of integration methods, achieves better learning outcomes and lays the foundation for the assimilation of the following topics: definite integrals, improper integrals, multiple integrals, and

differential equations. To really get how well someone's trained in a certain field, it is important to break down the material into three areas: general, professional, and "propaedeutic." For the EEM speciality, the theoretical and practical material of a general nature is reflected in the diagram (Fig. 3), in which the sections are marked with solid lines.

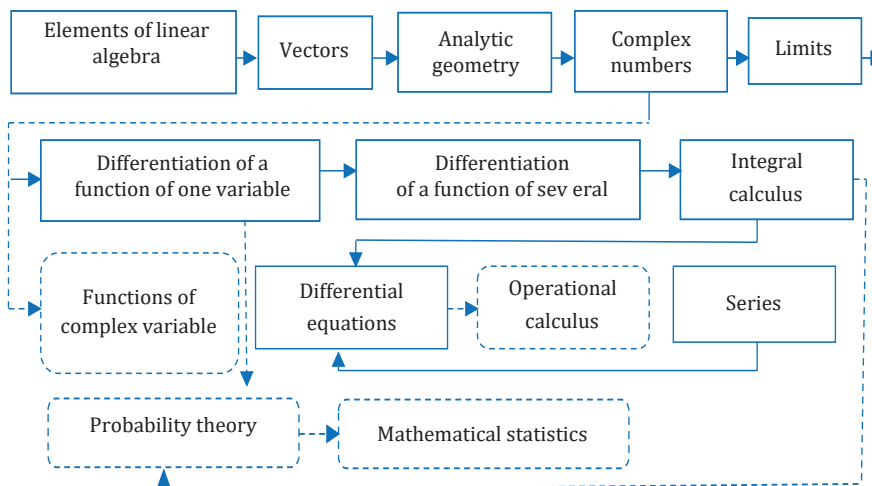


Figure 3. Algorithm for the sequence of studying higher mathematics material

Source: compiled by the authors

The sequence of basic topics shown in Figure 3 is logical, and each subsequent topic builds on knowledge from previous topics and covers the entire higher mathematics course. Solving professional problems is an integral part of practical knowledge. Some educational institutions offer applicants an elective course entitled "Mathematical Problems in Energy" (Vinnytsia National University, National University of Water and Environmental Engineering, Kyiv Polytechnic Institute, etc.), which allows to go beyond the scope of the "Higher Mathematics" course to deepen professional knowledge. Most teachers include practical problems as examples of the application of theoretical

knowledge in electrical engineering. For example, when studying derivatives, they consider the problem of current strength, and when studying second-order differential equations, they consider the mathematical model of electrical circuits.

The general material does not include sections that are referred to in the diagram (Fig. 1) as "propaedeutic" material and marked with dotted lines in Figure 3, namely "Functions of complex variables", "Operational calculus", "Probability theory", "Mathematical statistics", the study of which largely determines the formation of competencies provided for by the educational and professional programme in this speciality. The absence of

material from the “propaedeutic” sections should be an impetus for closer contacts between the teacher of the discipline and the head of the department, the guarantor of the educational and professional programme, and interested teachers of the specialised department. This will allow for certain adjustments to be made by monitoring the disciplines on which mathematical knowledge is based, including forecasting and statistical data processing. This knowledge will be a priority in the study of higher mathematics. All of the above materials have determined the structure of the methodology for filling and forms of conveying knowledge of higher mathematics to applicants. This made it possible to highlight the interdisciplinary connections of higher mathematics and, in particular, for the EEM speciality for the qualitative training of future specialists.

The formation of this and other views on the interpretation of the essence of education quality is based on the ESG Standards and Guidelines, presented in Standards and Guidelines for Quality Assurance in the European Higher Education Area (ESG) (2015), which form the basis of Law of Ukraine No. 1556-VII (2014). Given that the main burden of responsibility for the quality training of higher education applicants lies with educational institutions, internal departments for quality assurance in education have been created. They are aimed at implementing a number of measures: checking educational programmes; providing the educational process with appropriate resources; evaluating the knowledge of applicants and the qualifications of scientific and pedagogical workers, etc. According to the author O. Liuta (2018), the result of ensuring the quality of education can be a number of requirements: level of qualification; competitiveness in the labour market; the presence of characteristics such as competence and responsibility; the ability to navigate not only in one's own field of activity, but also in related fields; readiness for professional growth and achievement of world standards; mobility, etc.

To identify trends in the quality of secondary education, which is the basis for higher education, one can use the international PISA studies on the quality of education (Ukrainian Centre for Educational Quality Assessment, 2024), which began in 1997. Ukraine joined these studies only in 2016, and the first monitoring of education quality took place in 2018. The next study is scheduled for 2025 with a three-year cycle. Not only fifteen-year-old schoolchildren are surveyed, but also the administration of educational institutions in order to determine the impact of the following factors: the level of professional training of teachers; teaching methods; curricula and work programmes, etc. (Ukrainian Centre for Educational Quality Assessment, 2024). According to the latest study in 2022, in which eighteen regions of the country participated, knowledge of mathematics, reading and natural sciences was tested with the participation of 3,876 students from 164 educational

institutions. PISA defines mathematical literacy as the ability to think and formulate mathematically, applying mathematical knowledge to solve real-world problems. According to the 2022 results, 42% of Ukrainian schoolchildren did not reach the basic level (441 points) of mathematical literacy. This indicates a lag of one and a half years behind the results obtained in the countries of the Organisation for Economic Co-operation and Development (OECD). It should be noted that the lag behind their peers in these countries is 1.6 years, while the previous result (2018) recorded this lag at only 0.7 years. In other words, there is a general trend towards a deterioration in mathematical knowledge. As for natural science disciplines, which include physics, the basic level achievement is 66%, and the lag behind peers is 1.8 years, compared to the previous value of 0.7 years. Based on the results of these studies, a general trend towards a decline in the conscious study of mathematics and physics was noted, which involves using the acquired knowledge and skills in possible life situations and challenges (Ukrainian Centre for Educational Quality Assessment, 2024). Based on the general trend of annual deterioration in schoolchildren's knowledge, it is necessary to test their residual knowledge of the school mathematics course before they start higher education. Without such a measure and an assessment of its results, it is difficult for teachers to orient themselves to the mathematical level of preparation of applicants and to choose specific corrective approaches in each particular case. Due to the lack of classroom time, various forms of correction are possible, namely, consultation, independent work under the supervision of a teacher, the formation of additional reference materials, etc.

It is important for the formation of Ukrainian educational experience to familiarise oneself with world experience, which was summarised by L. Mykhailenko (2020). The author summarised the experience of monitoring the methodological training of mathematics teachers as a key component in the formation of a system of quality knowledge. The author drew attention to the TEDS-M report of the International Association for the Evaluation of Educational Achievement, in which testing showed a direct relationship between the level of professional training of teachers, the content of educational programmes and the results obtained. The researcher cited the results of the German COACTIN study on the content of knowledge, which identified the main conditions for effective learning: maximum use of teaching time; the ability to encourage students to engage in cognitive activity; and quality support for students during learning. Noteworthy is the study by S. Huber *et al.* (2024), who, in addition to analysing the results of education quality monitoring by various international organisations, conducted a study on the motivation of teachers themselves in their professional activities. The authors concluded that most teachers

pay more attention to evaluating their personal results than to the learning outcomes of students.

Researchers O. Strakh & T. Lukashova (2021) and N. Honhalo (2022) proposed various approaches to improve the quality of professional training. For example, changing methodological approaches when teaching certain sections of higher mathematics, which is appropriate and depends on the complexity of the material and the students' preparation for perceiving specific material. According to M. Kovalchuk (2020), a broader approach involves creating a system of tasks for professional training and methodological guidelines at the level of educational institutions. The author concluded that systematic basic knowledge is important, without which it is difficult to acquire specialised knowledge. Based on research on the definition of the "level of development of mental action techniques", the scientist determined that only up to 25% of students have a high level of development. Therefore, M. Kovalchuk (2020) proposed moving on to algorithmic knowledge, which correlates with the material of this article, in which this approach is considered not a basic but an additional tool. The professional training goals formulated by the scientist are general in nature (intellectual development, the ability to meet the requirements of related disciplines from a mathematical point of view, etc.), but there is no specification of these goals in accordance with educational and professional programmes for each specific speciality.

According to I. Maksimov *et al.* (2021), it is proposed to use a system of professionally-oriented tasks in teaching mathematics, some of which were used by leading university scientists when writing their dissertations. This not only demonstrates the practical application of mathematical tools, but also motivates students to engage in scientific research and fulfils educational functions, enhancing the authority of the teacher. A. Kokarieva (2019) examined the procedural and activity-based component of engineer training in close connection with the requirements of social demand, taking into account both Ukrainian and international standards. To achieve this, in the author's opinion, universities should ensure at a minimum: software and hardware equipment; educational and methodological support; electronic resources; emotional and motivational components, etc. For this purpose, a classification of the professional training system was proposed, depending on regulatory provision, aims, and objectives, which includes components, structure, content, methods, and results of training. However, all these interpretations were exclusively general in nature and deserve to be considered when creating a system for quality training of students in specific specialities.

The research by O. Baryl'nyk-Kurakova & I. Korobova (2020) on the implementation of interdisciplinary connections is based on an analysis of regulatory documents that ensure a competence-based approach. The

researchers developed a classification of professional and educational competencies into external and internal. They considered the main goal of the interdisciplinary approach to be the creation of prerequisites for broadening the perspective on the subject of research, which leads to a more thorough analysis of the discipline's content, closer interaction with administrative and teaching structures, and the selection of the most appropriate forms and methods for organising the educational process. All the measures listed are only individual links in the creation of a systemic approach to learning, but they do not encompass the whole picture. Educator O. Zayika (2025) called inter-subject connections "integrated", meaning they are embedded in the system of knowledge, without which quality training of future specialists is impossible. In particular, an example of such an approach in teaching mathematical statistics is given by researchers such as V. Kovalchuk & T. Kovalchuk (2021) in the form of reference notes for the systematisation and evaluation of large and small samples. Researcher O. Sulima (2025) also linked the effectiveness of distance learning with the use of: online learning platforms (Moodle, Google Classroom, Zoom, MS Teams, etc.) to ensure communication between the lecturer and the student; adaptation of educational and methodological material to the online format; and the use of interactive tools (GeoGebra, MATLAB, Wolfram Mathematica, Maple, etc.). These statements emphasised the importance of mastering internet technologies and adapting the educational process to distance learning formats.

The lack of unified educational and work programmes is a hindrance to the development of interdisciplinary connections. In the United States of America, this problem was resolved through the Washington Accord (The Institution of Engineers of Kenya, 2021), signed in 1989, which focuses on academic programmes related to professional-level engineering practice and the accreditation of engineering academic programmes. The Accord became a key foundation for professional-level engineering practice. Professors and lecturers at the Kenyan University of Technology noted that the Accord provides a list of knowledge, the main of which is engineering knowledge, which includes knowledge of mathematics for solving engineering problems. Identifying, formulating, researching, and analysing engineering problems to achieve substantiated conclusions using the principles of mathematics, natural sciences, and engineering sciences is the main goal of training.

Researcher D. Kanundu (2021) drew attention to the crucial importance of engineering and technological education, for which the country's universities must be at the centre of the latest innovative research. The author identified a correlation between the availability of engineering personnel and the country's development, whereby for every 1 engineer there are: 6,300 people in

Kenya; 3,166 people in South Africa; 543 people in Malaysia; 389 people in the USA; 311 people in Great Britain; 285 people in South Korea; 227 people in Brazil; 157 people in India; 130 people in China. Given the rapid development of China and India, and the innovative achievements of South Korea, which are the most technologically advanced in the Asian region, this statistic once again underlines the importance of training qualified personnel for the vital activity and development of any country. Studying the experience of teaching organisation indicates that all the highlighted problems are inherent at both school and higher education levels. The presented studies on creating a holistic system of quality knowledge for a future specialist at each stage of its formation are important tasks for the functioning of educational institutions.

■ Conclusions

According to the results of the research, the set goal was achieved. Unlike the existing approaches of a number of Ukrainian scientists to individual components of the educational process and analysis of world experience, the authors have created a comprehensive system of qualitative knowledge that improves the methodology for training specialists in technical specialities. The main elements of the system, which outlined a number of components of the organisational and methodological mechanism, have been substantiated. Methodological principles for testing residual knowledge have been developed, which include two main stages of research. The first stage involves the development of the form and content of school mathematics course assignments. At the second stage, an algorithm for assessing residual knowledge was developed and criteria for its assessment were defined. Instead of an average score, an interval assessment was proposed, which took into account the discrepancy in assessment, which made it possible to determine

the result for the maximum number of applicants. The methodology was tested on the example of training students of electrical engineering, which made it possible to identify the part of the school material that was subject to correction during higher education.

The established correspondence between the volume of material and the hourly workload enabled the basic material for classroom teaching to be established. To improve the quality of knowledge in distance learning, visual reference notes have been developed, the main purpose of which is both cognitive and explanatory. In order to acquire professional competencies, in addition to the basic material and professional material in higher mathematics provided for in the work programme, it is proposed to extend it to “propaedeutic” material in the form of extracurricular forms of training. A list of sections of “propaedeutic” material for electrical engineering specialities is presented. The system of forming qualitative knowledge is not limited to its use only for technical specialities, but can be extended to others, which is the subject of further research. Based on the analysis of problems in teaching higher mathematics and the solutions proposed by scientists, conclusions have been made regarding the need to take into account both regional factors and the specifics of professional training of engineering specialists. All this helps to prepare engineering personnel who will be competitive both in the Ukrainian labour market and in the markets of other countries.

■ Acknowledgements

None.

■ Funding

None.

■ Conflict of Interest

None.

■ References

- [1] Afanasieva, O., Lalazarova, N., & Goncharova, S. (2021). Features of distance teaching for technical disciplines. *New Collegium*, 3(105), 29-32. doi: 10.30837/nc.2021.3.29.
- [2] Bachelor's educational programme “Electric Power Engineering, Electrical Engineering and Electromechanics”. (n.d.). Retrieved from <http://aespt.knu.edu.ua/educational-programs/eee/>.
- [3] Baryllyk-Kurakova, O., & Korobova, I. (2020). [Interdisciplinary links as a leading principle in education of maritime professionals](#). *Professionalism of the Teacher: Theoretical and Methodological Aspects*, 13, 57-72.
- [4] Declaration of Helsinki. (2013). Retrieved from <https://www.wma.net/what-we-do/medical-ethics/declaration-of-helsinki/>.
- [5] Didyk, A. (2019). Implementation of interdisciplinary connections in the process of teaching electrical engineering and electronics. *Scientific Notes. Series: Pedagogical Sciences*, 143, 80-87. doi: 10.31392/NZ-npu-143.2019.10.
- [6] Honhalo, N. (2022). Implementation of cross-disciplinary relations in the learning process higher mathematics using MS Excel. *Physical and Mathematical Education*, 36(4), 32-37. doi: 10.31110/2413-1571-2022-036-4-004.
- [7] Huber, S., Reinhold, F., Obersteiner, A., & Reiss, K. (2024). Teaching statistics with positive orientations but little knowledge? Teachers' professional competence in statistics. *Statistics Education Research Journal*, 23(1), article number 2. doi: 10.52041/serj.v23i1.610.

- [8] Ivanashko, O., Kozak, A., & Knysh, T. (2023). Effectiveness and efficiency of the educational process in higher education in the conditions of crisis phenomena. *Scientific Journal of M.P. Dragomanov National Pedagogical University. Series 5 Pedagogical Sciences: Realities and Perspectives*, 91, 106-112. doi: [10.31392/NPU-nc.series5.2023.91.22](https://doi.org/10.31392/NPU-nc.series5.2023.91.22).
- [9] Kanundu, D.A. (2021). [Education for industrializing Kenya](#). *Engineering Education*, 4, 20-25.
- [10] Kokarieva, A. (2019). Model of the professional training system of engineers at the technical university. *Collection of Scientific Papers Uman State Pedagogical University*, 4, 97-106. doi: [10.31499/2307-4906.4.2019.200162](https://doi.org/10.31499/2307-4906.4.2019.200162).
- [11] Kovalchuk, M. (2020). [Professional orientation of mathematics teaching as an integration basis for professional training of engineering students](#). Vinnytsia: Vinnytsia National Technical University.
- [12] Kovalchuk, V., & Kovalchuk, T. (2021). The prerequisites for educational training of specialists in economics and entrepreneurship on the basis of mathematical statistics knowledge. *Business Inform*, 1, 139-145. doi: [10.32983/2222-4459-2021-1-139-145](https://doi.org/10.32983/2222-4459-2021-1-139-145).
- [13] Law of Ukraine No. 1556-VII "On Higher Education". (2014, July). Retrieved from <http://fedmet.org/analytics/zakon-ukraini-pro-vishhu-osvitu/>.
- [14] Liuta, O.V. (2018). [Problems of development of the internal system of support quality of educational activities in higher education institutions of higher education in Ukraine](#). In *XIII international conference "Problems of using information technologies in education, science and industry"* (pp. 9-10). Dnipro: Dnipro University of Technology.
- [15] Maksimov, I., Kovalchuk, T., & Kovalchuk, V. (2021). Features of training candidates for the specialty "Mining" through the system of professionally oriented mathematical tasks. *Journal of Kryvyi Rih National University*, 53, 70-76. doi: [10.31721/2306-5451-2021-1-53-70-76](https://doi.org/10.31721/2306-5451-2021-1-53-70-76).
- [16] Mesarosh, L. (2023). Mathematical competencies of science students. *Scientific Journal of M.P. Dragomanov National Pedagogical University. Series 5 Pedagogical Sciences: Realities and Perspectives*, 91, 174-177. doi: [10.31392/NPU-nc.series5.2023.91.36](https://doi.org/10.31392/NPU-nc.series5.2023.91.36).
- [17] Mykhailenko, L. (2020). Foreign experience of methodical training of mathematical teachers. *Physical & Mathematical Education*, 1(23), 83-90. doi: [10.31110/2413-1571-2020-023-1-014](https://doi.org/10.31110/2413-1571-2020-023-1-014).
- [18] Standards and Guidelines for Quality Assurance in the European Higher Education Area (ESG). (2015). Retrieved from https://www.britishcouncil.org.ua/sites/default/files/standards-and-guidelines_for_qa_in_the_ehea_2015.pdf.
- [19] Strakh, O., & Lukashova, T. (2021). Interdisciplinary connections in the study of some topics of discrete mathematics and differential equations. *Physical and Mathematical Education*, 29(3), 112-118. doi: [10.31110/2413-1571-2021-029-3-017](https://doi.org/10.31110/2413-1571-2021-029-3-017).
- [20] Strimel, G., Kraus-Klein, L., Hensel, R.A.M., Kim, E., & Grubbs, M. (2018). [An engineering journey: A high school guide toward the engineering profession](#). Retrieved from https://www.researchgate.net/publication/318602234_An_Engineering_Journey_A_High_School_Guide_Toward_the_Engineering_Profession.
- [21] Sulima, O. (2025). Teaching higher mathematics in the context of training future engineering specialists for professional activity in war and post-war times in Ukraine. In *Professional training of future specialists amidst modern realities* (pp. 462-480). Latvia: Baltija Publishing. doi: [10.30525/978-9934-26-522-8-48](https://doi.org/10.30525/978-9934-26-522-8-48).
- [22] The Institution of Engineers of Kenya. (2021). [Engineering education, research and practice](#). Nairobi: The Institution of Engineers of Kenya.
- [23] Ukrainian Centre for Educational Quality Assessment. (2024). [PISA-2022. Results \(Vol. 1\)](#). Kyiv: Ukrainian Centre for Educational Quality Assessment.
- [24] Vadzyuk, S., Nakonechna, S., & Papinko, I. (2022). Control of the entry level of knowledge as a prerequisite for the effective organization of the educational process at the department. *Medical Education*, 4, 10-15. doi: [10.11603/m.2414-5998.2021.4.12686](https://doi.org/10.11603/m.2414-5998.2021.4.12686).
- [25] Yutkalo, S. (2020). Testing as a form of quality control of students' knowledge in German language classes. *Teaching Languages at Higher Educational Establishments at the Present Stage. Intersubject Relations*, 37, 117-129. doi: [10.26652073-4379-2020-37-09](https://doi.org/10.26652073-4379-2020-37-09).
- [26] Zayika, O. (2025) An integrated approach to learning discrete mathematics by future teachers of mathematics and computer science. *Innovative Pedagogy*, 79(1), 79-83. doi: [10.32782/2663-6085/2025/79.1.13](https://doi.org/10.32782/2663-6085/2025/79.1.13).

Методичні засади забезпечення якісної підготовки фахівців технічних спеціальностей у закладах вищої освіти

Тетяна Ковальчук

Кандидат технічних наук, доцент
Криворізький національний університет
50027, вул. Віталія Матусевича, 11, м. Кривий Ріг, Україна
<https://orcid.org/0000-0001-8272-8465>

Галина Ткаченко

Кандидат технічних наук, доцент
Криворізький національний університет
50027, вул. Віталія Матусевича, 11, м. Кривий Ріг, Україна
<https://orcid.org/0000-0003-2537-9195>

■ **Анотація.** Набуття компетентностей здобувачами вищої освіти стикається з проблемами погіршення шкільних базових знань, а також неструктурованості і фрагментарності викладання вищої математики, які утруднюють засвоєння фахових дисциплін. Метою дослідження було вдосконалення методичного інструментарію для формування цілісної системи якісних знань та їх усвідомленого засвоєння. Було розроблено основні напрямки створення методичних та організаційних умов забезпечення наступності навчання та побудови міждисциплінарних зв'язків. Методологічно дослідження спиралося на використання методів аналізу та узагальнення при створенні наочного базового матеріалу. Статистичні методи застосовувалися при систематизації і обробці результатів перевірки залишкових знань студентів та оцінці результатів тестування як вибірок малого обсягу. Тестування знань шкільного курсу з математики та фізики студентів електротехнічних спеціальностей висвітлювало недоліки їх підготовки, які необхідно враховувати при викладанні розділів вищої математики. Проаналізовано відповідність обсягів матеріалу дисципліни та часу на їх засвоєння, що дало змогу виділити із всього курсу вищої математики базові знання для забезпечення диференційованого підходу до набуття фахових знань. Розглянуто специфіку дистанційної форми навчання, що привело до створення наочних опорних конспектів з підвищеними роз'яснювальними функціями. Відповідно до фахових компетентностей запропонована класифікація матеріалу, що забезпечило міждисциплінарні зв'язки та розширило пропедевтичні можливості. Створений методичний підхід дозволив систематизувати навчальний матеріал з вищої математики, який може використовуватися професорсько-викладацьким складом, здобувачами та іншими учасниками навчального процесу, а також при розробці навчальних планів і складанні робочих навчальних програм

■ **Ключові слова:** якість навчання; методика; система знань; вища математика; електротехнічна спеціальність; пропедевтика



Specific features of the development of international academic mobility among Ukrainian humanities students in the digital society

Liudmyla Filipova*

Doctor of Pedagogical Sciences, Professor
Kharkiv State Academy of Culture
61057, 4 Bursatsky Uzviz, Kharkiv, Ukraine
<https://orcid.org/0000-0003-0273-7922>

David Miller

Master
Kharkiv State Academy of Culture
61057, 4 Bursatsky Uzviz, Kharkiv, Ukraine
<https://orcid.org/0009-0002-6610-880X>

■ **Abstract.** This article aimed to provide a comprehensive analysis and characterisation of the main directions and programmes of academic mobility for Ukrainian students, with particular attention to those specialising in information and library sciences. The methodological framework of the study included such methods as analysis and content analysis of academic sources – primarily online resources – along with critical and comparative analysis, generalisation, hypothesis formulation and forecasting. The article outlined various types of digital education programmes and initiatives available to students of humanities disciplines in Ukraine, taking into account their advantages and limitations, particularly in terms of their potential to enhance academic mobility. Key trends and directions in academic mobility and digital education programmes for humanities students in Ukraine were identified, and their potential to improve academic mobility and enrich the educational experience of students in these fields was discussed. The challenges and obstacles that must be overcome to realise the full potential of digital education programmes for academic mobility were addressed. There is considerable potential for the development of academic mobility within digital education programmes for humanities students in Ukraine; however, achieving this will require national stability, sustained effort and continued support. The prospects for academic mobility among Ukrainian humanities students through such programmes are linked to the ongoing adoption of digital technologies based on the experience of European universities, the exploration of international practices in innovative teaching methods, increased accessibility and flexibility in education, as well as the strengthening of cooperation and exchange within virtual learning environments

■ **Keywords:** student mobility; educational space; international placements; digital education projects; international programmes

■ Introduction

Academic mobility is a vital component of international cooperation in higher education, promoting knowledge exchange, cultural integration and personal development among students. These processes are of particular interest to young people within the context of the

European digital learning space. The digital revolution has brought both new opportunities and challenges for academic mobility, enabling remote learning, online collaboration and the exchange of digital resources. At the same time, it has raised important questions regarding

Suggested Citation:

Filipova, L., & Miller, D. (2025). Specific features of the development of international academic mobility among Ukrainian humanities students in the digital society. *Professional Education: Methodology, Theory and Technologies*, 11(1), 34-45. doi: 10.69587/pemtt/1.2025.34.



the exclusivity, accessibility and inclusivity of distance education, as well as the impact of digitalisation on traditional forms of educational mobility and the active participation of students from various disciplines, including those in the humanities. In Ukraine, where the higher education sector is undergoing comprehensive reform, academic mobility is viewed as a key driver of modernisation and internationalisation. The complex geopolitical situation, particularly the full-scale war, has significantly affected the academic mobility opportunities available to Ukrainian students. Power outages, internet disruptions, and both psychological and logistical difficulties have posed major challenges for those participating in international education programmes. Nevertheless, international digital education projects and platforms have helped to mitigate some of these difficulties by providing flexible learning opportunities and allowing students to complete coursework remotely.

The state of research on academic mobility within the European digital education space has been the subject of numerous studies. According to I. Shemelinets & Y. Nikolayev (2022), new formats of academic mobility have emerged as a result of the digitalisation of the learning process. The concept of digital mobility has also been explored by W. Shen *et al.* (2022), who emphasise the flexibility and accessibility offered by digital platforms. A.M. Samko (2022) has analysed the trends and patterns of academic mobility in Europe, paying particular attention to the role of digital technologies in enabling and shaping these processes. C. López-Duarte *et al.* (2021) highlighted the importance of international exchange for students' professional development, as well as the transformative role of digital technologies in reshaping traditional forms of academic mobility. Online courses, virtual symposia and the integration of electronic educational platforms are expanding access to international education – even for those students who are unable to travel physically.

In Ukraine, research on academic mobility within the European digital education space remains relatively limited. Most existing studies focus on broader issues such as educational reform, digitalisation, and international cooperation. However, there is a growing body of research aimed specifically at exploring the unique characteristics of academic mobility in the Ukrainian context. Academic literature reveals both similarities and differences when comparing the situation in Ukraine with wider European trends. According to O. Kalinichenko (2021), an attempt has been made to analyse changes in the structure of international mobility among higher education students in Ukraine, with particular emphasis on institutional strategies and the influence of digital tools. The study highlighted that digitalisation has become not merely a response to current demands, but a necessary condition for maintaining educational engagement during times of disruption. Researchers A.P. Martyniuk &

A.M. Hubina (2024) have emphasised the importance of strengthening international capacity in areas such as grant and project activities, the preparation and submission of project proposals for competitive funding, and the development of strategic partnerships. According to their view, academic mobility aims to ensure that all teaching staff and university personnel participate in study visits and international placements as part of their professional development. Scholars H. Cherusheva *et al.* (2023) focused on pedagogical innovation in the context of virtual mobility, presenting examples of how digital platforms have been integrated into the teaching process at Ukrainian higher education institutions. The authors examined the relationship between students' digital competencies and their readiness to engage in international educational projects. In the study by R. Karp (2024), attention was drawn to the social aspects of academic mobility, particularly the impact of intercultural adaptation on the academic performance of Ukrainian students in digital formats. The author emphasised the need to develop soft skills within the context of remote collaboration. The article by L. Mykhailova *et al.* (2023) presented an analysis of the transformation of humanities education under the conditions of digital mobility, based on empirical data from student participation in virtual international projects. The researchers concluded that humanities education is not only adapting to new realities but is also opening new interdisciplinary horizons through digital mobility. Authors A.-M. Chubniska & V. Guchko (2023) focused on the experiences of Ukrainian students participating in dual degree programmes, in which digital tools served not only as a platform for learning but also as a means of sociocultural integration. The study by O.V. Zhovnych & A.V. Duchenko (2024) examined the specific nature of academic mobility among students in regions destabilised by armed conflict, with particular emphasis on the importance of maintaining digital infrastructure and ensuring institutional flexibility within universities.

This article aimed to explore the current state of academic mobility programmes for students in Ukraine, including those involving digital education, and to discuss the challenges and opportunities that are unique to students in the humanities. The study assessed international academic mobility trends, analysed the participation of students from Kharkiv State Academy of Culture in relevant programmes, and identified prospects for the development of such initiatives under present-day conditions.

■ Materials and Methods

The theoretical basis of the research was a systems paradigm, which considers academic mobility as a complex phenomenon shaped by the interaction of social, political, institutional and technological factors. This approach made it possible to consider not only the direct experiences of participants but also the broader

context, including the influence of international cooperation, EU digital policies, and regional initiatives aimed at supporting mobility in times of crisis. Increasingly important is the need for students enrolled in humanities programmes to understand the content and requirements of international academic mobility initiatives delivered through digital technologies and distance learning tools. Special attention was therefore given to the integration of digital educational solutions into higher humanities education, particularly in the field of information and library sciences (speciality 029 ILAS). This discipline was selected due to its inherent need for mastering tools such as learning management system (LMS platforms), e.g., Canvas, analytical dashboards for monitoring academic performance, cloudbased services for collaborative work, and digital intercultural communication practices. The theoretical foundation for analysing trends in academic mobility within the European digital education space was also grounded in systems theory, which views academic mobility as a complex system influenced by economic, cultural, and political forces. The systems approach enabled a comprehensive analysis that took into account not only immediate factors but also broader institutional and societal structures.

The study was based on the author's personal experience gained through participation in academic mobility programmes, as well as on the analysis of informal conversations with colleagues who had also taken part in such initiatives. Key aspects of the research focused on academic mobility among Ukrainian higher education students with a view to integration into the European digital education space. A valuable contribution was the experience of participating in the BOBCATSSS (n.d.) 2023 symposium, held at Oslo Metropolitan University (Norway), which was attended by three students from Kharkiv State Academy of Culture (KSAC). During the event, participants engaged in discussions concerning the organisational structure of the programme, its content, the accessibility of digital resources, and the effectiveness of the implemented methods of interaction (American Sociological Association's Code of Ethics, 1997). These informal exchanges helped to better understand the strengths of the initiative and to identify limitations that affected the efficiency of academic engagement. Particular attention was given to digital learning platforms, notably the Canvas LMS, which was used to support remote interaction and provide assistance to symposium participants. Experience gained through the Seeds for the Future 2021 programme, organised by Huawei (Huawei announces a..., 2021), and the Wildau-Kharkiv IT Bridge (n.d.) project in 2022 (Germany) enabled a qualitative assessment of the structure, objectives, digital support, and impact of these programmes on the development of professional competencies. Within these programmes, issues related to digital academic

mobility among students of information and library sciences were explored, alongside the specific features of their integration into the international education space and the challenges posed by crisis situations.

The methodological framework of the study incorporated a range of methods selected per the specific nature of the subject. Analysis and content analysis were used to examine academic articles, analytical reports, regulatory documents (Law of Ukraine No. 1556-VII, 2014), and official materials from international programmes related to digital education and mobility. The method of critical analysis enabled an assessment of the advantages and disadvantages of different formats of academic mobility, particularly through a comparison between in-person and digital modes. Reflection on the experience of participating in the BOBCATSSS 2023 programme proved especially valuable, serving as an example of how international events have been adapted to hybrid and virtual formats. Comparative analysis was applied to evaluate the Seeds for the Future and Wildau-Kharkiv IT Bridge programmes, highlighting differences in educational formats, approaches to digital mobility depending on the organisers, target audiences, and programme duration. The method of generalisation supported the formulation of conclusions regarding current trends: the flexible use of digital platforms, the growing role of institutional autonomy in decisions about programme participation, and the importance of inclusivity in virtual environments. Using forecasting methods, an attempt was made to anticipate future directions in the development of digital academic mobility under martial law and the context of the post-crisis recovery of the education sector.

■ Results and Discussion

The concept of academic mobility within the European Higher Education Area (n.d.) (EHEA) refers to the movement of students, researchers, and academic staff between institutions across Europe, aimed at enhancing the quality and relevance of higher education, promoting the exchange of knowledge and experience, and strengthening international cooperation and mutual understanding. This process encompasses a range of activities, including study abroad programmes, Erasmus+ exchanges (Erasmus+ is the EU's programme..., n.d.), joint degree programmes, research collaborations, and academic conferences. Academic mobility is regarded as an essential component of the EHEA, which seeks to establish a harmonised and interconnected higher education system across Europe. The EHEA supports academic mobility as a means of fostering a shared European identity, building a knowledge-based society, and addressing the challenges of globalisation and the digitalisation of education.

In Ukraine, a regulatory and legal framework has been developed to govern student academic mobility programmes. This framework comprises a complex

system of laws, regulations, and policies operating at both national and institutional levels. The primary legal document regulating academic mobility in Ukraine is the Law of Ukraine No. 1556-VII (2014), which sets out the principles and general provisions concerning the organisation and functioning of higher education institutions, as well as their relationships with other participants in the educational process. Ukrainian universities and other higher education institutions also have their own internal policies and regulations governing academic mobility programmes, which must comply with national legislation. These institutional policies often provide additional guidance on the requirements and procedures for participation in mobility programmes, including eligibility criteria, application procedures, and rules for credit transfer and recognition.

For Ukrainian university students, such programmes offer a unique opportunity to broaden their cultural horizons, gain international experience, and improve their foreign language proficiency. Similarly, participation in academic mobility programmes can enhance students' career prospects by providing them with a competitive advantage in the labour market and helping them to develop key social skills, including adaptability, communication, and intercultural competence. Academic mobility programmes also contribute to the internationalisation of Ukrainian higher education institutions by promoting academic excellence and facilitating the exchange of best practices. Therefore, evaluating academic mobility programmes for Ukrainian university students is of particular importance, as it offers insights into current developments and the potential of the digital society, as well as the challenges facing the national higher education system.

This study examined and analysed international academic mobility programmes available to Ukrainian higher education institutions, specifically involving undergraduate and postgraduate students in information and library sciences (speciality 029 ILAS) at KSAC between 2014 and 2024. Among the programmes identified were Seeds for the Future (Cultivating digital talents..., n.d.), Wildau-Kharkiv IT Bridge (n.d.), and other short-term mobility initiatives, providing an overview of the opportunities available to Ukrainian students in this field. The Seeds for the Future 2021 (Huawei announces a..., 2021) international programme, organised by Huawei (China), invited the top students and graduates from Ukrainian higher education institutions who had successfully passed a competitive selection process. This important educational initiative, now in its seventh consecutive year since its launch in 2018, has been supported by the Ministry of Education and Science of Ukraine. It continues to promote the development of high-quality education and supports the future employment of talented Ukrainians in the field of information and communication technologies (ICT) (Seeds for the Future: The new..., 2023).

Seeds for the Future may be described as a unique international academic mobility programme aimed at enhancing knowledge exchange, deepening understanding of China and its culture, and fostering communication and cooperation in the ICT sector. The programme is funded by Huawei Technologies Co., Ltd., a global leader in ICT infrastructure and smart devices, and offers Ukrainian university students the opportunity to participate in remote learning, followed by a two-week study visit to China. Participants attend lectures and seminars on ICT developments and trends, visit Huawei's headquarters and research centres, learn about Chinese culture and way of life, and engage with professionals in the field as well as with fellow students from around the world. The programme is highly competitive and involves a rigorous selection process based on academic achievement, English language proficiency, and other criteria set by the sponsor. Successful participants receive certificates of completion and become part of a global alumni network (Huawei announces a..., 2021). Seeds for the Future supports various forms of academic mobility for Ukrainian students, combining both online and offline components. The online stage includes virtual courses and lectures on advanced ICT topics such as 5G, cloud computing, and artificial intelligence, aimed at providing students with solid theoretical knowledge in the field. The offline stage offers students the opportunity to travel to China, particularly to Huawei's headquarters in Shenzhen, where they participate in hands-on workshops and collaborate with industry professionals on real-world projects. The Seeds for the Future 2021 programme provided a blended model of academic mobility for Ukrainian students interested in ICT, aiming to equip them with comprehensive knowledge and practical skills in the sector.

The Seeds for the Future 2021 programme provided a blended model of academic mobility for Ukrainian students interested in ICT, aiming to equip them with comprehensive knowledge and practical skills in the sector. The programme offered Ukrainian students the opportunity to gain valuable experience and enhance their qualifications in the field of ICT, cutting-edge research and development, as well as the innovative application of ICT. It also enabled participants to interact and build professional connections with experts in the field. By taking part in Seeds for the Future 2021, students gained insight into the latest trends and innovations in ICT and broadened their cultural perspectives. However, certain drawbacks of the programme were noted. Participants were required to demonstrate a sufficient level of English proficiency, as the programme was conducted entirely in English. Additionally, Seeds for the Future is highly selective, accepting only a limited number of students each year. Although the programme covered travel and accommodation costs, daily expenses such as food and personal spending were not included. Despite these limitations, Seeds for the

Future 2021 provided Ukrainian students with a valuable opportunity to deepen their ICT knowledge and skills, gain practical experience, and establish connections with professionals in the field. Overall, participants evaluated the programme positively, expressing satisfaction with the learning outcomes – particularly the improvement of their English proficiency and applied ICT skills in academic contexts.

The Wildau-Kharkiv IT Bridge programme may be described as a cross-border academic mobility initiative aimed at fostering collaboration and knowledge exchange among students, researchers, and industry experts from Ukraine and Germany. The programme was designed to provide Ukrainian students with practical experience in the field of information technology (IT) through participation in various IT projects and workshops, organised with the support of the host institution, the Technical University of Applied Sciences Wildau. The Wildau-Kharkiv IT Bridge 2022 programme was expected to contribute to the development of the IT industry in both countries and to strengthen cultural and academic ties between Ukraine and Germany. It was intended to run for one academic year, during which students would participate in a range of activities aimed at expanding their knowledge and skills in IT (Wildau-Kharkiv IT Bridge, n.d.).

The Wildau-Kharkiv IT Bridge programme supports various forms of academic mobility aimed at promoting international exchange and collaboration among Ukrainian students. These types of mobility include a range of opportunities, such as short-term study visits, which enable participation in intensive courses organised by the host university, offering students the chance to gain specialised knowledge and skills in a chosen field. The programme also includes internships with host organisations, allowing students to apply their academic knowledge in professional settings while gaining valuable practical experience. Joint research projects offer opportunities for students to collaborate with individuals or teams from the host university, institutions, or industry partners, encouraging knowledge transfer, intercultural understanding, and innovation. In addition, language courses are available to help students develop or improve their language skills, facilitating communication and interaction with people from diverse cultural and social backgrounds. All these forms of mobility are designed to support students' academic and professional development, helping them strengthen the key competencies needed to contribute to Ukraine's digital society and succeed in the global labour market.

Participation in the Wildau-Kharkiv IT Bridge 2022 programme had both advantages and certain drawbacks that should be considered in its evaluation. Among the positive aspects were the enhancement of academic and professional skills in the field of IT, made possible through participation in lectures, seminars, and practical training sessions. Exposure to a different

academic environment and teaching approaches also played a significant role in broadening participants' perspectives. Students had the opportunity to develop cross-cultural competencies and global awareness, establish international contacts, and build collaborative relationships with students and lecturers from the Technical University of Applied Sciences Wildau. An important outcome of the programme was the improvement of future employment prospects through the acquisition of new knowledge and hands-on experience. However, participation in the programme was not without challenges. One of the main limitations was the strict selection criteria, which narrowed the pool of potential candidates. Additionally, the short duration of the programme sometimes made it difficult to fully benefit from all the available opportunities. A limited number of places created competition among applicants, even those who met the formal requirements. Further difficulties arose from academic and logistical issues, such as missing classes or exams at the home university and the need to ensure the transfer of academic credits. After completing the programme, some participants encountered limited employment opportunities, which also affected the overall assessment of the programme's effectiveness.

It is important to note that the advantages and disadvantages of participating in the Wildau-Kharkiv IT Bridge 2022 programme may vary depending on individual circumstances and expectations. Students are advised to carefully consider their educational, personal, and professional goals before applying. The comparison of international academic mobility programmes for Ukrainian students was based on several criteria. These included the types of mobility supported by each programme, student eligibility requirements, the benefits and drawbacks of participation, and the challenges faced by students involved in such programmes. A detailed assessment of each programme was carried out using these criteria. The analysis revealed that the Seeds for the Future 2021 programme offered long-term mobility opportunities for Ukrainian students in the field of ICT. It allowed students to gain deeper insight into the latest technological developments in ICT and take part in cultural exchange. However, the programme was limited to ICT students, and the highly competitive selection process made it difficult for many applicants to gain admission. The Wildau-Kharkiv IT Bridge 2022 programme provided short-term mobility opportunities for Ukrainian students. It was focused on strengthening students' skills in software development and IT project management. The programme also offered opportunities for interaction with lecturers and students from various higher education institutions and a closer look at their teaching methods and research practices. Nonetheless, the programme was open to only a limited number of participants, and its short duration restricted the depth of learning.

It can be concluded that both the Seeds for the Future 2021 and Wildau-Kharkiv IT Bridge 2022 programmes had their respective strengths and weaknesses. The Seeds for the Future 2021 programme offered a relatively modest opportunity for long-term learning, whereas the Wildau-Kharkiv IT Bridge 2022 provided a short-term yet intensive educational experience. The participant requirements for both programmes aligned with the intended learning outcomes, although the selection process for Seeds for the Future was exceptionally competitive. It is therefore recommended that the selection procedures for international academic mobility programmes be made more transparent and accessible to a broader range of students. The challenges faced by students participating in international academic mobility programmes in Ukraine are varied and complex, and can be analysed from multiple perspectives (López-Duarte *et al.*, 2021). One of the key challenges involves adapting to an entirely new academic and cultural environment, which can be a difficult and demanding experience for many students. Unfamiliar teaching methods, differing academic norms and expectations, and overcoming language barriers can also present significant challenges for students. Another issue relates to the social and emotional impact of international mobility, which can be both positive and negative. On the one hand, students may form new friendships, engage with different cultures, and acquire valuable skills and knowledge that can benefit their future careers. On the other hand, they may experience feelings of isolation, homesickness, and cultural disorientation, all of which can affect their academic performance and overall well-being. Financial constraints can also pose a major obstacle, particularly for students from low-income backgrounds or those with limited access to scholarships and financial support. Universities and policy-makers need to recognise and address these challenges in order to enhance the effectiveness and sustainability of international academic mobility programmes in Ukraine. Doing so will contribute to greater educational cooperation and exchange on the global stage.

It is worth highlighting the projects organised by the renowned international association BOBCATSSS, affiliated with the European Association for Library and Information Education and Research (EUCLID), which annually hosts symposia and forums for both professionals and students (presided over by Tania Todorova, University of Library Studies and Information Technologies, Bulgaria). The name BOBCATSSS itself is an acronym derived from the cities originally involved in the collaboration: Budapest, Oslo, Barcelona, Copenhagen, Amsterdam, Tampere, Stuttgart, Sheffield, and Szombathely. The annual symposia aim to promote academic mobility among students of higher education institutions. Held every year since 1993, the symposia seek to create a platform for students and professionals to exchange knowledge and experience, support educational

and professional development, and foster interdisciplinary collaboration. The BOBCATSSS International Symposium (BOBCATSSS, n.d.) is widely recognised as a prominent academic forum, offering professionals, students, and researchers in the field of library and information science an opportunity to share ideas, exchange expertise, and contribute to the advancement of the discipline. It serves as a platform for discussing current trends and challenges in the field, while also exploring the potential of emerging technologies and innovations.

BOBCATSSS 2023 was expected to attract a diverse international audience, including students, academics, and researchers from around the world (Terra, 2023). This symposium represents a significant event, generating interest in the academic mobility of students from Ukrainian higher education institutions. Its importance and relevance to academic mobility in Ukraine are evident in its strong focus on promoting international collaboration and the exchange of ideas between students and professionals. The symposium offers students a valuable platform to engage with peers and experts from various countries, allowing them to explore diverse perspectives and approaches to academic and professional development. Participation in BOBCATSSS also contributes to the enhancement of intercultural communication skills and the cultivation of global thinking – both of which are essential competencies in today's digital society. The theme of BOBCATSSS 2023 centred on contemporary trends and future prospects related to academic mobility in the digital age. Topics covered a wide range of issues, including – but not limited to – digital literacy, innovation, big data and analytics, information management, and emerging technologies. Overall, the target audience of BOBCATSSS is not limited to any single group or profession; rather, it includes a broad and diverse community of individuals with a shared passion for library and information science. The venue and date of the BOBCATSSS 2023 symposium were determined well in advance and widely promoted through various media channels. The symposium was scheduled to take place in Oslo, Norway, from 25 to 27 January 2023, with Oslo Metropolitan University selected as the host institution. This choice was based on several factors, including the university's excellent facilities, its central location within the city, and its reputation as a hub for academic research and innovation. The time and place of the symposium were carefully selected to maximise participation and engagement from both academic professionals and students.

The BOBCATSSS programme is organised by students and lecturers from various European universities, providing a unique platform for the exchange of ideas and best practices. It may be considered an example of hybrid academic mobility, as participants can engage both in person and remotely. The main tool for communication and educational management during the event was the Canvas LMS – a learning platform

that provided access to educational materials, assignments, and communication channels between students and lecturers. This platform played a crucial role for Ukrainian students, who faced barriers to accessing educational content due to the ongoing war. In particular, during periods of frequent power outages in Ukraine, the ability to download materials for offline use significantly improved the effectiveness of the learning process in conditions of an unstable internet connection.

Participation in the BOBCATSSS symposium offers several benefits for students of higher education institutions in Ukraine. Firstly, the symposium provides a platform for engaging in academic discussions and exchanging ideas with professionals in their field. It gives students the opportunity to broaden their knowledge and gain valuable insights into current trends and practices within their areas of study. Secondly, the symposium enables students to network with a range of experts and potential employers. This can lead to career opportunities, collaborative projects, and mentoring relationships that significantly contribute to students' academic and professional development. Finally, the symposium allows students to explore different cultures and international perspectives, helping to enhance their social and communication skills, as well as their ability to adapt to diverse environments.

The activities available to BOBCATSSS participants include: various academic and professional panels on library and information science, as well as information management more broadly; interactive sessions and round tables dedicated to current issues in the field; and pre-conference workshops offering hands-on experience and training in relevant software and hardware. These workshops are designed to strengthen the skills and competencies of professionals working in the field of librarianship and information science. In addition, participants have the opportunity to engage with like-minded scholars and practitioners, gaining fresh perspectives on some of the most pressing challenges facing the rapidly evolving information landscape in the digital age. Participation in the BOBCATSSS symposium offers Ukrainian students in higher education a valuable opportunity for academic and professional development. By taking part in various workshops, lectures, and events presented at the symposium, students can acquire relevant knowledge and skills applicable to their field of study. The symposium also enables students to network with professionals and peers from their disciplines, potentially opening pathways for collaboration, mentorship, and future career advancement. For Ukrainian university students seeking to strengthen their academic and professional prospects, participation in the symposium represents a meaningful investment.

However, attending BOBCATSSS may involve certain potential drawbacks that could deter Ukrainian students. One such challenge is the potential language barrier, as presentations and discussions at the

symposium are held in English and other languages. This could pose difficulties for individuals who are not proficient in the languages used during the event and may limit their ability to fully engage with the seminars, lectures, and discussions on offer. In such cases, participants may struggle to fully grasp the content of the conference, which could negatively affect their overall experience. However, it should be noted that these challenges can be mitigated through the provision of translation services and language support for those who require them. Ultimately, the time commitment needed to participate in the symposium may be a drawback for some students, as they might miss classes or other academic obligations. Nevertheless, with careful planning and communication with their lecturers, students can minimise the impact of their absence and catch up on coursework upon their return. It is important to acknowledge the potential barriers to attending conferences such as BOBCATSSS 2023, so that appropriate measures can be taken to ensure an inclusive and positive experience for all participants. While BOBCATSSS may present certain difficulties for Ukrainian students, these can be overcome through proactive strategies and planning. The benefits of participating in the symposium – including enhanced academic and professional development – make it a valuable opportunity that should not be overlooked. An analysis of the international annual BOBCATSSS symposium provides useful insights into the advantages and potential limitations of participating in academic mobility programmes for students at Ukrainian higher education institutions. The symposium offers a series of workshops, lectures and other activities that contribute to students' learning and skills enhancement. Overall, participation in programmes such as BOBCATSSS is of significant importance for Ukrainian students, as it allows them to engage with diverse perspectives and strengthen the competencies and knowledge needed to thrive in Ukraine's digital society.

The integration of digital education programmes into academic mobility initiatives remains a relatively recent development, and empirical research into their effectiveness is still limited. However, numerous successful examples demonstrate the potential of this approach. For instance, several universities in Ukraine have begun implementing online courses as part of their academic mobility programmes, enabling students to study abroad while remaining connected to their home institutions. Despite these positive developments, the current state of academic mobility programmes for students in the humanities in Ukraine – particularly those involving digital education – faces several challenges and limitations. One of the key issues is the lack of infrastructure and resources required to support such initiatives, particularly in the areas of technology and communication. Similarly, there is often a need for additional training and support for academic staff and

administrators involved in these programmes, as well as a need to develop more precise methods for evaluating and analysing their effectiveness.

The participation of students from Kharkiv State Academy of Culture in international academic mobility programmes has proved to be a key factor in the development of their professional competencies. The most notable impact was observed in the areas of digital literacy, intercultural communication, and adaptive skills – all of which directly influence future professional activities in the field of library and information science. The Seeds for the Future 2021 programme, organised by Huawei, provided students with practical knowledge in the field of information and communication technologies. The educational content, which covered topics such as 5G, cloud computing, artificial intelligence, and cybersecurity, aligned with current demands for digital competence among specialists in the humanities. Participation in virtual training sessions, team projects, and English lectures contributed not only to professional development but also to the students' linguistic proficiency, significantly broadening their future opportunities for international collaboration.

The Wildau-Kharkiv IT Bridge project also had a positive impact on the development of students' professional skills. As part of this cross-border partnership, students participated in real-life IT projects, seminars, and workshops delivered by lecturers from the Technical University of Applied Sciences Wildau (Germany). Engagement with representatives of the German academic community enabled participants to explore practical aspects of managing educational platforms, digital document workflows, and innovative methods of information processing. The experience gained served as a foundation for further professional specialisation in areas such as digital libraries, electronic archives, and information management. The BOBCATSSS 2023 programme exemplified a hybrid form of academic mobility. The use of the Canvas LMS platform as the primary tool for remote interaction during the symposium provided students with hands-on experience in working with modern digital services. This contributed to the development of both asynchronous and synchronous communication skills – an essential component of professional practice in the library and information sector. Such skills have become particularly relevant during the transition to remote and blended service formats in libraries, archives, and information centres.

In addition to professional development, mobility programmes also contributed to the enhancement of soft skills, including intercultural communication, teamwork, time management, and digital ethics. Participation in international projects improved students' ability to adapt to new environments, respond swiftly to changes, and think critically when analysing information. These skills form a foundation for future career progression, particularly within international projects,

educational platforms, digital libraries, and the field of scientific and information support. The findings indicate that participation in international academic mobility programmes opens up a range of opportunities for students. Graduates are more likely to be competitive in the international job market, engage in joint research initiatives, work in digital communications, and take on roles as coordinators of international educational projects. The development of such initiatives is fostering a new generation of humanities professionals who not only possess subject-specific expertise but are also equipped to operate effectively in the context of digital transformation.

The current state of academic mobility programmes for students in the humanities in Ukraine, particularly those involving digital education, is both complex and evolving. While this approach offers numerous opportunities and potential benefits, it also presents widespread challenges that must be addressed to realise its full potential. Despite the clear advantages of digital academic mobility, researchers have highlighted several issues associated with its implementation. As noted by R.M. Ryan *et al.* (2021), limited social interaction due to the absence of direct communication with lecturers and peers may reduce the effectiveness of learning and negatively affect student motivation. Furthermore, not all students possess sufficient skills to use online tools effectively, underscoring the issue of low digital literacy. According to A. Bozkurt & R.C. Sharma (2020), distance learning also requires a high level of self-discipline and organisation, which can be particularly demanding for some students – especially in times of crisis.

Despite considerable academic interest and publication activity in this area, certain aspects of academic mobility in the European digital education space remain under-researched. In particular, there is a need for greater insight into how digital technologies are shaping mobility models and the lived experiences of mobile students in the humanities, many of whom have limited proficiency in information and communication technologies. In the context of growing interest in academic mobility in Ukraine, it is worth highlighting the study by A.M. Samko (2022), who analysed the impact of martial law on the educational process and emphasised the need to adapt academic mobility programmes to new realities, particularly through the use of digital technologies to ensure continuity of learning. On the other hand, in their article, T.A. Vasileva & Yu.M. Petrushenko (2022) explored the integration of Ukrainian students into the European educational space via academic mobility programmes. The researchers stressed the importance of intercultural competence and foreign language proficiency as key factors for the successful integration of students into the international academic environment. S. Amelina & I. Kononchuk (2023) argued that effective practical training for future translators in Germany includes

internships, the completion of profession-oriented tasks, and participation in a semester abroad, all of which contribute to the development of strong translation competence. The study also placed significant emphasis on the independent search for internship placements by students, which fosters their sense of responsibility and adaptability to professional environments.

Several key areas have been identified where further research is required. These include: the impact of digitalisation on academic mobility; the role of intercultural competence within mobility programmes; and the effects of academic mobility on host institutions. Investigating these issues is essential for the sustainable development of academic mobility within the European digital education space and for shaping strategies to enhance the quality and inclusiveness of the mobility experience for all students. While academic mobility is becoming increasingly accessible in the digital age, it also demands the adaptation of curricula and the provision of appropriate student support within new educational formats (Shkarlet, 2022).

The findings of this study suggest that digital academic mobility programmes have considerable potential to influence the professional training of students in the humanities. A comparison with existing scholarly research confirmed the relevance of such initiatives, while also indicating some shifting areas of focus. In the research of W. Shen *et al.* (2022), emphasis was placed on the importance of technical support and a stable digital environment for the effective delivery of virtual mobility. The experience of students from KSAC supports these observations: unstable internet access in Ukraine under martial law significantly complicated the learning process. However, the functionality of the Canvas LMS platform enabled participants to download materials for offline use, which helped to mitigate some of the digital barriers. C. López-Duarte *et al.* (2021) argued that the main challenge of digital academic mobility remains the limited level of social interaction, which negatively affects the development of intercultural competence. However, the present study revealed a contrasting perspective: programmes such as Seeds for the Future and Wildau-Kharkiv IT Bridge enabled students to develop social skills through teamwork on projects, participation in debates, and engagement in online seminars. This suggests that different programme models foster varying mechanisms of socialisation.

Y. Chen *et al.* (2021) focused on the emotional challenges associated with digital learning, including decreased motivation, feelings of isolation, and screen fatigue. Similar difficulties were observed in the present study; however, the presence of mentors, support from programme coordinators, and regular feedback helped to alleviate these issues to some extent. The insights of A. Bozkurt & R.C. Sharma (2020) are particularly valuable, as they argued that digital mobility requires a rethinking of pedagogical approaches, including

adaptation to cultural differences and the introduction of new forms of assessment. The experience of BOBCATSSS 2023 and Wildau-Kharkiv IT Bridge demonstrated that the most successful elements of these programmes involved the use of interactive teaching methods – such as peer review, digital portfolios, and virtual presentations. This highlights the essential role of innovative pedagogy in delivering effective digital mobility.

It has been found that humanities disciplines remain underrepresented in current research on digital mobility. For example, the publications of W. Shen *et al.* (2022) focused primarily on technical and management-related fields, while the impact of digital mobility on the formation of professional identity among library and archival science specialists has received little scholarly attention. The experience of students from KSAC highlights the considerable potential of such programmes for integrating digital technologies into the humanities and for fostering flexible, interdisciplinary competences. It is important to note that international academic mobility in digital format holds significant social value for humanities students in Ukraine. It contributes to reducing educational inequality – particularly in times of war, when physical travel abroad is either restricted or impossible. Virtual participation in mobility programmes such as BOBCATSSS serves as a tool for social integration, enabling Ukrainian students to remain part of the global academic community.

It must also be acknowledged that scholarly literature still lacks an in-depth analysis of the emotional dimension of digital mobility, particularly concerning the impact of stress, cognitive overload, and fluctuations in motivation. These issues were mentioned only briefly in the articles of Y. Chen *et al.* (2021) and R.M. Ryan *et al.* (2021). This study partially reflects these aspects through students' reflections on the challenges of adapting to the intensive format of virtual interaction. This opens up new avenues for further psychological research in the field. Accordingly, the findings of the analysis support the conclusion that digital academic mobility, despite its limitations, has a tangible impact on the professional training of Ukrainian students. It contributes to the development of flexible competences, lifelong learning skills, self-management, intercultural communication, and digital literacy. These attributes align with the demands of the 21st-century labour market and help prepare future professionals to navigate the realities of a global digital society. Comparing the results of this study with the conclusions of other researchers not only confirms key trends but also highlights underexplored areas – particularly within the sphere of digital mobility in the humanities, institutional autonomy in the context of non-formal educational initiatives, and the effects of crisis conditions (such as war and the pandemic) on emerging forms of mobility. These aspects may serve as a foundation for further interdisciplinary research at the intersection of

education studies, cultural studies, information technology, and pedagogy.

■ Conclusions

As a result of the study, it was established that academic mobility in digital format offers new opportunities for humanities students, particularly in the context of social and political instability. Participation in international programmes such as Seeds for the Future 2021, Wildau-Kharkiv IT Bridge 2022, and BOBCATSSS 2023 demonstrated significant potential for the development of students' professional and intercultural competences. These initiatives contributed not only to the enhancement of digital skills but also to the advancement of interdisciplinary collaboration, critical thinking, self-organisation, and communication in multilingual environments.

The experience of engaging in digital forms of academic mobility showed that humanities students are capable of effectively adapting to new models of learning and professional development. Digital mobility programmes facilitated a deeper understanding of current technological trends, which is essential for future careers in information, library and archival sciences. However, several limitations were also identified, including technical difficulties, insufficient levels of digital literacy, and unequal access to quality internet infrastructure. The analysis of mobility programmes made it possible to identify the components that most strongly influence the success of student participation: the availability of digital learning platforms, active engagement with mentors, support

from coordinators, and flexibility in organisational arrangements. These factors proved crucial for the successful integration of KSAC students into international academic environments.

Digital academic mobility is an effective tool for the professional training of students in the humanities. It helps to compensate for the limitations of physical mobility, particularly under wartime conditions, and lays the groundwork for the future integration of the Ukrainian education system into the European and global academic space. The prospects for developing academic mobility for humanities students through digital education programmes in Ukraine are clearly promising and merit further enhancement. Digital technologies create new opportunities for innovative teaching and learning practices, increased accessibility and flexibility in education, and stronger collaboration and exchange in virtual environments. The development of digital education programmes will help to overcome some of the barriers to academic mobility, such as geographical constraints and financial limitations, by enabling students to take part in remote exchange programmes, online courses, and joint research projects.

■ Acknowledgements

None.

■ Funding

None.

■ Conflict of Interest

None.

■ References

- [1] Amelina, S., & Kononchuk, I. (2023). Practical training of future translators in Germany. *Humanities Studies: Pedagogy, Psychology, Philosophy*, 11(2), 8-14. doi: 10.31548/hspedagog14(2).2023.8-14.
- [2] American Sociological Association's Code of Ethic. (1997). Retrieved from <https://www.asanet.org/about/ethics/>.
- [3] BOBCATSSS. (n.d.). Retrieved from <https://bobcatsss.info/>.
- [4] Bozkurt, A., & Sharma, R.C. (2020). A global outlook to the interruption of education due to COVID-19 pandemic: Navigating in a time of uncertainty and crisis. *Asian Journal of Distance Education*, 15(1). doi: 10.5281/zenodo.3778083.
- [5] Chen, Y., Liu, Y., Zhang, Y., Li, Z., & Zhou, T. (2021). The effect of fear of the COVID-19 on depression among Chinese outbound students studying online in China amid the COVID-19 pandemic period: The role of resilience and social support. *Frontiers in Psychology*, 12, article number 750011. doi: 10.3389/fpsyg.2021.750011.
- [6] Cherusheva, H., Kolesnyk, S., & Dovbnia, S. (2023). European and world practice of academic mobility for innovative development of the educational space of Ukraine. *Academic Visions*, 17. doi: 10.5281/zenodo.7791200.
- [7] Chubniska, A.-M., & Guchko, V. (2023). Academic mobility as a subject of scientific and pedagogical research. *Academic Visions*, 23. doi: 10.5281/zenodo.8433819.
- [8] Cultivating digital talents and young future leaders. (n.d.). Retrieved from <https://www.huawei.com/minisite/seeds-for-the-future/program.html>.
- [9] Erasmus+ is the EU's programme to support education, training, youth and sport. (n.d.). Retrieved from <https://erasmusplus.org.ua/>.
- [10] European Higher Education Area. (n.d.). Retrieved from <https://ehea.info/index.php>.
- [11] Huawei announces a competitive selection for participation in the global online programme Seeds for the Future 2021. (2021). Retrieved from <https://www.huawei.com/ua/news/ua/2021/20210505>.

- [12] Kalinichenko, O. (2021). Digital transformation of higher educational establishments of Ukraine. *Herald of Kyiv National University of Trade and Economics*, 6, 147-154. doi: [10.31617/visnik.knute.2021\(140\)12](https://doi.org/10.31617/visnik.knute.2021(140)12).
- [13] Karp, R. (2024). Main problems of internationalisation of the higher education system: Academic mobility of students. *Science and Technology Today*, 4(32), 660-667. doi: [10.52058/2786-6025-2024-4\(32\)-660-667](https://doi.org/10.52058/2786-6025-2024-4(32)-660-667).
- [14] Law of Ukraine No. 1556-VII "On Higher Education". (2014, July). Retrieved from <https://zakon.rada.gov.ua/laws/show/1556-18#Text>.
- [15] López-Duarte, C., Maley, J.F., & Vidal-Suárez, M.M. (2021). Main challenges to international student mobility in the European arena. *Scientometrics*, 126, 8957-8980. doi: [10.1007/s11192-021-04155-y](https://doi.org/10.1007/s11192-021-04155-y).
- [16] Martyniuk, A.P., & Hubina, A.M. (2024). Academic mobility of students as a significant component of the internationalization of education. *Academic Studies. Series "Pedagogy"*, 2, 35-43. doi: [10.52726/as.pedagogy/2024.2.6](https://doi.org/10.52726/as.pedagogy/2024.2.6).
- [17] Mykhailova, L., Kocharyan, A., & Savastru, N. (2023). The impact of mobility on the quality of education: Benefits and challenges in the era of innovative technologies. *Scientific Innovations and Advanced Technologies*, 13(27), 758-768. doi: [10.52058/2786-5274-2023-13\(27\)](https://doi.org/10.52058/2786-5274-2023-13(27)).
- [18] Ryan, R.M., Deci, E.L., Vansteenkiste, M., & Soenens, B. (2021). Building a science of motivated persons: Self-determination theory's empirical approach to human experience and the regulation of behavior. *Motivation Science*, 7(2), 97-110. doi: [10.1037/mot0000194](https://doi.org/10.1037/mot0000194).
- [19] Samko, A.M. (2022). [International academic mobility as an integral factor of Ukraine's European integration](#). In *The IV international scientific and practical conference "Education of Ukraine under martial law: Management, digitalization, European integration aspects"* (pp. 321-323). Kyiv: State Scientific Institution Institute of Educational Analytics.
- [20] Seeds for the Future: The new season in Ukraine has begun. (2023). Retrieved from <https://www.huawei.com/ua/news/ua/2023/seeds%20opening>.
- [21] Shemelinets, I., & Nikolayev, Y. (2022). *Academic mobility in a new way*. Retrieved from <https://osvitanalytika.kubg.edu.ua/2022/05/25/akademichna-mobilnist-po-novomu/>.
- [22] Shen, W., Xu, X., & Wang, X. (2022). Reconceptualising international academic mobility in the global knowledge system: Towards a new research agenda. *Higher Education*, 84, 1317-1342. doi: [10.1007/s10734-022-00931-8](https://doi.org/10.1007/s10734-022-00931-8).
- [23] Shkarlet, S. (Ed.). (2022). *Education in Ukraine under martial law*. Kyiv: Ministry of Education and Science of Ukraine & Institute of Educational Analytics.
- [24] Terra, A.L. (2023). *BOBCATSSS 2022*. Retrieved from <https://bobcatsss.info/category/bobcatsss-conference/bobcatsss-2022/>.
- [25] Vasilieva, T.A., & Petrushenko, Yu.M. (2022). *Digital technologies in education: Current experience, problems and prospects*. Sumy: Sumy State University.
- [26] Wildau-Kharkiv IT Bridge. (n.d.). Retrieved from <https://wildau-it-bridge.de/>.
- [27] Zhovnych, O.V., & Duchenko, A.V. (2024). Modernisation of primary education through the introduction of academic mobility programmes as a factor in the development of soft skills. *The Pedagogical Academy: Scientific Notes*. doi: [10.5281/zenodo.12648939](https://doi.org/10.5281/zenodo.12648939).

Особливості розвитку міжнародної академічної мобільності українських студентів гуманітарного профілю в цифровому суспільстві

Людмила Філіпова

Доктор педагогічних наук, професор
Харківська державна академія культури
61057, узвіз Бурсацький, 4, м. Харків, Україна
<https://orcid.org/0000-0003-0273-7922>

Давид Міллер

Магістр
Харківська державна академія культури
61057, узвіз Бурсацький, 4, м. Харків, Україна
<https://orcid.org/0009-0002-6610-880X>

■ **Анотація.** Мета цієї статті – всебічний аналіз та характеристика основних напрямів і програм академічної мобільності для українських студентів, з акцентом на здобувачах інформаційно-бібліотечного профілю. Методологічний апарат дослідження включав такі методи, як: аналіз та контент-аналіз наукових джерел, переважно – інтернет-ресурсів, метод критичного та порівняльного аналізу, метод узагальнення, метод гіпотези та прогнозування. У статті описано різні типи цифрових освітніх програм та ініціатив, доступних для студентів гуманітарних спеціальностей в Україні, а також враховано їхні переваги та недоліки, зокрема з погляду їхнього потенціалу для посилення академічної мобільності. Визначено ключові тенденції та напрями академічної мобільності та програм цифрової освіти для студентів гуманітаріїв в Україні, а також обговорено їхній потенціал для підвищення академічної мобільності та покращення освітнього досвіду студентів гуманітарних спеціальностей. Висвітлено виклики та перешкоди, які доведеться подолати, щоб реалізувати весь потенціал цифрових освітніх програм для академічної мобільності. Існує великий потенціал для розвитку академічної мобільності в рамках цифрових освітніх програм для студентів гуманітарних спеціальностей в Україні, хоча для подолання викликів і повної реалізації цього потенціалу знадобляться: стабільність в країні, постійні зусилля та підтримка. Перспективи розвитку академічної мобільності серед українських студентів гуманітарних спеціальностей за такими програмами спрямовані на подальше опанування цифрових технологій із досвіду європейських університетів; ознайомлення з міжнародним досвідом використання інноваційних практик навчання, підвищення доступності та гнучкості освіти, посилення співпраці та обміну у віртуальному середовищі

■ **Ключові слова:** студентська мобільність; освітній простір; зарубіжне стажування; цифрові освітні проекти; міжнародні програми



The influence of international experience on the development of the vocational education system in Ukraine

Oksana Mkrtychian*

Doctor of Pedagogical Sciences, Professor
H.S. Skovoroda Kharkiv National Pedagogical University
61002, 29 Alchevskyyh Str., Kharkiv, Ukraine
<https://orcid.org/0000-0003-4962-3631>

Nataliia Rzhavska

PhD in Pedagogical Sciences, Associate Professor
Hryhorii Skovoroda University in Pereiaslav
08401, 30 Sukhomlynskyi Str., Pereiaslav, Ukraine
<https://orcid.org/0000-0001-8695-5964>

■ **Abstract.** This study aimed to examine and analyse the key factors influencing the modernisation of vocational education in Ukraine to enhance its alignment with contemporary labour market demands. The research focused on the impact of international experience on the development of Ukraine's vocational education system. The methodology employed a systemic approach, enabling an examination of the vocational education system within the context of global trends. This approach facilitated the identification of links between international educational practices and transformations within Ukraine's vocational education system. Adopting global practices and models represents a crucial step in reforming the country's education system, contributing to improving specialist training quality and competitiveness in the global labour market. The study explored examples of the successful integration of international teaching approaches, the adaptation of professional standards, and the implementation of advanced technologies in the educational process. Attention was given to the analysis of European countries' experience, where vocational education is based on the principles of the dual training system, as well as the use of distance learning technologies in response to contemporary global challenges. The key findings indicated that the implementation of international approaches significantly enhances the level of vocational training and students' adaptability to the conditions of the modern labour market. The study also identified certain challenges and limitations, including cultural and socio-economic differences that may affect the effectiveness of integrating foreign experience into Ukraine's education system. A crucial aspect is the need to adapt international models to national conditions, requiring close cooperation between government bodies, educational institutions, and businesses. The main findings highlight the importance of systematically studying and adapting international experience to ensure the sustainable development of Ukraine's vocational education system

■ **Keywords:** innovative educational models; education reform; vocational education students; innovative technologies; educational trends

■ Introduction

The relevance of examining the impact of global practices on the modernisation of Ukrainian vocational education is driven by globalisation and the country's

integration into the global educational and economic landscape. In a world of rapid technological advancement and changing demands for worker qualifications,

Suggested Citation:

Mkrtychian, O., & Rzhavska, N. (2025). The influence of international experience on the development of the vocational education system in Ukraine. *Professional Education: Methodology, Theory and Technologies*, 11(1), 46-56. doi: 10.69587/pemtt/1.2025.46.



the Ukrainian vocational education system faces the need to adapt to contemporary challenges. International experience provides valuable examples of effective practices that can be applied in the Ukrainian educational system to enhance its competitiveness in the job market. However, there is a mismatch between the national vocational education system and the needs of the modern job market. Educational programmes often fail to incorporate innovative methods and approaches that are already widely used in other countries. The shortcomings of the Ukrainian regulatory framework and the lack of a systematic approach to implementing international experience complicate the process of modernising educational programmes. The need to examine the role of global experience in transforming Ukrainian vocational education is driven by the necessity to enhance the quality of teaching and ensure that graduates meet the demands of the contemporary job market. Studying international experience allows for the identification of leading practices and their adaptation to Ukrainian realities, which will contribute to the development of an innovative economy and enhance the competitiveness of the national workforce.

Examining the impact of global experience on improving the vocational education system is a relevant issue in contemporary academic discourse, as it directly influences the development of the educational environment. In recent years, significant attention has been focused on analysing this issue. For example, T. Walsh (2024) noted that globalisation has significantly impacted the vocational education system, forcing it to adapt to new job market demands. They found that the process of globalisation requires the vocational education system to be flexible, open to innovation, and able to respond quickly to changes. The need to develop interdisciplinary skills in future specialists, enabling them to work in constantly changing conditions, is particularly emphasised. As highlighted by R. Dobrovolska *et al.* (2023), modern vocational education is increasingly focused on the use of digital technologies, which provide remote learning, access to diverse information resources, and the ability to create interactive learning environments. They also emphasised that the digitalisation of education promotes independence among higher education students and increases their motivation to learn. It is also noted that the development of digital literacy among lecturers and students is essential for the effective use of new technologies, as discovered by D. Nilendu (2024).

Research by C. Regehr *et al.* (2024) indicated that vocational education does not always meet the needs of the modern job market, creating the problem of graduate underemployment. The main reasons for this phenomenon are outdated curricula, insufficient attention to the development of practical skills, and a mismatch between theoretical knowledge and current industry demands. To address these issues, active collaboration

with employers, curriculum updates, and enhanced practical training for students are proposed. Literature, notably J.-H. Im & G. Park (2024), has been exploring the implementation of dual education systems, which combine theoretical learning in educational institutions with practical training in workplaces. This approach is already widely used in Western European countries and has proven its effectiveness in training highly qualified personnel. In Ukraine, there is also a growing interest in this system, and researchers point to its potential to address the problem of a mismatch between the training of specialists and the current demands of the job market. E. Cinkara & E.M. Yüksel (2024) also researched the dual education system, using Germany as an example. They found that the implementation of elements of dual education in Ukrainian vocational education contributes to better preparation of students for real working conditions and reduces youth unemployment.

I. Kocharian & O. Kratt (2022) studied the reform of the vocational education system in Ukraine, emphasising the importance of integrating European standards. They found that this contributes to improving the quality of the educational process and ensures the competitiveness of Ukrainian specialists in the international labour market. V. Naumchuk *et al.* (2024) focused on the pedagogical legacy of European countries, examining its significance for the modernisation of vocational education in Ukraine. They also noted that the integration of international educational approaches allows for increasing the level of innovation in vocational training. Contemporary researchers have not sufficiently studied the issue of effective mechanisms for implementing international experience into the Ukrainian vocational education system. In particular, there is a lack of comprehensive studies that would analyse successful cases of integrating educational practices from other countries into Ukrainian realities.

This research aimed to identify the key factors in modernising Ukrainian vocational education to increase its relevance to the current demands of the job market. The research aimed to analyse the main trends in the development of vocational education in Ukraine and to compare them with corresponding trends in other countries. It also sought to study international experiences in reforming vocational education, with a particular focus on Germany, Finland, Poland, and Canada, in order to identify successful practices that could be adapted to the Ukrainian context. Additionally, the research intended to identify potential obstacles and challenges in applying international experience to the Ukrainian vocational education system.

■ Materials and Methods

The methodological foundation of this research was a systematic approach to examine the Ukrainian vocational education system within the context of global trends.

This approach allowed for an understanding of the relationship between international educational practices and changes in the Ukrainian vocational education system. A comparative analysis of the educational systems of several countries was used, which helped to identify opportunities for applying international experience in the Ukrainian context. Four countries were selected for analysis: Germany, Finland, Poland, and Canada. Their educational models represent different approaches to vocational education. This selection includes countries with developed dual education systems, technological innovations, and flexible curricula, allowing for a comprehensive assessment of various effective practices and their potential for adaptation in Ukraine. The criteria for selecting these countries included the level of development of vocational education, its relevance to labour market demands, and the presence of successful reforms in this area. Germany was chosen for its dual education system, which combines theoretical learning with practical workplace training. Finland is known for its innovative approaches to education and high level of vocational training, making it an important model for research. Poland, as a country with a transitional economy and a reformed education system, represents an example of successful integration into the European educational space. Canada was chosen for its experience in developing vocational education programmes that are focused on the needs of the labour market and economic development.

The main evaluation criteria for the vocational education systems were adaptability to labour market needs, integration of modern technologies into the educational process, the level of cooperation between educational institutions and employers, and the effectiveness of educational programmes. In addition to this, the study used materials from international organisations, such as United Nations Educational, Scientific and Cultural Organization (UNESCO) (UNESCO World Heritage Convention, n.d.), the Organisation for Economic Co-operation and Development (OECD) (The organization for..., n.d.), and the European Commission (n.d.). These were used to ensure the objectivity and reliability of the research. They provided reliable data and analytical reports on the state and development of vocational education in various countries, which allowed for a deep and well-founded comparative analysis. The use of these sources helped to identify general trends and best practices that can be adapted to the Ukrainian context. The comparisons also made it possible to distinguish between common features and differences between approaches to vocational education in different countries. This aided in identifying elements of international experience that can be successfully adapted to Ukrainian conditions. For example, the integration of dual training systems and the use of cutting-edge technologies showed promise in improving the quality of specialist training.

At the same time, the research revealed specific conditions, such as cultural and socio-economic factors, that must be taken into account for the effective implementation of these elements in Ukraine. Understanding these factors helped to develop effective strategies for introducing new educational practices, ensuring their relevance to local realities and increasing the likelihood of successful change implementation.

■ Results

In the context of integration processes affecting all aspects of life, Ukrainian vocational education is undergoing reform and adaptation to new challenges and labour market demands. The main trends in the development of vocational education in Ukraine can be outlined through several important aspects. Digitalisation and informatisation of vocational education are becoming an integral part of the development of this field. The introduction of information technologies and distance learning allows for the expansion of access to education, especially for remote regions and socially vulnerable populations. Digital platforms, such as online courses, webinars, and educational portals, are becoming increasingly popular among students and lecturers. This not only simplifies access to knowledge but also promotes the development of new forms of learning that are more flexible and adaptable to the needs of modern society. The next important direction is increasing the practical focus of vocational education. The modern labour market requires graduates to have not only in-depth theoretical knowledge but also practical skills that can be directly applied in the workplace. In this regard, an important trend is expanding cooperation between educational institutions and employers, which allows for better alignment of educational programmes with real market needs. This includes internships, work placements, and employer participation in the development of curricula and standards.

A pressing issue remains the need to ensure inclusivity and accessibility of vocational education for all categories of the population, including individuals with special educational needs. This requires the creation of appropriate learning conditions, the adaptation of curricula, and the provision of necessary support for such students. Inclusivity in vocational education contributes to the development of a more just and socially responsible society, where everyone has equal opportunities to receive quality education and realise their potential. An important aspect is the need to update the material and technical base of educational institutions, ensuring the training of specialists to meet modern requirements. Many vocational education institutions in Ukraine face the problem of outdated infrastructure, equipment, and teaching materials. To address this issue, it is important to attract additional resources, including through cooperation with the private sector, international organisations, and foundations.

At the same time, lecturers working in vocational education must not only have a high level of knowledge in their fields but also continuously update their skills and competencies. This includes professional development, participation in training and seminars, and the exchange of experience with colleagues both domestically and abroad. Professional development of lecturers is a prerequisite for ensuring high-quality education and training of competitive specialists. The next direction worth considering is the internationalisation of vocational education, which involves the active participation of Ukrainian educational institutions in international exchange programmes, projects, and cooperation with foreign partners. This allows not only to improve the level of student training but also to expand opportunities for their future professional careers abroad. International cooperation also contributes to enhancing the prestige of Ukrainian vocational education on the global stage.

Finally, but no less important, is the growing need to harmonise the national vocational education system with European standards. This is due to Ukraine's integration into the European space, as well as the need to improve

the quality of education to ensure the competitiveness of graduates in the international labour market. An important role in this process is played by the introduction of European practices, such as the credit-modular learning system, dual education, professional standards, and certification. Dual education, for example, allows students to combine learning with practical activities in enterprises, which contributes to their acquisition of real professional skills and knowledge necessary for working in modern conditions.

Vocational education in Ukraine faces numerous challenges, including adapting to market needs, integrating modern technologies, developing cooperation with employers, and improving the effectiveness of educational programmes. These issues require a comprehensive approach and active interaction between the state, educational institutions, and employers. To overcome these challenges, it is necessary to ensure a closer link between the education system and the labour market, which will better prepare specialists capable of successfully competing in the modern labour market. An overview of the Ukrainian vocational education system is presented in Table 1.

Table 1. Analysis of vocational education in Ukraine based on relevant criteria

Criterion	Characteristics of Ukrainian vocational education
Adaptability to labour market needs	Vocational education in Ukraine continues to adapt to labour market needs, but changes are slow. The development of new curricula and specialisations often lags behind the rapid changes in the labour market. For example, in 2023, only 40% of educational institutions updated their programmes following current labour market requirements. This leads to graduates potentially experiencing difficulties when entering the labour market due to an insufficient match between their skills and knowledge and modern requirements.
Integration of modern technologies into the educational process	The integration of modern technologies into the educational process in Ukraine is not yet sufficiently widespread. Although there are individual initiatives and projects, most educational institutions do not keep pace with the rate of technological development. According to 2023 data, only 30% of educational institutions have implemented modern IT technologies into the educational process, which limits students' opportunities to acquire practical skills in relevant technologies.
Level of cooperation between educational institutions and employers	Cooperation between educational institutions and employers in Ukraine remains insufficient. According to 2023 data, only 25% of educational institutions have active partnerships with employers. This limits students' opportunities to gain practical experience and knowledge that meet the real demands of the labour market.
Effectiveness of educational programmes	The effectiveness of educational programmes varies depending on the specialisation and educational institution. However, in general, there are problems with the quality and relevance of educational programmes. Many of them are not sufficiently focused on the practical skills needed in a real working environment. 2023 data shows that about 50% of students note a mismatch between educational programmes and labour market needs.

Source: compiled by the authors based on data from S. Palamar et al. (2023), I.P. Deca et al. (2023)

Based on the information above, the main trends in the development of vocational education in Ukraine indicate its gradual and slow transformation towards improving quality, meeting modern labour market demands, and aligning with European standards. At the same time, the need for further modernisation of the system remains crucial. This includes digitalisation, strengthening the practical focus, updating the material and technical base, and enhancing the professional development of the

teaching staff. Therefore, it is important to consider the specifics of vocational education development in other countries to determine which trends and elements can be applied to modernise this sector in Ukraine. Vocational education in Germany and Finland is among the most successful and effective in the world, due to their flexibility, integration of modern technologies, close cooperation between educational institutions and employers, and high-quality educational programmes (Table 2).

Table 2. Analysis of vocational education in Germany and Finland based on the given criteria

Criterion	Country	
	Germany	Finland
Adaptability to labour market needs	This vocational education system is characterised by high adaptability to labour market needs. The dual education system, which combines theoretical learning in educational institutions with practical learning in workplaces, provides graduates with the necessary skills and knowledge for a successful career. Due to this, the youth unemployment rate in Germany is one of the lowest in Europe. Programmes are regularly updated to reflect changes in the labour market, allowing for rapid response to new demands.	The Finnish vocational education system demonstrates high adaptability to changes in the labour market. Educational programmes are regularly updated to meet new demands and trends in various sectors. A key aspect is the opportunity for students to adjust their educational pathways based on labour market needs, enhancing their chances of successful employment.
Integration of modern technologies into the educational process	The state actively implements modern technologies into the vocational education process. This includes the use of digital tools, automation, and Industry 4.0 technologies, preparing students for work in modern production conditions. Some educational institutions also offer specialised programmes aimed at developing IT competencies, allowing students to receive education in programming, robotics, artificial intelligence.	There is active implementation of modern technologies in vocational education, particularly digital tools, distance learning, and sustainable development technologies. Digital literacy is a key priority, in preparing students for work in a modern technological society. Significant attention is also given to eco-friendly technologies, in line with global trends in sustainable development.
Level of cooperation between educational institutions and employers	Enterprises actively participate in the development of curricula, provide workplaces for internships, and even finance parts of the educational processes. This allows educational programmes to remain relevant and provide students with real-world experience that they can apply in their future professional activities.	There is strong collaboration between vocational educational institutions and employers. Businesses are actively involved in developing and updating curricula, ensuring that the skills taught are aligned with labour market demands. Furthermore, workplace practice is a mandatory part of the training, helping students gain real work experience.
Effectiveness of educational programmes	Curricula are highly effective, as evidenced by the success of graduates in the labour market. Programmes focus on developing not only professional but also personal competencies, such as critical thinking, teamwork, and the ability to learn independently. High-quality standards and continuous monitoring and updating of programmes ensure their effectiveness and compliance with current industry requirements.	The effectiveness of educational programmes is supported by their flexibility, practical orientation, and continuous updates. These programmes focus on developing both professional and personal competencies, such as critical thinking, self-education, and interpersonal communication skills. Graduates of Finnish vocational institutions are in high demand in the labour market, indicating the high quality of their training.

Source: compiled by the authors based on data from A.M. van Engelenhoven et al. (2023), I. Sharifikia et al. (2024)

Finnish and German vocational education systems are distinguished by their flexibility, technological advancement, and close cooperation with employers, which allows for the training of competitive specialists in these countries. As for Ukraine, this sector is less adaptable to market needs, slowly integrates modern

technologies, and has insufficient interaction with businesses, which negatively affects the quality of graduate training. Vocational education in Canada and Poland has its own unique features, but they noticeably differ in the quality of training for future specialists. An analysis of this area is presented in Table 3.

Table 3. Analysis of vocational education in Canada and Poland based on the given criteria

Criterion	Country	
	Canada	Poland
Adaptability to labour market needs	The system is well adapted to changes in the labour market. Curricula are developed in close cooperation with employers and consider regional needs, allowing students to acquire relevant knowledge and skills. In addition, Canada has a large number of short-term courses and certifications that allow for rapid retraining or acquisition of new qualifications under market demands.	The Polish vocational education system strives to meet labour market needs, but the process of adaptation is slow. Although the government is implementing reforms to align educational programmes with current demands, there remains a gap between theoretical knowledge and the practical skills needed in the workforce. As a result, graduates are often not fully prepared to enter the job market immediately.
Integration of modern technologies into the educational process	Educational institutions actively implement the latest digital tools, virtual laboratories, and simulations, allowing students to gain practical experience in modern technological environments. The Canadian education system also supports distance learning, which expands the accessibility of educational resources for students from remote areas.	The integration of modern technologies in vocational education is improving, but not as rapidly as in leading countries. Although some educational institutions use advanced digital tools and technologies, the overall level of integration remains uneven. This is partly due to varying levels of funding and resource availability across different regions of the country.

Table 3. Continued

Criterion	Country	
	Canada	Poland
Level of cooperation between educational institutions and employers	Cooperation between educational institutions and employers is very close and effective. Many programmes include mandatory internships, workplace training, and joint projects with enterprises. This allows students not only to gain knowledge but also to acquire real experience, which increases their competitiveness in the labour market.	Cooperation between educational institutions and employers is improving but remains limited. The government and educational institutions are working to strengthen this collaboration, but employers are often not sufficiently involved in the development of curricula. There is a trend towards increasing the number of internship and work placement programmes, but their quality and availability vary.
Effectiveness of educational programmes	Curricula in Canada are highly effective due to their focus on practical skills and the ability to adapt to the individual needs of students. Programmes are constantly updated to remain relevant to labour market demands, and the quality of graduate training is ensured by a system of accreditation and quality control.	Despite efforts to update them, educational programmes often remain focused on outdated methods and approaches. They still place a significant emphasis on theoretical training, with less attention paid to developing practical skills. As a result, graduates may struggle to adapt to employers' demands and the contemporary labour market.

Source: compiled by the authors based on data from A. Luthra et al. (2024)

Canada and Poland are significantly ahead of Ukraine in the field of vocational education, demonstrating greater adaptability to labour market needs and effective cooperation with employers, which contributes to better graduate training. In Canada, the high level of modern technology integration and the flexibility of educational programmes are particularly notable, something that is lacking in the Ukrainian system. Poland, although it has some problems with programme updates and employer cooperation, still surpasses Ukraine in adapting educational programmes to market demands. Ukrainian vocational education requires significant reforms to improve its compliance with modern standards and provide graduates with relevant skills for the labour market. To adapt Ukrainian vocational education to the needs of the modern labour market, it is important to study and adopt the experience of those countries that have already successfully reformed their educational systems and achieved a high level of alignment between education and labour market demands. Consider what can be adapted from the educational systems of Germany, Finland, Poland and Canada.

As Germany is known for its dual education system, which successfully combines theoretical learning with practical on-the-job training, the Ukrainian vocational education system could adopt this approach, focusing more on the practical training of students. This model allows students to simultaneously gain theoretical knowledge in educational institutions and acquire practical experience in enterprises. An important aspect of this system is the close cooperation between educational institutions and employers, which provides students with real job opportunities after graduation. To achieve this, it is necessary to develop partnerships between educational institutions and businesses, which will contribute to a better understanding of labour market needs and provide graduates with in-demand skills. The Finnish education system is a model of

flexibility and adaptability to the needs of students and society. In Finland, significant emphasis is placed on an individual approach to learning, which allows students to choose their own educational path, focusing on their interests and abilities. An important component of the Finnish model is the integration of modern technologies into the learning process, which provides students with access to the latest knowledge and skills. For vocational education in Ukraine, this experience can be useful in developing individual learning trajectories, allowing each student to realise their potential in the field that best suits their abilities and interests. In addition, integrating modern technologies into the learning process, as they do in Finland, will help Ukrainian students better prepare for work in the digital economy. In Poland, vocational education is well integrated with higher education, allowing students to continue their studies at higher levels. Students from vocational-technical schools and colleges have the opportunity to transfer to universities and continue their education at the bachelor's and master's levels. Such a system allows students to combine practical skills with deep theoretical knowledge, which significantly increases their competitiveness in the labour market. Ukraine could introduce a similar system, which would promote greater student mobility between different levels of education. This country also has a developed system of independent certification and assessment of professional skills. This ensures the high quality of specialist training, as graduates receive certificates confirming their professional competencies. These certificates are recognised by employers and carry significant weight in the labour market. Ukraine could implement a similar system, which would contribute to the standardisation of professional skills and increase employer confidence in graduates. The Canadian cooperative education system allows students to undertake paid internships as part of their curriculum. This provides students not only

with valuable practical experience but also with the opportunity to earn money while studying. For Ukraine, this approach could be a useful tool in addressing the problem of insufficient links between education and the labour market. The introduction of cooperative education would allow students to gain real work experience while still studying, which would increase their chances of successful employment after graduation.

A comparative analysis revealed that Germany and Finland demonstrate the highest level of adaptation of educational programmes to the demands of the modern labour market, ensuring high competitiveness for graduates. Poland, although it has made some progress, is still in the process of adapting its education system to new challenges. Canada has distinguished itself with successful programmes aimed at training highly qualified specialists for the rapidly changing labour market. These results helped to identify key areas for improving the Ukrainian vocational education system based on international best practices. According to the above information, Ukraine has significant potential to improve its vocational education by adopting the successful practices of other countries. However, numerous obstacles and challenges may arise when applying international experience to the Ukrainian vocational education system. These include both general structural problems of the education system and specific issues related to the adaptation of foreign models to Ukrainian realities. The main obstacles and challenges can be identified as follows. The implementation of innovative educational models and technologies requires significant financial investment. The Ukrainian education system often faces underfunding, which limits the possibilities for updating the material and technical base, training personnel, and introducing new programmes. For example, the dual education system, which is so popular in Germany, requires significant resources to provide practical training for students in enterprises, and this can be a serious obstacle in Ukrainian conditions.

The adaptation of international experience requires the involvement of qualified educators and administrative staff who are capable of implementing new approaches into the educational process. However, Ukraine is experiencing a shortage of personnel with modern teaching methods and experience in working with the latest technologies. This can be a serious challenge when trying to introduce, for example, individual learning trajectories, as in Finland, or a cooperative education system, as in Canada. The Ukrainian education system also has a certain degree of institutional inertia, which manifests itself in resistance to change from the administration of educational institutions and the teaching staff. The introduction of new models and approaches may encounter reluctance or inability on the part of some educational institutions to change established practices. This can complicate the adaptation of, for example, the national qualifications system

according to the Polish model, which involves clear standardisation and updating of curricula.

International education models were developed in conditions that may differ significantly from Ukrainian realities. For example, the dual education system in Germany functions due to a high level of social partnership between the state, educational institutions, and enterprises, which is not always possible in Ukraine due to insufficient interaction between these sectors. In addition, cultural differences can affect the perception and implementation of new educational models. The application of foreign education models may require changes in national legislation and the regulatory framework. In Ukraine, educational legislation often does not keep pace with the needs of the times, which creates obstacles to the implementation of new approaches. The socio-economic situation in Ukraine can also be an obstacle to the implementation of international experience. High unemployment, economic instability, and labour migration can all negatively impact the implementation of educational reforms. For example, the cooperative education system, which functions successfully in Canada, may face problems in Ukraine due to instability in the labour market and uncertainty about the employment prospects of graduates. The introduction of new educational models may require students to have greater independence, activity, and responsibility. However, due to low levels of motivation and a lack of clear prospects in the labour market, some students may show indifference to innovative approaches to learning. This can hinder the successful implementation of, for example, individual learning trajectories, which require a high level of self-discipline and interest in personal development.

■ Discussion

The results of the study showed that the influence of other countries' experience on the development of Ukrainian vocational education is one of the key aspects of its modernisation and compliance with the current requirements of the global labour market. International experience plays an important role in the development of the vocational education system in Ukraine, contributing to the modernisation of educational programmes, improving the qualifications of lecturers, integrating modern teaching methods, and preparing specialists who are competitive in the international labour market.

Contemporary education faces numerous challenges, such as the need to modernise curricula, improve the qualifications of lecturers, and provide practical training for students. It has been found that one of the main directions of vocational education reform remains the integration of European standards and practices. Research by O. Pasko *et al.* (2023) confirmed these findings, emphasising that the implementation of the European Qualifications Framework (EQF) in Ukraine allows for the transparency of qualifications and pro-

motes the recognition of Ukrainian diplomas abroad. It is important to note that the mechanical transfer of European practices without considering national characteristics can have negative consequences. Research by V. Bolotina (2024) indicated that when international standards are implemented without proper adaptation, it can lead to the loss of national traditions and identity. This researcher emphasised that successful integration of European practices requires taking into account local conditions and context, which aligns with the conclusions of this study, which emphasises the need to adapt international experience to Ukrainian realities. Research by J. Li & X. Li (2024) and P. Martins *et al.* (2024) noted that participation in international programmes promotes the introduction of new learning technologies and improves the quality of education. However, attention should be paid to the potential risks associated with dependence on external funding sources, as noted in the research by S.H. Ubohov *et al.* (2021). The authors noted the need to create sustainable national models of vocational education that do not depend solely on international programmes. This aligns with the conclusions of this study, which emphasised that international experience should be used as a tool for developing the national education system, not replacing it.

The results obtained showed that one of the important directions of vocational education reform in Ukraine is the implementation of Western teaching methodologies, such as problem-based learning, dual education, and project-based learning. According to the conclusions of this study, these methodologies allow students to develop critical thinking, a creative approach, and practical skills, which are extremely important in the modern labour market. Research by T. Kovaliuk & N. Kobets (2020) and S. Danylenko *et al.* (2024) confirmed these findings, noting that Western teaching methodologies promote active student participation in the educational process and increase their motivation to learn. The implementation of these methodologies requires significant changes in curricula and the lecturer training system. X. Ma *et al.* (2022) drew attention to the fact that the adaptation of Western methodologies requires not only a change in learning approaches but also significant investment in infrastructure and lecturer training. These conclusions are consistent with the data of this study, which found that without proper training and resources, the implementation of Western methodologies may be ineffective. In addition, it is worth considering cultural and social characteristics that may affect the perception of new approaches to learning.

The analysis of international experience has shown that different countries use different approaches to modernising vocational education, and Ukraine can adopt some of them. For example, Germany's experience in developing a dual education system is an example of the successful integration of theoretical learning

with practical training in enterprises. However, it is necessary to consider that such models cannot always be directly transferred to Ukraine due to differences in economic, social, and cultural conditions. As noted in the article by N. Blankvoort *et al.* (2019), the implementation of dual education in Ukraine requires significant support from the state and businesses, which is not always possible in the current circumstances. Thus, while international experience can be useful, it must be adapted to Ukrainian realities, which aligns with the conclusions of this study.

The results obtained also showed that despite the numerous advantages associated with the integration of international experience into the vocational education system in Ukraine, there are also serious challenges. First of all, there is the issue of funding. The implementation of new methodologies and programmes requires significant financial resources, which are not always available to Ukrainian educational institutions. These conclusions are consistent with the results of research by M. Biasutti *et al.* (2021) and P. Kuo *et al.* (2023), who noted that financial instability is one of the main barriers to reforming the education system. In addition, attention should be paid to the issue of staffing. As research by I. Kriesi & F. Sander (2024) showed, for the successful implementation of international practices, it is necessary not only to modernise curricula but also to ensure the training of lecturers who can effectively apply new methodologies and approaches. This includes both improving their qualifications and developing new skills necessary to work in a modernised educational system. C.M. Jiang *et al.* (2022) also emphasised that there is a need to update the material and technical base of educational institutions, which is an important condition for the successful implementation of modern educational technologies. In addition, it is worth considering cultural aspects and mental characteristics that may affect the perception of new methodologies among students and lecturers. As researchers L. Dziak *et al.* (2022) noted, any innovations in education should be aimed at gradual implementation, taking into account national traditions and values. Otherwise, they may encounter resistance from participants in the educational process. This idea is also reflected in the results of this study, which emphasises the importance of considering cultural characteristics when implementing Western teaching methodologies in Ukraine. The impact of international experience on the development of vocational education in Ukraine is significant and multifaceted. International practices and standards contribute to the modernisation of education, improve its quality, and integrate Ukraine into the global educational space. However, the successful adaptation of this experience requires consideration of national characteristics, investment in infrastructure and lecturer training, and attention to cultural aspects. Only a comprehensive approach to the implementation

of international experience will ensure the effective development of vocational education in Ukraine and prepare specialists capable of successfully working in a globalised labour market.

■ Conclusions

Vocational education in Ukraine is undergoing a complex phase of adaptation to the demands of the labour market. It faces several critical challenges that require immediate resolution to ensure the training of competitive specialists. Ukrainian curricula often do not meet the current needs of the labour market. This results in graduates not always possessing the necessary skills and knowledge for successful employment. Given the rapid changes in technological development, updating curricula is a priority to meet the demands of the modern economy. The integration of modern technologies into the educational process remains insufficient. Despite digitalisation being a global trend, many Ukrainian educational institutions do not have adequate material and technical resources and qualified personnel to implement the latest technologies. This significantly reduces the level of student training and their readiness to work in the digital economy. It has been found that cooperation between educational institutions and employers is weak and unsystematic. In most cases, curricula are developed without the active participation of business representatives, leading to a gap between students' theoretical knowledge and the practical requirements of employers. To improve the quality of specialist training, it is necessary to create effective mechanisms for cooperation, including dual education, internships, and placements in enterprises, which will allow students to gain real work experience during their studies.

■ References

- [1] Biasutti, M., Concina, E., Frate, S., & Delen, I. (2021). Teacher professional development: Experiences in an international project on intercultural education. *Sustainability*, 13(8), article number 4171. [doi: 10.3390/su13084171](https://doi.org/10.3390/su13084171).
- [2] Blankvoort, N., Kaelin, V.C., Poerbodipoero, S., & Guidetti, S. (2019). Higher education students' experiences of a short-term international programme: Exploring cultural competency and professional development. *Educational Research*, 61(3), 356-370. [doi: 10.1080/00131881.2019.1632725](https://doi.org/10.1080/00131881.2019.1632725).
- [3] Bolotina, V. (2024). Domestic and foreign experience in forming the professional competences of bachelors in the information technology field. *Current Issues of the Humanities*, 73(1), 276-281. [doi: 10.24919/2308-4863/73-1-42](https://doi.org/10.24919/2308-4863/73-1-42).
- [4] Cinkara, E., & Yüksel, E.M. (2024). Perceived impact of English medium instruction on transnational graduates in Türkiye: Insights from a mixed-methods study. *Journal of English for Academic Purposes*, 71, article number 101421. [doi: 10.1016/j.jeap.2024.101421](https://doi.org/10.1016/j.jeap.2024.101421).
- [5] Danylenko, S., Nagornyyak, M., Bielousova, N., Yakovets, A., & Fursai, O. (2024). Human rights preservation and protection in the face of global risks and threats: The importance of democracy and ways to enhance it. *Social and Legal Studies*, 7(2), 9-18. [doi: 10.32518/sals2.2024.09](https://doi.org/10.32518/sals2.2024.09).
- [6] Deca, I.P., Ognisty, A.V., & Petrytsa, P.M. (2023). Possibilities of implementing the Canadian experience of professional training of occupational therapists in Ukraine. *Rehabilitation and Recreation*, 14, 37-48. [doi: 10.32782/2522-1795.2023.14.4](https://doi.org/10.32782/2522-1795.2023.14.4).
- [7] Dobrovolska, R., Mosendz, O., Symonenko, R., Manaylo-Prykhodko, V., & Zaitsev, V. (2023). Digitalization of the educational process in the field of culture and art: Challenges and prospects. *Journal of Curriculum and Teaching*, 12(5), 82-95. [doi: 10.5430/jct.v12n5p82](https://doi.org/10.5430/jct.v12n5p82).

To overcome these challenges, a comprehensive approach is needed that includes close interaction between the state, vocational education institutions, and employers. This will contribute to improving the quality of this sector, allowing for better training of specialists capable of successfully competing in the modern labour market. The implementation of such changes requires both strategic planning at the state level and the active participation of all stakeholders in the process of reforming the education system. This will contribute to the training of competitive specialists capable of meeting the demands of the modern labour market. The introduction of dual education, as in Germany, the development of individual learning trajectories as in Finland, and the introduction of co-operative education as in Canada will allow Ukrainian vocational education to become more adaptable to the needs of the labour market, integrate modern technologies into the learning process, increase the level of cooperation between educational institutions and employers, and improve the effectiveness of educational programmes. Further research could focus on a deeper analysis of the regional characteristics of vocational education in Ukraine, as well as on evaluating the impact of specific reforms and initiatives on the training of specialists.

■ Acknowledgements

None.

■ Funding

None.

■ Conflict of Interest

None.

- [8] Dziak, L., Klygunenko, O., Kravets, O., & Zozulya, O. (2022). Introduction of the concept of continuing professional education for anesthesiologists, neurologists and neurosurgeons. *Emergency Medicine (Ukraine)*, 18(5), 52-55. doi: [10.22141/2224-0586.18.5.2022.1511](https://doi.org/10.22141/2224-0586.18.5.2022.1511).
- [9] European Commission. (n.d.). Retrieved from https://commission.europa.eu/index_en.
- [10] Im, J.-H., & Park, G. (2024). Translingualism and the formation of identities: A duoethnography of two Korean ELT professionals in higher education. *System*, 123, article number 103296. doi: [10.1016/j.system.2024.103296](https://doi.org/10.1016/j.system.2024.103296).
- [11] Jiang, C.M., Nishioka, T., Hong, G., Yu, H., Zhang, C.-Y., & Chu, C.H. (2022). Mapping of dental graduates' career paths in Hong Kong, Japan and mainland China. *Frontiers in Oral Health*, 3, article number 994613. doi: [10.3389/froh.2022.994613](https://doi.org/10.3389/froh.2022.994613).
- [12] Kocharian, I., & Kratt, O. (2022). Electrical and arts education of Ukraine: A unified approach to the organization of the educational process under martial law. In *2022 IEEE 4th international conference on modern electrical and energy system (MEES)*. Kremenchuk: IEEE. doi: [10.1109/MEES58014.2022.10005718](https://doi.org/10.1109/MEES58014.2022.10005718).
- [13] Kovaliuk, T., & Kobets, N. (2020). Cluster model of IT education in Ukraine. In *2020 IEEE European technology and engineering management summit (E-TEMS)* (pp. 1-6). Dortmund: IEEE. doi: [10.1109/E-TEMS46250.2020.9111732](https://doi.org/10.1109/E-TEMS46250.2020.9111732).
- [14] Kriesi, I., & Sander, F. (2024). Academic or vocational education? A comparison of the long-term wage development of academic and vocational tertiary degree holders. *Journal for Labour Market Research*, 58, article number 10. doi: [10.1186/s12651-024-00368-9](https://doi.org/10.1186/s12651-024-00368-9).
- [15] Kuo, P., Washington, A., & Woo, H. (2023). Intersection of professional identity development and experiences of cultural insensitivity among international counselor education doctoral students. *Journal of Multicultural Counseling and Development*, 51(2), 136-146. doi: [10.1002/jmcd.12273](https://doi.org/10.1002/jmcd.12273).
- [16] Li, J., & Li, X. (2024). Professional values education for undergraduate nursing students: Developing a framework based on the professional values growth theory. *BMC Nursing*, 23, article number 226. doi: [10.1186/s12912-024-01743-0](https://doi.org/10.1186/s12912-024-01743-0).
- [17] Luthra, A., Dixit, S., & Arya, V. (2024). Evaluating the impact of faculty development on employee engagement practices in higher education: Analysing the mediating role of professional development. *The Learning Organization*, 31(4), 565-584. doi: [10.1108/TLO-01-2023-0014](https://doi.org/10.1108/TLO-01-2023-0014).
- [18] Ma, X., Gryshova, I., Koshkalda, I., Suska, A., Gryshova, R., Riasnianska, A., & Tupchii, O. (2022). Necessity of post-war renewal of university teachers' potential in terms of sustainable development in Ukraine. *Sustainability*, 14(19), article number 12598. doi: [10.3390/su141912598](https://doi.org/10.3390/su141912598).
- [19] Martins, P., Tinoca, L., & Alves, M. (2024). On the effects of Erasmus+ KA 1 mobilities for continuing professional development in teachers' biographies: A qualitative research approach with teachers in Portugal. *International Journal of Educational Research Open*, 7, article number 100368. doi: [10.1016/j.ijedro.2024.100368](https://doi.org/10.1016/j.ijedro.2024.100368).
- [20] Naumchuk, V., Shandryhos, V., Vynnychuk, O., Yednak, V., & Oliiar, M. (2024). Development of a methodology for assessing the quality of professional training of future specialists in physical education and sports. *Scientific Herald of Uzhhorod University. Series "Physics"*, 55, 2786-2797. doi: [10.54919/physics/55.2024.278pa6](https://doi.org/10.54919/physics/55.2024.278pa6).
- [21] Nilendu, D. (2024). Enhancing forensic education: Exploring the importance and implementation of evidence-based education system. *Egyptian Journal of Forensic Sciences*, 14, article number 6. doi: [10.1186/s41935-023-00375-w](https://doi.org/10.1186/s41935-023-00375-w).
- [22] Palamar, S., Brovko, K., & Semerikov, S. (2023). [Enhancing foreign language learning in Ukraine: Immersive technologies as catalysts for cognitive interest and achievement](https://doi.org/10.28390/2023-01-01-0001). In *Information technology and implementation (IT&I-2023)* (pp. 69-81). Kyiv: CEUR Workshop Proceedings.
- [23] Pasko, O., Omelchenko, H., Ostapyk, S., Koliesnikova, A., & Bondarenko, N. (2023). Features of the application of smart technologies for the development of various directions of design education. *Journal of Curriculum and Teaching*, 12(2), 103-117. doi: [10.5430/jct.v12n2p103](https://doi.org/10.5430/jct.v12n2p103).
- [24] Regehr, C., Birze, A., Palmer, M., Sewell, K., Paterson, J., Kuehl, D., & Fallon, B. (2024). Comparing an in-person and online continuing education intervention to improve professional decision-making: A mixed methods study. *Research on Social Work Practice*, 34(5), 535-547. doi: [10.1177/10497315231185534](https://doi.org/10.1177/10497315231185534).
- [25] Sharifikia, I., Khoshnood, Z., Hosseinejad, A., Farokhzadian, J., & Rohani, C. (2024). Exploring a guide for codes of ethics for the development of ethical competence in Iranian nursing students: A systematic review and meta-synthesis. *BMC Nursing*, 23, article number 519. doi: [10.1186/s12912-024-02208-0](https://doi.org/10.1186/s12912-024-02208-0).
- [26] The Organization for Economic Cooperation and Development (OECD). (n.d.). Retrieved from <https://www.state.gov/the-organization-for-economic-co-operation-and-development-oecd/>.
- [27] Ubohov, S.H., Soloviov, S.O., Yurkovska, L.H., & Todorova, V.I. (2021). Modern approaches to the formation of professional competencies of pharmacists on issues of medicines quality assurance. *Wiadomości Lekarskie Medical Advances*, 74(2), 334-340. doi: [10.36740/WLek202102130](https://doi.org/10.36740/WLek202102130).

- [28] UNESCO World Heritage Convention. (n.d.). Retrieved from <https://whc.unesco.org/>.
- [29] Van Engelenhoven, A.M., Geiger, J.L., Ünal, A.B., Spinder, R.N., & van der Zande, I.S.E. (2023). Student perceptions of Living Lab research internships in the COVID-19 pandemic – a Dutch case study. *Education + Training*, 65(10), 65-80. doi: [10.1108/ET-06-2022-0236](https://doi.org/10.1108/ET-06-2022-0236).
- [30] Walsh, T. (2024). Alignment and coherence in the context of policy and curriculum development in Ireland: Tensions, debates, and future directions. In P.P. Trifonas & S. Jagger (Eds.), *Handbook of curriculum theory, research, and practice* (pp. 543-563). Cham: Springer. doi: [10.1007/978-3-031-21155-3_10](https://doi.org/10.1007/978-3-031-21155-3_10).

Вплив міжнародного досвіду на розвиток системи професійної освіти в Україні

Оксана Мкртічян

Доктор педагогічних наук, професор
Харківський національний педагогічний університет імені Г.С. Сковороди
61002, вул. Алчевських, 29, м. Харків, Україна
<https://orcid.org/0000-0003-4962-3631>

Наталія Ржевська

Кандидат педагогічних наук, доцент
Університет Григорія Сковороди в Переяславі
08401, вул. Сухомлинського, 30, м. Переяслав, Україна
<https://orcid.org/0000-0001-8695-5964>

■ **Анотація.** Метою дослідження було вивчення та аналіз основних факторів, що впливають на модернізацію української професійної освіти з метою покращення її відповідності сучасним вимогам ринку праці. Дослідження присвячене аналізу впливу міжнародного досвіду на розвиток системи професійної освіти в Україні. Методологія включала системний підхід, який дозволив розглянути систему професійної освіти України в контексті глобальних тенденцій. Завдяки цьому підходу вдалося виявити взаємозв'язок між міжнародними освітніми практиками та трансформаціями в українській системі професійної освіти. Залучення світових практик та моделей є важливим кроком у реформуванні освітньої системи країни, що спрямоване на підвищення якості підготовки фахівців та їх конкурентоспроможності на глобальному ринку праці. У дослідженні розглянуто приклади успішної інтеграції міжнародних підходів до навчання, адаптації професійних стандартів і запровадження новітніх технологій у навчальний процес. Увагу приділено аналізу досвіду європейських країн, де професійна освіта базується на принципах дуальної системи навчання, а також використанню дистанційних технологій у зв'язку з викликами сучасного світу. Основні результати дослідження свідчать про те, що імплементація міжнародних підходів суттєво підвищує рівень професійної підготовки та адаптивність студентів до умов сучасного ринку праці. Дослідження також виявило певні виклики та обмеження, зокрема культурні й соціально-економічні відмінності, що можуть впливати на ефективність впровадження іноземного досвіду в українській системі освіти. Важливим аспектом є необхідність адаптації міжнародних моделей до національних умов, що вимагає тісної співпраці між урядовими структурами, навчальними закладами та бізнесом. Основні результати дослідження підкреслюють значущість систематичного вивчення та адаптації міжнародного досвіду для забезпечення сталого розвитку системи професійної освіти в Україні

■ **Ключові слова:** інноваційні освітні моделі; реформування освіти; здобувачі професійної освіти; інноваційні технології; освітні тренди



Theoretical foundations for the development of digital skills of vocational education teachers: Innovative tools, integrative approaches

Yevhen Kuznietsov*

Postgraduate Student

Hryhorii Skovoroda University in Pereiaslav
08401, 30 Sukhomlynskyi Str., Pereiaslav, Ukraine
<https://orcid.org/0009-0008-3994-9092>

■ **Abstract.** The digital transformation of education is a key factor in professional training, as it fundamentally reshapes approaches to teacher preparation and transforms educational paradigms. The relevance of this study is driven by the need to adapt professional education to the challenges of war, national reconstruction, and European integration, necessitating the development of new digital skills. The study aimed to analyse the theoretical foundations of developing digital skills among vocational education teachers, their essence, structure, and the impact of innovative tools on the quality of teacher training in professional education. The research materials included the professional standards “Vocational Education Teacher” and “Higher Education Lecturer”, academic articles dedicated to the digitalisation of education, and interactive tools such as cloud services, immersive technologies, and automated robotic systems. The research methods encompassed a review of scientific sources, interpretation, comparison, systematisation, and content analysis. The study’s results included a comparative analysis of professional standards, the identification of common and distinct requirements for digital skills, and the determination of areas for their improvement. It was found that teachers’ digital skills integrate technological, informational-analytical, ethical, communicative, and organisational components that ensure the effective use of digital resources to achieve educational goals. The essence and structure of digital skills were systematised, distinguishing them into basic, specialised, and immersive categories. The trends in education digitalisation were analysed, covering the use of cloud services, STEM methodologies, and automated robotic systems, while the impact of interactive simulations, virtual laboratories, and learning management systems on the quality of the educational process was examined. The study proposed the integration of competency-based, educational, technological, and pedagogical approaches for the harmonious development of teachers’ digital skills and their adaptation to current challenges. The concept of innovative tools has been developed. The practical significance of the study lies in the improvement of teaching by highly digitalised vocational education teachers, the modernisation of educational programs, and the enhancement of teacher training for European-integrated professional work in the context of rapidly advancing digital transformation

■ **Keywords:** competency-based approach; vocational training; digital culture; STEM methods; adaptive learning; education modernisation; European integration

■ Introduction

Digital transformation is a dominant driver of change in vocational education and training, affecting all aspects of the educational process. In the context of the war and the ongoing need to rebuild Ukraine, the development of digital skills of vocational teachers has become

strategically important. These skills not only contribute to improving the quality of education, but also form the basis for modernising educational approaches in the global digital environment. The essence of digital competence lies in the ability of vocational teachers to

Suggested Citation:

Kuznietsov, Ye. (2025). Theoretical foundations for the development of digital skills of vocational education teachers: Innovative tools, integrative approaches. *Professional Education: Methodology, Theory and Technologies*, 11(1), 57-69. doi: 10.69587/pemtt/1.2025.57.



Copyright © The Author(s). This is an open access article distributed under the terms of the Creative Commons Attribution License 4.0 (<https://creativecommons.org/licenses/by/4.0/>)

*Corresponding author

effectively use innovative tools for organising the educational process, monitoring learning outcomes and developing the skills of vocational education students.

According to O. Bazelyuk (2019), it is worth focusing on the role of teachers' technological literacy in the process of digitalisation of education. The author concluded that the formation of digital culture is a prerequisite for the effective implementation of innovative tools in vocational education. Yu.O. Danilevych (2023) considered digital culture as an integrative component of the educational environment, including critical thinking and fair use of data. The scientist emphasised that the development of teachers' digital culture contributes to improving the quality of the educational process. S. Dembitska & O. Kobylanskyi (2024) emphasised that the digital culture of vocational teachers is formed through the introduction of innovative tools such as digital technologies, cloud services and interactive platforms. In their research, they analysed in detail how these tools affect the professional development of teachers and concluded that interactive tools significantly increase the effectiveness of teaching. M. Kiryanova (2024) studied how digital tools are implemented in vocational education. The author emphasised that the effectiveness of these tools depends on their ability to ensure interactivity, quality and adaptability of learning. As stated in the professional standards "Teacher of a Higher Education Institution" (Order of the Ministry of Education and Science of Ukraine No. 1466, 2024) and "Vocational Teacher" (Order of the Institute of Vocational Education of the National Academy of Vocational Education of Ukraine No. 38-OD, 2022), these tools include the use of interactive platforms, cloud services, mobile applications, simulations, and even robotic assistants. According to G. Kashyna (2022), digital tools should take into account the specifics of vocational education and be aimed at ensuring the quality, adaptability and interactivity of learning.

The Moodle platform has been identified as one of the most effective platforms for vocational learning due to its flexibility, adaptability and ability to integrate with other tools. This was also confirmed by O. Kuzminska *et al.* (2022), who emphasised that innovative tools should provide personalised learning that meets the real challenges of vocational education. They concluded that the Moodle platform is one of the most adaptive and flexible tools capable of integrating various technologies and resources to improve learning effectiveness. R. Grushko & O. Romanyshyna (2023) analysed how digital platforms and cloud services contribute to the creation of an interactive learning environment. The researchers found that these tools allow educators to develop personalised educational trajectories, increasing the engagement of students. I. Verbovskiy & A. Melnyk (2023) emphasised the importance of technological changes in vocational education. In their research, they emphasised that the automation of administrative

tasks allows teachers to pay more attention to the development of innovative teaching approaches.

N. Lazarenko *et al.* (2022) emphasised the importance of integrating approaches to the development of digital skills of vocational teachers, which combines competence-based, pedagogical, technological and educational components. The competence approach is aimed at developing key skills such as analytical thinking, adaptation to new technologies and crisis management. The pedagogical approach focuses on improving teaching methods through the introduction of digital tools. The technological approach ensures the integration of robotic automation. The educational approach promotes the creation of adaptive and inclusive educational environments. The challenges of the war and the need for ongoing reconstruction of Ukraine have necessitated new approaches to teacher training. F. Rauner (2021) emphasised the importance of developing innovative thinking and crisis management skills in vocational teachers. This included not only technological training, but also the ability to use digital tools to support the psychological well-being of students, manage stressful situations, and ensure the continuity of the educational process.

Despite a significant number of studies on the use of innovative tools in vocational education, most focused on individual aspects without providing a comprehensive view of the structure of vocational teacher's digital competence and its relationship with the effectiveness of the educational process. That is why this study was aimed at identifying key theoretical provisions related to the formation of relevant digital skills of vocational teachers by studying, interpreting, analysing and systematising scientific publications and regulatory documents. The formation of digital skills of vocational teachers is a multifaceted process that includes the development of innovative thinking, integration of advanced technologies and consideration of the specifics of vocational education. The successful implementation of innovative tools in the educational process depends on the ability of vocational teachers to adapt to new conditions and use technology to improve the quality of education and ensure its sustainable development.

■ Materials and Methods

The research methodology was based on a competence-based approach that integrates educational, technological and pedagogical components to develop digital skills of vocational teachers. The study was based on 37 sources related to the modern digitalisation of vocational education. These include the professional standards "Vocational Teacher" (Order of the Institute of Vocational Education of the National Academy of Vocational Education of Ukraine No. 38-OD, 2022) and "Teacher of a Higher Education Institution" (Order of the Ministry of Education and Science of Ukraine No. 1466, 2024), which outline the

requirements for the professional activities of teachers, in particular in terms of digital competence and the use of technology in the educational process. The choice of these two standards is explained by their direct relevance to the training of vocational teachers (VETs) in higher education institutions.

The Vocational Educator standard defines the competences required to implement the educational process in the field of vocational education, including digital skills and the use of technology in teaching. In turn, the standard “Teacher of a Higher Education Institution” sets out the requirements for teachers who train future vocational teachers in higher education institutions. These standards are interrelated, as one regulates the training of vocational teachers and the other regulates the activities of those who teach them. Since there are no other relevant professional standards covering this specificity as of 2025, their analysis was the best way to assess the requirements for digital skills of vocational teachers and develop ways to improve them. The synthesis of the regulatory framework in the form of the above professional standards allowed to integrate the requirements for teachers’ digital skills and formulate directions for their development in accordance with popular trends in the digitalisation of education.

The study used a review of scientific literature, interpretation and comparison to explore the concepts and requirements for digital skills in professional standards. Comparison of the concepts of innovative tools, digital information processing, and professional learning platforms made it possible to identify their common and distinctive features, define the specifics of scientific approaches, and identify ways to improve the training of vocational teachers. The study of the standards helped to identify key requirements for teachers’ digital competence and to define areas for integrating digital technologies into vocational education, including mastery of digital tools, organisation of distance learning, use of interactive platforms and implementation of adaptive educational technologies. In addition to professional standards, the study analysed scientific works on the digitalisation of education and the development of teachers’ digital skills, including the adaptation of the educational process to the conditions of digital transformation (Kovalchuk *et al.*, 2023; Orshanskyi *et al.*, 2023). The works of authors who studied the introduction of innovative digital tools in vocational education were also considered (Kremin, 2022; Dembitska & Kobylanskyi, 2024). Scientific articles on innovative approaches to vocational training were also analysed (Bazelyuk, 2019; Borysova, 2023). Particular attention was paid to research on interdisciplinary approaches (Ivanuk *et al.*, 2020; Miroshnychenko, 2020) and the development of digital skills of students (Kashyna, 2022; Lazarenko *et al.*, 2022). The analysis of these sources helped to identify key trends in the digitalisation of vocational education.

The article analysed modern interactive tools, including cloud-based distance learning services, immersive technologies (virtual and augmented reality) for simulating the professional environment, and robotic and automated systems that contribute to the development of practical skills of students. The content analysis of scientific sources made it possible to summarise current trends in the digitalisation of vocational education and identify opportunities for integrating innovative tools into the educational process. The systematisation of the data obtained was carried out by means of comparative analysis, which allowed to identify the differences and common features between the professional standards “Teacher of a higher education institution” and “Vocational teacher”, as well as to assess the effectiveness of digital tools for vocational education. The graphical method was used, as the results of the analysis are presented in the form of 7 tables, which highlight the specifics of the definition of concepts, the concept of innovative tools, requirements for working with digital information and the possibilities of using different learning platforms. The tables revealed the advantages and limitations of innovative tools, their effectiveness in forming knowledge and skills in accordance with the digital competence framework, and the possibility of using them in professional training.

■ Results and Discussion

Effective implementation of innovative tools in professional learning is ensured by the integration of educational, technological and pedagogical components within a competence-based approach (Shevchenko & Shevchenko, 2024). This synergy is aimed at creating a holistic process of teacher training, which includes the development of digital culture, the formation of methodological models and practical solutions for effective work in a high-tech environment. As part of this integration, the technological component covers mastery of digital tools for content creation, management of information platforms, work with big data and cybersecurity. The pedagogical component is aimed at adapting the educational process to the global digital environment, using interactive technologies to personalise learning and supporting students’ independent work. The educational component focuses on the introduction of digital technologies into teaching methods, structuring educational materials, and optimising the educational process. The development of digital culture among vocational teachers ensures the formation of flexible competences necessary for interactive work in the context of digitalisation and constant change. The integration of these approaches improves the quality of vocational training, ensures adaptability and sustainability of the educational process, creates innovative learning environments and contributes to the modernisation of the vocational education system in line with technological challenges.

The use of digital tools presented in Table 1 ensures flexibility of the educational process, increases the level of engagement of students and promotes the development of key competencies such as critical thinking, creativity, collaboration and digital literacy, which are an integral part of successful professional activity in an innovative digital environment. The integration of

these components requires vocational teachers to have not only deep technological knowledge, but also pedagogical skills, the ability to adapt innovative tools to the specifics of various educational components in practice and the age characteristics of students, while ensuring compliance with legislative norms in the field of labour protection and personal data protection.

Table 1. Digital tools (comparison of two standards)

Category	Professional standard "Teacher of a Higher Education Institution"	Professional standard "Vocational Teacher"
Planning tools	Use of personal computers (PCs), office equipment, pedagogical software tools	Use of PCs, software, access to social partner databases
	Learning Management System (LMS) integration for organising and managing training	Electronic forms of regulatory documents
Training tools	Interactive platforms: multimedia, simulations, virtual tools	Distance and blended learning programmes
	Organisation of individual and group activities of students	Tools for individualising professional training
Evaluation tools	Digital tests, analytical platforms for assessing results	Automated systems for monitoring progress
	Using electronic materials to analyse progress	Electronic forms for monitoring learning outcomes
Inclusion tools	Resources for creating equal learning opportunities for students with special needs	Digital tools for adapting materials to different levels of training
Cloud services	Platforms for access to learning materials and data storage	Collaboration between teachers and students in cloud environments

Source: analysed and systematised by the author based on Order of the Institute of Vocational Education of the National Academy of Vocational Education of Ukraine No. 38-OD (2022), Order of the Ministry of Education and Science of Ukraine No. 1466 (2024)

The results of the systematisation of digital tools presented in Table 1 demonstrate that professional standards focus on the use of innovative tools to improve the educational process, while revealing the specifics of their application in different educational contexts. The use of digital tools in the two standards emphasises the importance of technology for improving the educational process. Innovative planning, learning and assessment tools play an important role in improving the effectiveness of teaching. Cloud services promote flexibility, interactivity and collaboration between participants in the educational process. Inclusive digital tools provide equal opportunities for students with different needs. There is a difference in priorities between the standards: higher education institutions are focused on the integration of innovative

solutions, while vocational training is mainly focused on their practical application. The conclusions of Table 1 have clearly demonstrated that digital tools are an integral part of the innovative educational process of professional training, but their effective use requires a clear understanding of the basic concepts associated with all advanced technologies. Table 2 systematises the definitions of key concepts in the form of a comparative analysis of their interpretation in the professional standards "Teacher of a Higher Education Institution" (Order of the Ministry of Education and Science of Ukraine No. 1466, 2024) and "Vocational Teacher" (Order of the Institute of Vocational Education of the National Academy of Vocational Education of Ukraine No. 38-OD, 2022) in order to identify conceptual differences and common approaches.

Table 2. Definitions of concepts (comparison of two standards)

Definition	Professional standard "Teacher of a Higher Education Institution"	Professional standard "Vocational Teacher"
Digital literacy	The initial level of use of digital technologies in the educational process	Basic ability to work with PCs and software
Digital competence	Integration of digital tools into the educational process with regard to pedagogical goals	Using digital technologies to achieve educational goals
Digital culture	Ethical, social and responsible use of digital technologies	A set of technical, social and cultural skills for working in a digital environment
Interactive tools	Interaction platforms, multimedia and simulation technologies	Tools to support interactive learning and active engagement of students
Self-diagnosis	Tools for analysing the level of teacher professional development	Methods for determining professional competences and building a teacher development trajectory

Source: compiled by the author based on Order of the Institute of Vocational Education of the National Academy of Vocational Education of Ukraine No. 38-OD (2022), Order of the Ministry of Education and Science of Ukraine No. 1466 (2024)

Table 2 reveals common and distinctive features in approaches to digital literacy, competence, culture, use of innovative tools and self-diagnosis. The data analysis demonstrated a tendency to integrate digital technologies into the educational process, and also emphasised the importance of the ethical, social and digital component in the activities of VETs. Digital literacy is a key basis for the development of digital skills and digital culture in both standards. The concept of digital competence reflects the integration of technology into teaching methods, which contributes to the effectiveness of the educational process. Significant attention is paid to the ethical component of digital culture, especially in the context of interaction between teachers and students. Interactive tools play an important role in supporting the involvement of students in the educational process through the use of up-to-date technological

solutions. In addition, self-diagnostics promotes continuous professional development and improvement of teaching staff, ensuring their compliance with the latest educational requirements. In order to ensure a competence-based approach to the development of digital education, the concept of innovative tools has been developed, as presented in Table 3. This concept is based on a comparative analysis of the professional standards of “Teacher of a Higher Education Institution” and “Vocational Teacher” and allows to identify common and distinctive features in the use of digital technologies in different types of educational institutions. The proposed concept can be used as a guideline for developing individual plans for the development of digital competence of vocational teachers, as well as for creating effective work-based curricula that meet the requirements of a dynamic educational environment.

Table 3. *The concept of innovative instruments specified in the standards*

Category	Professional standard “Teacher of a Higher Education Institution”	Professional standard “Vocational Teacher”
Digital platforms	LMS, in particular Moodle, as a key learning management tool	Use of educational platforms for vocational training
Multimedia resources	Creation of interactive content (videos, presentations, simulations)	Integrating multimedia to develop practical skills
Immersive technologies	Using VR/AR to simulate complex learning situations	Creating an immersive training environment
Interactive tools	Use of interactive whiteboards, online discussions and polls	Tools to stimulate active participation of students
Cloud services	Expand collaboration opportunities with Google Workspace, Microsoft Teams, and more	Creating a flexible environment for storing and sharing materials

Source: *systematised by the author based on Order of the Institute of Vocational Education of the National Academy of Vocational Education of Ukraine No. 38-OD (2022), Order of the Ministry of Education and Science of Ukraine No. 1466 (2024)*

An in-depth analysis of the professional standards of higher education teachers and vocational educators presented in Table 3 revealed clear trends in the integration of digital tools into the educational process. The data confirmed the growing focus of education on the use of digital technologies to improve the effectiveness of vocational training. It has been established that innovative tools contribute to interactivity, personalisation and improvement of the quality of the educational process. The use of immersive technologies allows teachers to simulate real-life situations, which increases the practical relevance of professional training. The analysis showed that digital platforms, in particular Moodle, remain the main means of managing the educational process. It was confirmed that cloud services significantly expand the possibilities of cooperation between teachers and students, facilitating the rapid exchange of information. Both standards emphasise the importance of multimedia and interactive technologies that ensure more efficient organisation of educational activities. The effective use of digital tools in the educational process, in the context of current challenges in Ukraine, requires professional development of teachers not only

in technical literacy, but also in a deep understanding of pedagogical principles and the ability to adapt to change. The results showed that the level of technical training of Ukrainian teachers is uneven: some teachers are actively implementing digital technologies in their work, while others face difficulties in using complex digital platforms and services. This is a significant drawback, as insufficient digital competence limits the ability to integrate innovative tools into the educational process, which in turn affects the quality of learning.

Table 4 demonstrates that professional standards for both higher education and vocational teachers define a wide range of digital information processing skills that are necessary to ensure quality education. In author’s opinion, attention should be paid to the ability to work in open cloud environments, which is relevant for educational institutions that, for objective reasons, are not always able to purchase expensive licensed software. In order to improve the level of technical training of vocational teachers, it is advisable to implement comprehensive professional development programmes focused on the practical mastery of modern digital tools. An effective solution would be to develop certificate

programmes on the integration of digital technologies into teaching, organise workshops on the use of adaptive educational platforms, and create communities of teachers to share experiences. It is important to strengthen

support from the administrations of educational institutions, providing vocational teachers with the necessary resources and technical support, which will help reduce barriers to the digitalisation of the educational process.

Table 4. Ability to work with digital information

The stage of working with information	Professional standard "Teacher of a Higher Education Institution"	Professional standard "Vocational Teacher"
Gathering information	Use of databases, electronic resources and repositories	Search for information in electronic libraries and from social partners
Data analysis	Analytical platforms, digital tools for big data processing	Tools for evaluating the information received in the professional field
Systematisation	Using cloud services to structure data	Catalogue data in spreadsheets and databases
Application	Integrating the data into training materials	Use of information in preparing and conducting classes
Feedback	Analysing and using the results of information processing in the educational process	Use of monitoring results to adapt training/educational programmes

Source: systematised by the author

The analysis of the professional standards for higher education teachers and vocational educators presented in Table 4 demonstrates the key role of data in the educational process. Both standards emphasise the importance of a competence-based approach to information processing, which includes its collection, analysis, systematisation and application to improve the quality of professional training (Yaprynets *et al.*, 2022). The results of the study confirmed the existence of clear stages of working with information, including its collection, processing, structuring and practical use. Particular attention was paid to monitoring and analytical tools that help to improve the efficiency of the educational process. The analysis has shown that the use of the data obtained plays an important role in the development of educational materials, and the use of cloud services simplifies their structuring and information management. In addition, feedback mechanisms provide flexibility and the ability to adapt curricula to meet the needs of students. The requirements of the changing educational space dictate the need to use innovative approaches to learning. Students expect their teachers (vocational educators) to use advanced technologies that make the educational process more interesting and effective. Information technology (IT) platforms contribute to the creation of a flexible learning ecosystem that meets the needs of progressive learners.

V. Radkevych (2022) noted that digital platforms provide an opportunity to create individualised learning paths for each student, which is especially relevant

in vocational education focused on practical training. At the same time, the author emphasised the problems of low digital literacy of teachers, which significantly complicates the effective implementation of innovative tools. Agreeing with this statement, it is worth noting that in addition to the level of digital skills of vocational teachers, administrative, financial and technical barriers play a significant role in the implementation of innovative tools. At the same time, there is a positive trend towards the development of professional development programmes that facilitate the adaptation of educators to an effective digital environment and improve the use of innovative tools in the educational process.

The variety of IT platforms for vocational education provides educators with ample opportunities to choose the best solutions that meet their educational needs and goals. Each platform has its own advantages, functionalities and approaches to the organisation of the educational process, which allows taking into account both the specifics of the disciplines and the technical resources of the educational institution. Table 5 provides a detailed comparison of popular platforms, which helps to analyse their key characteristics, including interactivity, usability and adaptation to current educational standards. Such an analysis not only facilitates the selection of the most appropriate IT platform, but also helps to identify innovative tools that most effectively support the development of digital skills of both vocational educators and students, meeting the challenges of a dynamic educational environment.

Table 5. Comparison of professional learning platforms

Criterion	Moodle	Google Classroom	Microsoft Teams	Canvas	Blackboard
Availability	Open platform, free for basic use	Free, integrated with Google	High-value, enterprise solution-focused	High-value, university-friendly	Expensive, high maintenance costs
Integration of tools	Supports plug-ins for interactivity, testing, assessment	Minimal integration of third-party tools	High integration with enterprise applications	Good support for interactivity	Limited integration for professional needs

Table 5. Continued

Criterion	Moodle	Google Classroom	Microsoft Teams	Canvas	Blackboard
Customisation options	Full customisation of the interface, modules, and reporting	Minimal settings	Limited customisation, standardised look	Good customisation for teachers	Customisation is complex and expensive
Supporting professional training	High level of support for a modular approach, flexibility in creating courses	Suitable for simple tasks	Easy for collaboration, but challenging for educational standards	Difficult for technical specialities of vocational education	Focused on academic teaching
Ease of use	Intuitive interface with learning resources	Simple interface but limited functions	Suitable for advanced users	Convenient, but requires training	Complicated for beginners
Specialising in education	Optimal for vocational education	Common platform	Targeted at business teams	Convenient for large universities	Focused on scientific research
Mobile device support	Excellent (mobile app)	Very good (by Google)	Convenient for use on smartphones	Average mobility support	Resource-intensive

Source: systematised by the author

The analysis of the platforms presented in Table 5 revealed significant differences in the key criteria that are crucial for choosing the best innovative tools for vocational education. In particular, the Moodle platform stands out as the most adaptive solution due to its accessibility, functional flexibility and support for integrations. Google Classroom, Microsoft Teams, Canvas and Blackboard also have their advantages, but their use is often limited by technical or financial factors. Summarising the results of the analysis, several important conclusions were made. Moodle has demonstrated the best functionality for vocational education due to its modular approach, flexible course creation, and the possibility of full customisation. Compared to Google Classroom and Microsoft Teams, Moodle is a more specialised platform that focuses on the needs of teachers and vocational education students. With its high integration with additional tools such as plugins, assessment, and reporting, Moodle is an ideal choice for specialised training programmes. Canvas and Blackboard also provide the necessary functionality for vocational education, but their use is often hampered by high cost, less availability and difficulty in implementing in regional educational institutions. Moodle stands out among other platforms as the optimal solution for vocational education due to its accessibility, progressiveness and ongoing support from the development community.

Innovative tools are an important component of the digitalisation of vocational education, as they contribute to the efficiency of the educational process. As noted by V.H. Kremin (2022), the use of digital platforms such as Moodle (partially Google Classroom) allows automating the process of organising vocational training while providing feedback. These tools also contribute to the development of learners' independence. Sharing this position, it is worth emphasising that the results of this study fully confirmed the effectiveness of digital platforms in increasing autonomous learning. At the same time, it is important to bear in mind that the success

of their use largely depends on the level of digital literacy of vocational teachers and the quality of integration of these tools into the educational process.

The systematisation of the data presented in Table 6 has highlighted the role of the Moodle platform as a convenient and multifunctional tool for digitalisation of vocational teachers. This analysis reflected its practical use in the implementation of professional standards for higher education teachers and vocational educators, especially in the context of the modernisation of the educational process. Moodle enables effective and engaging communication among participants in the educational process, organises testing, creates individual educational trajectories and monitors the completion of tasks. Its tools allow you to adapt educational content to the needs of different categories of students, supporting personalised learning. As a result, the platform not only facilitates the implementation of key professional requirements, but also contributes to the overall effectiveness of teacher training by adapting them to the challenges of the digital age. Through systematisation, the author of this article has managed to compare in detail the popularity, functionality and prospects of the Moodle platform in different educational contexts, identifying its strengths, limitations and application features. This comparison demonstrated how the IT platform contributes to improving the efficiency of the educational process by meeting the needs of higher education teachers, vocational educators and students. Moodle supports interactive interaction, enables the creation of personalised educational trajectories, provides access to a wide range of innovative tools, and allows the educational process to be organised in accordance with the future requirements of digitalisation. The platform helps to harmonise the educational process with key labour market standards, social expectations and challenges of the digital age, creating conditions for increasing the competitiveness of teachers and students.

Table 6. *The role of the Moodle platform in the effectiveness of professional training*

Aspect	Professional standard "Teacher of a Higher Education Institution"	Professional standard "Vocational Teacher"
Moodle's popularity	Widespread implementation for course management and outcome tracking	A tool for distance learning and interactive interaction
Moodle functionality	Support for testing, forums, integration with other resources	Creating individual educational trajectories for students
Moodle progressiveness	Constant adaptation to the needs of teachers and students	Integration with innovative progress monitoring tools
Moodle's future prospects	Ability to adapt to different models of education (online, blended)	Support for vocational training in line with labour market standards
Moodle in demand	Used in the world's leading universities	Adoption as the main tool of vocational education

Source: *author's systematisation based on Order of the Institute of Vocational Education of the National Academy of Vocational Education of Ukraine No. 38-OD (2022), Order of the Ministry of Education and Science of Ukraine No. 1466 (2024)*

The analysis has confirmed the importance of the Moodle platform as a universal tool for organising the educational process in various formats – distance, blended and face-to-face. Its functionality, adapted to the requirements of vocational education, allows for the effective implementation of professional standards, interactivity and individualisation of vocational training. Due to continuous improvement and integration with innovative tools, the Moodle platform meets the needs of educators and remains relevant in both higher and vocational education. The analysis of the Moodle platform has highlighted its unique characteristics. A special feature of the platform is a wide range of learning tools in various formats. Constant updating of features and support for integration with advanced technologies, such as assessment, communication and analytics tools, ensure that the platform remains relevant. By adapting to the needs of a flexible learning ecosystem, Moodle supports interactivity, ease of communication and the ability to introduce innovations into the educational process.

In addition to educational process management platforms, progressive methodologies and technologies aimed at integrating practical experience with learning play a significant role in the modernisation of vocational education. The digitalisation of the educational environment stimulates the use of innovative approaches that combine academic disciplines and technologies, creating new opportunities for the development of students' professional competences. In this context, STEM methods that promote interdisciplinary learning and the practical application of knowledge in changing realities are important. STEM methods that integrate science, technology, engineering and mathematics are widely used in vocational education. As noted by S. Dembitska & O. Kobylanskyi (2024), the use of digital methods contributes to the development of critical thinking and practical problem-solving skills, which is extremely important for vocational education. The results of this study confirmed this thesis, as the integration of robotic systems into the educational process not only allows students to operate equipment, but also

forms a deeper understanding of the principles of its functioning. The analysis of the data obtained showed that the effectiveness of this approach largely depends on the level of digital training of teachers and the availability of the relevant material and technical base.

Sharing the opinion of K. Osadcha *et al.* (2023) about the growing popularity of immersive technologies in vocational education, it should be emphasised that they open up new opportunities for creating simulation environments where students can enhance their applied skills without risk to health. The results obtained indicate the significant effectiveness of these technologies in modelling production processes, particularly in technical and medical specialities. This study has shown that the lack of integration of immersive technologies into curricula and limited access to appropriate equipment can significantly hinder their implementation. Supporting the position of S. Borysova (2023) on the importance of cloud services in the process of digitalisation of vocational education, it should be noted that the results confirmed their key role in ensuring mobility, interactivity and personalisation of learning. The use of Google Drive, Moodle, and Microsoft Teams platforms facilitates convenient access to educational materials, project collaboration, and prompt feedback. At the same time, this study has shown that the insufficient level of digital competence of teachers makes it difficult to realise the full potential of innovative tools, which requires the introduction of comprehensive professional development programmes. As noted by R. Chepok (2023), the requirements for teachers' qualifications in the digital age are changing rapidly, and the teacher must not only be proficient in innovative tools but also skilfully adapt them to the needs of students. The analysis of the results of this study confirmed this thesis, as the use of the latest technologies in the educational process significantly increases its effectiveness. At the same time, the success of their application depends not only on the digital literacy of teachers, but also on the organisational conditions of educational institutions, including the availability of technical resources and administrative support for innovative initiatives.

The results of this study are also consistent with the findings of Y. Yang (2025) on the role of AI in vocational education. The analysis showed that the use of automated learning systems contributes to the development of practical skills that meet the needs of a competitive labour market. At the same time, the implementation of such systems requires significant financial resources, as well as high-quality training of vocational teachers to work with them. Supporting the thesis of A. Sattorov & A. Fatullaev (2020) on the need to integrate educational, technological and pedagogical approaches in vocational education, it should be emphasised that the results of this study confirmed the importance of an integrated approach to innovation. The analysis has shown that the use of innovative tools should be accompanied by methodological support that allows for effective adaptation of technologies to specific educational contexts. The results confirmed the views of scientists on the key role of digital technologies in vocational

education and the need for an integrated approach to their implementation. The integration of cloud services, immersive technologies and automated robotic systems creates new opportunities for the training of highly qualified vocational teachers, but requires not only technical support, but also methodological justification and strategic planning.

Completing the study of the role of innovative tools in the context of developing digital skills in vocational teachers is impossible without analysing scientific works that cover the development and application of these tools in pedagogical practice. Mastery of scientific research contributed to a deeper understanding of theoretical foundations and facilitated the evaluation of the effectiveness of implementing modern digital technologies in education. Table 7 summarises the concept of innovative tools presented in 15 scientific papers that studied their application in pedagogy and their impact on improving the quality of professional learning.

Table 7. *The concept of innovative instruments mentioned in scientific research*

Innovative tools	Approaches to implementation	Application examples
Interactive platforms	Integration	Using Zoom in professional training
Digital whiteboards	Pedagogical	Interactive tasks on Miro
Cloud services	Integration	Google Workspace for collaboration
Interactive technologies	Competence	Interactive simulations in Moodle
LMS platforms	Educational	Using Moodle
Analytical tools	Technological	Google Classroom analytics systems
Multimedia tools	Integration	Zoom video conferences
Cloud services	Educational	Using cloud storage
E-learning platforms	Competence	Creating courses in Moodle
Mobile apps	Pedagogical	Using Quizlet for testing
Online training courses	Technological	Using Coursera for learning
Interactive whiteboards	Integration	Padlet application
Electronic resources	Educational	Using online libraries
Distance learning platforms	Competence	Using Google Meet
Interactive simulations	Educational	VR simulations
Chat Rooms and Forums	Pedagogical	Using Telegram chats
Digital platforms	Technological	Implementing Google Classroom

Source: *systematised by the author based on T. Myronenko & P. Kuzmenko (2020), F. Rauner (2021), V. Kremin (2022), V. Radkevych (2022), Yu.O. Danilevych (2023), Yu.O. Danilevych et al. (2023), S. Borysova (2023), L. Orshanskyi et al. (2023), O. Roskvas (2024), A. Tasdere & M. Isikli (2024), S. Dembitska & O. Kobylanskyi (2024), Y. Yang (2025)*

The analysis of scientific papers presented in Table 7 allowed to better assess the concept of using innovative tools in vocational education. The studies highlighted various approaches to their implementation, which confirmed the significant role of these tools in the modernisation of the educational process. They help to increase the effectiveness of learning, the interest of students and meet the current requirements of the labour market. The integration of digital technologies ensures the creation of a flexible and adaptive educational environment that helps to optimally prepare students for real professional challenges. In most scientific studies, cloud services are recognised as the most promising for vocational education due to their functionality and accessibility. The integration of

various innovative tools helps to solve complex problems in organising the educational process, optimising it and increasing the engagement of students. Interactive platforms play a key role in shaping a digital environment that responds to challenges. In addition, the research results confirmed that the development of digital skills of vocational teachers has a positive impact on the quality of training of students, contributing to the creation of an innovative educational process.

The theoretical study has shown the significant potential of innovative tools for the transformation of vocational education. Cloud services, interactive platforms, multimedia, immersive technologies, STEM methods, robotic and automated systems, and IT platforms contribute to the adaptability of the educational

process by supporting the integration of interdisciplinary approaches. These tools ensure the development of digital skills of vocational teachers and students, creating an innovative educational environment that meets the challenges of digital transformation, European integration and the needs of a competitive labour market. M. Rostoka & O. Hermak (2020) explored the transformation of the role of the teacher who has become a coordinator of the educational process, using digital technologies to improve learning efficiency. They emphasised that critical assessment of tools and teaching students to use them independently have become key to effective work. While agreeing with this, it is worth noting that in the context of the war in Ukraine, this role is largely limited by the lack of access to technical facilities and digital infrastructure. However, their approach can be complemented by the need for teachers to adapt digital tools for blended and mobile learning, which has become critical during the war. A. Dzhurylo (2023) studied the problem of rapid obsolescence of technologies and concluded that teachers were forced to constantly learn new tools, which created a significant workload. While partially agreeing with this statement, it should be added that the situation in Ukraine was further complicated by economic constraints, which often delayed technology upgrades. However, in contrast to the workload of teachers, the obsolescence of technology could stimulate the development of universal and less resource-intensive solutions that would not require significant changes over time.

O.A. Miroshnychenko (2020) and M. Pohorielov *et al.* (2024) proved that the digital culture of teachers had a positive impact on the engagement of students and improved the quality of technology use. While agreeing that digital culture was important for technology integration, it should be noted that its formation in Ukraine was hampered by a lack of methodological support for teachers. On the other hand, the development of digital culture required support not only for teachers, but also for students, who also often faced limited access to the Internet and digital devices. O. Yezhova (2024) considered digital skills as part of a teacher's professional competence and insisted on the continuous development of such skills. This conclusion was logical, but it did not consider the circumstances in which the continuity of learning was disrupted due to psychological pressure and the lack of stable infrastructure. In the context of the war and European integration, lifelong learning required external support, including funding and adaptation of international experience. I. Verbovskiy & A. Melnyk, (2023) emphasised the importance of the role of a cross-curricular digital facilitator who should coordinate the learning of several student groups in parallel, using artificial intelligence and automated systems. Contrasting this statement with the realities of vocational education in

Ukraine, it should be noted that the use of such approaches has been significantly hampered by a lack of resources and appropriate teacher training. This model, although promising, has not been implemented in many educational institutions due to current economic difficulties.

The authors R.S. Grushko & O.Ia. Romanyshyna (2023) investigated the problem of information overload, noting that teachers spend considerable time searching for and adapting educational materials. Appealing to this, it should be noted that the challenges in Ukraine require the creation of centralised databases and cloud libraries that would provide vocational teachers with quality content, reducing their workload. R. Chepok (2023) emphasised that foreign language skills have become important for working with international educational platforms. This conclusion is fully in line with the requirements of European integration, so it is worth noting that to overcome language barriers, Ukrainian VET teachers need to additionally master foreign languages. In the context of military threats, when financial resources are directed to ensuring the country's defence capability, the use of expensive digital AI translators is unlikely. Therefore, the ability of teachers to work effectively with international platforms largely depends on their own language skills.

The impact of martial law on the digitalisation of education was studied by I. Verbovskiy & A. Melnyk (2023). Researchers noted that some vocational teachers work in conditions of limited access to the Internet and infrastructure. Reconciling this statement with the realities of the Ukrainian education ecosystem, it should be emphasised that such challenges require the introduction of autonomous systems that can operate even under minimal technical conditions. VET teachers' digital skills are a key element of their overall competence. On the one hand, their development has been complicated by such challenges as the rapid obsolescence of technology, the effects of war, and the difficulties of implementing European integration standards. On the other hand, the development of digital skills has accelerated due to the need to address current issues immediately. Effective improvement of VET teachers' digital skills requires constant state support, local adaptation of innovative tools, systematic improvement of teachers' language training, and creation of conditions for continuous professional development.

The results of the theoretical study confirmed that an integrated model of using innovative tools and integration approaches opens up new opportunities for the development of digital skills of vocational teachers. This contributes not only to an effective response to global challenges, but also supports the recovery of Ukraine's economy by uniting the efforts of teachers in implementing innovations that improve the quality of education and meet the strategic goals of the country's digital development.

■ Conclusions

The theoretical study has highlighted the importance of innovative tools and integration approaches in the development of digital skills of vocational teachers. In this context, this integration is seen as a comprehensive combination of educational, technological and pedagogical components aimed at creating an adaptive learning environment that meets the positive challenges of digitalisation and socio-economic needs. This synergy allows for the simultaneous development of both the technological competencies of teachers and their ability to implement innovations in practice, ensuring the integration of theoretical knowledge and practical skills. The results showed that higher education institutions are mainly focused on the integration of innovative technologies into the educational process, while professional training is focused on the practical application of these tools. This trend is effective, but requires further improvement, in particular through the wider use of innovative tools in vocational education. This is important in the context of integration approaches that allow for an organic combination of theoretical training and practical aspects of learning. This creates the preconditions for the development of a dynamic digital environment that meets the needs of modern society.

The benefits of the synergy of innovative tools and integration approaches include improving the quality of learning, adapting to changing conditions, and developing critical thinking, collaboration, and creativity among students. A number of shortcomings have also been identified, including the insufficient level of technological training of teachers and limited access to

high-tech tools in some educational institutions. This indicated the need to improve the infrastructure and resource provision in educational institutions. Gaps in the implementation of digital platforms and cloud services have been identified that require systematic analysis and resolution. Further research will focus on improving methods of integrating innovative tools into vocational education, in particular through the development of new approaches to the organisation of the educational process and improving teacher training. Attention should be paid to the development of infrastructure for the use of advanced technologies, as well as to the professional development of teachers. This will not only ensure more effective use of innovative tools and integration approaches, but will also contribute to the creation of a sustainable vocational education ecosystem that meets the current needs of society.

■ Acknowledgements

The author expresses sincere gratitude to the library of Hryhorii Skovoroda University in Pereiaslav for providing access to its state-of-the-art facilities and interactive resources. The library's automated systems and modern digital services greatly supported the research process, ensuring seamless access to essential materials and fostering an efficient and innovative academic environment.

■ Funding

None.

■ Conflict of Interest

None.

■ References

- [1] Bazelyuk, O. (2019). Selection and use of digital tools in the educational process of vocational education institutions. *Adult Education: Theory, Experience, Prospects*, 2(16), 20-28. doi: 10.35387/od.2(16).2019.20-28.
- [2] Borysova, S. (2023). The importance of the digital educational environment for the professional training of students. *Education. Innovation. Practice*, 11(9), 7-14. doi: 10.31110/2616-650x-vol11i9-001.
- [3] Chepok, R. (2023). Theoretical foundations for implementing interdisciplinary connections in vocational education. *Prospects and Innovations of Science (Series "Psychology", Series "Pedagogy", Series "Medicine")*, 10(28), 484-493. doi: 10.52058/2786-4952-2023-10(28)-484-493.
- [4] Danilevych, Yu.O. (2023). Communication skills and competence: Their role in education. *Nursing*, 2, 56-65. doi: 10.11603/2411-1597.2023.2.14330.
- [5] Dembitska, S., & Kobylanskyi, O. (2024). Formation of professional competence of future specialists in professional education using digital technologies. *Health and Safety Pedagogy*, 8(1-2), 1-7. doi: 10.31649/2524-1079-2023-8-1-001-007.
- [6] Dzhurylo, A. (2023). Efficiency of public-private partnerships in modernizing vocational education systems. *Innovative Vocational Education*, 2(9), 204-209. doi: 10.32835/2786-619x.2023.2.9.204-209.
- [7] Grushko, R.S., & Romanyshyna, O.Ia. (2023). Developing digital skills in informatics classes using cloud services. In *Humanitarian and innovative perspective of professional mastery: Explorations of young scientists: IX all-Ukrainian scientific and practical conference of students, postgraduates, and young scientists* (pp. 382-385). Odesa: Liha-Pres. doi: 10.36059/978-966-397-357-9-114.
- [8] Ivanuk, H.I., Kuzemko, L.V., & Novyk, I.M. (2020). Training program "designing a multimedia environment of general secondary education and preschool education institutions" as an instrument for future educators' digital skills formation. *Information Technologies and Learning Tools*, 79(5), 73-89. doi: 10.33407/itlt.v79i5.3901.

- [9] Kashyna, G. (2022). Enhancing digital skills among academic staff of medical universities in postgraduate education systems. *Higher Education of Ukraine*, 1-2, 44-50. doi: [10.31392/npu-vou.2022.1-2\(84-85\).06](https://doi.org/10.31392/npu-vou.2022.1-2(84-85).06).
- [10] Kiryanova, M. (2024). The educator's information and digital competence as a foundation for professional success in the context of the information and educational environment. *Pedagogical Sciences*, 27(2), 63-72. doi: [10.33989/2524-2474.2024.2.63](https://doi.org/10.33989/2524-2474.2024.2.63).
- [11] Kovalchuk, V., Maslich, S., & Movchan, L. (2023). Digitalization of vocational education under crisis conditions. *Educational Technology Quarterly*, 1, 1-17. doi: [10.55056/etq.49](https://doi.org/10.55056/etq.49).
- [12] Kremin, V.H. (Ed.). (2022). *Scientific and methodological support for the digitalization of Ukrainian education: State, problems, prospects*. Kyiv: Institute for Digitalisation of Education of The National Academy of Educational Sciences of Ukraine.
- [13] Kuzminska, O., Hlazunova, O., Mokriiev, M., Korolchuk, V., & Voloshyna, T. (2022). [Technologies of integration of educational resources and services in conditions of distance learning](https://doi.org/10.55056/etq.49). *Humanities Studios: Pedagogy, Psychology, Philosophy*, 10(2), 38-46.
- [14] Lazarenko, N., Gurevych, R., Opushko, N., Gordiychuk, H., & Kobysia, V. (2022). Preparation of future teachers for professional activities using digital means. *Collection of Scientific Works of the National Academy of the State Border Guard Service of Ukraine*, 30(3), 291-315. doi: [10.32453/pedzbirnyk.v30i3.1211](https://doi.org/10.32453/pedzbirnyk.v30i3.1211).
- [15] Miroshnychenko, O.A. (2020). Organizational and pedagogical conditions of formation digital competence of the future higher educational institutions teachers. *Pedagogy of Creative Personality Formation in Higher and General Academic Schools*, 68(2), 72-76. doi: [10.32840/1992-5786.2020.68-2.14](https://doi.org/10.32840/1992-5786.2020.68-2.14).
- [16] Myronenko, O., & Kuzmenko, P. (2020). Ways of improving professional and pedagogical training of future vocational education teachers. *Problems, Achievements and Prospects of National and Foreign Professional Education*, 8, 51-57. doi: [10.33989/2519-8254.2020.8.239453](https://doi.org/10.33989/2519-8254.2020.8.239453).
- [17] Order of the Institute of Vocational Education of the National Academy of Vocational Education of Ukraine No. 38-OD "Professional standard "Vocational teacher"". (2022, December). Retrieved from https://register.nqa.gov.ua/uploads/0/521-pedagog_profesijnogo_navcanna.pdf.
- [18] Order of the Ministry of Education and Science of Ukraine No. 1466 "On Approval of the Professional Standard "Teacher of a Higher Education Institution of Higher Education"". (2024, October). Retrieved from <https://mon.gov.ua/npa/pro-zatverdzhennia-profesiinoho-standartu-vykladach-zakladu-vyshchoi-osvity1466>.
- [19] Orshanskyi, L., Nyshchak, I., & Yasenytskyi, V. (2023). Risks and benefits of digital transformation of vocational education system. *Youth and Market*, 10(218), 23-27. doi: [10.24919/2308-4634.2023.292869](https://doi.org/10.24919/2308-4634.2023.292869).
- [20] Osadcha, K., Buksha, M., & Manzhula, O. (2023). Digitization for professional training of future specialists in the field of vocational and technical education. *Educational Discourse*, 43(1), 7-21. doi: [10.28925/2312-5829.2023.11](https://doi.org/10.28925/2312-5829.2023.11).
- [21] Pohorielov, M., Lavrentieva, O., Bondarenko, V., Britchenko, I., & Dorohan, A. (2024). Electronic educational methodical complex "Construction of car" in vocational training of future teachers of professional education. *CTE Workshop Proceedings*, 11, 255-272. doi: [10.55056/cte.686](https://doi.org/10.55056/cte.686).
- [22] Radkevych, V. (2022). [Ensuring innovative development of vocational education of Ukraine](https://doi.org/10.33989/2519-8254.2020.8.239453). In *Scientific and methodological support of vocational education and training: Proceedings of the XVI all-Ukrainian scientific and practical conference* (pp. 200-209). Kyiv: Institute for Digitalisation of Education of The National Academy of Educational Sciences of Ukraine.
- [23] Rauner, F. (2021). Measuring professional competence of teachers of professional disciplines (TPD). In *Measuring and developing professional competences in COMET* (pp. 389-422). Singapore: Springer. doi: [10.1007/978-981-16-0957-2_10](https://doi.org/10.1007/978-981-16-0957-2_10).
- [24] Roskvas, O. (2024). Using CLIL in professional training of future vocational education teachers in leading European countries. *Comparative Professional Pedagogy*, 14(1), 66-71. doi: [10.31891/2308-4081/2024-14\(1\)-8](https://doi.org/10.31891/2308-4081/2024-14(1)-8).
- [25] Rostoka, M., & Hermak, O. (2020). Stem-management of electricians training in the postmodern space of education. *Adaptive Management: Theory and Practice. Series: Pedagogy*, 9(17). doi: [10.33296/2707-0255-9\(17\)-17](https://doi.org/10.33296/2707-0255-9(17)-17).
- [26] Sattorov, A., & Fatullaev, A. (2020). Professional training of future teachers of physical education. *Academia: An International Multidisciplinary Research Journal*, 10(11), 510-514. doi: [10.5958/2249-7137.2020.01414.7](https://doi.org/10.5958/2249-7137.2020.01414.7).
- [27] Shevchenko, R., & Shevchenko, N. (2024). [Theoretical analysis of the concept of "key competencies of future specialists"](https://doi.org/10.33989/2519-8254.2020.8.239453). *Ukrainian Professional Education*, 8(1), 77-83.
- [28] Tasdere, A., & Isikli, M. (2024). Technology integration into education from teachers' perspective: Experiences and challenges. *Journal of Elementary Education: Theory and Practice (JELEDU)*, 2(1), 37-74. doi: [10.5281/zenodo.10876806](https://doi.org/10.5281/zenodo.10876806).
- [29] Verbovskiy, I., & Melnyk, A. (2023). Modern trends in the training of future computer science teachers in the conditions of digital transformation of education. *Zhytomyr Ivan Franko State University Journal. Pedagogical Sciences*, 1(112), 5-28. doi: [10.35433/pedagogy.1\(112\).2023.5-28](https://doi.org/10.35433/pedagogy.1(112).2023.5-28).

- [30] Yang, Y. (2025). The practice, challenges, and future pathways of professional development for vocational education teachers. *World Vocational and Technical Education*, 1(1), 80-93. doi: [10.1515/wvte-2025-2004](https://doi.org/10.1515/wvte-2025-2004).
- [31] Yaprynets, T., Kelemesh, A., & Petrash, R. (2022). Teachers' project competence formation in the process of professional training. *Ukrainian Professional Education*, 12, 121-127. doi: [10.33989/2519-8254.2022.12.279048](https://doi.org/10.33989/2519-8254.2022.12.279048).
- [32] Yezhova, O. (2024). Professional training of future specialists in the field of technology and design using digital technologies. *Journal of Vasyl Stefanyk Precarpathian National University*, 11(1), 20-24. doi: [10.15330/jpnu.11.1.20-24](https://doi.org/10.15330/jpnu.11.1.20-24).

Теоретичні засади розвитку цифрових навичок педагогів професійного навчання: інноваційні інструменти, інтеграційні підходи

Євген Кузнєцов

Аспірант

Університет Григорія Сковороди в Переяславі
08401, вул. Сухомлинського, 30, м. Переяслав, Україна
<https://orcid.org/0009-0008-3994-9092>

■ **Анотація.** Цифрова трансформація освіти є ключовим чинником у професійному навчанні, оскільки докорінно змінює підходи до підготовки педагогів і трансформує освітні парадигми. Актуальність дослідження зумовлена необхідністю адаптації професійної освіти до викликів війни, відбудови країни й євроінтеграції, що потребує розвитку нових цифрових навичок. Мета дослідження полягала в аналізованні теоретичних засад розвитку цифрових навичок педагогів професійного навчання, їхньої сутності, структури та впливу інноваційних інструментів на якісну підготовку викладачів професійної освіти. Матеріалами дослідження стали професійні стандарти «Педагог професійного навчання» та «Викладач закладу вищої освіти», наукові статті, присвячені цифровізації освіти, а також інтерактивні інструменти, серед яких хмарні сервіси, імерсивні технології й автоматизовано-роботизовані системи. До методів дослідження віднесено огляд наукових джерел, інтерпретацію, компарування, систематизацію та контент-аналіз. Результати дослідження охопили проведене порівняння професійних стандартів, виокремлення спільних і відмінних рис вимог до цифрових навичок і визначення напрямів їх удосконалення. Виявлено, що цифрові навички педагогів є інтеграцією технологічних, інформаційно-аналітичних, етичних, комунікаційних та організаційних складових, що забезпечують ефективне використання цифрових ресурсів для досягнення освітніх цілей. Систематизовано сутність і структуру цифрових навичок, які диференційовано на базові, спеціалізовані й імерсивні. Проаналізовано тенденції цифровізації освіти, що охопили використання хмарних сервісів, STEM-методик і автоматизовано-роботизованих систем, досліджено вплив інтерактивних симуляцій, віртуальних лабораторій і систем управління навчанням на якість освітнього процесу. Запропоновано інтеграцію компетентнісного, освітнього, технологічного та педагогічного підходів для гармонійного розвитку цифрових навичок педагогів та їхньої адаптації до поточних викликів. Розроблено концепцію інноваційних інструментів. Практичну цінність визначено в удосконаленні викладання якісно цифровізованими педагогами професійного навчання, модернізації освітніх програм і підвищенні професійної підготовки викладачів до євроінтегрованої праці в умовах швидко прогресуючої цифрової трансформації

■ **Ключові слова:** компетентнісний підхід; професійна підготовка; цифрова культура; STEM-методики; адаптивне навчання; модернізація освіти; євроінтеграція



Development of information and digital technologies in higher education institutions

Mark Vaintraub*

Doctor of Pedagogical Sciences, Professor
Hryhorii Skovoroda University in Pereiaslav
08401, 30 Sukhomlynskyi Str., Pereiaslav, Ukraine
<https://orcid.org/0000-0002-2701-7094>

Inna Levchenko

Doctor of Pedagogical Sciences, Professor
Hryhorii Skovoroda University in Pereiaslav
08401, 30 Sukhomlynskyi Str., Pereiaslav, Ukraine
<https://orcid.org/0009-0007-7193-2680>

Andrii Lytvyn

PhD in Pedagogical Sciences, Associate Professor
Hryhorii Skovoroda University in Pereiaslav
08401, 30 Sukhomlynskyi Str., Pereiaslav, Ukraine
<https://orcid.org/0000-0003-1400-6510>

■ **Abstract.** The relevance of the study was due to the need to implement and develop digital tools and systems for any specialties, in particular the transport industry and logistics, professional education in labour protection, and technological education. The purpose of the article was to substantiate the planning of the development of information and digital technologies in higher education institutions. In the research process, general scientific and pedagogical research methods were used: theoretical analysis (comparative, systemic, analytical-synthetic, inductive, deductive) to substantiate the strategic plan for the development of information and digital technologies in higher education institutions; synthesis (general scientific, intersectoral, interdisciplinary) to substantiate the unity of interconnected tools and systems in higher education institutions, formulation of a conclusion; classification, systematisation, generalisation with the aim of generalising methods, electronic resources, interactive tools, platforms, etc. The article was devoted to the problem of development of information and digital technologies in higher education institutions. The relevance and necessity of developing information and digital technologies were substantiated to determine: planning, implementation and development of digital tools and systems; steps to modernise curricula; training teachers in digital skills; creation of electronic resources for learning. A graph of the development of information and digital technologies in higher education institutions was developed. The specific directions of its development were substantiated: needs analysis, improving the level of qualification of scientific and pedagogical staff, modernisation of curricula, creation of electronic resources, implementation of analytics systems, ensuring access, security and confidentiality, support and development, evaluation and optimisation. The elements of the development of information and digital technologies were substantiated. The practical significance of this work is to determine the planning of the development of information and digital technologies in higher education institutions in the relevant areas, which allowed to predict the increase in the professional development of scientific and pedagogical workers, to provide high-quality education to students and trainees in difficult conditions

■ **Keywords:** graph; innovative technologies; technological education; occupational safety; transport; logistics

Suggested Citation:

Vaintraub, M., Levchenko, I., & Lytvyn, A. (2025). Development of information and digital technologies in higher education institutions. *Professional Education: Methodology, Theory and Technologies*, 11(1), 70-79. doi: 10.69587/pemtt/1.2025.70.



■ Introduction

The problem of the development of information and digital technologies (IDT) in institutions of higher education encompasses many topical issues characteristic of the modernisation of the higher education system in Ukraine, particularly in the context of martial law and post-war times in the future. The problem of the development of IDT in higher education is a priority all over the world. The current state of these technologies and their development determine the future of higher education. The relevance of the research lies in the urgent need to develop digital technologies for any field of education, particularly the transportation and logistics industries, as well as vocational and technical education. The process of integration of Ukrainian education into the global educational space necessitates critical thinking and substantiation of information and digital technologies into a single system. Scientists rightly point to the improvement of teachers' qualifications aimed at the development of general ideas about the ways and prospects of education informatisation; application of information digital technologies, etc.

L. Khoruzh *et al.* (2020) figured out that the teacher's ability to perceive the new, use information and communications technologies (ICT) in the educational process, improves the quality of learning activities. In their study, authors rightly concluded that ICT used by teachers during teaching significantly improve the learning process, motivate and increase students' interest and learning effectiveness. As noted by O. Myroshnychenko (2020), the formation of digital competence among higher education graduates is a pressing problem because it requires rapid adaptation to the conditions of the information environment. N. Manoylenko *et al.* (2021) concluded that digitalisation of education is considered a leading direction in improving the efficiency of learning and the quality of the educational process. It is worth noting the conclusion of Ukrainian scientists V. Kornyat *et al.* (2022) that the digitalisation of the educational process is due to the emergence of new requirements for the formation of key competencies of specialists in connection with the new digital generation. The authors rightly pointed out that the issue of digitalisation also becomes relevant during distance and blended learning as a result of the war with the Russian Federation.

As A. Lazko & I. Tomashevska (2023) rightly emphasised in their study, the spread of digital technologies will make citizens' digital skills dominant among other skills of the 21st century. Like other researchers of these technologies, the authors emphasise the extreme importance of timely digitalisation for modern production. This involves full automation of production, design and product maintenance. As for the reform of the digitalisation of education, the authors rightly point out the need to improve software quality. This will allow to use educational resources, developments, scientific researches,

electronic scientific libraries, etc. As noted by Ukrainian scholars N. Seiko & M.O. Ershov (2021), information technologies in education provide for: constant continuous improvement of the content of educational programs; functioning of educational IT centres; development of distance and virtual learning, etc. Ukrainian scientists L. Kononenko *et al.* (2022) convincingly concluded that it is advisable for teachers need to improve their level of training in the use of digital technologies, and blended learning using various forms of learning is the most optimal way to improve the quality of education. In their research, scientists came to the conclusion that improving the quality of education is impossible without information resources of high school, an information environment in the global information space. Despite the large number of studies by Ukrainian scientists in the field of using computer technologies in higher education, the problem of developing information and digital technologies in higher education remains insufficiently studied. The aim of this article was to justify the advancement of innovative digital technologies within higher education institutions.

■ Materials and Methods

During the study, well-known pedagogical and scientific methods were used, in particular – when teaching the disciplines of the transport industry and occupational safety of vocational education, to substantiate the unity of interconnected tools and systems in higher education institutions using the example of these specialties, formulating a conclusion; analysis of the educational and work programs of the various degrees of higher education (Transport, Occupational Safety) to clarify the state of training of pedagogical specialists in the transport industry and occupational safety; method of surveying teachers, students and administration of the above-mentioned industries to identify problems related to the development of information and digital technologies; modelling method – to create a graph of the development of information and digital technologies in higher education institutions. When using the theoretical research method, pedagogical scientific works among Ukrainian scientists and scientists from other countries were analysed. The analysis was focused on the difficulties and advantages of the educational process when using information and digital technologies. Using a systematic approach in scientific research, the constituent elements of the development of information and digital technologies in higher education institutions were systematised and a graph with these relevant elements was developed based on the modelling method.

The survey was attended by 178 respondents from the Faculty of Technological and Mathematical Education, specialty 015 Vocational Education (Occupational Safety) at the Hryhorii Skovoroda University in

Pereiaslav and students from the transport sector of the educational and scientific centre of the National Centre of Vocational and Technical Education and Vocational Education of the National Academy of Sciences of Ukraine, as well as the administration of the relevant institutions. All survey participants were informed about its purpose and content, and they gave their consent to participate while guaranteeing the confidentiality and anonymity of their responses. According to the American Sociological Association Code of Ethics (1997), the collected data were used exclusively for scientific purposes and were not disclosed to anyone. A survey was conducted in the form of a questionnaire, in which respondents were asked the following questions: are you satisfied with the state of use (implementation) of IDT in the institution, how often do you use information and digital technologies per week, what, in your opinion, should be the software during the educational process, what is the use of IDT, what should be the training of specialists in IDT, what are the problems and the path of development of information and digital technologies in higher education, how do you see increasing your competence in information and digital technologies, what skills and abilities in working with information and digital technologies need to be improved by Ukrainian teachers so that student education is more productive and high-quality, what is the provision of access, security and confidentiality when using information and digital technologies, what are the specific directions of development of IDT in higher education institutions, what needs to be modernised in educational institutions, programs, which technologies (disciplines, practical or laboratory) need to be introduced. This survey helped to reveal a number of shortcomings in the organisation of the development of IDT.

■ Results and Discussion

The main objective of the survey was to determine how ICT should be developed in higher education institutions. The questionnaires sent to respondents from the transport sector and occupational health and safety of vocational education (future teachers among students and teachers and administration) were aimed at finding out what difficulties arise when using and implementing information and digital technologies. The question "Are you satisfied with the state of use (implementation) of information and digital technologies in the institution?" offered the following answer options: "yes", "no", "insufficient", "rather yes". The answers of the majority of respondents showed dissatisfaction with the state of implementation and use of these technologies.

The answers also allowed to analyse the frequency of ICT use and move on to the next question: "How often do you use ICT per week?". Considering the results, it turned out that 28% of respondents (50 students) regularly use ICT during the week, 25% (45 students) several times a week when performing educational tasks

of the educational process (searching for information on the Internet, preparing term papers and self-study works, essays, research papers, etc.). 32% (56 students) rarely used it, 1.8% (3 students) – never. When asked "what software should be used during the educational process in your opinion", 75% (134 students) of respondents noted that the use of such educational platforms as Moodle, Google Classroom and Teams makes it possible to organise blended and distance learning, which is a necessary condition of the war that the Russian Federation unleashed against Ukraine. When asked "what skills and abilities in working with information and digital technologies do Ukrainian teachers need to improve in order to make student learning more productive and high-quality?" 10% of respondents (18 students) noted the introduction of cloud technologies, in particular Microsoft 365 to implement data storage security during work, as well as video courses for students for the convenience of learning.

Among the specific areas of development of information and digital technologies in higher education institutions, 23% of respondents (41 students) identified the modernisation of educational programs with their adaptation to the requirements of the information and digital era. It should be noted that the information educational environment, which includes information and digital technologies, during teaching at such departments: theory and methods of vocational training of the Hryhorii Skovoroda University in Pereiaslav, as well as on the basis of the National Centre for Vocational Training, provided: communication between scientific and pedagogical workers (NPT), administration, students; effectively plans teaching in the institution; quickly provides information on the organisation and monitoring of the educational process; the content of educational complexes for the study of disciplines and practices; safe organisation of the educational process, in particular during a pandemic or martial law. The graph the problem studied in this article, shown in Figure 1, aims to plan the optimisation of the educational process using modern technologies.

According to the authors of this article, the problem under consideration is one of the current issues in higher education in Ukraine. Due to modern ICT, it is possible to reach a more modern level of education. The needs analysis for the assessment of the institution of higher education in digital solutions (AN) takes into account the following aspects: surveying students, teachers and administration to determine their needs and expectations from digital solutions; market analysis to examine education and digital trends, competitive landscape and potential opportunities for improvement; evaluation of existing digital solutions in the educational institution and their compliance with educational tasks and the needs of the modern market; involvement of experts in the field of education to receive advice and recommendations on improving digital solutions.

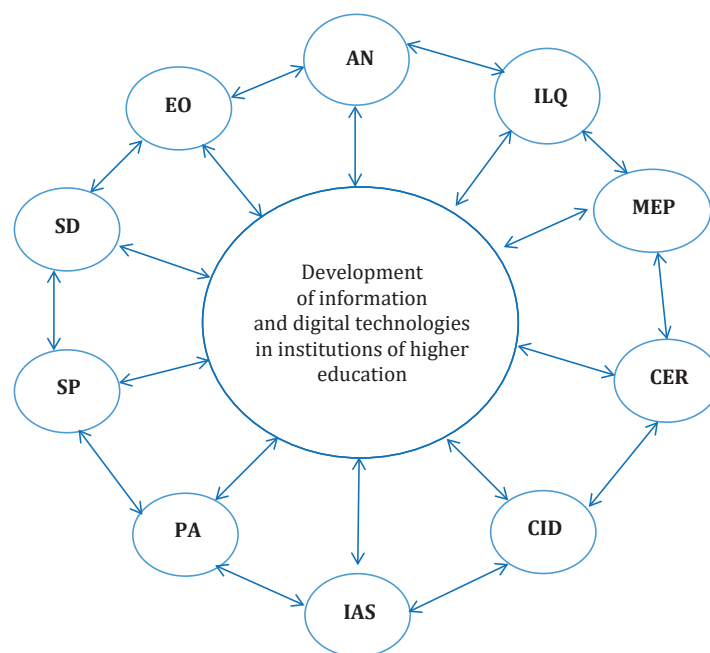


Figure 1. Graph of the development of information and digital technologies in institutions of higher education

Note: **AN** – analysis of needs; **ILQ** – increasing the level of qualification; **MEP** – modernisation of educational programs; **CER** – creation of electronic resources; **CID** – creation of information and digital platforms; **IAS** – implementation of analytics systems; **PA** – provision of access; **SP** – security and privacy; **SD** – support and development; **EO** – evaluation and optimisation

Source: developed by the authors

Increasing the level of qualifications (**ILQ**) may include the following stages and measures: studying the current level of training of teachers in the use of computer technologies during teaching and educational work; development of educational programs and courses taking into account the individual needs of employees; conducting trainings, master classes, advanced training courses and other forms of training; carrying out an assessment of the effectiveness of educational activities, as well as tracking changes in the employee performance after the completion of training; creation of a support and motivation system for employees involved in professional development, for example, providing access to resources for self-study, awarding for achievements, etc. These measures will help to ensure the effective promotion of scientific research and teachers improve the quality of teaching.

The modernisation of educational programs (**MEP**) is manifested through the introduction of modern technologies, the updating of the content of mandatory and optional subjects, as well as educational, production, technological and pedagogical practices. The modernisation of educational programs has the following aspects: the inclusion of modern topics that reflect modern technological and social trends, including artificial intelligence, cybersecurity, data processing, media education, etc.; use of interactive platforms, online resources, video lectures, virtual reality and other digital tools to improve the learning process; focusing on

the development of digital competencies, taking into account critical thinking, problem solving, online communication, etc.; using innovative assessment methods (projects based on real tasks, skills development portfolios, as well as the use of digital tools for data collection and analysis; providing teachers with access to professional development so that they can effectively use new technologies and approaches in their practice. The creation of electronic resources (**CER**) includes the development and implementation of educational materials, online courses and other information and digital resources for students.

The creation of information and digital platforms (**CID**) for online education of students allows: to ensure the opportunity to use various resources during training, remote communication, the possibility of interactive learning and promotion of a flexible form of education; increase access to education and provide students with a wide range of educational opportunities (Dashko, 2023). The creation of information and digital platforms can be considered through the following steps and aspects: determining the needs and goals of students, employees of the institution of higher education in order to develop a platform that meets their requirements; choosing technology solutions that best suit the needs, including web platforms, mobile applications, online collaboration tools, etc.; creation of electronic scientific and methodological materials, tests, discussion forums, etc.; development of a

convenient and understandable interface for students and teachers to facilitate the use of the platform; use of measures to protect personal data of students and information about studies; providing accessible and effective support to users, including online chats, e-mail, supporting documentation, etc.; continuous evaluation of the platform and implementation of appropriate improvements based on user feedback. These steps will help to provide an effective and innovative platform for online student learning.

The implementation of analytics systems (**IAS**) for tracking student success, the effectiveness of education and training, and improving programs is manifested in the collection and analysis of data on academic achievements, participation in classes and other aspects of student life. For the successful implementation of analytics systems for tracking student performance, firstly it is important to determine the purpose of the system, select the necessary metrics and performance indicators, collect and store relevant data, develop and configure analytical tools, and ensure protection of student privacy. After the implementation of the system, it is important to constantly monitor and analyse the received data, make the necessary adjustments to improve the quality of education. This allows to identify trends, personalise learning, support students in important aspects, identify possible difficulties and problems in time to improve the learning process. The provision of access (**PA**) to information and digital resources and platforms for students, taking into account their capabilities and needs. Ensuring access to information and digital resources and platforms for students includes: establishing access rights for users, using authentication and authorisation, monitoring network security, regularly updating the information and digital security system to effectively manage access and prevent unauthorised actions.

The security and privacy (**SP**) of the development of considered computer technologies is carried out using cybersecurity measures, data encryption, ensuring access only to authorised users, network and system security audits, as well as regular software and hardware updates to prevent potential threats. Security and privacy can be considered through the following aspects: using measures to protect information using encryption methods, etc., to protect the privacy of data during transmission and storage; requiring complex and unique passwords to access systems, using two-factor authentication to increase the level of security; installation of security measures, including antivirus software, intrusion protection, etc. against cyber-attacks; conducting regular security audits of systems and software, including the rapid implementation of patches and updates to close vulnerabilities; training users in the basics of cybersecurity, including awareness of threats, proper use of programs and services, procedures for behaviour in the event of a suspected cyber-attack;

collection, processing and storage of users' personal data according to the requirements of data protection legislation, ensuring users' rights to be forgotten and access to their data; regularly creating backup copies of data to prevent information loss in the event of cyber-attacks, accidental deletion or equipment failure.

Support and development (**SD**) should be systematic. Evaluation and optimisation (**EO**) determine the continuous evaluation of the effective implementation of solutions and optimisation taking into account changes in the educational environment. The needs analysis for the assessment of the high school in digital solutions takes into account the following aspects: surveying students, teachers and administration to determine their needs and expectations from digital solutions; market analysis to examine education and digital trends, competitive landscape and potential opportunities for improvement; evaluation of existing digital solutions in the educational institution and their compliance with educational tasks and the needs of the modern market; involvement of experts in the field of education to receive advice and recommendations on improving digital solutions.

Raising the level of qualifications may include the following stages and measures: studying the current level of formed competencies of scientific and pedagogical staff regarding the use of modern ICT during teaching and educational work; development of educational programs and courses taking into account the individual needs of employees; conducting trainings, master classes, advanced training courses and other forms of training for the purpose of improving the qualifications of teachers; carrying out an assessment of the effectiveness of educational activities, as well as tracking changes in the work and effectiveness of scientific and pedagogical workers after the completion of training; creation of a support and motivation system for employees involved in professional development, for example, providing access to resources for self-study, awarding for achievements, etc. These measures will help to ensure the effective promotion of teachers and improve the quality of teaching. The modernisation of educational programs in higher schools is manifested through the introduction of modern technologies, the updating of the content of mandatory and optional subjects, as well as educational, production, technological and pedagogical practices. The modernisation of educational programs has the following aspects: the inclusion of modern topics that reflect modern technological and social trends, including artificial intelligence, cybersecurity, data processing, media education, etc.; use of interactive platforms, online resources, video lectures, virtual reality and other digital tools to improve the learning process; focusing on the formation of competencies needed in the digital world, in particular critical thinking, problem solving, online communication, etc.; using innovative assessment methods (projects based

on real tasks, skills development portfolios, as well as the use of digital tools for data collection and analysis; providing teachers with access to professional development so that they can effectively use new technologies and approaches in their practice.

The creation of information and digital platforms for online education of students allows: to ensure the opportunity to use various resources during training, remote communication, the possibility of interactive learning and promotion of a flexible form of education; increase access to education and provide students with a wide range of educational opportunities. The creation of information and digital platforms can be considered through the following steps and aspects: determining the needs and goals of students, employees of the institution of higher education in order to develop a platform that meets their requirements; choosing technology solutions that best suit the needs, including web platforms, mobile applications, online collaboration tools, etc.; creation of electronic scientific and methodological materials, tests, discussion forums, etc.; development of a convenient and understandable interface for students and teachers to facilitate the use of the platform; use of measures to protect personal data of students and information about studies; providing accessible and effective support to users, including online chats, e-mail, help documentation, etc.; continuous evaluation of the platform and implementation of appropriate improvements based on user feedback. These steps will help to provide an effective and innovative platform for online student learning.

The security and privacy of the development of information and digital technologies is carried out through the implementation of cybersecurity measures, data encryption, ensuring access only to authorised users, network and system security audits, as well as regular software and hardware updates to prevent potential threats. Security and privacy can be considered through the following aspects: use of information protection measures using encryption methods, etc.; requiring complex and unique passwords to access systems, using two-factor authentication to increase the level of security; installation of security measures, including antivirus software, intrusion protection, etc. against cyber-attacks; conducting regular security audits of systems and software, including the rapid implementation of patches and updates to close vulnerabilities; training users in the basics of cybersecurity, including awareness of threats, proper use of programs and services, procedures for behaviour in the event of a suspected cyber-attack; collection, processing and storage of users' personal data according to the requirements of data protection legislation, ensuring users' rights to be forgotten and access to their data; regularly creating backup copies of data to prevent information loss in the event of cyber-attacks, accidental deletion or equipment failure.

Ensuring access to information and digital resources and platforms for students includes: establishing access rights for users, using authentication and authorisation, monitoring network security, regularly updating the information and digital security system to effectively manage access and prevent unauthorised actions. The implementation of analytics systems for tracking student success, the effectiveness of education and training, and improving programs is manifested in the collection and analysis of data on academic achievements, participation in classes and other aspects of student life. For the successful implementation of analytics systems for tracking student performance, it is important to determine the purpose of the system, select the necessary metrics and performance indicators, collect and store relevant data, develop and configure analytical tools, and ensure protection of student privacy. After the implementation of the system, it is important to constantly monitor and analyse the received data, make the necessary adjustments to improve the quality of education. This allows to identify trends, personalise learning, support students in important aspects, identify possible difficulties and problems in time to improve the learning process.

Modernisation of curricula in high school was manifested through the introduction of modern ICT, updating the content of mandatory and elective disciplines, as well as educational, faculty, production, technological and pedagogical practices. As shown by the practice of working with students at such departments: theory and methods of vocational training of the Hryhorii Skovoroda University in Pereiaslav, as well as on the basis of the educational and scientific centre based on the National Centre for Vocational Training, the creation of information and digital platforms for online learning of students allowed: to provide access to educational resources, remote communication, the possibility of interactive learning and promote a flexible form of learning; to increase the accessibility of education and provide students with a wide range of educational opportunities. The security and confidentiality of the development of modern ICT, was ensured through the implementation of cybersecurity measures, data encryption, ensuring access only to authorised users, network and system security audits, and regular updates of software and hardware to prevent potential threats. The authors of this article believe that ensuring access to information and digital resources and platforms for students included: establishing access rights for users, using authentication and authorisation, monitoring network security, and regularly updating the information and digital security system to effectively manage access and prevent unauthorised actions. The implementation of analytics systems to track student performance, teaching and learning effectiveness, and program improvement was manifested in the collection and analysis of data on

academic achievement, class participation, and other aspects of student life. This allowed to identify trends, personalise learning, support students in important aspects, and timely identify potential difficulties and problems to improve the learning process.

The obtained results indicate that the development of the studied technologies takes its rightful place in the work of educational institutions. The role of informatisation in education, which is one of the priority areas, that was studied by the Chinese scientist Z. Kai (2022). The researcher defined the properties and functions of ICT in education, didactic tasks for their use. It is noteworthy that the choice of a particular method and means of teaching is determined by the specifics of the academic discipline, the specific solution of the didactic task, the didactic properties of specific teaching aids, and ICT are considered as an important means of organising the cognitive activity of students. Ukrainian researchers O. Chubrey *et al.* (2021) in their work dedicated to the formation of computer literacy of students in higher education, rightly argue that the formation of a competent specialist of a new generation is impossible without the creation of a holistic educational space at its various levels and stages when using digital technologies in higher education. Taking this into account, it is appropriate to agree with the opinion of the Ukrainian scientist Ya. Yurkiv (2022) that during the formation of a teacher's information and digital competencies, information and media literacy, analytical thinking, programming and information security competencies, and computer ethics are gradually formed.

The authors of this article were convinced of the correct conclusion of Ukrainian scientists I.A. Bekhta & T.I. Kovalevska (2022) that the emergency digitalisation of education corresponds to the realities of the modern educational process, due to the limitation of social contacts. According to the co-author of this article M. Vaintraub (2021), the success of organising the effective use of ICT is to timely adjust the conditions changing in the information environment, organise constant monitoring and control measures to manage these conditions. The well-founded result of the study by scientist O. Sukhomlin (2022) is noteworthy, who summarised students' skills in more effective possession of digital competence and developed a number of didactic tasks for the development of students' digital and professional competence. It is worth emphasising that scientists L. Sultanova & M. Prokofieva (2022) in their work rightly concluded that for the safety of the uncontrolled spread of fake information, teachers and students need to improve their digital competence. It should be agreed with scientists that this is facilitated by the creation of interdisciplinary courses based on digital educational platforms, etc. In this case, it is appropriate to cite the study of A. Samko (2021), who carefully analysed framework documents on digital competencies, and also fairly and reasonably

considered the conditions for teachers to acquire digital competence during teacher training.

A. Lytvyn *et al.* (2023) indicated that the effectiveness of distance learning depends on the platform, mutual communication between teachers and students, as well as the interaction of students with each other. O. Kucheryaviy (2022) studied the system of professional digital competencies of a teacher of a higher pedagogical educational institution and rightly identified three main professionally determined functions: heuristic-digital, managerial-digital, and self-developing-digital. S. Tolochko (2021) thoroughly researched and theoretically substantiated the ways of digitalisation of educational institutions, sufficiently fully revealed the essence and features of teachers' competencies related to computer technologies, in particular digital and distance learning. It is worth noting that scientists L. Kosharska *et al.* (2022) rightly showed in their work that digital technologies for the educational process are an important, but not a necessary condition for increasing the efficiency of the educational process. The authors have sufficiently clearly and reasonably formulated the hypothesis about the need for scientifically based implementation of digital technologies in the work of higher and vocational educational institutions. However, one should agree with the opinion of researchers O. Braslavskaya & L. Ozerova (2022) that a teacher have to develop professional competence, and pedagogical skills, be ready to process significant amounts of information and use modern information technologies. The European Commission panel considered and approved the vision of digital development of the EU until 2030, which defines the goals of digital transformation and ways to achieve them until 2030. European Commissioner Thierry Breton stated on the European Commission website, regarding the European Digital Decade, which manifests itself in the fact that Europe must give its citizens and businesses access to modern technologies for a better and safer life. This is exactly the way a digitally sovereign Europe can be rebuilt (European Commission sets..., n.d.). Many studies by scientists emphasise the idea that the development of computer technology during learning creates a new paradigm of education, and the digital capacity of the country in the future depends on how effectively these technologies are implemented.

■ Conclusions

In the conditions of war as a result of the aggression of the Russian Federation against Ukraine, higher education institutions were forced to switch to distance and blended learning, which emphasised the importance of implementing the considered information technologies. Possession of digital and information technology competencies by students, teachers and administration of higher education institutions is important and extremely necessary in modern conditions. The analysis

showed that ICTs provide effective training and prepare graduates for competitiveness in the labour market in Ukraine. Regarding this, a high level of digital literacy becomes an integral part of high-quality professional training of graduates and teachers of higher education institutions, who must adapt to the modern labour market.

During a survey of teachers, students and management personnel in the transport industry and labour protection at the departments of Hryhorii Skovoroda University in Pereiaslav, as well as at the National Centre for Vocational Training, it was found that 28% of respondents regularly use ICT per week. Searching for information on the Internet, preparing research papers, essays and other educational tasks of the educational process are used by 25% of respondents several times a week. The majority of respondents (75%) noted that popular educational platforms, such as Moodle, Google Classroom and Teams – allow for the organisation of blended and distance learning, which in martial law conditions is in many cases a necessary condition. A smaller number of respondents (10%) determined the convenience of implementing video courses and

cloud technologies into the educational process, among which they singled out Microsoft 365 for the security of data storage during work. According to the analysis of the obtained results, it was found that the implementation of the elements of the developed schedule (needs analysis, teacher training, modernisation of curricula, creation of electronic resources, implementation of analytics systems, ensuring access, security and confidentiality, support and development, evaluation and optimisation) has a positive effect on the educational process. Further research will be devoted to examining the development of the system of integrated technologies in various educational institutions in Ukraine and abroad.

■ Acknowledgements

None.

■ Funding

None.

■ Conflict of Interest

None.

■ References

- [1] American Sociological Association Code of Ethics. (1997, June). Retrieved from <https://www.asanet.org/about/ethics/>.
- [2] Bekhta, I.A., & Kovalevska, T.I. (2022). Educators' digital competence in frames of education emergency digitalization. *Scientific Notes of Ostroh Academy National University: Philology Series*, 14(82), 109-112. doi: 10.25264/2519-2558-2022-14(82)-109-112.
- [3] Braslavska, O., & Ozerova, L. (2022). Formation of digital competence of future teachers in higher education institutions. *Problems of Training a Modern Teacher*, 1(25), 126-135. doi: 10.31499/2307-4914.1.2022.258486.
- [4] Chubrey, O., Mudrenko, A., & Shepel, O. (2021). Formation of professional competence of students in the conditions of the adaptive-digital environment of the institution of higher education. *Current Issues of the Humanities*, 2(46), 185-193. doi: 10.24919/2308-4863/46-2-30.
- [5] Dashko, Y. (2023). Information technologies in the educational process: Features and advantages. *Pedagogical Sciences*, 6(2), 46-51. doi: 10.33989/2524-2474.2023.82.295094.
- [6] European Commission sets strategic goals for EU digital development by 2030. (n.d.). Retrieved from <https://www.ukrinform.ua/rubric-world/3205020-evrokomisia-viznacila-strategichni-cili-cifrovogo-rozvitku-es-do-2030-roku.html>.
- [7] Kai, Z. (2022). Ways of improving digital competence (ICT) for university students. *Innovation in Upbringing*, 15, 349-354. doi: 10.35619/jiu.v1i15.451.
- [8] Khoruzh, L., Proshkin, V., & Glushak, O. (2020). High school teachers' competence development by means of digital technologies. *Information Technologies and Learning Tools*, 78(4), 298-314. doi: 10.33407/itlt.v78i4.3042.
- [9] Kononenko, L., Oryshaka, O., & Selishcheva, E. (2022). Formation of digital competence as the basis of transformation of higher education in conditions of globalizatynics processes. *Bulletin of Science and Education*, 1(1), 169-180. doi: 10.52058/2786-6165-2022-1(1)-169-180.
- [10] Kornyat, V., Romanyshyn, Y., & Golyardyk, N. (2022). Digitalization of Ukrainian education: Prospects and current risks. *Innovative Pedagogy*, 53(1), 155-159. doi: 10.32782/2663-6085/2022/53.1.30.
- [11] Kosharska, L., Bredneva, V., & Levitskiy, A. (2022). The role of digital technologies in the modern system of higher education. *Herald of the Odessa National Maritime University*, 67(22), 102-116. doi: 10.47049/2226-1893-2022-1-168-188.
- [12] Kucheryaviy, O. (2022). System of professional-digital competencies of a teacher of a higher pedagogical educational institution. *ScienceRise: Pedagogical Education*, 2(47), 44-49. doi: 10.15587/2519-4984.2022.255072.
- [13] Lazko, A., & Tomashevskaya, I. (2023). Key trends in composites: Higher education and digitalization. In *Higher education reforms in Ukraine: Challenges, status and prospects* (pp. 180-211). Latvia: Baltija Publishing. doi: 10.30525/978-9934-26-360-6-9.

- [14] Lytvyn, A., Velykdan, Yu., Khyshchenko, O., & Krolivets, N. (2023). Efficiency of implementing remote learning in higher education institutions: Challenges and prospects. *Current Issues in Modern Science*, 3(9), 440-453. doi: [10.52058/2786-6300-2023-3\(9\)-440-453](https://doi.org/10.52058/2786-6300-2023-3(9)-440-453).
- [15] Manoylenko, N., Kononenko, O., & Kramarenko, N. (2021). Digitalization of the educational process in the conditions of distance learning in higher education institutions. *Academic Notes. Series: Pedagogical Sciences*, 201, 108-112. doi: [10.36550/2415-7988-2021-1-201-108-112](https://doi.org/10.36550/2415-7988-2021-1-201-108-112).
- [16] Myroshnychenko, O. (2020). The content and the structure of digital competence of future teachers of higher educational institutions. *Pedagogy of Creative Personality Formation in Higher and General Academic Schools*, 3(70), 119-123. doi: [10.32840/1992-5786.2020.70-3.22](https://doi.org/10.32840/1992-5786.2020.70-3.22).
- [17] Samko, A. (2021). Digital competence of pedagogical staff in the system of postgraduate pedagogical education. *Educational Analytics of Ukraine*, 2(13), 33-43. doi: [10.32987/2617-8532-2021-2-33-43](https://doi.org/10.32987/2617-8532-2021-2-33-43).
- [18] Seiko, N., & Ershov, M.O. (2021). Developing IT education: Foreign practices. *Ukrainian Educational Journal*, 4, 54-64. doi: [10.32405/2411-1317-2021-4-54-64](https://doi.org/10.32405/2411-1317-2021-4-54-64).
- [19] Sukhomlin, O. (2022). Values of digital competence of future philologists from the point of view of modern existing realities of society's life. *Youth & Market*, 2(200), 170-176. doi: [10.24919/2308-4634.2022.256055](https://doi.org/10.24919/2308-4634.2022.256055).
- [20] Sultanova, L., & Prokofieva, M. (2022). Digital security in higher education. *Adult Education: Theory, Experience, Prospects*, 21(1), 106-117. doi: [10.35387/od.1\(21\).2022.106-117](https://doi.org/10.35387/od.1(21).2022.106-117).
- [21] Tolochko, S. (2021). Digital competence of teachers in the conditions of digitalization of educational establishments and distance learning. *Bulletin of the T.H. Shevchenko National University "Chernihiv Colehium"*, 169(1), 28-35. doi: [10.5281/zenodo.5077823](https://doi.org/10.5281/zenodo.5077823).
- [22] Vaintraub, M. (2021). Organization of effective ICT use in higher education institutions of Ukraine during the pandemic. *Academic Notes. Series: Pedagogical Sciences*, 196, 14-17. doi: [10.36550/2415-7988-2021-1-196-14-17](https://doi.org/10.36550/2415-7988-2021-1-196-14-17).
- [23] Yurkiv, Ya. (2022). Information and digital competence of the teacher in the educational process online. *Bulletin of the Luhansk National Taras Shevchenko University. Pedagogical Sciences*, 3(351), 385-394. doi: [10.12958/2227-2844-2022-3\(351\)-385-394](https://doi.org/10.12958/2227-2844-2022-3(351)-385-394).

Розвиток інформаційно-цифрових технологій в закладах вищої освіти

Марк Вайнтрауб

Доктор педагогічних наук, професор
Університет Григорія Сковороди в Переяславі
08401, вул. Сухомлинського, 30, м. Переяслав, Україна
<https://orcid.org/0000-0002-2701-7094>

Інна Левченко

Доктор педагогічних наук, професор
Університет Григорія Сковороди в Переяславі
08401, вул. Сухомлинського, 30, м. Переяслав, Україна
<https://orcid.org/0009-0007-7193-2680>

Андрій Литвин

Кандидат педагогічних наук, доцент
Університет Григорія Сковороди в Переяславі
08401, вул. Сухомлинського, 30, м. Переяслав, Україна
<https://orcid.org/0000-0003-1400-6510>

■ **Анотація.** Актуальність дослідження зумовлена необхідністю впровадження та розвитку цифрових інструментів та систем для будь-яких спеціальностей, зокрема транспортної галузі й логістиці, професійної освіти з охорони праці, технологічної освіти. Метою статті було обґрунтування планування розвитку інформаційно-цифрових технологій в закладах вищої освіти. Під час дослідження було використано педагогічні, наукові методи дослідження: теоретичний аналіз (порівняльний, системний, аналітико-синтетичний, індуктивний, дедуктивний) для обґрунтування стратегічного плану розвитку інформаційно-цифрових технологій в закладах вищої освіти; синтез (загальнонауковий, міжгалузевий, міжпредметний) для обґрунтування єдності взаємопов'язаних інструментів та систем в закладах вищої освіти, формулювання висновку; класифікація, систематизація, узагальнення з метою узагальнень методів, електронних ресурсів, інтерактивних засобів, платформ тощо. Стаття була присвячена проблемі розвитку інформаційно-цифрових технологій в закладах вищої освіти. Обґрунтовано актуальність і необхідність розвивати інформаційні й цифрові технології для визначення: планування, впровадження та розвитку цифрових інструментів та систем; кроків по модернізації навчальних програм; навчання викладачів цифровим навичкам; створення електронних ресурсів для навчання. Розроблено граф розвитку інформаційно-цифрових технологій в закладах вищої освіти. Обґрунтовано специфічні напрями його розвитку: аналіз потреб, підвищення рівня кваліфікації науково-педагогічних працівників, модернізація навчальних програм, створення електронних ресурсів, впровадження систем аналітики, забезпечення доступу, безпека і конфіденційність, підтримка і розвиток, оцінка та оптимізація. Обґрунтовано елементи розвитку інформаційно-цифрових технологій. Практична значимість цієї роботи полягає у визначенні планування розвитку інформаційно-цифрових технологій в закладах вищої освіти за відповідними напрямками, що дозволяє спрогнозувати підвищення професійного розвитку рівня науково-педагогічних працівників, надавати якісну освіту студентам та слухачам у складних умовах

■ **Ключові слова:** граф; інноваційні технології; технологічна освіта; охорона праці; транспорт; логістика



Philosophy of education as a basis for the development of innovative pedagogical technologies

Viacheslav Riznyk*

Doctor of Pedagogical Sciences, Associate Professor
Hryhorii Skovoroda University in Pereiaslav
08401, 30 Sukhomlynskyi Str., Pereiaslav, Ukraine
<https://orcid.org/0000-0002-6083-2242>

Volodymyr Nosachenko

PhD in Pedagogical Sciences, Associate Professor
Hryhorii Skovoroda University in Pereiaslav
08401, 30 Sukhomlynskyi Str., Pereiaslav, Ukraine
<https://orcid.org/0000-0003-0266-5199>

■ **Abstract.** The article aimed to explore the influence of philosophical concepts on the implementation of pedagogical innovations in the educational process. To achieve this, several philosophical movements were analysed in the context of their impact on educational innovations, and a survey of Ukrainian teachers was conducted. The results of the study demonstrated the significant influence of philosophical concepts on the development of educational technologies and pedagogical practices. According to the survey of Ukrainian teachers, constructivism was recognised as the most influential approach by 24.5% of respondents, while humanism was chosen by 20%. Pragmatism and existentialism were also named as important philosophical movements for fostering critical thinking and student autonomy. At the same time, a significant portion of respondents (31%) identified the lack of material and technical resources as the main obstacle to implementing innovations in the educational process. The study found that the integration of such innovative technologies as interactive platforms and virtual learning environments can significantly improve the quality of education if properly implemented. The research also showed that the use of innovative approaches can enhance student engagement in the learning process and increase the effectiveness of educational practices. The necessity of adapting educational technologies to the requirements of the 21st century was highlighted as crucial for the development of critical thinking, creativity, and social responsibility among students. Innovative approaches based on various philosophical concepts can ensure a higher quality educational process, contribute to personal development, and prepare students for the challenges of the 21st century. The study demonstrated that educational innovations can facilitate a rethinking of teaching approaches, improve adaptability, and enhance the relevance of the educational process

■ **Keywords:** constructivism; interactive platforms; critical thinking skills; student personal development; social responsibility

■ Introduction

The digital age has brought continuous changes to education, driven by the rapid development of technology and evolving societal demands. Educational institutions increasingly face the need to adapt their approaches

Suggested Citation:

Riznyk, V., & Nosachenko, V. (2024). Philosophy of education as a basis for the development of innovative pedagogical technologies. *Professional Education: Methodology, Theory and Technologies*, 11(1), 80-92. doi: 10.69587/pemtt/1.2025.80.



to ensure that curricula meet new challenges and societal needs. In an information society where digitalisation and rapid transformations are an integral part of reality, there is a growing need for new methods that help students acquire theoretical knowledge and develop practical skills in critical thinking, adaptability, and independence. One of the possible ways to create more effective educational technologies is to turn to philosophical concepts that can serve as a foundation for the development of new pedagogical approaches. Implementing innovations based on philosophical approaches can provide new momentum for educational development, help design more flexible methods to address contemporary challenges, and offer students opportunities for comprehensive growth. Examining philosophical approaches in the context of technological and social changes can create conditions for a deeper understanding of the role of education and its impact on personality development. It can also identify philosophical ideas that contribute to the formation of a more adaptive, inclusive, and high-quality educational system.

Previous studies on the implementation of innovative educational technologies have revealed various aspects of this issue, particularly their relevance in the educational process and the challenges encountered. T. Voropayeva *et al.* (2022) explored the experience of implementing innovative technologies in the training of management professionals, highlighting the importance of modernising teaching approaches to align with labour market requirements. The authors found that the implementation process often faced resistance from educators and educational institutions, as well as a lack of resources, which hindered its effectiveness. Meanwhile, N. Mukan & S. Kravets (2022) defined the concept of “innovative pedagogical technologies” and concluded that it encompasses not only new teaching methods but also a comprehensive system that enhances the quality and effectiveness of education while fostering students’ personal development. R. Susanto *et al.* (2020) found that technology use can significantly improve education quality, but success depends on the level of teacher training and student motivation. The study emphasised the need for a comprehensive approach to technology integration to ensure sustainable learning outcomes.

Studies of educational environments and their impact on the learning process have highlighted the importance of adapting learning spaces to the challenges of the 21st century. J. Charteris *et al.* (2020) examined how new materialist approaches transformed educational environments, making them active participants in the learning process. The authors found that the use of adaptive environmental elements promoted creative and dynamic interactions between students and teachers, which, in turn, increased learning effectiveness. I. Sasson *et al.* (2021) focused on creating educational

spaces that support critical thinking, creativity, and personalised learning approaches. The integration of innovative pedagogical models in learning space design encouraged active student participation, positively impacting the quality of the educational process. A student-centred approach to adapting environments to individual needs facilitated better material comprehension and the development of essential future skills.

Research on the philosophy of education has revealed significant challenges and opportunities in this field. S. Hook (2020) emphasised that educational reforms could foster responsible citizens capable of actively participating in society and addressing its problems, while G.M. Ildefonso-Sanchez (2019) noted that incorporating leisure as an active element in educational programmes could promote critical thinking, creativity, and self-reflection. According to E. Muliadi & U. Nasri (2023), integrating philosophical approaches into education can positively influence the formation of a generation capable not only of adapting to changes but also of actively shaping them, addressing global issues, and supporting social transformations. While these studies outlined the importance of updating educational approaches, they did not provide sufficient practical recommendations for implementing these approaches in specific educational contexts.

Previous research in the philosophy of science has demonstrated the substantial impact of digital technologies on education and society while emphasising the importance of critically analysing scientific activities. M. Kulitaeva (2020) examined how digital technologies alter human nature and the educational process, highlighting their dual impact: on the one hand, they created new learning opportunities, making education more accessible; on the other, they questioned traditional educational values and weakened interpersonal interactions. A. Rosenberg & L. McIntyre (2019) stressed the significance of the philosophy of science as a tool for critically analysing knowledge creation and verification, emphasising ethics, objectivity, and the social significance of scientific discoveries. Despite significant achievements, the reviewed studies lacked concrete practical recommendations for integrating philosophical approaches into digitalisation and scientific activities in real educational contexts, necessitating further research.

Previous research has shown that the implementation of innovative educational technologies faces several challenges, including the absence of a unified conceptual framework and insufficient attention to the practical aspects of their integration into the learning process. The aim of this study was to determine how philosophical concepts influence the creation and implementation of innovative pedagogical technologies. To achieve this goal, the following objectives were set: analysing philosophical concepts and their impact on educational practices; conducting a survey among

teachers to identify the most effective approaches; and developing recommendations for educational institutions on integrating philosophical approaches into pedagogical practice.

■ Materials and Methods

At the first stage of the study, the method of analysis was used to examine the following philosophical approaches: constructivism, pragmatism, humanism, existentialism, postmodernism, the transformational approach, and critical pedagogy. Specifically, the analysis involved studying the fundamental principles of each approach, their evolution, and their impact on pedagogical practices. The synthesis method was used to generalise the obtained information and identify interconnections between different concepts, which allowed for a holistic understanding of their influence on educational practices. The deductive method enabled the transition from general philosophical concepts to specific innovative teaching methods and revealed their practical impact on 21st-century education.

The empirical part of the study involved conducting an online survey among 290 teachers. The sample was formed non-randomly from teachers of grades 1-11 in general secondary schools in the government-controlled territory of Ukraine. Among the respondents, there were 211 women and 79 men, with an average age of 50.8 years. The study was conducted in compliance with the ICC/ESOMAR International code on market, opinion and social research and data analytics (2016). During the survey, respondents were provided with online questionnaires, which allowed for the collection of data regarding teachers' perceptions of the influence of various philosophical concepts on their practice. The questionnaires included the following open and closed questions:

1. Which of the following philosophical concepts, in your opinion, have had the greatest influence on modern pedagogical practices?

- a. Constructivism
- b. Pragmatism
- c. Humanism
- d. Existentialism
- e. Postmodernism
- f. Transformational approach
- g. Critical pedagogy

2. Which examples of innovative pedagogical technologies do you consider the most successful in your practice?

3. What are the main challenges you see in implementing innovative technologies?

4. Do you believe that certain philosophical concepts can help overcome these challenges? If so, which ones?

5. Which of the following aspects, in your opinion, most hinder the implementation of innovations?

- a. Lack of material and technical resources (equipment, educational materials, infrastructure)

- b. Lack of human resources
- c. Insufficient teacher training
- d. Lack of support from management
- e. Resistance to change among staff
- f. Insufficient funding
- g. Lack of a clear implementation strategy

6. How important is the philosophical foundation for the development of new educational technologies? (Scale from 1 to 5, where 1 – not important at all, 5 – critically important)

7. What opportunities does the implementation of innovative technologies based on philosophical approaches offer?

8. Which of the following concepts have the greatest impact on pedagogical technologies?

- a. Constructivism
- b. Pragmatism
- c. Humanism
- d. Existentialism
- e. Postmodernism
- f. Transformational approach
- g. Critical pedagogy

The method of content analysis was applied to process teachers' responses, which made it possible to determine which concepts are considered the most influential and promising in the educational environment. To gain a clear understanding of the distribution of responses to closed questions, the survey results were processed using tables in Excel. Meanwhile, for drawing conclusions, interpreting, and generalising research results, the method of induction was used, allowing for the identification of general patterns in the perception of philosophical concepts and their influence on pedagogical practices.

■ Results

Theoretical foundations of innovative pedagogical technologies: The influence of philosophical concepts on the development of educational methods and practices

The main philosophical trends, including constructivism, pragmatism, humanism, existentialism, postmodernism, the transformational approach, and critical pedagogy, have become a significant foundation for the development of innovative teaching methods. Each of these concepts has contributed to shaping different approaches to education, influencing the content and nature of pedagogical technologies and allowing them to be adapted to educational needs.

For example, constructivism, which is based on the idea of actively constructing knowledge, has formed the basis for methods focused on collaboration and interactivity in the learning process. This approach created conditions for project-based learning and problem-based learning, in which students not only receive information but also actively create new knowledge while interacting with the educational material. It is

known that constructivism can have a particular impact on developing critical thinking skills, analytical abilities, and independence in problem-solving (Shah, 2019; Tan & Ng, 2021; Larison, 2022), which has become the foundation for integrating modern technologies into the educational process.

Pragmatism is characterised by the practical application of knowledge and the value of experience, which has stimulated the development of learning based on experimental activities. The approach of John Dewey, an American philosopher, educator, psychologist, and founder of the philosophy of education, focuses on creating learning situations that simulate real-life problems, forming the basis for the integration of inquiry-based and experiential learning (Riga, 2020). Pragmatism has contributed to the development of adaptive teaching practices aimed at forming students' life competencies and their ability to adapt to a changing world.

Humanistic approaches have highlighted the importance of personal development and self-actualisation, playing a crucial role in shaping teaching methods that consider students' individual needs. Carl Rogers and Abraham Maslow emphasised the importance of creating an environment that fosters self-expression and personal growth for each student (Maslow, 2019; Krikorian, 2023), which has led to the implementation of individualised educational programs, coaching technologies, and methods focused on supporting personal achievements. The humanistic approach has also significantly contributed to the development of mentoring, allowing students to receive support and guidance throughout their education.

Existentialism, with its focus on freedom of choice, personal responsibility, and the search for meaning, has influenced teaching methods that promote reflection and critical thinking. Existentialists such as Jean-Paul Sartre and Martin Heidegger emphasised the importance of personal experience and independent decision-making, which has been reflected in pedagogical practices focused on dialogical learning and the formation of individual educational trajectories (Akinbode, 2023; Larivière & Quintin, 2023). This approach has contributed to the development of methods that encourage students to examine their values and beliefs, helping to shape and reconsider them.

Postmodernism, in turn, questioned established truths and norms, stimulating the development of inclusive educational practices that considered the diversity and uniqueness of each student. Postmodernist ideas (including knowledge decentralisation and critical analysis) became the foundation for methods that sought to take cultural and social contexts into account in learning. This influenced the development of multicultural education, which considered different perspectives and provided each student with the opportunity to express their opinion, fostering tolerance and an appreciation of diversity. The transformational

approach, which focused on a deep re-evaluation of one's beliefs and a shift in worldview, became an essential part of pedagogy and contributed to the development of methods such as reflective learning and learning through participation in socially significant projects. This approach emphasised the importance of critically understanding one's experiences, allowing students not only to acquire new knowledge but also to integrate it into their lives, changing their attitudes and values. Thus, transformational learning contributed to the formation of individuals capable of social responsibility and active citizenship. Critical pedagogy, aimed at overcoming social inequality through education, significantly influenced the development of methods focused on shaping social awareness and an active civic stance. Paulo Freire, one of the founders of critical pedagogy, believed that education should serve as a tool for emancipation (Freire, 1978). This idea was reflected in the implementation of educational practices focused on analysing social issues, developing critical awareness, and engaging students in social projects. Such approaches helped shape students into active participants in society, capable of analysing social realities and influencing them.

Scholars noted that the impact of philosophical concepts on the development of innovative teaching methods is evident and multifaceted (Gordon & Lawton, 2002; Rosenberg & McIntyre, 2019; Liu *et al.*, 2024). Each of the existing movements contributed to the formation of unique educational approaches, allowing the creation of diverse pedagogical practices that support the development of students' academic and personal competencies. The influence of philosophical concepts on the creation and use of innovative pedagogical technologies was manifested in the ways each movement's ideas were practically implemented in educational processes. Constructivism, for example, contributed to the introduction of technologies that encourage students to independently construct knowledge, such as interactive educational platforms and simulations, which allowed students to learn through experimentation and practice. These tools provided a personalised learning experience focused on inquiry and the practical application of knowledge.

Pragmatism influenced the development of pedagogical technologies that incorporate problem-based tasks and projects with a real social context. The use of digital tools for modelling and solving real-world problems (such as virtual laboratories or simulation games) became possible due to pragmatic ideas about learning through action and experience. Humanistic concepts were embodied in the creation of technologies that support an individualised approach to education. Tools such as learning systems with adaptive algorithms that adjust to each student's needs, or platforms for mentorship and coaching, illustrate the impact of humanistic ideas on innovative technologies.

These tools helped create an environment where students could feel supported in their personal development. Existentialism inspired educators to implement educational technologies that fostered student autonomy and self-determination. Self-directed learning platforms, which allow students to choose the pace and content of their studies according to their interests, emerged from existentialist ideas. Additionally, technologies that promote reflection, such as digital journals or portfolios, enabled students to analyse their own experiences and take responsibility for their learning. Postmodernism influenced the development of technologies that ensure diverse perspectives are considered in the learning process.

Innovative pedagogical platforms such as forums and online discussions allowed students to freely debate different viewpoints, fostering critical thinking and analytical skills. Postmodernism also facilitated the integration of multimedia resources into education, enabling the creation of multi-layered learning materials adapted to various cultural contexts. The transformational approach influenced the development of educational technologies aimed at deep personal change in students. Technologies that support reflection and socially meaningful activities – such as platforms for collaboration on social projects or tools for maintaining reflective journals – became an essential element of transformational learning. These

technologies provided opportunities for critical reflection on experiences and encouraged students to reconsider their beliefs. Critical pedagogy contributed to the creation of educational technologies focused on analysing social realities and developing students' social engagement. For instance, platforms for civic education or simulators that model social processes allowed students to immerse themselves in societal issues and seek solutions, helping to cultivate critical awareness and a responsible civic stance, which are fundamental to critical pedagogy.

Results of expert interviews on the implementation of innovative technologies based on philosophical approaches

The results of expert interviews provided deeper insight into how philosophical foundations have influenced the implementation of innovative pedagogical technologies. During the survey, diverse opinions of educators were gathered, revealing their practical views on the importance of philosophical approaches in the educational process. This helped to understand both the theoretical influence of various concepts and their real-world applications in educational institutions. Such an approach made it possible to identify the factors that contributed to the successful implementation of innovations as well as the challenges educators faced (Fig. 1).

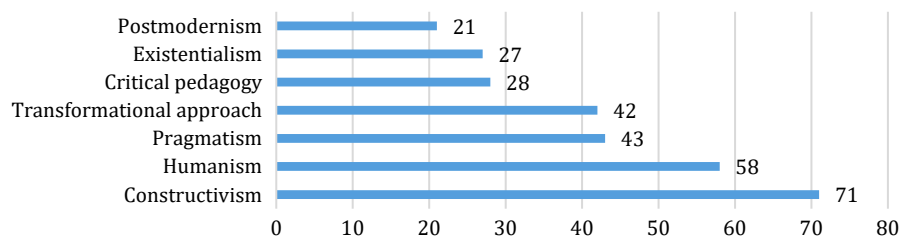


Figure 1. "Which of the following philosophical concepts, in your opinion, have had the greatest influence on modern pedagogical practices?"

Source: compiled by the authors

The survey results presented in Figure 1 showed that 71 respondents – 24.5% – preferred constructivism as the primary philosophical concept influencing existing pedagogical practices. Humanism also received significant support (58 respondents), garnering 20%, indicating the importance of creating an individualised and supportive learning environment for students. Pragmatism accounted for 14.8% of responses, while the transformational approach received 14.5%, highlighting the importance of the practical application of knowledge and personal development. These results may be linked to the characteristics of the Ukrainian education system, which is undergoing a transformation toward innovation and inclusivity. Constructivism and humanism have gained particular popularity due to educators' desire to promote active learning and

personal student development, reflecting a general trend toward individualisation and more interactive approaches. Meanwhile, the popularity of pragmatism and the transformational approach indicates teachers' aspiration to make education more applied, preparing students for real-life challenges. A lower number of responses (28 respondents) regarding critical pedagogy (9.7%), existentialism (9.3%), and postmodernism (7.2%) may indicate that these concepts are less adapted to traditional teaching methods in Ukraine, where greater emphasis has been placed on standardised approaches and less on independence and critical rethinking of knowledge.

Responses to the question about examples of innovative pedagogical technologies revealed key trends in Ukrainian education. The majority of survey participants

emphasised the importance of interactive methods, such as project-based learning, which enables students to work on real-world tasks and apply their knowledge in practice: “Project-based learning is the most effective way to engage students because they see the practical significance of their work”, stated one respondent. Project-based learning was also identified as a method for developing critical thinking and collaboration skills. Respondents also highlighted the importance of digital tools such as Google Classroom and Edmodo for interactive testing, as well as virtual laboratories, including PhET Interactive Simulations and Labster. Teachers stressed that these technologies make the learning process more accessible and interactive. As one respondent, a chemistry teacher, explained: “The use of virtual laboratories allows students to see what is difficult to organise in the classroom. Virtual laboratories enhance understanding of complex scientific concepts and enable me to conduct experiments that are not feasible under normal conditions”. Teachers also mentioned blended learning as an effective approach that combines traditional lessons with remote elements, giving students more autonomy. “Blended learning has allowed me to provide an individualised approach to each student”, shared one of the survey participants, a special education teacher. This suggests that blended learning contributes to meeting students’ educational needs more effectively by adapting the learning process to each individual’s abilities.

Coaching methods and mentoring were recognised as effective ways to motivate students and create a supportive environment. According to the respondents, these methods help develop soft skills such as leadership and critical thinking, which are crucial for preparing students for real-life challenges. Respondents identified several key challenges in implementing

innovative technologies in the educational process. Most teachers noted a lack of material and technical resources. “There is not enough equipment to implement new technologies, even when there is a strong desire to do so”, noted one educator. The absence of proper technical infrastructure limits the potential for using modern tools in education. Another significant challenge mentioned was insufficient teacher training. “Not all educators have the necessary knowledge or experience to work with digital technologies, and this becomes a serious obstacle”, emphasised one of the survey participants, an IT teacher. The lack of training and professional development programmes may create barriers to the effective use of innovations.

Teachers also pointed out resistance to change from colleagues, particularly those from older generations: “Resistance to change is often encountered, especially among colleagues accustomed to traditional teaching methods”. In response to the question of whether certain philosophical concepts could help overcome challenges, most respondents agreed with this assertion and highlighted humanism as a foundation that could support the development of both teachers and students in a supportive environment. Respondents also mentioned constructivism, which allows students to be actively engaged in the learning process through project-based tasks. “Constructivism enables to work alongside students as true partners in learning rather than merely serving as sources of knowledge”, noted one teacher. Additionally, some educators highlighted pragmatism and the practical application of knowledge. “Pragmatism helps focus on the outcomes and benefits of innovations”, observed one respondent, adding: “This approach facilitates the more effective implementation of new technologies”. Other factors hindering innovation are presented in Figure 2.

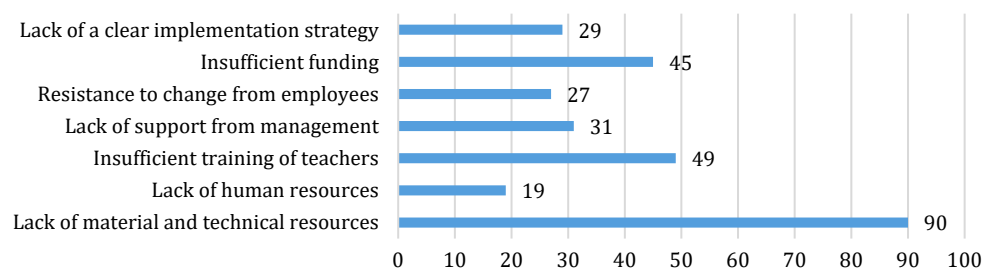


Figure 2. Distribution of responses among Ukrainian teachers regarding factors that hinder the implementation of innovations

Source: compiled by the authors

The most significant challenge for surveyed teachers in implementing innovative technologies was the lack of material and technical resources, as cited by 90 respondents (31%). This indicates that many schools in Ukraine face a shortage of necessary equipment and infrastructure, limiting the ability to integrate modern technologies into the educational process. Insufficient

teacher training and lack of support from school leadership were also identified as major obstacles, highlighting the need for professional development and the creation of favourable working conditions for educators. The relatively low percentage of responses mentioning a lack of human resources and resistance to change among staff suggests that these issues have a

lesser impact but still require attention for the successful implementation of innovations. The importance of a philosophical foundation for the development of new educational technologies is illustrated in Figure 3.

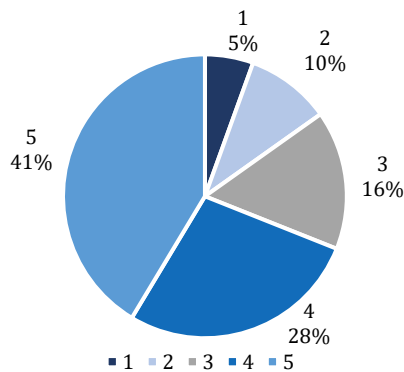


Figure 3. Distribution of responses among Ukrainian teachers regarding the importance of a philosophical foundation in the development of new educational technologies

Note: 1 – not important at all, 5 – critically important

Source: compiled by the authors

The majority of respondents stated that a philosophical foundation is important for the development of new educational technologies. Specifically, 41% of teachers rated the importance of a philosophical foundation at the highest level (5), while a further 28% rated it as a 4. The results indicate that over two-thirds of respondents consider philosophical concepts significant for the creation of effective educational innovations. Only a small proportion of respondents rated its importance at a low level: 6% at 1 and 10% at 2. This suggests that philosophical ideas are predominantly perceived by teachers as a foundation for successfully implementing

new technologies, enhancing understanding of the educational process and students' needs.

The implementation of innovative technologies based on philosophical approaches presents significant opportunities for improving the educational process. Many respondents noted that such technologies promote individualised learning and provide a more flexible approach to students' needs. "Innovative technologies based on humanism allow to focus on each student's needs and create an environment where everyone feels supported", emphasised one survey participant, a primary school teacher. Other respondents noted that innovative technologies help ensure that each student can progress at their own pace. Additionally, respondents highlighted those technologies based on constructivism contribute to the development of critical thinking and active student engagement in the learning process. One respondent, a mathematics teacher, remarked: "When I encourage students to use technologies that require independent research and analysis, they absorb information much more effectively". Overall, the implementation of innovative technologies based on philosophical approaches was identified as promoting individualised education, the development of critical thinking, and fostering responsibility for one's own learning.

The survey results indicated that, according to teachers, constructivism has the greatest influence on pedagogical technologies, receiving 25.9% of the votes (75 respondents). This is not surprising, as constructivism encourages active student participation in the learning process and knowledge creation, which forms the foundation of many existing educational approaches. Teachers are increasingly moving away from ideas of passive information absorption and seeking methods that enable students to become co-creators of their learning experience (Fig. 4).

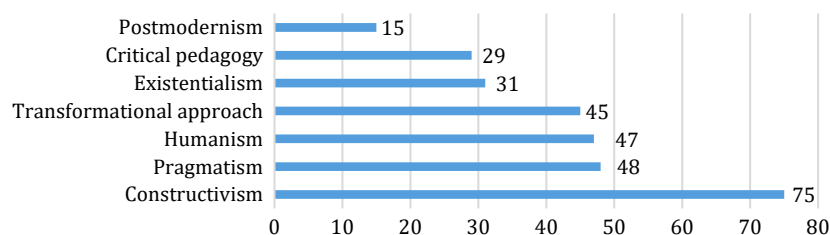


Figure 4. Distribution of responses among Ukrainian teachers regarding which philosophical concepts have the greatest influence on pedagogical technologies

Source: compiled by the authors

Pragmatism (16.6%) and humanism (16.2%) also have significant influence, as the former emphasises practicality and the usefulness of learning, aligning with the requirements for preparing students for real-life challenges, while the latter fosters a supportive learning environment that considers the individual needs of each student. These approaches help maintain a balance between academic achievement and students' personal

development. The transformational approach also received substantial support (45 respondents – 15.5%), indicating educators' interest in changing educational paradigms and developing students as independent thinkers. Meanwhile, existentialism, critical pedagogy, and postmodernism have a lesser influence, which may be due to their lower practicality or the complexity of integrating them into everyday educational practice.

Postmodernism, which received only 5.2% of the votes (15 respondents), often requires a deep rethinking of traditional approaches, which is not always easy to implement in modern school settings. Teachers prefer concepts that support active student engagement, practical knowledge application, and the creation of a supportive environment.

Recommendations for the development and implementation of innovative pedagogical technologies based on philosophical concepts

Determining optimal approaches to implementing innovations based on various philosophical concepts is crucial for ensuring the development of a holistic and effective education system. Constructivism, pragmatism, humanism, existentialism, postmodernism, the transformational approach, and critical pedagogy represent diverse epistemological and methodological perspectives that can be integrated to create a comprehensive strategy for innovative educational implementation. The synthesis of these concepts allows for the formation of an educational process that meets challenges and satisfies the diverse needs of learners.

Constructivism advocates for the active involvement of students in knowledge creation, enabling the incorporation of innovations such as project-based learning and inquiry-based learning. These methods foster a deep understanding of educational material through active engagement, ensuring that students are not passive consumers of information but active participants in knowledge construction. This is fundamental to developing critical thinking skills and independent problem-solving abilities (Petrasová, 2018). Pragmatism adds an emphasis on practicality and the real-world applicability of learning, which can help integrate educational tasks oriented toward solving real-life problems. Combining these approaches can promote the development of essential life skills among students. Humanism, by focusing on the individual needs and development of each student, supports the implementation of technologies that allow for adaptive learning tailored to personal capabilities, including individualised learning plans and the use of digital platforms for self-directed learning. Existentialism, in turn, adds a component of self-awareness, fostering responsibility for one's own learning and the development of critical thinking. Postmodernism and critical pedagogy emphasise the development of critical thinking, the ability to analyse different perspectives, and the consideration of issues from unconventional viewpoints. Applying these approaches can be particularly effective in creating an environment where students feel free to express their ideas and develop independent thinking. The transformational approach enables not only the transmission of knowledge but also the transformation of students, helping them become more autonomous and open to new experiences.

The practical application of philosophical principles in designing and implementing new educational technologies can significantly enhance the learning process's effectiveness and contribute to students' comprehensive development. For educational institutions and teachers, it is essential to consider several key recommendations based on different philosophical approaches to integrate these concepts into the learning process as effectively as possible. The implementation of constructivist approaches requires creating conditions where students can actively interact with materials and construct their own knowledge. This recommendation can be realised through project-based learning, research assignments, and interactive laboratories that encourage students to explore, experiment, and analyse. Educational institutions should provide access to resources that allow students to be active participants in the process rather than mere consumers of information. The pragmatic approach focuses on real-world student needs and the practical application of knowledge: educators can use tasks that simulate real-life situations or problems, helping students understand the significance of learning. For example, collaboration with local communities or businesses can aid in implementing interdisciplinary projects that demonstrate the value of acquired knowledge.

The humanistic approach to education aims to create a supportive environment that considers each student's individual needs. This can be achieved through personalised learning plans and providing psychological support to ensure students feel valued and motivated in their educational journey. Institutions can organise teacher training sessions on applying humanistic principles in the educational process, emphasising the development of emotional competence and supportive communication. Critical pedagogy and postmodernist approaches, which focus on developing critical thinking, require teachers to encourage students to analyse different perspectives and deconstruct established norms. Practical exercises involving discussions on social and cultural issues, media text analysis, or debates can help students develop skills in critical reflection and independent decision-making. The transformational approach involves creating conditions for students' personal growth through reflection and gaining new experiences. The use of coaching methods and mentoring elements can help students find personal meaning in learning and develop a deeper understanding of themselves and the world around them. Educational institutions can establish mentorship programs where teachers act as coaches, supporting students' individual development. Integrating philosophical principles into the creation and application of new educational technologies can enhance their effectiveness and significance for students. Practical recommendations based on these concepts enable educational institutions and teachers to create an innovative and

individualised learning environment that promotes students' comprehensive development and prepares them for real-world challenges.

■ Discussion

The conducted study has examined in detail the impact of philosophical concepts on the development of innovative educational technologies and pedagogical practices. Particular attention was given to constructivism, pragmatism, humanism, existentialism, postmodernism, the transformational approach, and critical pedagogy. It was found that each of these schools of thought has significantly contributed to the formation of innovative teaching methods that help adapt education to the demands of the 21st century and foster students' key competencies.

The analysis of pragmatist philosophy in education demonstrated that this approach emphasises the practical application of knowledge and the value of experience. The views of John Dewey laid the foundation for pragmatic education, which focuses on creating learning situations that model real-world problems. Pragmatism has promoted learning through experimentation and action, enhancing the adaptability of pedagogical practices and developing students' life competencies, aligning with the need for education that prepares them for life in a dynamic world. The study by C. Koopman & D. Garside (2019) revealed the necessity of rethinking the philosophy of pragmatist education in light of social and cultural changes brought about by technological advancements and the digitalisation of education. The authors suggested that pragmatism should be reoriented toward a more dynamic understanding of education, considering both individual needs and societal changes. Unlike Dewey's approach, which focused on real-world problem models, C. Koopman & D. Garside (2019) proposed making pragmatism more adaptive. They emphasised that education should become active and flexible, centered on critical action, creative problem-solving, and social engagement, thereby expanding traditional pragmatist ideas and making them more relevant in 21st-century educational settings.

The presented methods for developing critical thinking in education highlighted the importance of fostering conditions for independent student thought, active learning participation, and the consideration of alternative perspectives. Approaches such as open-ended questions, discussions, text analysis, and integrating real-world problems into learning can promote critical analysis and reflection skills. M.A. Peters (2020) examined Ludwig Wittgenstein's philosophy as a tool for developing critical thinking in education. Wittgenstein emphasised the importance of linguistic analysis, reflection, and self-criticism, helping educators avoid dogmatic approaches. Compared to the recommended active participation methods, Wittgenstein's approach

focused on deep reflection and avoiding simplistic truths. Both approaches aim to shape students into independent thinkers capable of critically understanding the world. However, Wittgenstein's methods can complement students' learning by fostering a deeper comprehension of the educational process.

The study of philosophical foundations in education has revealed a significant diversity of approaches, including constructivism, pragmatism, humanism, existentialism, postmodernism, the transformative approach, and critical pedagogy. Each of these approaches has contributed to the development of innovative educational technologies: pragmatism emphasised methods for the practical application of knowledge, humanism underscored the importance of considering students' individual needs, existentialism encouraged the development of reflection and personal responsibility skills, while critical pedagogy focused on social justice and civic engagement. Thus, the examined philosophical approaches have not only influenced the formation of pedagogical methods but also ensured the comprehensive development of educational technologies that address the challenges of the 21st century, directing education toward preparing well-rounded individuals capable of critical thinking, social responsibility, and active participation in society. A.A. Abdi (2021) examined the philosophies of Paulo Freire and Ubuntu, considering them as complementary in creating an educational environment focused on collaboration and solidarity. Freire emphasised critical consciousness and liberation through education, whereas Ubuntu highlighted the importance of community and collective responsibility. The integration of these approaches could contribute to the development of students' critical thinking and social responsibility. Y. Waghid (2020) also explored the implementation of Ubuntu principles in higher education in Africa to enhance inclusivity and cultural relevance. Unlike Western models, Ubuntu fostered a supportive environment that helped reduce social inequalities in educational opportunities. Compared to other philosophical approaches analysed in this study, Freire's and Ubuntu's philosophies are more oriented toward collective development and interaction, which can serve as an essential foundation for overcoming inequality and fostering a more just society.

The role of philosophers in shaping the philosophy of education and pedagogical innovations is crucial for understanding educational approaches in the 21st century. In particular, the contributions of philosophers such as John Dewey, Paulo Freire, Jean-Paul Sartre, and others have significantly influenced the development of pedagogical ideas aimed at active participation, student independence, critical thinking, and social responsibility. The ideas of these thinkers have formed the foundation for new pedagogical practices that promote student integration into the learning process and the

development of their value system. The study by I. Snir (2020), compared to the analysis of philosophers' roles in developing educational philosophy presented in this study, revealed an additional level of critical reflection. The author examined the educational ideas of philosophers from the continental tradition, such as Adorno, Arendt, Deleuze, Derrida, and Rancière, which focused on criticising standardisation and creating conditions for the development of critical thinking. While John Dewey and Freire emphasised active student engagement, Adorno and Arendt highlighted the need for critical reflection and creating space for discussion. These approaches, though different in their orientations, complement each other and contribute to a broader foundation for developing educational systems aimed at forming conscious and responsible citizens.

A survey of Ukrainian teachers on the impact of various philosophical schools on students and pedagogical practice showed that constructivism, humanism, pragmatism, and the transformative approach had the greatest significance. Most teachers favoured constructivism, as it promotes active student engagement in the learning process and the development of critical thinking skills. Humanism and pragmatism were identified as philosophical movements that, in the pedagogical context, consider students' individual needs and the practical application of knowledge, which is especially important in the 21st century. Meanwhile, the transformative approach fosters students' rethinking of their own beliefs and the formation of socially responsible individuals. Comparing these results with the study by R. Hung *et al.* (2021), one can see similarities in emphasising the importance of moral education and collective responsibility. The Confucian and Buddhist approaches examined by the authors also highlight the significance of social harmony and self-improvement, aligning with the humanistic values of Ukrainian teachers. The study by S. Sappe (2020) emphasised the importance of combining spiritual and rational aspects of knowledge, complementing the pragmatic approach of Ukrainian teachers, who noted the need to balance academic knowledge with moral principles. This indicates that different cultural philosophical traditions can mutually complement each other in creating a well-rounded educational model.

The analysis of innovations in technical support for educational institutions and pedagogical approaches demonstrated significant interest in integrating technologies and implementing new teaching methods. Technical innovations included digital tools such as virtual laboratories, Google Classroom, Edmodo, and other platforms that enhanced interactivity and student engagement. These technologies can create conditions for more dynamic student involvement in the learning process and help teachers organise education more effectively. Thus, pedagogical innovations focus on using

active learning methods, including project-based learning, developing critical thinking through problem-oriented tasks, and individualised approaches that allow for consideration of each student's needs, ensuring interactivity and personal development. The study by P. Jandrić & J. Knox (2022) examined the concept of the post-digital society and its impact on educational practice. Unlike traditional digitalisation, the authors defined technology integration as a background element of education that has already become a familiar part of the learning process. In the post-digital era, it is essential not only to use technology but also to create conditions for the development of critical thinking, creativity, and collaboration. Unlike the presented innovations, which emphasised technological capabilities, the approach of P. Jandrić & J. Knox (2022) contributed to rethinking the role of technology as an integral part of society and the need to adapt educational paradigms to new realities. The reviewed studies primarily focused on the significance of philosophical concepts for the development of educational innovations. However, certain gaps require further investigation, particularly the practical methods for adapting philosophical approaches to real learning conditions and the effectiveness of their implementation in different cultural and social contexts.

■ Conclusions

The conducted study identified the significant influence of philosophical concepts on the development of innovative pedagogical technologies. The main philosophical schools were examined: constructivism, pragmatism, humanism, existentialism, postmodernism, the transformative approach, and critical pedagogy, which laid the foundation for the creation of existing teaching methods. Each of these concepts uniquely influenced the formation of educational practices and contributed to their adaptation to the demands and needs of 21st-century education. For example, constructivism facilitated the development of collaboration- and interactivity-oriented methods such as project-based and problem-oriented learning, while pragmatism emphasised the importance of the practical application of knowledge and stimulated research and experiment-based learning. Humanism supported the development of individualised educational programs and coaching technologies focused on students' personal growth. Existentialism influenced the implementation of methods that fostered reflection and critical thinking, whereas postmodernism promoted inclusivity and consideration of cultural diversity. The transformative approach introduced practices of rethinking personal experience and values, while critical pedagogy encouraged social consciousness and active civic engagement.

The empirical part of the study included a survey of Ukrainian teachers regarding the influence of philosophical concepts on pedagogical practices and the

implementation of innovative technologies. The results showed that 38% of respondents considered constructivism to be the most influential concept shaping modern teaching approaches, while 34% identified humanism as such a concept. Respondents particularly emphasised that constructivism fostered active student engagement in the learning process, encouraged collaboration, and promoted critical thinking. As for humanism, many educators highlighted the importance of creating a supportive environment that would accommodate the individual needs of each student and contribute to personal development. This indicated teachers' aspiration to ensure active learning and a safe educational environment, aligning with trends in the individualisation of education and the development of critical thinking. Additionally, 25% of teachers noted that pragmatism has a significant impact on educational practices, particularly in the context of the practical application of knowledge and problem-solving in real-world situations. Meanwhile, 20% of respondents mentioned the transformational approach, recognising its role in fostering independent thinking skills and encouraging students to reconsider their own experiences.

The survey results also identified key challenges in implementing innovative technologies. Among these, 31% of teachers cited a lack of material and technical resources, 17% pointed to insufficient teacher training,

and 10% mentioned resistance to change from some staff members. At the same time, 45% of teachers believed that philosophical approaches, particularly humanism and constructivism, could help overcome these challenges by creating a favourable environment for both students and educators. The study demonstrated that the implementation of innovative technologies based on philosophical concepts has significant potential for improving the learning process. Further research is needed to explore the integration of critical pedagogy into educational technologies, particularly in digital learning, which could significantly enhance students' social awareness. Research in this area has the potential to contribute to the development of a learning environment more focused on social justice, inclusivity, and active student participation in social processes, which would ultimately have a positive impact on the formation of responsible citizens.

■ Acknowledgements

None.

■ Funding

None.

■ Conflict of Interest

None.

■ References

- [1] Abdi, A.A. (2021). Freirean and Ubuntu philosophies of education: Onto-epistemological characteristics and pedagogical intersections. *Educational Philosophy and Theory*, 54(13), 2286-2296. doi: [10.1080/00131857.2021.1975110](https://doi.org/10.1080/00131857.2021.1975110).
- [2] Akinbode, E. (2023). [Jean-Paul Sartre's existential freedom: A critical analysis](#). *International Journal of European Studies*, 1(1), 15-18.
- [3] Charteris, J., Smardon, D., & Nelson, E. (2020). [Innovative learning environments and new materialism: A conjunctural analysis of pedagogic spaces](#). In L. Benade & M. Jackson (Eds.), *Design, education and pedagogy (1st ed.)*. London: Routledge.
- [4] Freire, P. (1978). [Pedagogy of the oppressed](#). In J. Beck, C. Jenks, N. Keddie & M.F.D. Young (Eds.), *Toward a sociology of education* (pp. 374-386). London: Routledge.
- [5] Gordon, P., & Lawton, D. (2002). *A history of Western educational ideas*. London: Routledge. doi: [10.4324/9781315821993](https://doi.org/10.4324/9781315821993).
- [6] Hook, S. (2020). *Education for modern man*. Eugene: Wipf and Stock.
- [7] Hung, R., et al. (2021). Philosophy of education in a new key: East Asia. *Educational Philosophy and Theory*, 53(12), 1199-1214. doi: [10.1080/00131857.2020.1772028](https://doi.org/10.1080/00131857.2020.1772028).
- [8] ICC/ESOMAR International code on market, opinion and social research and data analytics. (2016). Retrieved from <https://esomar.org/uploads/attachments/ckqtawvj00uukdtrhst5sk9u-iccesomar-international-code-english.pdf>.
- [9] Ildefonso-Sanchez, G.M. (2019). Revaluing leisure in philosophy and education. *Studies in Philosophy and Education*, 38, 163-176. doi: [10.1007/s11217-019-09651-6](https://doi.org/10.1007/s11217-019-09651-6).
- [10] Jandrić, P., & Knox, J. (2022). The postdigital turn: Philosophy, education, research. *Policy Futures in Education*, 20(7), 780-795. doi: [10.1177/14782103211062713](https://doi.org/10.1177/14782103211062713).
- [11] Koopman, C., & Garside, D. (2019). Transition, action and education: Redirecting pragmatist philosophy of education. *Journal of Philosophy of Education*, 53(4), 734-747. doi: [10.1111/1467-9752.12399](https://doi.org/10.1111/1467-9752.12399).
- [12] Krikorian, M. (2023). Carl Rogers: A person-centered approach. In B.A. Geier (Eds.), *The Palgrave handbook of educational thinkers* (p. 1-13). Cham: Palgrave Macmillan. doi: [10.1007/978-3-030-81037-5_106-1](https://doi.org/10.1007/978-3-030-81037-5_106-1).
- [13] Kultaieva, M. (2020). Homo digitalis, digital culture and digital education: Explorations of philosophical anthropology and of philosophy of education. *Philosophy of Education*, 26(1), 8-36. doi: [10.31874/2309-1606-2020-26-1-1](https://doi.org/10.31874/2309-1606-2020-26-1-1).

- [14] Larison, K.D. (2022). On beyond constructivism. *Science & Education*, 31, 213-239. doi: [10.1007/s11191-021-00237-8](https://doi.org/10.1007/s11191-021-00237-8).
- [15] Larivière, N., & Quintin, J. (2023). Heidegger and human occupation: An existential perspective. *Journal of Occupational Science*, 30(2), 251-261. doi: [10.1080/14427591.2020.1858941](https://doi.org/10.1080/14427591.2020.1858941).
- [16] Liu, S., Yin, H., Wang, Y., & Lu, J. (2024). Teacher innovation: Conceptualizations, methodologies, and theoretical framework. *Teaching and Teacher Education*, 145, article number 104611. doi: [10.1016/j.tate.2024.104611](https://doi.org/10.1016/j.tate.2024.104611).
- [17] Maslow, A.H. (2019). *Motivation and personality: Unlocking your inner drive and understanding human behavior by A.H. Maslow*. New Delhi: Prabhat Prakashan.
- [18] Mukan, N., & Kravets, S. (2022). The definition of “innovative pedagogical technologies” concept. *Pedagogy of the Formation of a Creative Person in Higher and Secondary Schools*, 2(80), 92-96. doi: [10.32840/1992-5786.2022.80.2.17](https://doi.org/10.32840/1992-5786.2022.80.2.17).
- [19] Muliadi, E., & Nasri, U. (2023). Future-oriented education: The contribution of educational philosophy in facing global challenges. *Jurnal Ilmiah Profesi Pendidikan*, 8(4), 2420-2427. doi: [10.29303/jipp.v8i4.1807](https://doi.org/10.29303/jipp.v8i4.1807).
- [20] Peters, M.A. (2020). Philosophy as pedagogy: Wittgenstein’s styles of thinking. In *Wittgenstein, anti-foundationalism, technoscience and philosophy of education* (ch 8). London: Routledge. doi: [10.4324/9781003017035](https://doi.org/10.4324/9781003017035).
- [21] Petrasová, A. (2018). Ability to think critically as a determinant of the transformation of the education system and education. *Scientific Bulletin of Mukachevo State University. Series “Pedagogy and Psychology”*, 4(2), 64-67. doi: [10.31339/2413-3329-2018-2\(8\)-64-67](https://doi.org/10.31339/2413-3329-2018-2(8)-64-67).
- [22] Riga, F. (2020). Pragmatism – John Dewey. In B. Akpan & T.J. Kennedy (Eds.), *Science education in theory and practice* (pp. 227-239). Cham: Springer. doi: [10.1007/978-3-030-43620-9_16](https://doi.org/10.1007/978-3-030-43620-9_16).
- [23] Rosenberg, A., & McIntyre, L. (2019). *Philosophy of science: A contemporary introduction*. New York: Routledge. doi: [10.4324/9780429447266](https://doi.org/10.4324/9780429447266).
- [24] Sappe, S. (2020). Differences in knowledge science in Islamic education philosophy perspective. *International Journal of Asian Education*, 1(1), 1-8. doi: [10.46966/ijae.v1i1.22](https://doi.org/10.46966/ijae.v1i1.22).
- [25] Sasson, I., Yehuda, I., Miedijensky, S., & Malkinson, N. (2021). Designing new learning environments: An innovative pedagogical perspective. *The Curriculum Journal*, 33(1), 61-81. doi: [10.1002/curj.125](https://doi.org/10.1002/curj.125).
- [26] Shah, R.K. (2019). Effective constructivist teaching learning in the classroom. *International Journal of Education*, 7(4), 1-13. doi: [10.34293/education.v7i4.600](https://doi.org/10.34293/education.v7i4.600).
- [27] Snir, I. (2020). *Education and thinking in continental philosophy: Thinking against the current in Adorno, Arendt, Deleuze, Derrida and Rancière*. Cham: Springer. doi: [10.1007/978-3-030-56526-8](https://doi.org/10.1007/978-3-030-56526-8).
- [28] Susanto, R., Rachmadtullah, R., & Rachbini, W. (2020). Technological and pedagogical models: Analysis of factors and measurement of learning outcomes in education. *Journal of Ethnic and Cultural Studies*, 7(2), 1-14. doi: [10.29333/ejecs/311](https://doi.org/10.29333/ejecs/311).
- [29] Tan, C., & Ng, C.S.L. (2021). Constructivism in education. *Oxford Research Encyclopedia of Education*. doi: [10.1093/acrefore/9780190264093.013.92](https://doi.org/10.1093/acrefore/9780190264093.013.92).
- [30] Voropayeva, T., Jarvis, M., Boiko, S., Tolchieva, H., & Statsenko, N. (2022). European experience in implementing innovative educational technologies in the training of management specialists: Current problems and prospects for improvement. *International Journal of Computer Science & Network Security*, 22(7), 294-300. doi: [10.22937/IJCSNS.2022.22.7.35](https://doi.org/10.22937/IJCSNS.2022.22.7.35).
- [31] Waghid, Y. (2020). Towards an ubuntu philosophy of higher education in Africa. *Studies in Philosophy and Education*, 39, 299-308. doi: [10.1007/s11217-020-09709-w](https://doi.org/10.1007/s11217-020-09709-w).

Філософія освіти як основа розробки інноваційних педагогічних технологій

Вячеслав Різник

Доктор педагогічних наук, доцент
Університет Григорія Сковороди в Переяславі
08401, вул. Сухомлинського, 30, м. Переяслав, Україна
<https://orcid.org/0000-0002-6083-2242>

Володимир Носаченко

Кандидат педагогічних наук, доцент
Університет Григорія Сковороди в Переяславі
08401, вул. Сухомлинського, 30, м. Переяслав, Україна
<https://orcid.org/0000-0003-0266-5199>

■ **Анотація.** Метою статті було розкрити вплив філософських концепцій на можливості впровадження педагогічних інновацій у навчальний процес. Для цього було проаналізовано ряд філософських течій у контексті їхнього впливу на освітні інновації та проведено опитування українських вчителів. Результати проведеного дослідження продемонстрували значний вплив філософських концепцій на розвиток освітніх технологій і педагогічних практик. За результатами опитування українських вчителів, конструктивізм визнали найбільш впливовим напрямком 24,5 % респондентів, тоді як гуманізм обрали 20 %. Прагматизм і екзистенціалізм також були названі важливими філософськими течіями для формування навичок критичного мислення та самостійності учнів. Разом з тим, значна частина респондентів (31 %) відзначила недостатність матеріально-технічних ресурсів як основну перешкоду для впровадження інновацій у навчальний процес. У ході роботи було виявлено, що інтеграція таких інноваційних технологій, як інтерактивні платформи й віртуальні навчальні середовища, може значно покращити якість освіти за умови належного впровадження. Також дослідження показало, що використання інноваційних підходів може сприяти більш активному залученню учнів до навчального процесу та підвищенню ефективності освітніх практик. Було виявлено необхідність адаптації освітніх технологій до вимог XXI століття, що є важливим для розвитку критичного мислення, творчості та соціальної відповідальності учнів. Інноваційні підходи, засновані на різних філософських концепціях, здатні забезпечити більш якісний освітній процес, сприяти особистісному розвитку та підготовці учнів до викликів XXI століття. Дослідження продемонструвало, що інновації в освіті здатні сприяти переосмисленню підходів до навчання, підвищити адаптивність та релевантність освітнього процесу

■ **Ключові слова:** конструктивізм; інтерактивні платформи; навички критичного мислення; особистісний розвиток учнів; соціальна відповідальність



Adaptation of curricula to labour market requirements

Yuliya Koval*

PhD, Associate Professor

Vinnytsia Cooperative Institute

21009, 59 Academician Yangel Str., Vinnytsia, Ukraine

<https://orcid.org/0009-0001-3770-922X>

■ **Abstract.** The study aimed to assess the effectiveness of adapting curricula to labour market requirements and their efficiency in contemporary conditions. Three disciplines were selected – Computer Science, Business Management, and Marketing – as they align most closely with current professional demands. To evaluate effectiveness, student progress was monitored, participants in the educational process were surveyed, and academic performance outcomes were analysed. The key findings indicated that curricula adapted to modern market needs demonstrated significantly greater effectiveness in preparing students. Following the introduction of new modules incorporating up-to-date knowledge and skills, students reported improved competency levels and higher employment success compared to control groups following outdated curricula. The study involved an analysis of existing curricula, the development of new modules aligned with labour market requirements, and the implementation of these curricula in several educational institutions. The findings indicated that continuous revision of curricula in response to evolving labour market requirements is essential for ensuring the high competitiveness of graduates. Curriculum adaptation has enhanced alignment with contemporary labour market needs, positively impacting student preparation and readiness for professional activities. The introduction of new curriculum modules has been found to improve students' knowledge of practical skills and modern technologies, facilitating their more effective integration into professional environments. An assessment of the key research outcomes confirmed a significant improvement in students' knowledge and skills, highlighting the necessity of regularly updating study programmes. The positive impact of curriculum adaptation on graduates' professional competencies underscores the importance of further developing and supporting such initiatives to enhance education quality and its alignment with current labour market demands

■ **Keywords:** educational process; knowledge updating; competencies; revision; effectiveness

■ Introduction

Changes in the labour market, technological progress and the evolution of professional standards create new demands for the qualifications and skills of graduates. In this context, curriculum adaptation becomes critical to meeting current needs and trends. Constant changes in technologies and business processes lead to students' knowledge quickly becoming outdated. Updating curricula allows learners to acquire the necessary knowledge that meets modern standards and market requirements. This provides them with the necessary

skills for successful employment in a modern environment. In particular, curriculum adaptation helps to increase the level of employment of graduates (Grynyov *et al.*, 2024). In cases where study programmes include current knowledge and skills that are in demand in the labour market, students have more chances to find a suitable job after graduation. This helps to reduce the imbalance between the supply of educational services and the requirements of employers. Educational institutions that quickly respond to changes in the labour

Suggested Citation:

Koval, Yu. (2025). Adaptation of curricula to labour market requirements. *Professional Education: Methodology, Theory and Technologies*, 11(1), 93-103. doi: 10.69587/pemtt/1.2025.93.



market and adapt their curricula can attract more students and enhance their reputation (Samaradivakara *et al.*, 2024). This also helps to maintain the relevance and effectiveness of educational services.

Studying the curriculum adaptation to the requirements of the labour market is key to improving the quality of education, increasing the competitiveness of graduates and ensuring their readiness for the modern challenges of the professional world. Z.K. Abdul-Hasan & N.I. Abed (2024) emphasised the importance of these curricula having sufficient flexibility to quickly adapt to the new requirements of the labour market. They argued that changes in the economy and technology dictate new conditions that require university graduates not only to have deep theoretical knowledge but also the ability to apply it in practice. V. Dmytrenko & V. Dmytrenko (2022) investigated the effectiveness of various teaching methods in preparing higher education students for the labour market, studying the success of their integration. The study showed that modular learning and project work are most effective for developing students' practical skills. Research into this issue contributes to the development of innovations in the educational process. Integrating new methods and technologies into curricula can improve the quality of education, making it more practical and adapted to real working conditions. It can also stimulate the adoption of new approaches to learning, such as project-based learning or internships. The study by O. Zadorina *et al.* (2023) found that even technical specialities require curriculum expansion through courses that develop these skills. They emphasised that curriculum adaptation should take into account not only technical aspects but also social and communication skills, which are becoming increasingly important in the modern labour market.

Updating curricula is also crucial for preparing students for global challenges and opportunities, as in the context of globalisation and international integration, educational programmes should reflect not only local realities but also international trends and requirements. T. Rehman (2025) studied the impact of globalisation on the content of educational programmes, pointing out that increasing international competition requires universities to integrate international standards into their curricula. The author argued that modern curricula should be oriented not only to the domestic labour market but also to take into account the requirements of the global market, which is especially relevant for graduates seeking to work abroad. The problem of curriculum standardisation was studied by L. DelaTorre-Diaz *et al.* (2025), arguing that while standardisation helps to ensure a certain level of quality of education, it can at the same time hinder innovation and flexibility of curricula. A. Aliya Putri *et al.* (2023) examined how effectively

a technical unit of Indonesia's Ministry of Manpower addressed the country's skilled workforce need between 2019 and 2021. By 2020, the government aimed to have 60% of students in vocational education and 40% in academic institutions, but only 49% of students were in vocational education. vocational education, asking for increased industry-vocational school cooperation to give graduates employer-required skills. The study recommended strategic cooperation between educational institutions, government agencies, and industry stakeholders to promote adaptive training programs that meet industry needs, enhancing employability and economic growth.

N. Shabangu & N.E. Madondo (2024) examined the persistent challenge of graduate unemployment, emphasising the misalignment between higher education curricula and labour market requirements. They highlighted that many programmes lack sufficient practical training and career support, which leaves graduates underprepared for the workplace. The authors argued that closer collaboration between universities, employers, and government agencies is required to reform curricula, integrate experiential learning opportunities, and regularly update programme content in line with market demands. A.O. Lobatskii (2024) focused on the need for dual education, where students gain practical experience alongside theoretical training. E. Albayrak & Ö. Akgün (2022), proved that it is important to constantly update curricula in the field of information technology, where changes are happening most rapidly. They also noted that these curricula should include the latest advances in this field to ensure graduates are competitive. This research highlighted that the inability of curricula to be update in a timely manner can lead to graduates being unprepared for the demands of modern employers. Each of the researchers made a significant contribution to the study of this issue, but the question of integrating existing curricula that can be successfully adapted to the needs of the labour market was not sufficiently disclosed. The study aimed to assess the effectiveness of curriculum adaptation to meet the requirements of the labour market to improve student training and their competitiveness in the modern market.

■ Materials and Methods

This study employed an experimental method to adapt curricula to meet labour market demands. The first stage was the analysis of existing curricula. The study selected specific curricula from three specialities that are in greatest demand in the labour market: Computer Science, Business Management and Marketing. These specialities were chosen based on an analysis of market trends, which showed their high popularity and importance to the economy. An analysis of the educational programmes of Taras Shevchenko National University of Kyiv was conducted, which offers training in

three in-demand specialities, namely the educational program “Computer Science”, as well as the educational program “Business Management” and the educational program “Marketing”.

A survey of employers (130 women and 170 men), whose average age was 35 years, with variations from 25 to 48 years, was conducted, which consisted of the following questions:

1. How do you assess the level of practical skills demonstrated by graduates during the performance of professional duties?

2. Does the theoretical knowledge of graduates correspond to modern trends in your industry?

3. How important do you consider the introduction of interdisciplinary approaches in the training of specialists?

4. How often do you encounter a situation where graduates do not possess the necessary practical skills to effectively perform their duties?

5. Which aspects of educational programmes, in your opinion, require the most changes to meet modern labour market requirements?

The participants represented companies from various sectors of the economy, which allowed for a comprehensive understanding of the requirements for graduates from different specialities. This made it possible to identify the curricular misalignment through a detailed study of the requirements for graduates, gathering information from employers. The second stage was the creation and application of a new curriculum model, which included current knowledge and skills that meet modern market requirements. It was improved and integrated with traditional curricula. This stage involved the implementation of these new curricula in several higher education institutions. Several pilot groups of students were selected who underwent training under the updated curricula. To ensure the statistical significance and representativeness of the research results, a sample of 200 students was selected. The age of the participants ranged from 20 to 24 years. Women made up 45% (90 participants), men – 55% (110 participants). During the educational process (September 2023 – May 2024), student progress was regularly monitored, and the effectiveness of new curricula was also evaluated by surveying students and teachers, as well as through analysis of student performance. The study was conducted in accordance with the American Sociological Association's Code of Ethics (1997). After the completion of the experimental period, the results between the groups studying under the new curricula and the control groups studying under the old curricula were compared according to the criteria of their academic performance for the year.

■ Results

Various organisations and institutions, namely the Institute of Professional Education, the Boston Consulting

Group, the European Association for Quality Assurance in Higher Education, and the Ministry of Education and Science of Ukraine, are constantly monitoring curriculum adaptation to the modern labour market. The state of this research showed that the adaptation of educational programmes to meet labour market demands demonstrates significant differences between different educational institutions and specialities. About 40% of higher education institutions are actively implementing changes in their curricula, focusing on current trends and employer requirements. This includes updating teaching materials, introducing practice-oriented courses, expanding opportunities for internships and practical training, as well as close cooperation with companies to prepare students for real working conditions. A significant part of curricula remains insufficiently adapted to the modern needs of the market. About 30% of curricula are still based on outdated learning approaches, with an emphasis on theoretical knowledge, without sufficient attention to the development of practical skills. This creates a certain gap between what the education system offers and what the modern labour market demands. Another 20% of curricula are in the process of partial updating. In these cases, educational institutions have already started the modernisation process, but it is not yet complete. This means that changes have been made to individual courses or specialities, but a systematic approach to adapting curricula has not yet been fully implemented. Students of these curricula receive some access to new knowledge and skills, but not in their entirety. In particular, 10% of curricula have hardly undergone any changes, which makes them the most distant from the modern requirements of the labour market (Abina *et al.*, 2024). Students studying under such curricula face difficulties in finding employment, as their knowledge and skills do not meet the needs of employers.

In general, the situation requires further development and acceleration of the process of adapting curricula to provide students with an adequate level of training and competitiveness in the modern labour market. All curricula should allow students to choose specialisations, additional courses or double degree programmes. There should be up-to-date internships, created real project works that prepare students for real working conditions. The university should provide support in finding employment, organise connections with employers and opportunities for internships and practical training. The Computer Science curriculum at Taras Shevchenko National University of Kyiv includes a wide range of courses covering key disciplines such as algorithms, programming, databases, cybersecurity and artificial intelligence. However, despite the wide range of theoretical knowledge, significant gaps in the curriculum become apparent when preparing students

for the real challenges of professional activity. One of the biggest problems is the insufficient emphasis on the development of practical skills that are necessary for performing professional duties. Although the curriculum includes laboratory work and project assignments, this is not enough to prepare students for the complex and dynamic conditions of the modern information and communication (ICT) industry. The lack of a sufficient number of practical classes, which would allow students to develop the skills to solve real problems, leads to the fact that graduates are not always ready to effectively apply their knowledge in practice. Another significant gap is the mismatch of theoretical knowledge with current trends in the industry. In particular, the rapid development of technologies and the constant updating of tools and approaches in software engineering and data science often leave curricula outdated. For example, many programming courses focus on languages and technologies that are no longer relevant in modern IT companies. This means that graduates, although possessing deep theoretical knowledge, may face difficulties in finding a job, as their skills do not meet the current requirements of the market.

Similar problems are observed in the Business Management curriculum. Even though the courses cover important aspects such as entrepreneurship, marketing, finance and human resources management, there is a significant mismatch between what is taught in the classrooms and what employers expect from graduates. Basically, this is because curricula often remain theoretically oriented, providing students with knowledge that does not always meet the modern requirements of the labour market. Although some courses involve case analysis and modelling of business situations, this is not always enough for students to fully immerse themselves in the real problems of business. For example, the lack of in-depth practical classes that would simulate the real challenges faced by modern managers leads to the fact that graduates are not sufficiently prepared to make decisions in conditions of uncertainty and rapid change. These curricula often fail to keep pace with the latest trends in the business environment, which further widens the gap between what students learn and what they need to know for successful work. Gaps in practical training and the lack of updated knowledge led to the fact that graduates are often not ready to work in real business conditions, where it is necessary to quickly adapt to changes and make decisions based on current data and trends. Therefore, there is a need to review approaches to teaching business management to better prepare students for the challenges that await them in their professional activities.

The Marketing curriculum, despite focusing on product and service promotion strategies, market analysis and digital marketing, also has its drawbacks. One

of the biggest challenges is that students often lack real experience with modern marketing tools. Courses often focus on general concepts, while specific skills, such as managing advertising campaigns on social media or using analytical platforms to evaluate the effectiveness of marketing strategies, remain on the periphery of learning. This leads to the fact that graduates may not have sufficient training to work in a highly competitive market, where knowledge of modern technologies and tools is critical. Business management often combines theoretical training with practical cases covering entrepreneurship, marketing, finance and human resources management. An analysis of the selected curricula from three fields – Computer Science, Business Management, and Marketing – revealed significant gaps that affect graduates' readiness for successful employment and effective work in their chosen industries. Insufficient development of practical skills and the mismatch of theoretical knowledge with current trends leave graduates unprepared for the challenges posed by employers. In order to overcome these gaps, it is necessary to revise the curricula, increase the number of practical classes and update the courses following the needs of the modern labour market. Only in this way can graduates be provided with the necessary training for a successful career in their chosen specialities.

Data collected from employers involved in the development of professional competency standards showed that there are significant gaps in curricula. This concerns both the insufficient development of practical skills necessary for the performance of professional duties and the mismatch of theoretical knowledge with current trends in the industry. As a result, graduates are insufficiently prepared for successful employment and effective work in their chosen specialities. To identify discrepancies in the curricula of the three specialisms, a detailed study was conducted, during which information was gathered from employers through a survey.

According to the results obtained, 73% of employers noted that existing curricula do not provide an adequate level of practical skills for graduates, 58% pointed to the obsolescence of theoretical knowledge that does not correspond to modern trends in the industry, and 42% drew attention to the insufficient implementation of interdisciplinary approaches, which are critical for a comprehensive understanding of the profession. These data clearly identified problematic aspects within the curricula and confirmed their misalignment with labour market needs. Based on this, the main aspects that need to be improved in the analysed curricula were identified, namely the actualisation of educational content, interactivity and more successful practical training, their flexibility and preparation for the global labour market. This became the basis for the further application of the updated curricula (Table 1).

Table 1. Key aspects for improving the analysed curricula

Aspect	Curricula		
	Computer Science	Business Management	Marketing
Relevance of learning content	Increase courses on machine learning, artificial intelligence, and big data analysis. Curricula should meet the growing demand for specialists capable of protecting information systems from cyberattacks	Should better integrate modern management concepts and tools, such as digital transformation, change management, innovative thinking and strategic management, to adapt to rapid changes in the business environment. Increase emphasis on financial management and business analytics to master skills that are important for making data-driven management decisions	More active inclusion of digital marketing disciplines that cover social networks, content marketing, and search engine optimisation. Include additional courses in marketing analytics and working with big data to master the tools needed to analyse market trends and consumer behaviour patterns
Interactivity and practical training	Improved practical training, including laboratory classes and participation in real projects. Ability to choose courses in software development, where students work on creating projects that meet real business tasks. Organisation of programmes that offer the opportunity to undergo internships in leading IT companies	Analysis of real cases and implementation of projects that model real business situations. Increase in the number of hours for internships and cooperation with companies, participation in joint projects or even work on real business tasks during training, which contributes to preparing for work in a real business environment	Inclusion in training activities with real projects, and cooperation with companies to develop marketing strategies, which allows students to apply their knowledge in practice with real clients. After all, students gain real experience, which is extremely important for their further employment
Curriculum flexibility and specialisations	Real choice of specialisations (e.g., data science, software engineering) to tailor studies to the ever-changing demands of the job market. The option to combine computer science with other disciplines, such as business or marketing, enables graduates to acquire a broad set of skills in demand across various industries	The ability to choose specialisations such as international business, marketing, human resource management, or operations management, allows students to tailor their studies to specific career goals. Combining business studies with other fields, such as computer science or engineering, enhances graduates' flexibility and adaptability to various sectors of the economy	Opportunities for students to combine marketing with other disciplines, such as business analysis or design, providing them with a broader knowledge base and improving their competitiveness in the job market
Career opportunities and support	Structuring the curriculum in a way that allows graduates to continue their studies at the postgraduate or PhD level, opening additional career opportunities	Establishing a career centre that provides students with assistance in job search, interview preparation, and employment readiness. This includes organising career fairs where students can interact directly with company representatives, network, and secure employment through recommendations and connections	Strong university support regarding employment, including assistance with CV writing, interview preparation, and the organisation of job fairs, facilitates graduates' swift entry into the workforce. Preparation for obtaining professional certifications, such as Google Ads, HubSpot, or Facebook Blueprint
Preparation for certifications and the global market	Preparation for obtaining professional certifications (e.g., in cybersecurity or data management) to enhance graduates' competitiveness in the job market	Increasing opportunities for more participants in the educational process to study or intern abroad, helping them understand global business trends and develop crosscultural management skills. All courses should include comprehensive language training to enable graduates to work in international companies	

Source: compiled by the author

Improving these aspects of curricula will contribute to the formation of a theoretical foundation for education, more effective assimilation of practical skills and obtaining career prospects that meet modern labour market requirements. Then, Computer Science curricula that offer modern content, integration with the labour market through internships and project work, as well as flexibility in choosing specialisations,

will be well adapted to the current requirements of the market. This will provide graduates with a competitive advantage in the labour market and open up a wide range of career opportunities in various industries. Business management curricula will demonstrate high adaptability to the requirements of the labour market, due to up-to-date educational content, flexibility in the choice of specialisations, and ample opportunities for

practical training and international experience. This will allow future professionals to be competitive in the labour market and ready to work in various sectors of the economy. Marketing curricula that focus on modern trends, such as digital marketing, data analytics and practical experience, will ensure high adaptability to the requirements of the labour market. Graduates of such curricula will have the necessary skills to work in a rapidly changing marketing environment and meet the needs of modern employers.

Having considered all the above-mentioned aspects of improvement, the educational process was organised in such a way as to compare the effectiveness of old and new curricula. The control group continued to study under the old curricula, which were less flexible and focused mainly on theoretical knowledge. Students in this group mostly worked individually, and practical tasks were more academic in nature, which limited their ability to apply the knowledge gained in real conditions (Table 2).

Table 2. Results of study participants based on studying under different curricula

Groups	Average score	Percentage of students with a score ≥ 4	Percentage of students with a score < 3	Percentage of students who passed exams the first time
Experimental group	4.2	85%	15%	95%
Control group	3.4	60%	5%	80%

Source: compiled by the author

The average score reflected the average value of all grades received by students on exams. The percentage of study participants who passed the exams the first time shows what percentage of students successfully passed all exams without the need for re-taking them. The evaluation results at the end of the year showed significant differences between the groups. In the control group, the average score was 3.4 on a five-point scale. At the same time, students of the experimental group demonstrated significantly better results, with an average score of 4.2. In addition, the experimental group showed an increase in the level of motivation and interest in learning, which was confirmed by an increase in activity in classes and extracurricular projects.

Analysing the results of student performance, several significant differences can be noted between the experimental and control groups, which indicate the effectiveness of new approaches to learning. During the study, it became obvious that students in the experimental group were significantly better at solving complex problems. Such tasks required not only knowledge of the theoretical aspects of the subject but also the ability to effectively apply this knowledge in practical conditions. This was the main goal of the updated curricula – not just to give students a set of theoretical knowledge, but also to teach them how to apply this knowledge in real conditions. Compared to the control group, higher education students in the experimental group showed a deeper understanding of the subject, as well as confidence in their actions when performing practical tasks. This demonstrated their ability to use the knowledge gained to analyse and solve real problems. For example, when solving tasks that required a creative approach or non-standard thinking, students in the experimental group usually offered more solutions than higher education students from the control group. This ability to generate new ideas and approaches is an important indicator of

the development of critical thinking and flexibility in the application of knowledge.

In contrast, in the control group, students, although demonstrating a high level of theoretical knowledge, often experienced difficulties in applying it in practice. It was found that they had difficulties in solving problems that required not just a mechanical reproduction of theoretical material, but its creative application. They were often unprepared for non-standard situations or tasks that went beyond the typical examples considered during classes. This indicated certain shortcomings of the traditional education system, which pays more attention to the assimilation of theoretical knowledge than to its practical application. Also, the study participants of the control group more often experienced failures when trying to apply their knowledge in new or unfamiliar contexts. Their approach to solving problems was more template-based, which limited their ability to independent thinking and decision-making in difficult conditions. This once again emphasised the need for the introduction of updated curricula that would provide more effective training of students for the real challenges of professional activity.

Analysing the above data, it is worth concluding that the implementation of updated curricula is crucial to improving the quality of student training. The experimental group, which studied under the new curricula, demonstrated a higher level of competence, flexibility and ability to think independently. This is a compelling argument in favour of the need to implement new approaches in education, especially in the context of modern challenges faced by professionals in various fields. The successful application of theoretical knowledge in practical conditions is becoming an increasingly important factor that determines the readiness of graduates for professional activity. Therefore, the results of the experiment show that updated curricula not only increase the level of theoretical knowledge of students

but also contribute to the development of their skills in applying this knowledge in practical situations. This emphasises the importance of continuing work in this direction and improving approaches to learning to prepare students for the effective performance of their professional duties.

Based on the data obtained, it was concluded that it is necessary to constantly review and adjust curricula to the changing requirements of the labour market to ensure the competitiveness of graduates in the modern labour market. The results of the study showed that students who studied under updated curricula demonstrated significantly better results compared to those who continued to study under old methods. The high average score and a significant percentage of students who successfully passed all exams the first time are clear evidence that new approaches to education contribute to deeper assimilation of the material and the development of necessary practical skills. One of the key aspects that influenced the success of the experimental group was the inclusion of teaching methods in the curricula, which are more focused on the practical training of students. In particular, the introduction of interdisciplinary courses, teamwork on real projects and the use of modern technologies allowed students not only to better understand the material but also to apply it in the context of real work tasks. This contributed to the formation of complex knowledge and skills, which are necessary for a successful career in the conditions of rapid changes in the labour market.

However, it is important to note that achieving high results requires constant monitoring and updating of curricula. The labour market is constantly changing, new technologies, methods of work and requirements for professional competencies are emerging. Therefore, curricula that work effectively may lose their relevance in a few years. This underscores the need for systematic analysis of labour market needs and making appropriate changes to the educational process. To do this, it is important to actively involve employers in the process of forming and adjusting curricula, and also use the results of research, such as surveys of graduates, employers and teachers, to evaluate the effectiveness of educational methods. Continuous feedback from the job market will allow not only for the timely identification of gaps in student preparation but also for swift responses to new challenges and trends. In addition, it should be taken into account that changes in curricula should not only be a response to the existing requirements of the labour market but also anticipate them. This means that educational institutions should actively explore future trends and prepare students for the conditions that may arise in the coming years. This approach will provide graduates with a high level of competitiveness and contribute to their successful employment, regardless of changes occurring in the economy and the labour market.

■ Discussion

The results of the study indicated that modifying educational programmes under the needs of the labour market is one of the most pressing challenges facing higher education institutions. The economy and technologies are changing rapidly, so it is important that education responds to these changes and provides graduates with the necessary skills and knowledge. The labour market places stringent demands on the competencies of graduates of higher education institutions. One of the key aspects is the need not only for theoretical knowledge but also for practical skills that enable integration into professional activities. As the research by X. Li & Y. Lu (2022), and N. Reims *et al.* (2023) showed, the success of employment of future specialists largely depends on how much the curriculum was aimed at preparing for real working conditions. They emphasised that educational programmes should reflect the current needs of the labour market, including the development of technical and soft skills, such as critical thinking, communication and project management. This study also revealed that employers place high demands on the professional training of graduates, especially in technical specialities. They expect that young professionals will not only be well prepared in their field but also have a wide range of competencies necessary for working in a rapidly changing labour market. This is consistent with the findings of A.T.H. Le *et al.* (2022), who noted that knowledge in the field of technologies, such as artificial intelligence, big data and automation, are becoming necessary for many professions, even those that previously did not require such skills.

One of the key elements of adapting curricula to meet labour market demands is the integration of practical experience into the learning process. R. Awashreh & H. Ghunaimi (2025) examined the trend of Gulf Cooperation Council students, particularly master's degree holders, pursuing doctoral studies for career advancement and social mobility, especially in government sectors, and critically assesses whether doctorates are relevant in a job market that increasingly values competencies and practical skills over academic qualifications. The findings showed that employers value certifications and practical experience, suggesting that organisations invest in professional development programs, adopt market-driven recruitment practices, and collaborate with educational institutions to create programs that integrate practical learning, internships, and project-based experiences to bridge the gap between academic qualifications and workforce needs.

The results of the study showed that an interdisciplinary approach in training contributes to increasing the competitiveness of graduates in the labour market, and this was confirmed in the research of G.M. Chans *et al.* (2024). They noted that employers are increasingly looking for specialists who can apply their knowledge and skills in various fields, which makes them more

valuable to employers. Graduates who have completed training in interdisciplinary curricula are more likely to receive offers from employers. Technology plays a crucial role in transforming the labour market, which affects the content and structure of curricula. The study by D. Shrymbay *et al.* (2025) noted that the introduction of digital technologies in the educational process, in particular online courses and platforms for self-learning, contributes to the development of new skills in students and increases their readiness to work in a digital environment. This research echoes the findings of this study, which also found that higher education institutions that actively implement digital technologies in the educational process provide their graduates with the knowledge and skills that are necessary for working in a digital economy.

An important aspect is also the individualisation of the educational process using technology. As this study showed, the use of adaptive learning platforms allows students to learn at a pace convenient for them, focusing on those aspects that require more attention. This not only increases students' motivation but also contributes to more effective assimilation of knowledge, which makes them more prepared for the requirements of the labour market. C. Lengua-Cantero *et al.* (2024) studied a project to create an intelligent learning system aimed at improving critical thinking among university students through personalised learning. An important invention was the learning progress algorithm, which automatically adapts to the student's progress, creating a personalised educational experience that improves critical thinking skills. This algorithm supported planning module can adapt to individual learning patterns, allowing for personalised education that optimises critical thinking development in challenging academic environments, demonstrating the effective integration of educational technology with the development of higher-order thinking skills.

The results of the study showed that interaction with employers is another important factor that contributes to the successful adaptation of curricula to the requirements of the labour market. These findings are consistent with studies by V. Barabash *et al.* (2022), and F.D. Fernández-Martín *et al.* (2024), who noted that universities that maintain a constant dialogue with business representatives can quickly update their curricula per changes in the structure of the labour market. This enables the preparation of students for real working conditions and equips them with the necessary knowledge and skills. In this study, it was determined that active cooperation between universities and employers is a key factor in the process of adapting curricula. Higher education institutions that regularly update their curricula based on employer recommendations train specialists who are better suited to the requirements of the labour market. This is confirmed by the higher level of employment of graduates of such educational institutions in

the first six months after graduation. The assumption about the importance of creating specialised curricula in cooperation with companies was confirmed by the results of the study, which coincides with the conclusions of M. Stan *et al.* (2023) and S. Lutz *et al.* (2023). These researchers focused on the fact that the creation of curricula that are developed jointly with representatives of the industry helps to more accurately meet the needs of the labour market and provide students with up-to-date knowledge. In this study, it was also found that students who studied under curricula developed in collaboration with employers had more opportunities for employment and career growth.

The research by M.M. Asad *et al.* (2023) emphasised the importance of flexible curricula that allow students to choose courses that best suit their professional interests and the needs of the labour market. They noted that flexible curricula help students respond more quickly to changes in each industry and adapt their knowledge to new conditions. This study also confirmed that universities that offer flexible curricula provide their students with better prospects in the labour market. The flexibility of curricula allows students to independently shape their educational path, which contributes to the development of individual skills and competencies necessary for a successful career. For example, students can choose courses from different disciplines, which allows them to acquire interdisciplinary knowledge and adapt to various professional roles. In addition, the flexibility of curricula is important from the point of view of the speed of reaction to changes in the labour market. Higher education institutions that are able to quickly update their curricula, adding new courses or changing the emphasis on existing ones, are able to better prepare their students for new challenges. This idea is complemented by the research of A. Auzhanova (2024) and it was found that adaptive curricula, which are regularly updated, provide students with access to the latest knowledge and technologies, which increases their competitiveness in the labour market. Thus, adapting curricula to the needs of the labour market is a complex and dynamic process that requires close cooperation between educational institutions, students and employers. Comparing the results of this study with other articles confirms the need for continuous updating of curricula following modern trends and challenges. The flexibility of curricula, the integration of practical experience, the introduction of the latest technologies and the development of continuing education are key factors that contribute to the training of competitive graduates.

■ Conclusions

The results of the study confirmed the importance of adapting curricula to the needs of the labour market to increase the competitiveness of graduates. Given the changes in the labour market, universities must

constantly review their curricula, adapting them to new requirements. This includes both updating the content of courses and introducing new forms of training, such as online courses, modular training and individual learning trajectories. It is important to continue to develop partnerships with employers, which will allow for a better understanding of the needs of the labour market and accordingly adjust curricula. The adaptation of educational programmes is a necessary condition for ensuring a successful career for graduates. Universities that are able to quickly respond to changes and offer students relevant knowledge and skills ensure their graduates' competitiveness in the labour market and contribute to their professional growth.

The analysis of the curricula in three relevant specialities showed that the programmes that were updated taking into account modern trends and employer requirements demonstrated significantly higher efficiency in preparing students for professional activities. Taking into account new aspects that include current knowledge and skills allowed students to increase their level of training. This was reflected in their academic performance and level of employment compared to those who studied under the old curricula. In particular, it was noted that graduates of updated curricula are better integrated into the professional environment, as they already possess practical skills and knowledge of modern technologies necessary for effective work. The

positive results of the study participants, obtained in the process of monitoring student progress and analysing their success, confirm the need for regular updating of curricula. This allows ensuring constant compliance of education with the requirements of the labour market, which contributes to increasing the level of knowledge and skills of students, as well as their readiness for professional activity.

The study also had certain limitations, in particular, it was conducted on the example of only three specialities, which does not allow for general conclusions for all fields of education. The evaluation of the effectiveness of new curricula was based on short-term monitoring, which does not take into account long-term results and the impact on the career growth of graduates. Prospects for further research include expanding the analysis to other specialities and conducting long-term observations of graduates to better understand the impact of adapting curricula on their professional development.

■ Acknowledgements

None.

■ Funding

None.

■ Conflict of Interest

None.

■ References

- [1] Abdul-Hasan, Z.K., & Abed, N.I. (2024). The effectiveness of an educational program based on generative learning in the development of classroom interaction among fourth-grade students in the subject of sociology. *International Journal of Religion*, 5(10), 914-924. doi: 10.61707/Onpn4517.
- [2] Abina, A., Salaj, A.T., Cestnik, B., Karalič, A., Ogrinc, M., Lukman, R.K., & Zidanšek, A. (2024). Challenging 21st-century competencies for STEM students: Companies' vision in Slovenia and Norway in the light of global initiatives for competencies development. *Sustainability*, 16(3), article number 1295. doi: 10.3390/su16031295.
- [3] Albayrak, E., & Akgün, Ö.E. (2022). A program development model for information technologies curriculum in secondary schools. *Participatory Educational Research*, 9(5), 161-182. doi: 10.17275/per.22.109.9.5.
- [4] Aliya Putri, A.N., Maulanda, F.D., Zulfiyandi, Z., Andrian, D., & Hakim, Z. (2023). Comparative analysis of big data utilization at vocational and productivity training centers (BBPVP) and the domestic job market. In *2023 IEEE international conference on data and software engineering (ICoDSE)* (pp. 31-36). Toba: Institute of Electrical and Electronics Engineers. doi: 10.1109/ICoDSE59534.2023.10291509.
- [5] American Sociological Association's Code of Ethic. (1997). Retrieved from <https://www.asanet.org/about/ethics/>.
- [6] Asad, M.M., Mahar, P., Dattoo, A.K., Sherwani, F., & Hassan, R. (2023). Impact of quality assurance on TVET programs for the digital employment market of IR 4.0 in Pakistan: A quantitative investigation. *Education + Training*, 65(6-7), 891-908. doi: 10.1108/et-08-2022-0295.
- [7] Auzhanova, A. (2024). Integration of ICT in higher education: Teaching and learning in Kazakhstan. *Scientific Herald of Uzhhorod University. Series "Physics"*, 55, 1543-1550. doi: 10.54919/physics/55.2024.154kl3.
- [8] Awashreh, R., & Ghunaimi, H.A. (2025). Rethinking the PhD: Aligning higher education with market needs and practical skills. *Forum for Linguistic Studies*, 7(2), 254-264. doi: 10.30564/fls.v7i2.7942.
- [9] Barabash, V., Milz, M., Kuhn, T., & Laufer, R. (2022). Development of a competence ecosystem for the future space workforce: Strategies, practices and recommendations from international master programs in northern Sweden. *Acta Astronautica*, 197, 46-52. doi: 10.1016/j.actastro.2022.05.017.
- [10] Chans, G.M., Tejeda, S., Becerril, M.P., & Camacho-Zúñiga, C. (2024). Assessing TEC21 educational model's impact on transversal competencies among undergraduates in internship programs. In *2024 IEEE global engineering education conference (EDUCON)* (pp. 1-5). Kos Island: Institute of Electrical and Electronics Engineers. doi: 10.1109/EDUCON60312.2024.10578325.

- [11] DelaTorre-Diaz, L., Ramírez-Pérez, H.X., & Escobar-Castillejos, D. (2025). The effectiveness of curriculum standardization in data analysis and tools proficiency for undergraduate education: A case study. *Frontiers in Education*, 10. doi: [10.3389/educ.2025.1537174](https://doi.org/10.3389/educ.2025.1537174).
- [12] Dmytrenko, V., & Dmytrenko, V. (2022). The discipline “Socio-cultural design” in the system of professional training of a culturologist. *Ukrainian Professional Education*, 6(2), 46-53. doi: [10.33989/2519-8254.2022.12.278996](https://doi.org/10.33989/2519-8254.2022.12.278996).
- [13] Fernández-Martín, F.D., Aznar-Díaz, I., Cáceres-Reche, M., & Trujillo-Torres, J. (2024). The impact of a social and emotional learning programme to improve pupils’ educational inclusion in vocational education and training. *Humanities and Social Sciences Communications*, 11, article number 65. doi: [10.1057/s41599-023-02238-0](https://doi.org/10.1057/s41599-023-02238-0).
- [14] Grynyov, R., Vishnikina, L., Shukanov, P., Dibrova, I., & Fedii, O. (2024). Assessment of the quality of curricula and educational technologies in vocational education in Ukraine in accordance with modern labor market requirements. *Periodicals of Engineering and Natural Sciences*, 12(2), 509-518. doi: [10.21533/pen.v12.i2.53](https://doi.org/10.21533/pen.v12.i2.53).
- [15] Le, A.T.H., Phung, Q., Nguyen, T.X., & Nguyen, T.L. (2022). Establishing a collaboration model for BIM training program in technical and vocational education and training (TVET): A Vietnam case study. *IOP Conference Series: Earth and Environmental Science*, 1101(9), article number 092032. doi: [10.1088/1755-1315/1101/9/092032](https://doi.org/10.1088/1755-1315/1101/9/092032).
- [16] Lengua-Cantero, C., Piñeres, M.C., Medina, M.G., & Oviedo, G.B. (2024). The expert and planning module of an intelligent pedagogical agent for the development of critical thinking. *SN Computer Science*, 5(8), article number 1080. doi: [10.1007/s42979-024-03424-w](https://doi.org/10.1007/s42979-024-03424-w).
- [17] Li, X., & Lu, Y. (2022). Education – occupation mismatch and nativity inequality among highly educated U.S. workers. *Demography*, 60(1), 201-226. doi: [10.1215/00703370-10404849](https://doi.org/10.1215/00703370-10404849).
- [18] Lobatskii, A.O. (2024). Training of specialists in digital technologies in the conditions of dual education. *Academic Studies. Series “Pedagogy”*, 4, 81-85. doi: [10.52726/as.pedagogy/2023.4.11](https://doi.org/10.52726/as.pedagogy/2023.4.11).
- [19] Lutz, S., Ebenbeck, N., & Gebhardt, M. (2023). Mathematical skills of students with special educational needs in the area of learning (SEN-L) in pre-vocational programs in Germany. *International Journal for Research in Vocational Education and Training*, 10(1), 1-23. doi: [10.13152/ijrvet.10.1.1](https://doi.org/10.13152/ijrvet.10.1.1).
- [20] Rehman, T.U. (2025). The transformative impact and evolving landscape: A comprehensive exploration of the globalization of higher education in the 21st century. *Journal of Further and Higher Education*, 49(3), 346-361. doi: [10.1080/0309877x.2025.2457537](https://doi.org/10.1080/0309877x.2025.2457537).
- [21] Reims, N., Rauch, A., & Nivorozhkin, A. (2023). Challenges and adaptation strategies of service providers in vocational rehabilitation – a mixed-methods analysis. *Rehabilitation*, 62(4), 207-215. doi: [10.1055/a-2053-6763](https://doi.org/10.1055/a-2053-6763).
- [22] Samaradivakara, C., Bell, R., & Raghubansie, A. (2024). The conceptualisation of employability among higher education administrators in Sri Lanka’s turbulent labour market. *Higher Education Skills and Work-based Learning*, 15(1), 191-204. doi: [10.1108/heswbl-10-2023-0289](https://doi.org/10.1108/heswbl-10-2023-0289).
- [23] Shabangu, N., & Madondo, N.E. (2024). Addressing graduate unemployment: Aligning higher education curricula with labour market demands. In *Atlantis highlights in social sciences, education and humanities* (pp. 74-87). Dordrecht: Atlantis Press. doi: [10.2991/978-94-6463-630-7_5](https://doi.org/10.2991/978-94-6463-630-7_5).
- [24] Shrymbay, D., Serikbayeva, S., Adylbekova, E., Sarybekov, M., & Akhmetzhanov, M. (2025). Development of professional qualifications of teachers based on the application of an online course. *International Journal of Innovative Research and Scientific Studies*, 8(3), 1898-1903. doi: [10.53894/ijirss.v8i3.6899](https://doi.org/10.53894/ijirss.v8i3.6899).
- [25] Stan, M., Țenea, D., Vintilă, D., & Tasențe, T. (2023). Curricular relevance and workforce preparedness: Student perspectives on practical experiences in urban planning and construction courses. *Studies in Business and Economics*, 18(3), 261-280. doi: [10.2478/sbe-2023-0058](https://doi.org/10.2478/sbe-2023-0058).
- [26] Zadorina, O., Burchak, L., Panas, O., Ardelian, O., & Apalat, H. (2023). Shaping the competencies of the future: The importance of developing soft skills in higher education. *Cadernos De Educação Tecnologia E Sociedade*, 16(2), 361-371. doi: [10.14571/brajets.v16.n2.361-371](https://doi.org/10.14571/brajets.v16.n2.361-371).

Адаптація навчальних програм до вимог ринку праці

Юлія Коваль

Доктор філософії, доцент

Вінницький кооперативний інститут

21009, вул. Академіка Янгеля, 59, м. Вінниця, Україна

<https://orcid.org/0009-0001-3770-922X>

■ **Анотація.** Метою дослідження було оцінити ефективність адаптації навчальних програм до вимог ринку праці та їхню дієвість у сучасних умовах. Було обрано три дисципліни – Комп’ютерні науки, Управління бізнесом та Маркетинг – оскільки вони найбільше відповідають сучасним професійним вимогам. Для оцінки їх ефективності проводився моніторинг успішності студентів, опитування учасників освітнього процесу та аналіз академічної успішності. Ключові результати дослідження засвідчили про те, що навчальні програми, адаптовані до потреб сучасного ринку, продемонстрували значно більшу ефективність у підготовці студентів. Після впровадження нових модулів, що включали сучасні знання та навички, студенти повідомили про покращення рівня компетентності та вищу успішність у працевлаштуванні порівняно з контрольними групами, які працювали за застарілими навчальними програмами. Дослідження включало аналіз існуючих навчальних програм, розробку нових модулів, що відповідають вимогам ринку праці, та впровадження цих навчальних програм у кількох навчальних закладах. Результати дослідження засвідчили про те, що постійний перегляд навчальних програм відповідно до змінних вимог ринку праці є важливим для забезпечення високої конкурентоспроможності випускників. Адаптація навчальних програм посилила їх відповідність сучасним потребам ринку праці, позитивно впливаючи на підготовку студентів та їхню готовність до професійної діяльності. Було виявлено, що впровадження нових навчальних модулів покращує знання студентів щодо практичних навичок та сучасних технологій, сприяючи їхній більш ефективній інтеграції в професійне середовище. Оцінка ключових результатів дослідження підтвердила значне покращення знань та навичок студентів, що підкреслює необхідність регулярного оновлення навчальних програм. Позитивний вплив адаптації навчальних програм на професійні компетенції випускників підкреслює важливість подальшого розвитку та підтримки таких ініціатив для підвищення якості освіти та її відповідності сучасним вимогам ринку праці

■ **Ключові слова:** освітній процес; оновлення знань; компетенції; перегляд; ефективність

Науковий журнал
«ПРОФЕСІЙНА ОСВІТА: МЕТОДОЛОГІЯ, ТЕОРІЯ ТА ТЕХНОЛОГІЇ»

Том 11, № 1
2025

Відповідальний редактор:
Н. Сердюк

Підписано до друку з оригінал-макета 21.03.2025
Ум. друк. арк. 12,3
Тираж 100 примірників

Видавництво:
Університет Григорія Сковороди в Переяславі
08401, вул. Сухомлинського, 30, м. Переяслав, Україна
E-mail: info@profedu.com.ua
<https://profedu.com.ua/uk>

Scientific Journal

“PROFESSIONAL EDUCATION: METHODOLOGY, THEORY AND TECHNOLOGIES”

**Volume 11, No. 1
2025**

Managing Editor:
N. Serdiuk

Signed to the print with the original layout 21.03.2025
Conventional Printed Sheet 12.3
Circulation 100 copies

Publisher:
Hryhorii Skovoroda University in Pereiaslav
08401, 30 Sukhomlynskyi Str., Pereiaslav, Ukraine
E-mail: info@profedu.com.ua
<https://profedu.com.ua/en>