













ORIGINAL

Innovative teaching methods for developing basic skills in higher education students through real professional contexts

Métodos didácticos innovadores para desarrollar las competencias básicas de los estudiantes de enseñanza superior a través de contextos profesionales reales

Iryna Tamozhska¹  , Ruslan Chubuk²  , Vadym Pienov³  , Nataliia Myroshnychenko⁴  , Lyubov Prokofyeva⁵  

¹V. N. Karazin Kharkiv National University, Institute of International Education for Study and Research, Department of Educational Sciences, Digital Education and Academic Entrepreneurship, Kharkiv, Ukraine.

²Petro Mohyla Black Sea National University, Educational and Scientific Institute of Public Management and Administration, Department of Social Work, Management and Pedagogy, Mykolaiv, Ukraine.

³Odesa I. I. Mechnikov National University, Biological Faculty, Department of Physiology, Human Health and Safety, and Natural Sciences Education, Odesa, Ukraine.

⁴Donetsk State University of Internal Affairs, Kropyvnytskyi, Ukraine.

⁵Odesa I. I. Mechnikov National University, Department of Pedagogical Education and Social Rehabilitation, Odesa, Ukraine.

Cite as: Tamozhska I, Chubuk R, Pienov V, Myroshnychenko N, Prokofyeva L. Innovative teaching methods for developing basic skills in higher education students through real professional contexts. *Salud, Ciencia y Tecnología - Serie de Conferencias*. 2024; 3:.1214. <https://doi.org/10.56294/sctconf2024.1214>


Submitted: 16-03-2024

Revised: 25-06-2024

Accepted: 02-10-2024

Published: 03-10-2024

Editor: Dr. William Castillo-González 

Corresponding author: Iryna Tamozhska 

ABSTRACT

Introduction: the intensification of the significance of educational activity as an indicator of active social development under the conditions of global digitalisation creates prerequisites for actualising the issues of its informational support.

Objective: the research is dedicated to analysing the functional capabilities of digitalisation in the context of forming critical competencies of students in conditions close to the realities of professional activity.

Method: the article outlines the functionality of innovative educational systems within the educational institution's information educational environment.

Results: the study found that today's students at various levels are ready to implement elements of e-learning, artificial intelligence technologies, and immersive tools. It is proven that the introduction of innovative technological solutions into the educational environment creates learning conditions close to the realities of professional activity, increasing the motivation of students for an effective learning process, stimulating the involvement of reserves in the organisation of the continuous self-education process, and intensifying responsibility and self-organisation. Identified within modern information systems are tools and services that diversify the learning process and increase the effectiveness of the educational process, contributing to the formation of key competencies of higher education students.

Conclusions: the research indicates a trend towards increasing the efficiency of student training based on the organisation of independent educational work with the implementation of innovative pedagogical opportunities in the educational process. The study's practical significance lies in determining the potential for improving the quality of education at the national level through modern information technologies.

Keywords: Digitalisation; Information Society; Educational Space; Integration; Learning Process; Information and Communication Technologies.

RESUMEN

Introducción: la intensificación de la importancia de la actividad educativa como indicador del desarrollo social activo en las condiciones de la digitalización global crea condiciones previas para la actualización de las cuestiones de su apoyo informativo.

Objetivo: la investigación está dedicada al análisis de las capacidades funcionales de la digitalización en el contexto de la formación de competencias críticas de los estudiantes en condiciones cercanas a las realidades de la actividad profesional.

Método: el artículo esboza la funcionalidad de los sistemas educativos innovadores en el entorno educativo informativo de la institución educativa.

Resultados: el estudio revela que los estudiantes actuales de distintos niveles están preparados para implementar elementos de e-learning, tecnologías de inteligencia artificial y herramientas inmersivas. Se ha comprobado que la introducción de soluciones tecnológicas innovadoras en el entorno educativo crea condiciones de aprendizaje cercanas a las realidades de la actividad profesional, aumentando la motivación de los estudiantes para un proceso de aprendizaje eficaz, estimulando la implicación de las reservas en la organización del proceso continuo de autoformación, e intensificando la responsabilidad y la autoorganización. Dentro de los sistemas de información modernos se identifican herramientas y servicios que diversifican el proceso de aprendizaje y aumentan la eficacia del proceso educativo, contribuyendo a la formación de las competencias clave de los estudiantes de enseñanza superior.

Conclusiones: la investigación indica una tendencia hacia el aumento de la eficiencia de la formación de los estudiantes basada en la organización del trabajo educativo independiente con la implementación de oportunidades pedagógicas innovadoras en el proceso educativo. La importancia práctica del estudio radica en la determinación del potencial de mejora de la calidad de la educación a nivel nacional mediante las modernas tecnologías de la información.

Palabras clave: Digitalización; Sociedad de la Información; Espacio Educativo; Integración; Proceso de Aprendizaje; Tecnologías de la Información y la Comunicación.

INTRODUCTION

Professional training of higher education students is placed as a pedagogical process, the expected result of which is the formation of a specialist's professional competence. Professional competence is essential to professional activity, synthesising its integrative abilities, competencies, and personal qualities.

The professional training of a future specialist is positioned as a complex integrative characteristic. It represents a system of a specialist's knowledge, skills, abilities, values, and personal qualities, based on which the goals of activity and the ability to realise professional-social functions are formed. As a pedagogical process, the expected result is the achievement of professional competence.

Recently, significant attention in the national educational space has been paid to the problem of forming professional competence in the context of the competency-based approach to the development of higher education. In this regard, the necessity of forming foreign business communication, communication skills, awareness of digitalisation concepts, and compliance with the requirements of the modern labour market is actualised. Consequently, the formation of key competencies of higher education students should take place in conditions close to the realities of professional activity.^(1,2)

Some modern developments highlight the structural elements of professional training in the aspects of labour market digitalisation,^(1,2,3) study various types of professional competence and sociocultural competence,^(4,5) analyse the process of forming professional qualities in the aspect of adaptability to the dynamics of social processes and digitalisation,⁽⁶⁾ and explore the culture of professional communication and communication of higher education students.⁽⁷⁾ At the same time, some scientists have generalised the problem of forming the structure of the professional training system.⁽⁸⁾

Conceptual foundations for forming students' critical competencies in conditions close to the realities of professional activity require further in-depth research, likely due to modern digitalisation technologies.

In some recent developments, the paradigm of the studied phenomenon in the context of personal maturity and the involvement of interdisciplinary integration functionality is positioned as a priority for optimising the professional training system.^(9,10,11,12,13) The conceptual horizons of the studied issues are expanded in the works of scientists Castro and Tumibay,⁽¹⁴⁾ Haleem et al.,⁽¹⁵⁾ who pay significant attention to the development of an individualised model of the professional competence formation process based on the principles of intercultural and informational-operational communication, as well as the use of modern digitalisation capabilities.

Detailed analytics of the studied phenomenon are carried out by scientists Alam,⁽¹⁶⁾ Eker and Eker,⁽¹⁷⁾ who

evaluate the competence of higher education students in the context of Industry 4.0. Significant contributions have also been made by scientists Zhao et al.,⁽¹⁸⁾ who advocate for a transformational approach to the higher education paradigm based on achieving competence through implementing immersive virtual reality technologies into the educational process.

At the same time, some scientists Burbules et al.⁽¹⁹⁾, and Adigüzel et al.⁽²⁰⁾ have generalised the issues of forming the structure of professional competence of higher education students based solely on theoretical training. In some recent developments, the paradigm of the studied phenomenon in the context of the personal maturity of students in economic specialities and the involvement of interdisciplinary integration functionality for creating learning conditions close to the realities of future professional activity is positioned as a priority for the development of the educational process.⁽²¹⁾ The conceptual horizons of the studied issues are expanded in the works of scientists Sinambela et al.⁽²²⁾ and Dzwigol et al.,⁽²³⁾ Mitschek et al.,⁽²⁴⁾ Gorski et al.,⁽²⁵⁾ Baird and Parayitam,⁽²⁶⁾ Abidoye and Adeyemi⁽²⁷⁾ who are engaged in the development of a realistic pedagogical model of the professional competence formation process of students based on the principles of communicative, intercultural, and informational-operational communication.

At the same time, the issue of forming a functional system for the digitalisation of the educational process, as well as the potential of modern information systems in creating realistic learning conditions, remains overlooked by scientists or studied fragmentarily, which actualises the need for an expanded study of the subject of this research.

The article aims to analyse digitalisation's functional capabilities in the context of forming students' key competencies in conditions close to those of professional activity.

METHOD

Relevant professional sectoral publications, manuals and monographs, materials from scientific conferences and dissertation research, and the conclusions of contemporary scientists' theoretical-analytical and practical developments form this article's theoretical and methodological basis.

The article is of a scientific review nature. A qualitative approach was employed in the research process to define the problem and formulate hypotheses. The results of qualitative research cannot be generalised, but they can be extremely useful for evaluating various programmes. The outcomes of qualitative research can be used as preliminary insights before conducting quantitative studies to identify key indicators.

The variables under investigation were formed based on statistical data concerning the use of different methods of innovative pedagogical technologies in contemporary higher education.

Several general scientific methods were used during the research, including analysis and synthesis, induction and deduction, formalisation and concretisation. The methods of analysis and synthesis were applied to isolate the main factors that form the essential functionality of information systems in the educational sphere in the context of innovative development. The inductive method was used to form predictive directions for developing the studied process. The deductive method was applied in the work process to isolate the priority vector of innovative transformation of the educational environment during the post-war recovery of Ukraine.

The study used the inductive method to form predictive directions for developing the studied process. The deductive method was applied in the work process to isolate the directions of forming an innovative educational concept. The formalisation method was used in the research process to identify the priority vectors of the educational paradigm development in forming professional competence and to structure the priorities and principles of the research object.

The method of concretisation was used in the course of the work to prove the effectiveness of modern educational methodology's innovative capabilities in forming professional competence in the higher education system.

There is no information about any financial or other material conflicts of interest that may affect the results of the study or their interpretation.

RESULTS

A relevant challenge in the context of global integration processes and active digitalisation of social life is developing and implementing the latest digital opportunities in the educational environment, particularly the active involvement of information systems. The current period of social progress is characterised by the powerful influence of information and communication technologies (ICT), which realise the dissemination of information flows, forming a global information space. An integral component of the strategic foundation of these processes is the digital optimisation of the educational sphere.

The information environment is perceived as a means of practical interaction among all educational participants. The main functionality of modern information systems is seen in the formation of the educational institution's informational environment, the implementation of new informational tools into the educational process, and the provision of an informational-methodological basis for the educational process (figure 1).

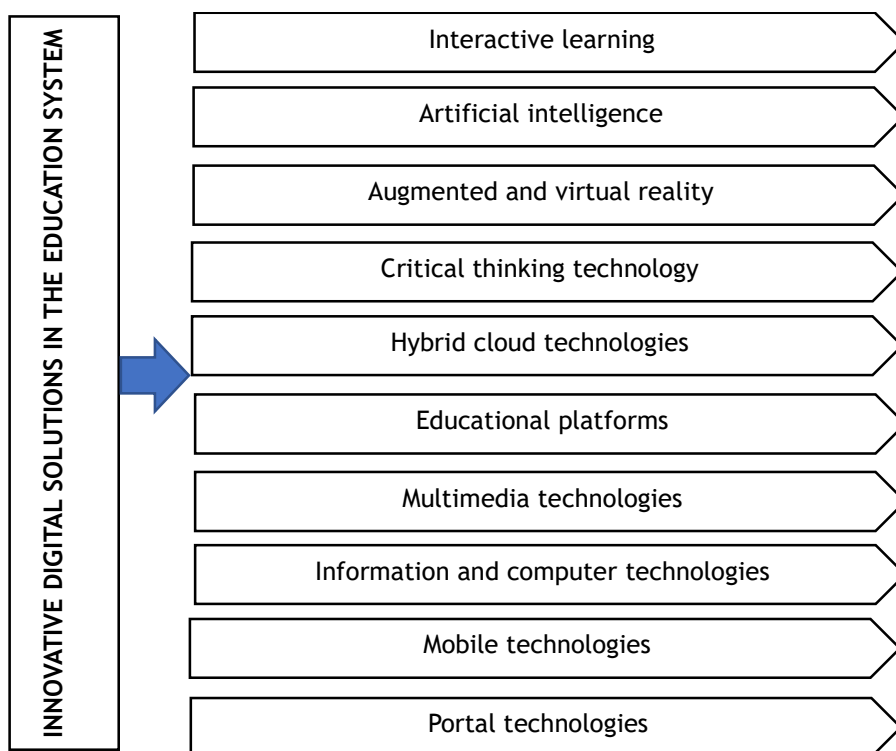


Figure 1. Digital technologies in the educational space of higher education

Modern approaches to forming the education system involve active interaction with the information environment, which is positioned as a location for accumulating relevant knowledge. The analytics of practical experience in using information and communication technologies and information systems to improve the quality of the educational process indicate their intensive implementation in the learning environment.

One of the leading approaches to understanding professional competence is to identify it as a systemic phenomenon that synergises knowledge, skills, and abilities, as well as professionally significant qualities of a specialist's personality, ensuring the fulfilment of their professional duties. Specific indicators of professional competence are value orientations, motives of activity, and integrated cultural markers.

Professional competence should be considered a holistic, systemic quality of the individual. Its structural elements are professional content, professional activity, and professional personal components. Overall, communicative, regulatory, informational, and integrative competencies are distinguished in the structure of professional competence. Some scholars refer to the components of professional competence as spheres, identifying motivational-theoretical, practical-applied, and research-reflective.

Communicative competence, as a component of the overall professional competence of a future specialist, involves the mastery of technologies for effective oral and written communication in various languages, the ability to distinguish different communicative situations, and the choice of the most favourable forms of interaction and approaches to solving communicative problems. The training of economics specialists with fluent foreign language skills is currently a top priority in the educational process of professional economics colleges. Given the global digitalisation trend, the skills of promptly and effectively perceiving and interpreting foreign language content are now a fundamental factor in making the correct managerial decisions.

Thus, communicative competence is inseparably linked with intercultural competence. Intercultural communication is a process of direct professional interaction between business cultures. Therefore, a future specialist must possess the skills to establish contact, focusing on national-specific features in communicative interaction. At the same time, an essential prerequisite for successful intercultural competence is overcoming the problem of understanding, which is considered at both the linguistic and sociocultural levels in the context of perceiving the communication partner.

The strategy for reforming the national educational environment is being activated by introducing information-computer technologies into educational programmes and using modern high-potential multimedia technologies. Regarding higher education systems, the global concept is characterised by the intensive implementation of new technologies that contribute to the formation of unlimited opportunities for creating innovative teaching methods. These methods synergise traditional and distance education elements and incorporate virtual reality technology algorithms. Specific portal and cloud technologies are promising, providing differentiated analytics

and informative data and offering remote access to arrays of educational information and targeted applications. At the same time, educational institutions have a variety of platform types to choose from.

Since students and educators in an integrated education system have expanded access to various digital resources and tools, traditional teaching practices have an adaptive dynamic. Through active interaction with digital content, students create new resources, communicate, and place the results of their learning activities in a personal digital environment. As a result of this process, the educator can organise the educational process based on blended technology, synergising online learning and the student's work. In this way, the educator can successfully select resources for personalised learning and organise practical interaction projects.

Given the global trend of implementing immersive technologies into the management process in most areas of social activity, it is worth noting that the education sector is currently the largest investor in the development of the virtual technology industry. Shortly, virtual and augmented realities will be positioned as everyday phenomena, similar to mobile devices. Immersive technologies are identified as a way to integrate virtual content into the physical environment, creating conditions for effective interaction. At the same time, the user perceives the virtual components as an integral part. The range of immersive technologies encompasses a variety of programs and tools that allow integration, immersion, or interaction with simulated environments and objects.

The development and implementation of the latest digital capabilities, particularly the active integration of cloud computing and artificial intelligence technologies, create prerequisites for the global transformation of demands and requirements for specialists, transforming the content of professional duties and significantly influencing the formation of demand for competencies. At the same time, an inadequate level of communication between the labour market and the professional training system leads to a cluster of unclaimed workers who possess outdated professional orientations and competencies. Particular attention is paid to the competence of a specialist, which is determined by the ratio of their professional skills and professional-psychological qualities, their adaptability, and their focus on continuous self-improvement.

The solution to the problem of implementing information systems to improve the quality of education is established on the use of concentric information technologies, which integrate a set of relevant information databases, tools, and methods of their synthesis into a single digital integrated space to meet the informational needs of educational institutions maximally. This strategy is based on integrating management tools in the information sphere to form a single digitised platform for the educational institution, the creation of universal informationisation tools, and methods of information interaction to reflect the dynamics of the information environment (figure 2).

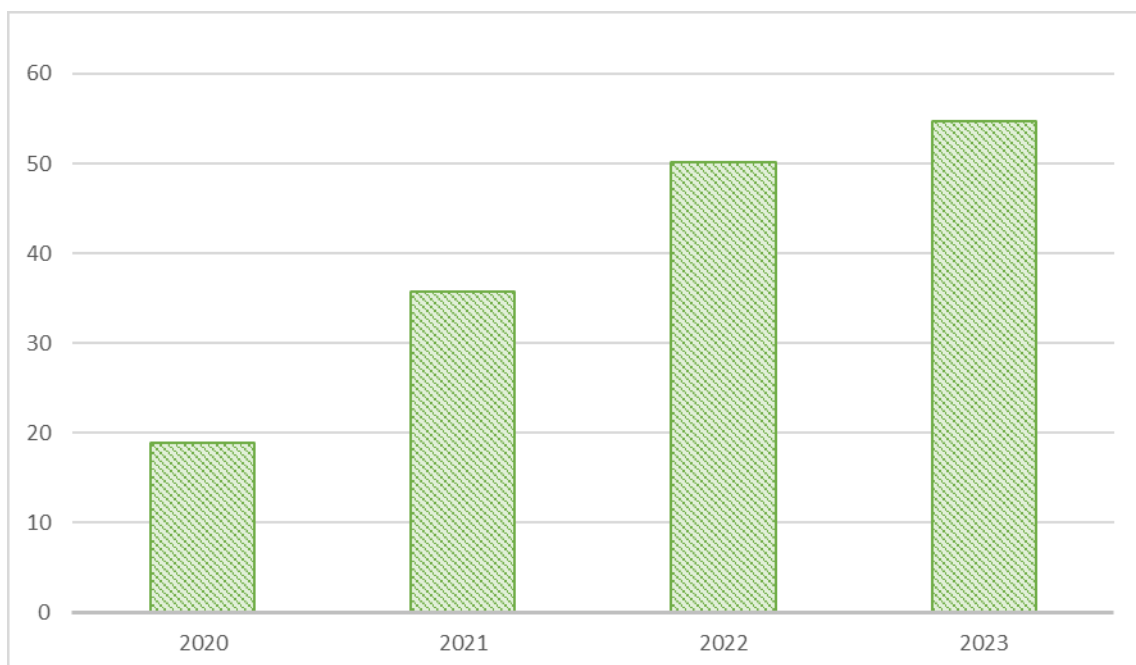


Figure 2. Use of information systems in the national higher education space % ⁽²⁸⁾

The operational component of professional competence is mastering the subject area of professional activity and being prepared to perform specialised tasks.

A fundamental aspect of practical multidisciplinary professional training in the higher education system is accumulating and analysing information to develop professional judgment based on processing significant

informative data sets using IT programs. To this end, future specialists must understand the principles of IT processes while remaining professional analysts who form the accounting and analytical foundation for making multifaceted managerial decisions. Refining necessary skills in practice through virtual reality technologies allows for the most accurate reproduction of future professional activity conditions, contributing to forming critical competencies in students. The particular practical value of the proposed approach is seen in the concept of forming key competencies in third-level (educational-scientific) higher education students (specialty: 011 Educational, Pedagogical Sciences; field of knowledge: 01 Education/Pedagogy) in conditions close to the realities of professional activity: possibilities of innovative pedagogical technologies.

Since the main task in the context of global integrated educational processes remains the preservation and enhancement of education quality, adequate technical support for the integrated educational process, the selection of optimal software for information systems and portal platforms, and the organisation of effective monitoring and control are necessary.

DISCUSSION

The discourse on the methodology of higher education in the era of digital transformation of the labour market in scientific literature represents a variety of meaningful interpretations of this concept. It indicates the need for a general conceptual approach to its definition. The analysis of scientific research on the topic created a foundation for the belief that the modern understanding of educational training is based on the use of modern software functionality to activate and stimulate the process of resource transformation and increase the effectiveness of activities by creating learning conditions as close as possible to the realities of professional activity.

Some scholars⁽²⁹⁾ consider the phenomenon of information systems in the current economic conditions, complicated by crisis phenomena, as a hub for digital optimisation of the scientific and educational sphere, which requires effective integration and coordination of the activities of its participants in the priority areas of socio-economic development. On the other hand, representatives of another scientific school⁽³⁰⁾ argue that the implementation of an innovative approach to the educational process is seen as possible only with a favourable overall societal situation and effective internal interaction, as well as the successful functioning of the relevant institutions. The authors separately emphasise the need to ensure the individualisation of solutions for each educational institution. It is worth supporting the scientific position of the scholars above, who see the step-by-step interrelated study of psychological, cultural, ethical, and deontological directions of education as the basis for the practical application of means of interdisciplinary integration in the educational process.

Among modern approaches to the convergence of digital and innovative transformations in the field of education, the position of researchers Hernandez-de-Menendez et al.⁽³¹⁾ stands out, advocating the positioning of the educational environment as a reflection of the overall societal situation. At the same time, the researchers emphasise that the intensification of ensuring the formation of critical competencies in students within the educational process is seen as possible through the jointly coordinated interaction of all involved participants to create conditions close to professional activity.

The analysis of scientific research on the topic created a foundation for the belief that the modern understanding of professional training is based on using modern software functionality to activate and stimulate the process of resource transformation and increase the effectiveness of activities. Thus, some scientists,^(18,21) considering the issue of professional competence as a necessary prerequisite for professional fulfilment, emphasise that the phenomenon of digital awareness is directly connected with positioning in the field of communication.

Some relevant scientific works reflect the essential elements of implementing and realising the professional training paradigm.^(19,20) In addition, scientists have conducted several studies that create a foundation for adapting the tools of interdisciplinary integration to the realities of the educational process.^(12,13)

The topic under investigation is considered from a slightly different angle by a number of contemporary scholars. In comparison, Mitschek et al.⁽²⁴⁾ place a top priority on increasing the efficiency of stakeholders' actions regarding the integration of the student information system in higher education institutions. The researchers argue that a motivated student is far more effective than dozens of strategic programmes and managerial decisions at the institutional level.

Furthermore, Gorski et al.⁽²⁵⁾ reveal that education for sustainable development is particularly explored within the context of innovations that ensure the effective utilisation of the limitless potential of young people.

Researchers Baird et al.⁽²⁶⁾ complement higher education needs with employer rankings concerning the importance of skills and competences required by college graduates for employment, focusing on the contexts of the USA and England. The scholars' conclusions are analogous to the findings of the current research on the prospects of integrated learning and the development of synergy between hard and soft skills.

Finally, Abidoye and Adeyemi⁽²⁷⁾, analysing the impact of information and communication technologies on the success of students, arrive at conclusions similar to the results of our study, highlighting the high

significance of these technologies for future educational development strategies in the sector.

The definition of the professional readiness of future specialists in terms of compliance with the requirements of digital changes in the modern labour market finds the most appropriate formulation in the works of researchers Castro and Tumibay,⁽¹⁴⁾ Haleem et al.,⁽¹⁵⁾ who interpret the phenomenon of professional training as a sociocultural foundation for socio-economic development. It is worth supporting the scientific position of the scientists above, who see the step-by-step interrelated study of psychological, cultural, ethical, and deontological directions of education in the professional training system as the basis for the practical application of interdisciplinary integration tools in forming professional competence.

CONCLUSION

The research proved that the priority direction for the quality development of higher education in Ukraine is the synergy of innovative implementation of information systems and digital transformation. The proposed concept reflects the modern vector of innovative technology development in educational activities under complex conditions of uncertainty.

Ukraine has the prerequisites for successfully implementing relevant digital and innovative solutions into the educational paradigm based on successful foreign experience. The formation of professional competence in future specialists is defined by communicative, intercultural, and informational-digital competence, considering the trend of integrating the educational space into the European community. Innovative digitalisation technologies, including immersive tools, virtual reality instruments, and artificial intelligence, are particularly effective in forming the critical competencies of higher education students in conditions close to professional activity realities.

A promising direction for future research on the outlined topic is the development of an algorithm for forming foreign language professional, communicative competence in higher education students through mixed reality technologies.

REFERENCES

1. Melnychuk YY. Principles of building information systems for educational purposes. Computer-integrated technologies: education, science, production. [Internet] 2023 [cited: 10 September 2024];50:77-83. Available in: <https://doi.org/10.36910/6775-2524-0560-2023-50-11>
2. Strashko VI. Strategic directions for improving the education system in the context of increasing workforce competitiveness in the labour market. Economics and management organization. [Internet] 2023 [cited: 10 September 2024];1(49):170-180. Available in: <https://doi.org/10.31558/2307-2318.2023.1.17>
3. Huraliuk AH. Digitalisation as a condition for the development of the education system. Bulletin of the T. H. Shevchenko National University "Chernihiv Collegium". 2021;169(13):3-8.
4. Chychkan O, Kostovskyi M. The use of information technologies in the distance learning for higher education students. Health, physical education and sport: perspectives and best practices. [Internet] 2021 [cited: 10 September 2024];56. Available in: https://zfvs.kubg.edu.ua/images/stories/Departaments/ilid/kfr/plani/Abstacts_FHPES_2021.pdf#page=56
5. Lubko DV, Sharov SV. Directions for using intelligent systems in the educational process. Ukrainian studies in the European context: a collection of scientific papers. [Internet] 2021 [cited: 10 September 2024];3:305-310. Available in: <http://eprints.mdpu.org.ua/id/eprint/11680>
6. Viunenken O, Honzales-Ahadzhanov K, Ahadzhanova S, Rudenko Yu. Information and communication technologies of e-learning as a basis for innovation in higher education. Education. Innovation. Practice. [Internet] 2023 [cited: 10 September 2024];11(4):13-19. Available in: <https://doi.org/10.31110/2616-650X-vol11i4-002>
7. Koval LV. Value orientations of vocational education: methodological aspect. Scientific Notes of Berdiansk State Pedagogical University. Series: Pedagogical Sciences. [Internet] 2021 [cited: 10 September 2024];2:239-246. Available in: <https://doi.org/10.31494/2412-9208-2021-1-2-239-246>
8. Herliand TM, Lypka LV. Promising areas of professional training of future specialists using digital learning technologies. Managing the quality of training in the digital environment. 2021;17.
9. Rusakova O, Tamozhska I, Tsoi T, Vyshotravka L, Shvay R, Kapelista I. The Changes in Teacher-Student

Interaction and Communication in Higher Education Institutions Due to the Covid-19 Pandemic. *Journal of Curriculum and Teaching*. [Internet] 2023 [cited: 10 September 2024];12(2):166-175. Available in: <https://doi.org/10.5430/jct.v12n2p166>

10. Borzenko O, Tamozhska I, Varhata O, Hetmanenko L, Shevchuk V. The Influence of Information Technologies on Modern Teaching Methods. *International Journal of Religion*. [Internet] 2024 [cited: 10 September 2024];5(10):403-411. Available in: <https://doi.org/10.61707/6demptw74>

11. Tamozhska I, Rud O, Medynskiy S, Polukhtovych T, Kuzemko N, Rudenko-Kraievskaya N. The Educational Paradigm as a Conceptual Model of Developing Competencies During Learning. *Revista Romaneasca Pentru Educatie Multidimensionala*. [Internet] 2024 [cited: 10 September 2024];16(2):152-164. Available in: <https://doi.org/10.18662/rrem/16.2/851>

12. Hawkrigde D. *New information technology in education*. Routledge; [Internet] 2022 [cited: 10 September 2024]. Available in: <https://doi.org/10.4324/9781003312826>

13. Szymkowiak A, Melović B, Dabić M, Jeganathan K, Kundi GS. Information technology and Gen Z: The role of teachers, the internet, and technology in the education of young people. *Technology in Society*. [Internet] 2021 [cited: 10 September 2024];65:101565. Available in: <https://doi.org/10.1016/j.techsoc.2021.101565>

14. Castro MDB, Tumibay GM. A literature review: efficacy of online learning courses for higher education institution using meta-analysis. *Education and Information Technologies*. [Internet] 2021 [cited: 10 September 2024];26(2):1367-1385. Available in: <https://doi.org/10.1007/s10639-019-10027-z>

15. Haleem A, Javaid M, Qadri MA, Suman R. Understanding the role of digital technologies in education: A review. *Sustainable Operations and Computers*. [Internet] 2022 [cited: 10 September 2024];3:275-285. Available in: <https://doi.org/10.1016/j.susoc.2022.05.004>

16. Alam A. Should robots replace teachers? Mobilisation of AI and learning analytics in education. In: *2021 International Conference on Advances in Computing, Communication, and Control (ICAC3)*. [Internet] 2021 [cited: 10 September 2024]:pp. 1-12. Mumbai, India. Available in: <https://doi.org/10.1109/ICAC353642.2021.9697300>

17. Eker B, Eker AA. Quality criteria in universities. *Journal of innovations in business and industry*. [Internet] 2023 [cited: 10 September 2024];1(02):65-70. Available in: <https://doi.org/10.61552/JIBI.2023.02.002>

18. Zhao Y, Llorente AMP, Gómez MCS. Digital competence in higher education research: A systematic literature review. *Computers and Education*. [Internet] 2021 [cited: 10 September 2024];168:104212. Available in: <https://doi.org/10.1016/j.compedu.2021.104212>

19. Burbules NC, Fan G, Repp P. Five trends of education and technology in a sustainable future. *Geography and sustainability*. [Internet] 2020 [cited: 10 September 2024];1(2):93-97. Available in: <https://doi.org/10.1016/j.geosus.2020.05.001>

20. Adıgüzel T, Kaya MH, Cansu FK. Revolutionising education with AI: Exploring the transformative potential of ChatGPT. *Contemporary Educational Technology*. [Internet] 2023 [cited: 10 September 2024];15(3) :art. no. ep429. Available in: <https://doi.org/10.30935/cedtech/13152>

21. Reis DA, Fleury AL, Carvalho MM. Consolidating core entrepreneurial competencies: Toward a meta-competence framework. *International Journal of Entrepreneurial Behavior and Research*. [Internet] 2021 [cited: 10 September 2024];27(1):179-204. Available in: <https://doi.org/10.1108/IJEER-02-2020-0079>

22. Sinambela EA, Mardikaningsih R, Arifin S, Ayu HD. Development of Self-Competence and Supervision to Achieve Professionalism. *Journal of Islamic Economics Perspectives*. [Internet] 2020 [cited: 10 September 2024];1(2). Available in: <https://doi.org/10.35719/jiep.v1i2.13>

23. Dzwigol H, Dzwigol-Barosz M, Miśkiewicz R, Kwilinski A. Manager competency assessment model in the conditions of industry 4.0. *Entrepreneurship and Sustainability Issues*. [Internet] 2020 [cited: 10 September 2024];7(4). Available in: [https://doi.org/10.9770/jesi.2020.7.4\(5\)](https://doi.org/10.9770/jesi.2020.7.4(5))

24. Mitschek MR, Sanares RN, del Rosario MG, Doctor JrJ. Effectiveness and stakeholders of the student information system integration in higher education institutions. *Journal of innovations in business and industry*. 2024;2(4):199-206.

25. Gorski A, Ranf E, Badea D, Halmaghi E, Gorski H. Education for Sustainability - Some Bibliometric Insights. *Sustainability*. [Internet] 2023 [cited: 10 September 2024];15(20):14916. Available in: <https://doi.org/10.3390/su152014916>

26. Baird AM, Parayitam S. Employers' ratings of the importance of skills and competencies college graduates need to get hired: Evidence from the New England region of USA. *Education + Training*. [Internet] 2019 [cited: 10 September 2024];61(5):622-634. Available in: <https://doi.org/10.1108/ET-12-2018-0250>

27. Abidoye FO, Adeyemi AD. Analysis of secondary school students' performance in biology and chemistry in Nigeria: Influence of ICT. *Journal of Engineering, Management and Information Technology*. [Internet] 2024 [cited: 10 September 2024];2,1(06):43-46. Available in: <https://doi.org/10.61552/JEMIT.2024.01.006>

28. Ministry of Education and Science of Ukraine; [Internet] 2024 [cited: 10 September 2024]. Available in: <https://mon.gov.ua/en>

29. Cebrián G, Junyent M, Mulà I. Competencies in Education for Sustainable Development: Emerging Teaching and Research Developments. *Sustainability*. [Internet] 2020 [cited: 10 September 2024];12(2):579. Available in: <https://doi.org/10.3390/su12020579>

30. Eizaguirre A, García-Feijoo M, Laka J. Defining Sustainability Core Competencies in Business and Management Studies Based on Multinational Stakeholders' Perceptions. *Sustainability*. [Internet] 2019 [cited: 10 September 2024];11(8). Available in: <https://doi.org/10.3390/su11082303>

31. Hernandez-de-Menendez M, Morales-Menendez R, Escobar CA. Competencies for Industry 4.0. *International Journal on Interactive Design and Manufacturing*. [Internet] 2020 [cited: 10 September 2024];14:1511-1524. Available in: <https://doi.org/10.1007/s12008-020-00716-2>

32. Henseruk HR, Boiko MM. Digital technologies as a means of improving the quality of the educational process of a higher education institution. *Innovative digital education technologies in higher and secondary education in Ukraine and the EU*. [Internet] 2020 [cited: 10 September 2024];5:110-111. Available in: http://dSPACE.tnpu.edu.ua/bitstream/123456789/15380/1/37_Henseruk_Boiko.pdf

FINANCING

The authors did not receive financing for the development of this research.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

AUTHORSHIP CONTRIBUTION

Conceptualization: Iryna Tamozhska, Ruslan Chubuk, Vadym Pienov, Nataliia Myroshnychenko, Lyubov Prokofyeva.

Data curation: Iryna Tamozhska.

Formal analysis: Ruslan Chubuk, Vadym Pienov.

Research: Iryna Tamozhska, Ruslan Chubuk, Vadym Pienov, Nataliia Myroshnychenko, Lyubov Prokofyeva.

Methodology: Iryna Tamozhska, Ruslan Chubuk, Vadym Pienov, Nataliia Myroshnychenko, Lyubov Prokofyeva.

Project management: Nataliia Myroshnychenko, Lyubov Prokofyeva.

Resources: Iryna Tamozhska, Ruslan Chubuk, Vadym Pienov, Nataliia Myroshnychenko, Lyubov Prokofyeva.

Software: Iryna Tamozhska.

Supervision: Ruslan Chubuk.

Validation: Vadym Pienov, Nataliia Myroshnychenko.

Display: Lyubov Prokofyeva.

Drafting - original draft: Iryna Tamozhska, Ruslan Chubuk, Vadym Pienov, Nataliia Myroshnychenko, Lyubov Prokofyeva.

Writing - proofreading and editing: Iryna Tamozhska, Ruslan Chubuk, Vadym Pienov, Nataliia Myroshnychenko, Lyubov Prokofyeva.