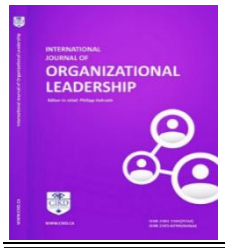


INTERNATIONAL JOURNAL OF ORGANIZATIONAL LEADERSHIP

WWW.CIKD.CA

journal homepage: https://www.ijol.cikd.ca

Leading the Digital Frontier: Harnessing Artificial Intelligence for Transformative Specialist Training in Higher Education

Larysa Tykha[1*], Iryna Zabiiaka[2], Viktoriia Kotenko[3], Tamara Nykoliuk[4], Liudmyla Korobchuk[5], Larysa Sadova[6], Larysa Pylypiuk[7]

[1,2,4,6,7]Department of Foreign and Ukrainian Philology, Faculty of Digital Educational and Social Technologies, Lutsk National Technical University, Lutsk, Ukraine
[3]Department of Automobile and Transport Technology, Faculty of Transport and Mechanical Engineering, Lutsk National Technical University, Lutsk, Ukraine
[5]Department of Ecology, Faculty of Agricultural Technologies and Ecology, Lutsk National Technical University, Lutsk, Ukraine

Keywords:
Artificial intelligence, Critical thinking, European experience, Higher education, Pedagogical technologies

Received
07 February 2025

Received in revised form
28 March 2025

Accepted
03 April 2025

***Correspondence:**
Tykha.larysa@gmail.com

ABSTRACT

The relevance of studying advanced technologies and using artificial intelligence in training specialists is primarily due to the rapid development of digital technologies, which significantly transform the educational process, increasing its flexibility, individualisation and efficiency. The study investigates the dynamics of the use of AI technologies in education and identifies the extent to which digital technologies influence the development of digital skills and literacy, which is important for ensuring the competitiveness of graduates in the modern economy. This study examines the factors that determine the success of using advanced educational technologies and AI in training specialists and assesses their impact on the quality of the educational environment. The main methods for qualitative analysis of the research components include synthesis of literature sources, case analysis, systematisation, and generalisation. During the quantitative research, a survey was conducted to collect data, and the available statistical information was analysed based on the calculation of the χi-square criterion. The analysis was based on data collection through a survey of 297 individuals pursuing a degree in Ukraine. The independent variables of the analysis were the educational degree being pursued by the respondents and the level of digital skills. In contrast, the dependent variables included the frequency of using AI-based educational platforms, the purpose of using AI in education, the level of satisfaction with the quantity and quality of available AI platforms for education, and the readiness to implement new educational technologies. The results of the study confirm that the frequency of access to AI-based platforms for learning by participants of the educational process, the purpose of using such technologies and satisfaction with their quality affect the process of integrating advanced educational technologies and artificial intelligence into higher education institutions. The study demonstrates the need for a systematic approach to introducing educational technologies in the training of specialists to ensure a qualitative transformation of the modern educational system.

At the current stage of digital transformation, advanced educational technologies and Artificial Intelligence (AI) have become an integral part of training specialists in various spheres of society. Integration of AI into the educational process opens up great opportunities for personalising education, automating routine tasks, and improving learning efficiency and knowledge accessibility. AI can adapt learning materials to the needs of students, offering individualised curricula, real-time feedback, and improved management of academic processes. However, despite the significant potential, the introduction of AI in education is accompanied by new challenges, including financial barriers, integration difficulties, and the issue of public acceptance of technology. The results of The Digital Education Council Global AI Student Survey, which includes responses from 3,839 students from 16 countries, show that students regularly use artificial intelligence during their studies (86%), including 54% of them who use it weekly to complete homework and prepare for exams. Despite this dynamic, 80% believe that expectations and benefits of AI applications and integration at their universities have not been met, and more than 50% of students also believe that over-reliance on artificial intelligence will negatively impact their academic performance (Digital Education Council, 2024). In this context, it is important to explore the role of universities in developing the skills necessary for the effective integration of innovations, including AI technologies, into the professional activities of specialists. Moreover, as a result, it is important to identify the patterns of influence of advanced technologies on the training of specialists in modern Higher Education Institutions (HEIs). Thus, the relevance of this study lies in the opportunity to deepen the understanding of technological changes in education and analyse the processes of adapting educational processes to the requirements of the digital educational environment.

The article aims to analyse the main factors influencing the use of advanced educational technologies in the educational process and formulate key areas for improving modern education in the context of digital transformation.

Literature Review

Integrating advanced educational technologies, including artificial intelligence, into the learning process is one of the key areas of the modern digital transformation of education. The introduction of artificial intelligence in education covers a wide range of tools, among which chatbots occupy a special place. In this context, Gorrostieta et al. (2013) argue that an Intelligent Tutoring System (ITS) is a system that provides personalised instruction or feedback to students without much teacher involvement. Advances in ITS include using natural language technologies to perform automated assessments of written text and provide feedback (Marouf et al., 2024). They contribute to developing digital skills and literacy by offering an interactive platform for students to interact with learning content (Zhang & Zhang, 2024). Other authors, such as Chukwuere and Handoko (2024), Goldweic and Getis (2024), and Xiao et al. (2024), show more interest in the introduction of AI-based chatbots in the educational environment. In particular, Goldweic and Getis (2024) argue that such chatbots can adapt to users' needs, providing instant access to information, answers to questions, and support in the learning process. Hidayat-ur-Rehman (2024) argues that such systems help to build key competences necessary for working in a digital environment and, as Alwazzan (2024) notes, develop critical thinking and independent learning skills. Instead, according to Hrynevych (2024), the level of

digital literacy is one of the key competences for modern educators, which determines their readiness to use interactive technologies in education and professional activities.

Method

During the study, a number of general scientific methods of cognition were used; in particular, the method of synthesis of literary sources was used to systematise the theoretical aspects of the application of artificial intelligence in the modern educational environment.

Case analysis was used to study the experience of various universities in developing and implementing advanced educational technologies, including AI technologies, in training specialists in higher education institutions.

The systematisation method was used to study the advantages and disadvantages of the European approach to regulating issues related to advanced technologies in higher education, particularly artificial intelligence.

By analysing statistical data, the level of specialist mastery of digital skills and the state of development of digital literacy were identified.

The survey for further calculations was conducted among 297 people pursuing a degree in Ukraine. The distribution of respondents by their level of digital literacy and the educational degree they are studying is shown in Figure 1. This survey was conducted by questionnaire by distributing the developed questionnaires among current students, postgraduate students and doctoral students of HEIs in Ukraine. The main hypotheses of this study are:

Hypothesis (H_1): The level of digital literacy of respondents affects the frequency of using advanced educational technologies in teaching;

Hypothesis (H_2): Respondents' educational level affects the frequency of using artificial intelligence in education.

The methodological basis of the study is the formula of the chi-square criterion:

$$E_{ij} = \frac{N_i * N_j}{N} \quad (1)$$

where E_{ij} is the expected frequency for the cell of the corresponding row i and column j;

N_i is the sum of frequencies for string i;

N_j is the sum of frequencies for column j;

N is the total number of observations.

The formula for expected frequencies to calculate the chi-square criterion:

$$\chi^2 = \sum \frac{(O_{ij} - E_{ij})^2}{E_{ij}} \quad (2)$$

where O_{ij} is the observed frequency for the cell.

The data for calculating frequencies are the results of the survey. Based on the frequencies obtained, the χi-squared criterion was calculated for each item in the survey. Then, the obtained indicators were compared with the critical value ($\chi^2_{critical}$), which primarily involves calculating the degrees of freedom for each value of the χi-square criterion:

$$df = (r - 1) * (c - 1) \quad (3)$$

wherer is the number of lines;

c is number of columns.

For further interpretation of the results, we directly calculated the critical value of the indicator for the 5% significance level ($\alpha = 0.05$) using the built-in function "CHISQ.INV.RT" of the Microsoft Excel analysis package, the calculation formula for which is as follows:

$$\chi^2_{\text{critical}} = \text{CHISQ. INV. RT}(1 - \alpha; \text{df}) \quad (4)$$

Based on the results obtained, the studied factors that influence the use of advanced educational technologies and artificial intelligence in training specialists in Ukraine are significant. If $\chi^2 \geq \chi^2_{\text{critical}}$, then there is a statistically significant relationship between the variables under study, and, therefore, the hypothesis is confirmed; if $\chi^2 < \chi^2_{\text{critical}}$, then there is no statistically significant relationship between the variables, i.e. the hypothesis is rejected.

The generalisation method is used to outline this study's conclusions, and its limitations and contribution to the modern scientific discourse in educational technologies are characterised.

Results and Discussion

Today, the use of artificial intelligence (AI) in education has become widespread, which has led to the need to develop and integrate innovative pedagogical technologies. One of the most progressive technological solutions confirming artificial intelligence's transformational potential in education is intelligent tutoring systems (ITS). Such systems are sophisticated educational technology designed to provide personalised instruction and feedback, i.e., imitate an individual teacher's guidance. ITS uses advanced artificial intelligence technologies, including machine learning, natural language processing, and adaptive algorithms, to simulate individualised learning, making it a relevant tool for personalised learning and rapid professional development (Marouf et al., 2024). An example of the application of this system is the experience of Loyola University Chicago in implementing an artificial intelligence-based digital assistant (LUie) built on the Oracle Digital Assistant platform. By integrating LUie with the existing Loyola PeopleSoft Campus Solutions system and the IntraSee chatbot, the system reduced the workload of the university's teaching staff by providing a prompt response to round-the-clock student queries in real-time with personalised information obtained directly from Loyola's administrative systems. This case study shows the positive results of implementing ITS in the educational environment; in particular, the system's successful response rate is currently at 86%, and, in addition, the transaction cost has been reduced from USD 4.25 to USD 0.29. The cost of the transaction was reduced from USD 4.25 to USD 0.29. The percentage of failed transactions is 2% (down 31% compared to 2021). Since the pandemic, this system has been an integral tool for improving the student experience in the university ecosystem (Oracle, 2022). Despite the potential and successful cases of ITS integration, Al-Nakhal and Naser (2017) note the need to address several current issues, including data privacy, systematic bias, and constant updates to reflect educational achievements in training. An empirical study by Gorrostieta et al. (2013) found that the intelligent system contributed to students' more effective work on projects, which was reflected in the improvement of the quality of their scientific texts: the control group did not consult with the teacher to improve their work, which led to an average lexical density result of 53% ("medium" level); and the experimental group, which used the intelligent learning system and actively interacted with the teacher, had a lexical density of 60% ("high" level).

Chukwuere and Handoko (2024) propose to solve a similar problem with the need to provide personalised learning and reduce the workload of teaching staff by introducing technologies

for processing student requests by integrating AI-based chatbots into the overall university system. The case of Northwestern University, which started developing the Canvas chatbot in 2017 to automatically answer students' questions about the learning management system (LMS), indicates the capabilities of AI technologies to provide prompt support to participants in the educational process. The main results of integrating the Canvas chatbot into the work of higher education institutions are the highest absolute content ratio (92%) in 2023 compared to previous periods, which indicates the bot's high ability to provide high-quality answers to user questions and, as a result, relieve the university administration; in addition, the increase in the number of users (by 50% in 2021-2022 and by 45% in 2022-2023) indicates the bot's ability to meet the needs of the student community (Goldweic & Getis, 2024). At the same time, the European experience indicates specific logistical challenges in supporting the growing international contingent of online students, partly due to the growing interest of Ukrainian refugees in European universities due to the danger of entering Ukrainian universities. In particular, The European School of Management and Business (EUDE), together with IBM, has started developing a virtual collaborative tutor based on generative artificial intelligence to improve the experience for students and teachers. Supporting administrative, academic, and logistical queries with real-time Natural Language Processing (NLP) has achieved sufficient student response time, increased engagement, and enabled tutors to focus on higher-value tasks (Cagle, 2024).

However, according to a global survey by the Digital Education Council (2024), 60% of students are concerned about the fairness of AI-assisted assessment. Students have mixed reactions to the prospect of using AI in teaching and learning, including using AI by teachers in assessments. Therefore, it is important to consider the validity of the provisions of the established European Union (EU) legal framework to promote the responsible development and deployment of AI in all member states. In this context, the European Artificial Intelligence Act (AI Act) proposed by the European Commission in April 2021 and agreed by the European Parliament and Council in December 2023 introduces a unified framework based on a forward-looking definition of artificial intelligence and a risk-based approach (from minimal to unacceptable risk) (European Union, 2024); that is, a risk-based approach to AI classification assigns obligations proportionate to the level of risk posed by each artificial intelligence system. This document establishes precise requirements and obligations for specific uses of AI while reducing companies' administrative and financial burdens. However, while EU policymakers envisage the development of innovative products and sustainable services, increased productivity and more efficient production (Directorate-General for Communication, 2024), Butt (2024) sees the system as resource-intensive and complex to keep small companies competitive in the market. As for the education and research sector, Morandín-Ahuerma (2024) is concerned about the potential constraints on developing EdTech solutions due to data collection and use restrictions. However, this is justified by the need to ensure system reliability and cybersecurity. According to Butt (2024), due to the above issues, less progressive educational institutions, particularly those in remote regions and developing countries, and less well-funded, are likely to avoid risk due to the complexity of compliance, in particular as universities will be considered high-risk AI system providers under the new legislation. The novelty of the legislation should be emphasised here, as the law came into force on 01 August 2024, and consultations on the Code of Practice for providers of General-Purpose Artificial

Intelligence (GPAI) models are still ongoing, which also creates a barrier to further development of AI technologies in the EU education and science sector.

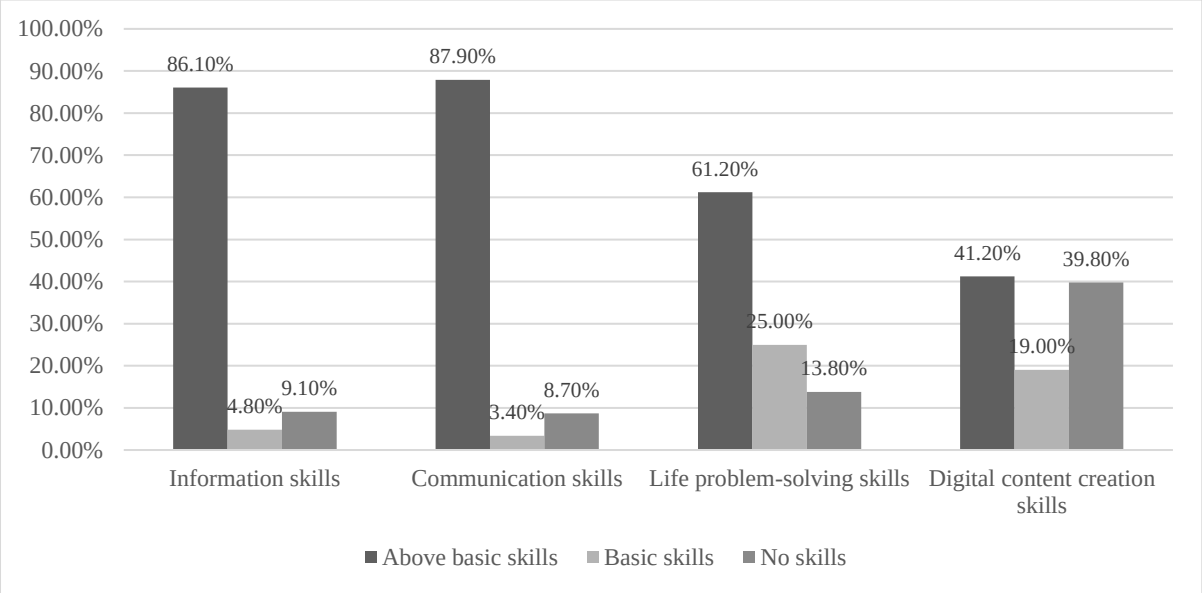
For Ukraine, the digitalisation of education and the involvement of more advanced technologies in the learning process has been acute since the pandemic. Although the results of digitalisation have been relatively positive, the discussion about rethinking the modern education system has deepened with the beginning of the full-scale invasion of Ukraine by the Russian army. Contemporary scholars, such as Hrynevych (2024), Semeniuk et al. (2024), and Spivakovsky et al. (2023), emphasise that the war caused severe losses and destruction in the Ukrainian higher education system, which requires adaptation of the educational process to new conditions. For example, Spivakovsky et al. (2023) note that using digital technologies has become a key element in ensuring the continuity of learning during the war. Antoniuk (2023) emphasises the need to develop institutional policies for effective implementation. Therefore, discussions on the need to develop regulatory mechanisms and policies for using AI in various economic sectors, including improving the educational system, continue both in the scientific field and among officials. Currently, the primary basis for legislative support for using AI technologies is the Concept of Artificial Intelligence Development, adopted by the Cabinet of Ministers of Ukraine № 1556-r, dated 02 December 2020. Its purpose is to identify priority areas and main tasks for developing artificial intelligence technologies to meet individuals' and legal entities' rights and legitimate interests, build a competitive national economy, and improve the public administration system. The implementation of the concept is envisaged for the period up to 2030. One of the priority areas for implementing this concept is the introduction of artificial intelligence technologies in education, economy, public administration, cybersecurity, defence, and other areas to ensure Ukraine's long-term competitiveness in the international market. Thus, according to the concept, education, science, and vocational training are its priority areas, which require legislation on the use of artificial intelligence technologies in line with international regulations. As in the case of the EU, there is some concern about the cybersecurity component of this document. Ukrainian society sees the main problem of such a priority area as developing cybersecurity software to track political disinformation (fake news). As a result of the allocation of state resources to the development of such programmes, which may cause excessive interest of the authorities in blocking or restricting access to "political disinformation", there is a significant risk of promoting restrictions on the freedom of expression. Nevertheless, a ban on artificial intelligence research cannot be effective in principle (Calo, 2017), and the introduction of restrictions on its use will not affect the spread of the risks of misuse of the technology (Kornieieva, 2021).

Such changes require policymakers and educational institutions to focus on the development of digital skills among students (Figure 1), as students' ability to think critically, analyse data, and work with innovative technologies will further determine the effectiveness of AI integration into various areas of education and science in Ukraine (Semeniuk et al., 2024). Rusandi et al. (2023) also emphasise the importance of developing critical thinking skills among students and researchers to ensure the effective use of AI and clearly distinguish between accurate information and deception and misinformation. Given that digital literacy is one of the most necessary competences, an essential condition for successful adaptation to the new challenges of digitalisation and post-war recovery is to improve educational programmes to cover a wide range of specialists in various fields, as the level of digital literacy of society

directly affects the ability of countries to effectively use modern technologies (Hrynevych, 2024).

Figure 1

The Overall Level of Digital Literacy of the Population

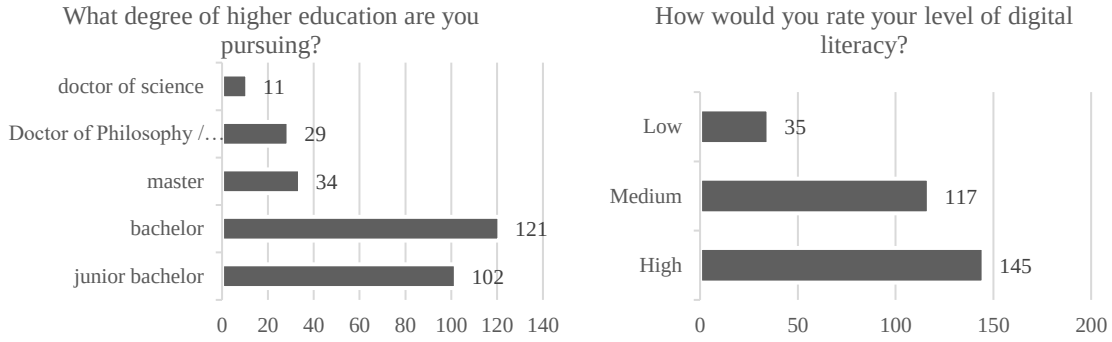


Source: Compiled by the author based on Diia.Education (2023)

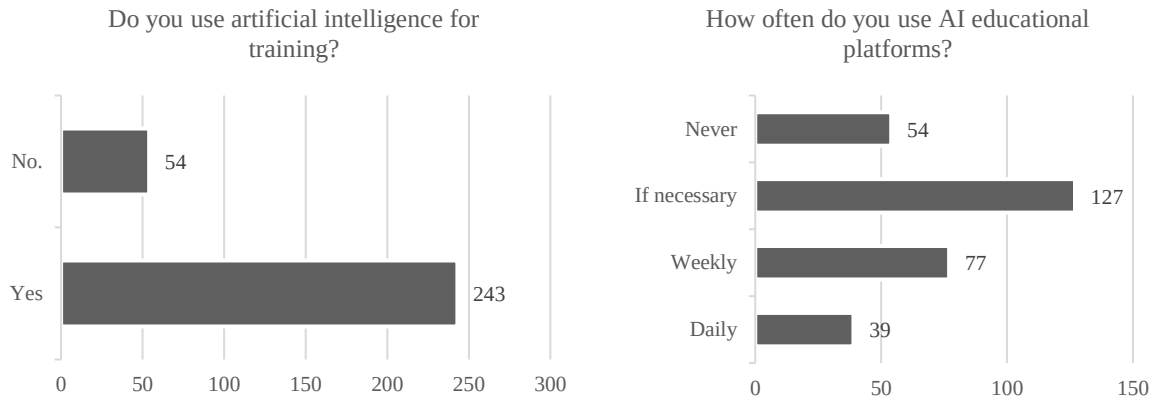
Given the high level of digital literacy in Ukraine, the issue of introducing advanced educational technologies and AI into the educational process is strategically important for the development of the educational system as a whole. The digitalisation processes that have been successfully implemented in the country over the past decades have created favourable conditions for integrating innovative technologies into the curricula of higher education institutions. However, despite the general technological readiness, there is still a need for a deeper understanding of the social and pedagogical factors that influence the effectiveness of these technologies. Therefore, it is important to conduct an empirical study of the factors influencing the use of advanced educational technologies and artificial intelligence in the educational process in Ukrainian higher education institutions. The main variables of the analysis are the results of a survey among respondents who are currently pursuing a degree in Ukraine (Figure 2).

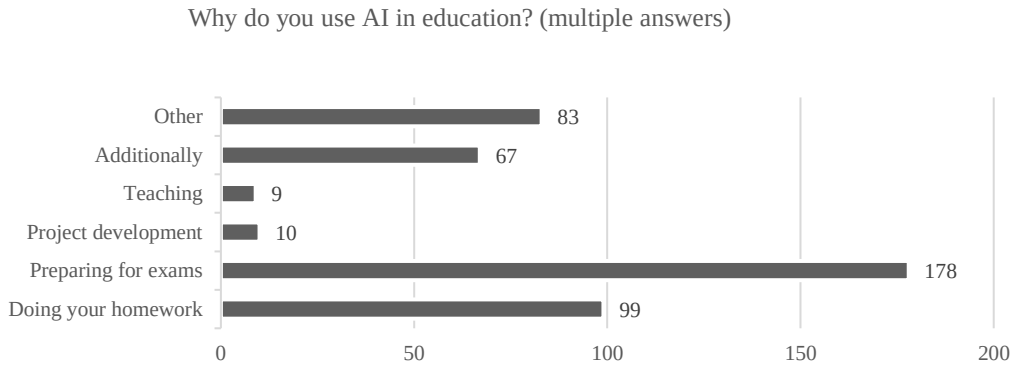
Figure 2

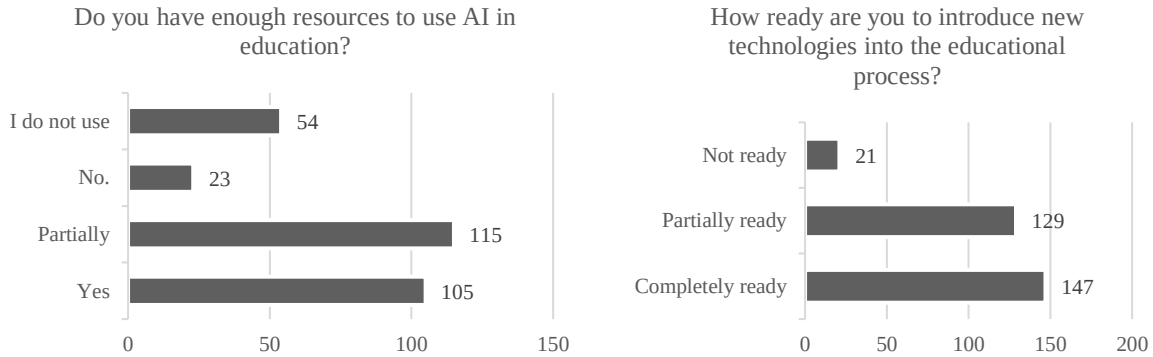
Results of the Survey of Respondents on the Use of Advanced Educational Technologies and Artificial Intelligence in the Educational Process



a) Independent variables for analysing the use of advanced technologies and AI in training







b) Dependent variables of the analysis of the use of advanced technologies and AI in the training of specialists

The results of the study indicate the following patterns:

I. The calculations revealed that the use of AI in obtaining an educational degree does not depend on the respondents' education level ($1{,}139 < 9{,}488$ at df = 4). However, in general, there is a clear relationship between the respondents' educational level and the frequency of using educational platforms based on AI ($32{,}285 > 21{,}026$ at df = 12), the purpose of using AI in education ($218{,}13 > 31{,}41$ at df = 20), satisfaction with the number and quality of available AI platforms for education ($36{,}88 > 15{,}507$ at df = 8), and readiness to introduce new educational technologies ($33{,}467 > 21{,}026$ at df = 12). Thus, the hypothesis ($H_{(2)}$) that there is a correlation between the educational degree obtained by respondents and the frequency of using artificial intelligence in education is confirmed.

According to modern scholars, the educational degree is an indicator of readiness to use more complex technologies, as students at higher levels of study are more likely to be involved in research or project tasks that require the integration of AI (Chukwuere & Handoko, 2024; Jafari & Keykha, 2024; Marouf et al., 2024; Munagandla et al., 2024). At the same time, academic programmes, especially at the master's and doctoral levels, have more significant opportunities to introduce and use these technologies due to developed infrastructure, access to resources, and higher levels of faculty training (Alshorman, 2024). The identified patterns are consistent with the study by the Digital Education Council, which is methodologically based on the synthesis of 3839 responses from bachelor's, master's and doctoral students from 16 countries. The study found that 24% of respondents use AI daily, another 54% daily or weekly, and 54% at least weekly. The purpose of using AI in education varies and includes information retrieval (69%), grammar checking (42%), summarising documents (33%), paraphrasing documents (28%), and creating drafts (24%). Therefore, the study highlights the need to consider AI as a core infrastructure of an educational institution, given the growing use of AI among young people (Kelly, 2024). A similar trend is also observed in schools, with the Junior Academy of Sciences of Ukraine (2023) reporting that 76% of teachers surveyed had used artificial intelligence, 37% had engaged students in AI use, and another 49% planned to integrate AI into the classroom.

II. The study also suggested that the focus on the respondents' educational level is not exhaustive, as the results can be misinterpreted due to different levels of digital literacy, which is an important factor in this context, given the discussion of the ability to use advanced technologies in the educational process. Therefore, we analysed the respondents' answers depending on their level of digital skills. The results showed a statistically significant relationship between the level of digital literacy of respondents and the frequency of use of AI-based educational platforms ($108{,}203 > 5{,}99$ at df = 2), the purpose of using AI in education ($61{,}93 > 18{,}307$ at df = 6), satisfaction with the number and quality of available AI platforms for education ($126{,}05 > 12{,}59$ at df = 6), and readiness to introduce new educational technologies ($46{,}268 > 9{,}488$ at df = 4). Thus, the hypothesis ($H_{(1)}$) about the significance of the impact of digital literacy on the use of advanced educational technologies was confirmed. According to Hrynevych (2024), digital literacy is a key competence of modern society that provides access to tools that expand learning opportunities. It is worth noting that respondents with a higher level of digital skills use AI more often and demonstrate a higher readiness to implement new educational solutions, which aligns with global education trends. This is

confirmed by a survey conducted by Oxford University Press in 2024. The survey results showed that 76% of academic researchers worldwide use some form of generative AI in their work (MacGregor, 2024a), while a national survey of students in the UK showed that 53% used generative AI to help with their research, with 66% of students finding it acceptable to use generative AI to explain concepts, 54% suggest research ideas, and 53% summarise articles (MacGregor, 2024b).

Conclusion

The results of the calculations revealed that the frequency of access to AI-based platforms by participants in the educational process during training, the purpose of using such technologies and satisfaction with their quality confirm the global trends in integrating AI into education. The study also demonstrates the relevance of implementing a systematic approach to developing digital literacy among all participants in the educational process. Taking these trends into account will ensure the effective integration of innovative technologies into education and, in addition, will help to foster a culture of responsible and ethical use of AI in academic and professional environments. The results obtained during the calculations can be used to prepare plans for implementing technological solutions in the educational process or organisational activities of higher education institutions. Prospects for further research include analysing the dependence of digital literacy on the speciality and identifying the factors that influence its formation. In addition, it is necessary to develop a methodology for a comparative study of interdisciplinary approaches to developing digital competences among technical, humanitarian and natural sciences students. In this way, it is possible to reach a consensus among university stakeholders in different training areas and optimise educational strategies, considering digital transformation's professional context and challenges.

Declarations

Acknowledgements

Not applicable.

Disclosure Statement

No potential conflict of interest was reported by the authors.

Ethics Approval

Not applicable.

Funding Acknowledgements

Not applicable.

Citation to this article

Tykha, L., Zabiiaka, I., Kotenko, V., Nykoliuk, T., Korobchuk, L., Sadova, L., & Pylypiuk, L. (2025). Leading the digital frontier: Harnessing artificial intelligence for transformative specialist training in higher education. *International Journal of Organizational Leadership, 14*(First Special Issue), 291-302. https://doi.org/10.33844/ijol.2025.60479

Rights and Permissions

References

Alshorman, S. M. (2024). The readiness to USE AI in teaching science: Science teachers' perspective. *Journal of Baltic Science Education*, *23*(3), 432–448. https://doi.org/10.33225/jbse/24.23.432

Al-Nakhal, M. A., & Naser, S. S. A. (2017). Adaptive intelligent tutoring system for learning computer theory. *European Academic Research*, *4*(10), 8770–8782. https://philpapers.org/archive/ALNAIT.pdf

Alwazzan, M. S. (2024). Investigating the effectiveness of artificial intelligence chatbots in enhancing digital dialogue skills for students. *European Journal of Educational Research*, *13*(2), 573–584. https://doi.org/10.12973/eu-jer.13.2.573

Antoniuk, V. P. (2023). Perspective chapter: the war as a factor of upheavals and transformations in higher education-experience of Ukraine. L. Waller & Sh. Waller (Eds.). *Higher education-reflections from the field-volume 1*. IntechOpen. https://doi.org/10.5772/intechopen.109688

Butt, J. (2024). Analytical study of the world's first EU Artificial Intelligence (AI) Act. *International Journal of Research and Publications*, *5*(3). https://doi.org/10.55248/gengpi.5.0324.0914

Cagle, P. (2024, 24 March). 5 AI case studies in education. *Simpler Media Group*. https://www.vktr.com/ai-disruption/5-ai-case-studies-in-education/?utm_source=chatgpt.com

Calo, R. (2017, August). Robots in American law. In *Robotics, Autonomics, and the Law.* (pp. 59–108). Nomos Verlagsgesellschaft mbH & Co. KG. https://ssrn.com/abstract=2737598

Chukwuere, J. E., & Handoko, B. L. (2024). The future of generative AI chatbots in higher education. *Journal of Emerging Technologies*, *4*(1), 36–44. https://www.ajol.info/index.php/jet/article/view/277916

Digital Education Council (2024). What Students Want: Key Results from DEC Global AI Student Survey 2024. *Digital Education Council*. https://www.digitaleducationcouncil.com/post/what-students-want-key-results-from-dec-global-ai-student-survey-2024

Diia.Education (2023). Survey of digital skills of Ukrainians: Third wave. *Ministry of Digital Transformation of Ukraine*, 1–70. https://osvita.diia.gov.ua/uploads/1/8800-ua_cifrova_gramotnist_naselenna_ukraini_2023.pdf

Directorate-General for Communication (2024). AI Act enters into force. *European Commission*. https://commission.europa.eu/news/ai-act-enters-force-2024-08-01_en

European Union (2024). Regulation (EU) 2024/1689 of the European Parliament and of the Council of 13 June 2024 laying down harmonised rules on artificial intelligence and amending Regulations (EC) No. 300/2008, (EU) No. 167/2013, (EU) No. 168/2013, (EU) 2018/858, (EU) 2018/1139 and (EU) 2019/2144 and Directives 2014/90/EU, (EU) 2016/797 and (EU) 2020/1828 (Artificial Intelligence Act) (Text with EEA relevance). *EUR-Lex*. http://data.europa.eu/eli/reg/2024/1689/oj

Goldweic, P., & Getis, V. (2024). The Canvas Chatbot: How Northwestern University Built Its Own AI-Enabled Tool: A Case Study. *EDUCAUSE*. https://er.educause.edu/articles/2024/4/the-canvas-chatbot-how-northwestern-university-built-its-own-ai-enabled-tool

Gorrostieta, J. M. G., López, S. G., & López-López, A. (2013). Results of a case study of an intelligent tutoring system for analysing of student projects presented as research papers. *Research in Computing Science*, (65), 103–110. https://doi.org/10.13053/rcs-65-1-9

Hidayat-ur-Rehman, I. (2024). Examining AI competence, chatbot use and perceived autonomy as drivers of students' engagement in informal digital learning. *Journal of Research in Innovative Teaching & Learning*, *17*(2), 196–212. https://doi.org/10.1108/JRIT-05-2024-0136

Hrynevych, L. (2024). The state of education in Ukraine and steps for future progress. In: OECD. *Learning during Crisis: Insights for Ukraine from across the Globe.* https://elibrary.kubg.edu.ua/id/eprint/48901/1/L_Hrynevych_Learning%20during%20Crisis_2024_FEU.pdf

Jafari, F., & Keykha, A. (2024). Identifying the opportunities and challenges of artificial intelligence in higher education: a qualitative study. *Journal of Applied Research in Higher Education*, *16*(4), 1228–1245. https://doi.org/10.1108/JARHE-09-2023-0426

Junior Academy of Sciences of Ukraine (2023). How artificial intelligence is changing school education: results of a study by the Small Academy of Sciences and the Projector Institute. *Junior Academy of Sciences of Ukraine*. https://man.gov.ua/en/about/news/yak-shtuchnij-intelekt-zminyuye-shkilsnu-osvitu-rezulstati-doslidzhennya-maloyi-akademiyi-nauk-i-projector-institute

Kelly, R. (2024, 28 August). Survey: 86% of students already use AI in their studies: Research. *1105 Media Inc.* https://campustechnology.com/articles/2024/08/28/survey-86-of-students-already-use-ai-in-their-studies.aspx

Kornieieva, S. R. (2021). Theoretical approaches to the definition of the concept and legal regulation of artificial intelligence. *Scientific Bulletin of Uzhhorod National University. Series: Law*, (66), 50–55. https://doi.org/10.24144/2307-3322.2021.66.9

MacGregor, K. (2024a). Oxford press surveys researchers on AI, builds tech bridges. *University World News*. https://www.universityworldnews.com/post.php?story=20240613105239492

MacGregor, K. (2024b). Most students use AI for studies, digital divide emerges – Survey. *University World News*. https://www.universityworldnews.com/post.php?story=20240202105653757

Marouf, A., Al-Dahdooh, R., Ghali, M. J. A., Mahdi, A. O., Abunasser, B. S., & Abu-Naser, S. S. (2024). Enhancing education with artificial intelligence: The role of intelligent tutoring systems. *International Journal of Engineering and Information Systems (IJEAIS)*, *8*(8), 10–16. https://philarchive.org/archive/MAREEW-2

Morandín-Ahuerma, F. (2024). Critical analysis of the European Union's considerations on the ethical use of artificial intelligence in education. In *Inteligencia Artificial: Oportunidades y Retos Para la Educación* (Cap. 4, 116–145). CONCYTEP, Puebla, México. https://doi.org/10.31219/osf.io/escqj

Munagandla, V. B., Dandyala, S. S. V., & Vadde, B. C. (2024). AI-driven optimisation of research proposal systems in higher education. *Revista de Inteligencia Artificial en Medicina*, *15*(1), 650–672. https://redcrevistas.com/index.php/Revista/article/view/175

Oracle (2022). Loyola University Chicago improves student services with Oracle Digital Assistant. *Oracle*. https://www.oracle.com/customers/loyola-university-chicago/

Rusandi, M. A., Ahman, Saripah, I., Khairun, D. Y., & Mutmainnah. (2023). No worries with ChatGPT: building bridges between artificial intelligence and education with critical thinking soft skills. *Journal of Public Health*, *45*(3), e602–e603. https://doi.org/10.1093/pubmed/fdad049

Semeniuk, R., Holovnia, Y., Huda, O., & Savastru, N. (2024). Innovative methodologies and approaches to teaching with artificial intelligence in Ukrainian Higher Education. *Future Education*, *4*(1), 24–52. https://doi.org/10.57125/FED.2024.03.25.02

Spivakovsky, O. V., Omelchuk, S. A., Kobets, V. V., Valko, N. V., & Malchykova, D. S. (2023). Institutional policies on artificial intelligence in university learning, teaching and research. *Information Technologies and Learning Tools*, *97*(5). https://doi.org/10.33407/itlt.v97i5.5395

Xiao, Y., Zhang, T., & He, J. (2024). The promises and challenges of AI-based chatbots in language education through the lens of learner emotions. *Heliyon*, *10*(18), e37238. https://doi.org/10.1016/j.heliyon.2024.e37238

Zhang, J., & Zhang, Z. (2024). AI in teacher education: Unlocking new dimensions in teaching support, inclusive learning, and digital literacy. *Journal of Computer Assisted Learning*, *40*(4), 1871–1885. https://doi.org/10.1111/jcal.12988