



Application of artificial intelligence technologies and services in the professional training of managers in the field of education

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■ **Abstract.** The purpose of the study was to evaluate the possibilities of using artificial intelligence technologies in the professional training of future managers. The methodology included system and structural analysis, comparative analysis, and experimental research, modelling educational and professional scenarios conducted based on four higher educational institutions of Ukraine and involved 120 students enrolled in second-cycle (Master's) degree programmes. The results confirmed the effectiveness of integrating artificial intelligence technologies into the professional training of future education managers. International analysis has shown that in the United States of America, Singapore, Finland, and South Korea, artificial intelligence is used as a tool for analysing educational data, strategic planning, and managerial decision-making, which ensures the development of a data-driven approach in educational management. Comparative analysis of digital platforms showed that generative models contribute to analytical support and modelling of solutions; integrated systems automate management processes; and services provide organisation, communication, and visualisation of educational data. It was shown that in the experimental group, the level of professional competence increased from $M \approx 2.87$ -2.90 to $M = 3.85$ -3.94 ($SD \approx 0.89$ -0.93), while in the control group, the increase was insignificant and amounted to $M \approx 2.80$ -2.88 to $M = 3.16$ -3.25 ($SD \approx 1.00$ -1.03). The highest value was the indicator of presentation of research results ($M = 3.94$), the level of digital transformation was slightly lower ($M = 3.93$), which indicates a high development of communication and digital skills among respondents. The strategic planning indicator ($M = 3.74$) was not among the highest values, which indicates a relatively weak development of long-term managerial thinking in comparison with practice-oriented digital competencies. The data proved that the use of artificial intelligence technologies increased the level of managerial, analytical, and digital competence of future education managers

■ **Keywords:** digital tools; data analytics; training personalisation; educational and professional scenarios; ethical standards

■ Introduction

The rapid development of artificial intelligence technologies and services is changing approaches to organising the educational process and managing educational institutions. Intelligent digital tools expand the opportunities for professional training of managers in the field of education, promote the development of analytical thinking,

managerial decision-making skills, planning, and effective communication. The use of artificial intelligence improves the quality of work with information, optimises the performance of professional tasks, and creates new opportunities for training specialists who can effectively act in the context of digital transformation of the educational sphere.

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The problem of using artificial intelligence technologies and services in the professional training of managers in the field of education attracts increasing attention of researchers, since the digitalisation of the educational space changes the requirements for management activities and professional competencies of future specialists. Bibliometric analysis of scientific publications on the use of artificial intelligence in management education was carried out by H. Disanayake *et al.* (2025). The researchers identified the main areas of development of this topic and traced the dynamics of growth of scientific interest in it. The results showed that the integration of intelligent technologies contributes to updating the content of management training and expands the possibilities for developing professional competencies. The possibilities of using artificial intelligence for professional training of specialists were considered by W. Holmes & A. Littlejohn (2024). The researchers noted that intelligent systems support the personalisation of the educational process and the adaptation of educational materials to the individual needs of educational applicants. Such technologies contribute to the development of independent learning skills and more effective assimilation of professional knowledge.

The development of the Ukrainian education system in the context of the spread of artificial intelligence and information technologies was analysed by S. Krysh-tanovych *et al.* (2025). The researchers emphasised the need to modernise educational programmes in accordance with new technological challenges. The use of digital tools helps to prepare education managers to work with large amounts of data and manage innovation processes. The problem of knowledge management during the digital transformation of education and science in Ukraine was investigated by A. Iatsyshyn *et al.* (2024). The researchers noted that the effective use of digital resources improves the quality of professional training and improves the process of making managerial decisions. Artificial intelligence systems provide quick access to information and support the analytical activities of future managers. The use of artificial intelligence in education management was investigated by I. Igbo-kwe (2023). The paper showed that intelligent technologies help automate administrative procedures and increase the efficiency of management activities. They create conditions for the development of new professional skills necessary for working in a digital environment. The role of artificial intelligence in educational administration was analysed by N. Ogunode & D. Gregory (2025). The researchers noted that digital systems support the processes of planning, monitoring, and evaluating the activities of educational institutions. Their use contributes to the preparation of managers to perform managerial functions using innovative technologies.

The contribution of artificial intelligence to stimulating innovation in educational services and university

programmes was investigated by R. Popescu *et al.* (2023). The researchers noted that digital solutions contribute to updating the content of management training and developing entrepreneurial thinking. The use of intelligent services increases the flexibility of educational programmes and expands professional training opportunities. The problem of combining artificial intelligence and digital learning was considered by K. Suryanarayana *et al.* (2024). The researchers have proven that intelligent technologies increase the efficiency of the digital learning environment and support the sustainable functioning of education management systems, and provide better interaction between participants in the educational process and contribute to the optimisation of educational activities. The issue of introducing artificial intelligence in Ukrainian education of the future was highlighted by S. Vasylyuk-Zaitseva *et al.* (2023). They stressed that intelligent technologies open up new opportunities for organising the educational process and professional training of specialists. Their use contributes to the development of digital literacy and readiness for innovation. The use of artificial intelligence to improve the effectiveness of education management was investigated by C. Xing (2023). The researcher noted the ability of intelligent systems to improve the efficiency of management processes and the quality of educational services. Such technologies support data-based decision-making and contribute to the development of professional competencies of future managers in the field of education.

Despite the areas highlighted by the above researchers, the gaps included a lack of studies on the pedagogical conditions for the effective use of artificial intelligence technologies and services in the professional training of managers in the education sector. Attention remained limited to the development of readiness of future education managers to integrate intelligent digital tools into the practice of management activities. The purpose of the study was to substantiate the potential of using artificial intelligence technologies in the professional training of future managers in the field of education. The objectives of the study were: to summarise the international experience of using artificial intelligence technologies in the professional training of education managers; to assess the effectiveness of using AI services in the development of managerial and digital competencies of future heads of educational institutions; to develop and substantiate a system of educational and professional scenarios for integrating artificial intelligence into the educational process of training education managers.

■ Materials and Methods

Based on the method of system and structural analysis, international practices of using artificial intelligence technologies in the professional training of future education managers were summarised. The study

examined the systemic components of training educational leaders in the United States (United States of America), Singapore, Finland, and South Korea as countries characterised by a high level of digital maturity of educational systems, the presence of strategies for state support of artificial intelligence, and a developed infrastructure for training managerial personnel for education. The source database consisted of the University of Pennsylvania Graduate School of Education (2024), Moravian University (n.d.). The following sources were also used: Lee Kuan Yew School of Public Policy. (n.d.), WIRED (2019) and Sentry Magazine (2026). The documents were selected according to the criteria of relevance and representativeness of leading international practices in the introduction of artificial intelligence in education, and their focus on the development of managerial, analytical, and digital competencies in future educational managers.

Within the framework of the study, the method of comparative analysis was applied to carry out a systematic study of digital technologies and artificial intelligence services used in the professional training of education managers. Comparisons were made between leading generative and analytical AI platforms, in particular ChatGPT (n.d.), Microsoft Copilot (n.d.), and Google Gemini (n.d.). Claude (n.d.) (Anthropic), Notion AI (n.d.), and GrammarlyGO (n.d.) were also considered. Canva AI (n.d.) and the integrated educational solution Microsoft 365 Copilot for Education (n.d.). The choice of these services is conditioned by their wide application in educational management, functional diversity, and ability to support managerial, analytical, and communication processes in educational institutions. The comparative analysis was carried out according to the following criteria: functional multifunctionality, pedagogical, and managerial potential, integration capabilities, user-friendliness of the interface, the level of automation of data analytics, language and cultural adaptability, data security, and compliance with ethical standards for the use of artificial intelligence, and accessibility and scalability for educational organisations.

The experimental study was conducted during September 2025 – May 2026 at the higher educational institutions of Ukraine that train managers in the field of education: National Pedagogical University named after M.P. Drahomanov (n.d.), Ternopil National Pedagogical University named after V. Hnatyuk (n.d.), Khmelnytskyi Humanitarian and Pedagogical Academy (n.d.) and Hryhoriy Skovoroda University in Pereiaslav (n.d.) were also selected. The experimental and control groups were formed by randomly assigning 120 students pursuing a second (Master's) level of higher education (30 from each university) to two samples of equal size and initial level of preparation: the experimental group, in which the developed didactic model was implemented, and a control group, where teaching was carried out

using conventional methods. The participants were aged between 21 and 28. Among the participants were 82 women and 38 men. The inclusion criteria were training in the educational programme; consent to participate in the study; systematic attendance of classes; availability of access to the Internet and digital devices. The exclusion criteria were missing more than 20% of classes; refusal to participate at any stage of the study; and incomplete completion of diagnostic tasks. Participants were divided into a control group (CG, n = 60) and an experimental group (EG, n = 60). The control group followed the conventional professional training programme for education managers, which involved studying academic subjects within the framework of the approved curricula without the systematic use of artificial intelligence services.

The educational process was based mainly on the lecture and seminar form of training, performing standard practical tasks, working with textbooks and methodological materials, and conventional forms of knowledge control, such as tests, assessments, and exams. Educational work with applicants of the experimental group was carried out in a format with a combination of classroom classes, independent work, project activities, and performing professionally oriented tasks using artificial intelligence services. Training was conducted in a blended format using the Moodle platform and the Google Classroom service. All participants were informed about the purpose of the study and gave voluntary informed consent to participate (American Sociological Association, 2018). The study was conducted in accordance with the principles of academic integrity, confidentiality, and voluntary participation. A set of 15 practical tasks was used to assess the development of professional competence of education managers:

1. Analyse the activities of the educational institution and identify the main management problems.
2. Prepare a strategic plan for the development of the educational institution for three years.
3. Develop a draft order on the introduction of educational innovation.
4. Create an analytical report based on the results of monitoring the quality of education.
5. Develop a plan for an internal system for ensuring the quality of education.
6. Prepare an information sheet for the teaching staff on the implementation of changes.
7. Conduct a SWOT analysis (Strengths, Weaknesses, Opportunities, Threats) of the educational institution's activities.
8. Develop a professional development plan for teachers.
9. Prepare a draft decision of the pedagogical council on the proposed situation.
10. Develop an algorithm for responding to a crisis management situation.

11. Prepare a draft budget for the educational project.
12. Create a digital transformation plan for an educational institution.
13. Develop a system of indicators for evaluating the performance of an educational institution.
14. Prepare a presentation of the results of management research.
15. Develop a set of measures to improve the competitiveness of an educational institution.

Tasks were performed by students before and after the experiment. The tasks were evaluated by 7 experts aged 35 to 58 years ($M = 46.2$; $SD = 7.1$), including 4 women and 3 men. The professional experience of experts ranged from 10 to 28 years. The criteria for the inclusion of experts were a Candidate of Sciences or Doctor of Sciences degree; at least 10 years' experience in the field of education management; and experience of teaching at a higher education institution. The exclusion criteria were lack of managerial experience or participation in the training of applicants. Experts evaluated each task on a five-point scale (from 1 to 5 points). Statistical processing of the results was carried out using the SPSS Statistics package (IBM SPSS Statistics, n.d.). The arithmetic mean (M), standard deviation (SD), and Student's t -test for independent samples were used to analyse the data. Differences at the level $p < 0.05$ were considered statistically significant. Based on the conducted research, a modelling method was applied, which allowed developing a system of educational and professional scenarios for training future education managers with the integration of artificial intelligence technologies. A limitation of the study is that it was conducted at higher education institutions in Ukraine and involved only a sample of Master's degree candidates specialising in "Educational Management", which may limit the generalisability of the results to other levels of education, other specialists, and broader international educational contexts.

■ Results

The use of artificial intelligence technologies and services in the professional training of managers in the field of education is considered as a systematic process of integrating digital tools into the content, methods, and organisational forms of training, aimed at forming analytical, managerial, and innovative competence among future managers of educational institutions. Artificial intelligence in this context performs the function of a decision support tool that provides processing of large amounts of educational data, modelling management situations, forecasting the results of the educational process, and optimising organisational strategies for the development of educational institutions (Bankins *et al.*, 2024).

International experience shows the gradual introduction of artificial intelligence technologies in the

professional training of future education managers through specialised programmes for the development of educational leadership and digital management. One of the most developed examples is the United States, where the University of Pennsylvania Graduate School of Education implements the Pioneering AI in School Systems (PASS) programme, aimed at school principals and educational administrators. As part of the programme, students learn to use generative artificial intelligence to analyse educational data, predict learning outcomes, develop management strategies, and form policies for using AI in educational institutions (University of Pennsylvania Graduate School of Education, 2024). Additionally, Moravian University has an AI Leadership Lab, where future educational leaders master the practical use of ChatGPT and other AI services for preparing reports, strategic planning, analysing the effectiveness of educational programmes, and supporting management decision-making processes (Moravian University, n.d.). In Singapore, managers are trained to work in a digital transformation environment through the Leading an AI-Powered Future programme developed by the Lee Kuan Yew School of Public Policy. Training involves analysing real-world management cases, using artificial intelligence tools to assess risks, processing large amounts of data, and developing organisational development strategies. Considerable attention was paid to the development of data-based decision-making skills, innovation management, and ethical aspects of using AI in educational institutions. This approach is aimed at training managers who are able to work effectively in the face of rapid technological change (Lee Kuan Yew School of Public Policy, n.d.).

In Finland, an example of the development of AI competencies is the international educational initiative Elements of AI, created by the University of Helsinki and Reaktor (WIRED, 2019). Although the programme is aimed at a wide audience, it is actively used for training management personnel and educational workers. The course covers the basics of artificial intelligence, the principles of algorithms, ethics, data analysis, and decision-making. For future education managers, it is particularly valuable to develop the ability to assess the opportunities and risks of using AI, organise digital transformation of the educational environment, and implement management based on analytical data. In South Korea, the development of competencies in the field of artificial intelligence is supported through the activities of specialised leadership training centres, in particular, the AI Leadership Centre. The training is aimed at developing skills in managing organisational change, using decision support systems, and implementing AI technologies in the activities of institutions. Participants work with practical cases related to digital transformation of organisations, data analysis, performance forecasting, and development strategies (Sentry

Magazine, 2026). This approach allows future managers to master artificial intelligence tools not only as users of technologies, but also as managers responsible for their effective and safe implementation in the educational environment.

The international experience of implementing artificial intelligence technologies in the professional training of educational managers indicates the transition to a new paradigm of management education based on the data-driven approach, digital analytics, and the use of generative AI tools to support decision-making. In the leading countries (USA, Singapore, Finland, South Korea), the training of heads of educational institutions focuses on the development of practical competencies in the field of educational data analysis, strategic planning, change management, and digital transformation of educational organisations. Common characteristics of certain programmes are the use of real management cases, the integration of AI services into educational tasks, the emphasis on the ethical use of technologies, and the development of decision-making abilities in conditions of digital uncertainty. The use of artificial intelligence is considered not as a separate technological skill, but as a tool for improving the efficiency of management activities, providing analytical support, forecasting educational results, and optimising organisational processes. The results obtained confirm the

expediency of integrating AI-oriented scenarios into the system of professional training of future education managers and the need to develop a comprehensive digital, analytical, and innovative competence as a key condition for the effective functioning of contemporary educational systems.

Artificial intelligence technologies in education are considered in scientific sources as tools for expanding managerial, analytical, and cognitive capabilities of a person, providing automation of data processing, decision support, and improving the efficiency of organisational management. The study by F. Miao *et al.* (2021) highlighted that AI in education contributes to the transition to data-driven approaches in managing and personalising educational processes, while requiring compliance with ethical principles and transparency in the use of algorithms. In particular, the OECD (Organisation for Economic Co-operation and Development) (n.d.) report on digital transformation of Education noted that the use of AI and Big Data Analytics allows educational managers to improve the quality of decision-making, predict learning outcomes, and optimise management processes in educational organisations. Table 1 provides a comparative analysis of digital platforms and artificial intelligence services used in the professional training of education managers by key functional, pedagogical, integration, and analytical characteristics.

Table 1. Comparative analysis of digital platforms and artificial intelligence services used in the professional training of education managers

AI platform/ service	Functional versatility	Pedagogical and managerial potential	Integration capabilities	Convenience of the interface	Data analytics and automation	Language/ cultural adaptability	Safety and ethical standards	Availability and scalability
ChatGPT (OpenAI)	Text generation, information analysis, solution support, content creation	Management decision support, strategic planning, scenario modelling	API-integration with external systems, use in LMS via third-party services	Intuitive interaction through the dialogue interface	Processing of text data, generalisation of information, development of analytical conclusions	Support for multilingualism, adaptation to different educational contexts	Content security policies, filtering of sensitive data	Use via the web and API, scaling depending on needs
Microsoft Copilot	Document generation, automation of office processes, working with spreadsheets and presentations	Support for management reporting, analysis of educational data, activity planning	Deep integration with Microsoft 365, Teams, Power BI	Interface within office applications	Automated data analysis in Excel, generating reports and dashboards	Support for the Microsoft multilingual environment	Corporate data protection standards, access control	Use in educational and corporate environments
Google Gemini	Text generation, data analysis, search support	Analysis of educational processes, preparation of management materials	Integration with Google Workspace, Classroom	Work through the web interface and Google services	Processing of structured and unstructured data	Support for multilingualism and global educational contexts	Google security policies, user data control	Use in Google's educational ecosystems
Claude (Anthropic)	Text generation, analytical generalisation, working with large documents	Support of analytical thinking, preparation of management documents	API integration with individual services	Simple text interface	Analysis of text arrays, information structuring	Support for multilingualism with an emphasis on the English-language context	Increased ethical restrictions in content generation	Use via cloud services

Table 1. Continued

AI platform/service	Functional versatility	Pedagogical and managerial potential	Integration capabilities	Convenience of the interface	Data analytics and automation	Language/cultural adaptability	Safety and ethical standards	Availability and scalability
Notion AI	Creation and organisation of texts, knowledge management, and planning	Support for the organisation of educational management, documentation of processes	Integration with workspaces and external services	Work in a single work environment	Information structuring, basic content analytics	Support for multilingual content	Standard privacy policies	Use in team and individual projects
Grammarly GO	Text editing, generation of communication materials	Support of professional communication in education management	Integration with browsers and office applications	Built-in hints in text editors	Analysis of speech errors, improvement of text structure	Adapting to English and multilingual writing	Personal data protection policies	Widespread use in digital communication
Canva AI	Creation of visual content, presentations, and infographics	Support for visualisation of management and educational data	Integration with LMS, social platforms	Visual drag-and-drop interface	Visual representation of data, infographics	Support for multilingual content	Content security policies	Mass use in education
Microsoft 365 Copilot for Education	Document automation, analytics, and creation of training materials	Support for the management of educational institutions, data analysis, planning	Full integration with the Microsoft Education ecosystem	Interface in a familiar office environment	Educational data analytics, reporting automation	Support for multilingual educational environments	Educational standards of security and administration	Use in large-scale educational systems

Note: API – Application Programming Interface

Source: compiled by the author based on the analysis of ChatGPT (n.d.), Microsoft Copilot (n.d.), Google Gemini (n.d.), Claude (n.d.), Notion AI (n.d.), GrammarlyGO (n.d.), Canva AI (n.d.), Microsoft 365 Copilot for Education (n.d.)

A comparative analysis has shown that the AI platforms under consideration form a comprehensive digital ecosystem for the professional training of education managers, within which not only is technological support provided for the educational process, but also a profound transformation of the managerial mindset and professional behaviour of future leaders takes place. The author's interpretation of the results indicates that generative models contribute to the transition from reproductive assimilation of managerial knowledge to their analytical and predictive application, ensuring the development of a strategic vision, the ability to model managerial decisions, and critical work with educational data. Simultaneously, integrated digital solutions contribute to streamlining management processes, increasing their transparency and efficiency, which leads to a transition to a more structured, data-driven approach in educational management.

Communication and organisational tools strengthen coordination, efficiency of decision-making and

quality of professional interaction, forming a new culture of digital leadership in education. In general, the use of these technologies in the professional training of future education managers ensures the development of integrated digital, analytical, and innovative competence necessary for effective management of educational organisations in the context of digital transformation. A pedagogical experiment was conducted to test the effectiveness of the system using artificial intelligence technologies and services. At the beginning and after the completion of the formative stage, an assessment of the development of professional competence of future education managers in a set of practical tasks was carried out. The obtained results of the control and experimental groups determined the dynamics of changes in the studied indicators and evaluated the effectiveness of the proposed training system. The results of the experiment are presented in Table 2.

Table 2. Results of expert assessment of the development of professional competence of future education managers

Tasks	CG before	M ± SD	CG after	M ± SD	EG before	M ± SD	EG after	M ± SD
1. Analyse the activities of the educational institution and identify the main management problems	1-12%, 2-26%, 3-34%, 4-20%, 5-8%	2.86 ± 1.05	1-6%, 2-18%, 3-36%, 4-28%, 5-12%	3.22 ± 1.01	1-10%, 2-28%, 3-33%, 4-21%, 5-8%	2.89 ± 1.04	1-2%, 2-8%, 3-20%, 4-38%, 5-32%	3.90 ± 0.92
2. Prepare a strategic plan for the development of the educational institution for three years	1-14%, 2-24%, 3-32%, 4-20%, 5-10%	2.88 ± 1.09	1-8%, 2-18%, 3-34%, 4-28%, 5-12%	3.18 ± 1.03	1-12%, 2-27%, 3-31%, 4-20%, 5-10%	2.90 ± 1.06	1-3%, 2-10%, 3-22%, 4-40%, 5-25%	3.74 ± 0.95

Table 2. Continued

Tasks	CG before	M ± SD	CG after	M ± SD	EG before	M ± SD	EG after	M ± SD
3. Develop a draft order on the introduction of educational innovation	1-11%, 2-25%, 3-35%, 4-20%, 5-9%	2.90 ± 1.02	1-7%, 2-17%, 3-36%, 4-29%, 5-11%	3.20 ± 1.00	1-13%, 2-26%, 3-32%, 4-20%, 5-9%	2.87 ± 1.05	1-2%, 2-9%, 3-18%, 4-41%, 5-30%	3.88 ± 0.91
4. Create an analytical report based on the results of monitoring the quality of education	1-15%, 2-23%, 3-33%, 4-20%, 5-9%	2.83 ± 1.07	1-8%, 2-19%, 3-34%, 4-27%, 5-12%	3.17 ± 1.02	1-12%, 2-28%, 3-30%, 4-21%, 5-9%	2.86 ± 1.05	1-3%, 2-8%, 3-19%, 4-39%, 5-31%	3.85 ± 0.93
5. Develop a plan for the internal quality assurance system of education	1-13%, 2-24%, 3-34%, 4-21%, 5-8%	2.85 ± 1.06	1-7%, 2-18%, 3-35%, 4-28%, 5-12%	3.19 ± 1.02	1-11%, 2-27%, 3-33%, 4-20%, 5-9%	2.88 ± 1.04	1-2%, 2-7%, 3-17%, 4-42%, 5-32%	3.92 ± 0.90
6. Prepare an information letter for the teaching staff on the implementation of changes	1-12%, 2-25%, 3-33%, 4-20%, 5-10%	2.88 ± 1.06	1-6%, 2-18%, 3-34%, 4-28%, 5-14%	3.25 ± 1.00	1-11%, 2-26%, 3-32%, 4-21%, 5-10%	2.90 ± 1.04	1-2%, 2-7%, 3-18%, 4-40%, 5-33%	3.92 ± 0.90
7. Conduct a SWOT analysis of the educational institution's activities	1-14%, 2-24%, 3-32%, 4-20%, 5-10%	2.86 ± 1.08	1-8%, 2-18%, 3-34%, 4-28%, 5-12%	3.20 ± 1.02	1-12%, 2-27%, 3-31%, 4-20%, 5-10%	2.89 ± 1.05	1-3%, 2-9%, 3-20%, 4-40%, 5-28%	3.76 ± 0.94
8. Develop a professional development plan for teachers	1-13%, 2-26%, 3-33%, 4-20%, 5-8%	2.83 ± 1.07	1-7%, 2-19%, 3-34%, 4-28%, 5-12%	3.18 ± 1.03	1-11%, 2-28%, 3-32%, 4-20%, 5-9%	2.87 ± 1.05	1-2%, 2-8%, 3-18%, 4-42%, 5-30%	3.88 ± 0.91
9. Prepare a draft decision of the pedagogical council	1-15%, 2-23%, 3-33%, 4-20%, 5-9%	2.82 ± 1.09	1-8%, 2-18%, 3-34%, 4-28%, 5-12%	3.16 ± 1.03	1-13%, 2-26%, 3-31%, 4-20%, 5-10%	2.88 ± 1.06	1-3%, 2-9%, 3-19%, 4-39%, 5-30%	3.85 ± 0.93
10. Develop an algorithm for responding to a crisis management situation	1-14%, 2-25%, 3-32%, 4-20%, 5-9%	2.84 ± 1.08	1-7%, 2-18%, 3-34%, 4-28%, 5-13%	3.21 ± 1.02	1-12%, 2-27%, 3-31%, 4-20%, 5-10%	2.90 ± 1.05	1-2%, 2-8%, 3-17%, 4-41%, 5-32%	3.90 ± 0.90
11. Prepare a draft budget for the educational project	1-15%, 2-24%, 3-32%, 4-20%, 5-9%	2.81 ± 1.09	1-8%, 2-18%, 3-33%, 4-28%, 5-13%	3.18 ± 1.03	1-13%, 2-26%, 3-31%, 4-20%, 5-10%	2.87 ± 1.06	1-3%, 2-8%, 3-18%, 4-41%, 5-30%	3.86 ± 0.92
12. Create a digital transformation plan for an educational institution	1-14%, 2-25%, 3-33%, 4-20%, 5-8%	2.83 ± 1.08	1-7%, 2-19%, 3-34%, 4-28%, 5-12%	3.19 ± 1.02	1-12%, 2-27%, 3-31%, 4-20%, 5-10%	2.89 ± 1.05	1-2%, 2-7%, 3-17%, 4-42%, 5-32%	3.93 ± 0.90
13. Develop a system of performance evaluation indicators	1-13%, 2-26%, 3-33%, 4-20%, 5-8%	2.82 ± 1.07	1-7%, 2-18%, 3-35%, 4-28%, 5-12%	3.20 ± 1.02	1-11%, 2-28%, 3-32%, 4-20%, 5-9%	2.88 ± 1.05	1-2%, 2-8%, 3-18%, 4-41%, 5-31%	3.89 ± 0.91
14. Prepare a presentation of the research results	1-12%, 2-24%, 3-34%, 4-20%, 5-10%	2.86 ± 1.06	1-6%, 2-17%, 3-35%, 4-29%, 5-13%	3.23 ± 1.01	1-10%, 2-27%, 3-33%, 4-21%, 5-9%	2.91 ± 1.04	1-2%, 2-7%, 3-16%, 4-43%, 5-32%	3.94 ± 0.89
15. Set of measures for competitiveness	1-15%, 2-23%, 3-33%, 4-20%, 5-9%	2.80 ± 1.10	1-8%, 2-18%, 3-34%, 4-28%, 5-12%	3.17 ± 1.03	1-13%, 2-26%, 3-31%, 4-20%, 5-10%	2.86 ± 1.06	1-3%, 2-8%, 3-17%, 4-42%, 5-30%	3.88 ± 0.92

Source: compiled by the author based on the conducted research

The results of the pedagogical experiment showed the positive dynamics of the development of professional competence of future education managers in both groups, but the intensity of changes significantly differed,

which is conditioned by the different level of integration of technological and activity components of training. In the control group, a slight increase in indicators (from $M \approx 2.8-2.9$ to $M \approx 3.1-3.2$) is explained by the predominance of conventional teaching methods focused on reproductive assimilation of managerial knowledge without systematically involving students in data analysis, modelling of managerial situations, and digital decision support.

In the experimental group, a significant increase in results to the level of $M \approx 3.8-3.9$ is conditioned by the complex action of the proposed training system, the key components of which were practice-oriented training, work with real management cases, analysis of educational data, development of digital literacy, and regular performance of tasks that model the activities of the head of an educational institution in the context of digital transformation. The greatest influence on the results obtained was precisely the analytical and practical component (working with data and management situations), the reflexive and evaluation component (analysing their own management decisions and errors), and the technological and instrumental component (using digital

tools to support decision-making), which ensured the transition from theoretical assimilation of the material to its applied use. Statistical analysis using the Student's t-test for independent samples confirmed the reliability of differences between the indicators of the control and experimental groups after the formative stage ($t = 4.2-5.6$; $p < 0.05$), which indicates a statistically significant effect of the implemented system and its impact on the development of managerial and digital competencies.

Educational and professional scenarios ensure the development of comprehensive digital, analytical, and managerial competence of future education managers, contribute to the development of the ability to make informed decisions based on data, effective use of artificial intelligence technologies in the strategic and operational management of educational institutions, and increase readiness for innovation and digital transformation of educational systems. Table 3 presents a generalised system of educational and professional scenarios for training future education managers with the integration of artificial intelligence technologies, developed based on international experience in the USA, Singapore, Finland, and South Korea.

Table 3. Educational and professional scenarios for training future education managers with the integration of artificial intelligence technologies (based on international experience)

Preparation scenario	International practice / international example	AI platforms and tools	Content of educational and professional activities	Developed competencies
Analysis of educational data and forecasting of results	University of Pennsylvania Graduate School of Education (PASS, USA)	ChatGPT (OpenAI), Microsoft Copilot, Google Gemini	Analysis of large amounts of educational data, forecasting of educational results, modelling of management decisions	Analytical competence, data-driven thinking, management forecasting
Strategic management and decision-making	Moravian University AI Leadership Lab (USA)	ChatGPT, Claude (Anthropic), Microsoft 365 Copilot	Preparation of strategic plans for the development of an educational institution, creation of management reports, decision support	Strategic thinking, managerial competence, digital leadership
Digital transformation of educational systems	Leading an AI-Powered Future (Singapore)	Microsoft Copilot, Google Gemini, ChatGPT	Modelling of digital educational policies, risk assessment, innovation change management	Innovative competence, system management, digital transformational capacity
AI-literacy and critical thinking in education	Elements of AI (University of Helsinki, Finland)	ChatGPT, GrammarlyGO, Claude	Mastering the principles of AI, ethical analysis of the use of algorithms, risk and opportunity assessment	AI-literacy, critical thinking, ethical competence
Change management and educational innovation	AI Leadership Centre (South Korea)	Microsoft 365 Copilot for Education, Canva AI, Notion AI	Management of educational changes, development of innovative solutions, support of organisational development	Innovation management, organisational competence, project thinking

Source: compiled by the author based on the analysis of University of Pennsylvania Graduate School of Education (2024), Moravian University (n.d.), Lee Kuan Yew School of Public Policy (n.d.), WIRED (2019), Sentry Magazine (2026), ChatGPT (n.d.), Microsoft Copilot (n.d.), Google Gemini (n.d.), Claude (n.d.), Notion AI (n.d.), GrammarlyGO (n.d.), Canva AI (n.d.), Microsoft 365 Copilot for Education (n.d.)

Ukraine could adapt the international scenarios outlined above for training future education managers by integrating AI-focused modules into professional development programmes for heads of educational institutions and into master's programmes in educational management. In particular, the educational data analytics scenario can be implemented using ChatGPT (n.d.) platforms, Microsoft Copilot (n.d.), and Google Gemini (n.d.) to train managers to work with large amounts

of educational statistics, monitor the quality of education, and predict students' learning outcomes. This will allow switching to data-driven management of schools and universities, which is necessary in the context of digital transformation of the Ukrainian educational system. Scenarios of strategic management, digital transformation, and AI literacy can be implemented through the creation of national laboratories of educational leadership, similar to international models,

where future education managers will work with real cases, digital simulations. Adaptation of international scenarios for training education managers in Ukraine involves the integration of AI-oriented training modules into master's programmes and advanced training systems, which will contribute to the development of skills in educational data analytics, strategic planning, and quality management of education, and ensure the development of a contemporary model of data-driven educational management in the context of digital transformation. It is advisable to focus on the ethical use of artificial intelligence, the development of critical thinking and change management in conditions of uncertainty, which will ensure the development of a comprehensive digital, analytical and innovative competence of education leaders who can effectively implement AI solutions in Ukrainian educational institutions.

■ Discussion

Artificial intelligence technologies and services have taken a significant place in the professional training of managers in the field of education and contributed to the development of competencies necessary for management activities in a digital educational environment, improving the efficiency of information processing, supporting managerial decision-making, expanding opportunities for personalisation of training, and the development of strategic planning skills, providing a combination of theoretical knowledge with practical digital skills. The results obtained were consistent with the conclusions of F. Aslam (2023), who revealed the potential of intelligent chatbots to support learning activities and automate communication processes.

The identified effectiveness of using generative services in the training of education managers confirms their ability to provide quick access to information, advice, and support for the educational process, which is reflected in the high average indicators of the development of relevant competencies ($M \approx 3.8-3.9$). This indicates that the integration of such tools contributes to improving the quality of management training, developing digital and analytical skills, and making educational decisions quickly. The results coincided with the provisions of M. Bassey & E. Owushi (2023), who analysed the advantages and difficulties of implementing artificial intelligence in the library and information sphere. The established advantages of using intelligent systems in the professional training of education managers are accompanied by an awareness of the need to overcome organisational and technological barriers. The study showed that the use of artificial intelligence contributes to improving the quality of management training by optimising data analysis and decision-making processes. The results obtained were consistent with the reasoning of J. Berg *et al.* (2023), who proved that artificial intelligence creates new opportunities for generating value through more efficient use of information

resources. The identified advantages of digital tools confirm their ability to support the activities of future heads of educational institutions.

Comparative analysis showed that generative AI models (ChatGPT, Google Gemini, Claude) provide analytical support and modelling of solutions, while integrated systems (Microsoft Copilot, Microsoft 365 Copilot for Education) automate management processes, and services (Notion AI, GrammarlyGO, Canva AI) contribute to the organisation and visualisation of educational data. Artificial intelligence services allow adapting the educational process to the individual needs of educational applicants, providing flexible trajectories of professional development. Such conclusions were consistent with the results of the study by Z. Chen (2022), who introduced the concept of a virtual trainer for personalised training. The obtained data confirm the effectiveness of individualisation of the educational process using intelligent technologies. Similar trends were observed in the study by M.R. Bilad *et al.* (2023), who described the current areas of using artificial intelligence tools in education. The data confirmed that generative services, analytical platforms, and intelligent training support systems expand the opportunities for professional training of future education managers and contribute to improving the effectiveness of the educational process.

The established increase in the level of involvement of educational applicants and the improvement of educational outcomes was consistent with the conclusions of C. Davis *et al.* (2024). The study proved that adaptive mechanisms of artificial intelligence provide a personalised learning experience. The use of intelligent services contributes to greater motivation to master management disciplines and develop professional competencies. The study showed that the training of education managers requires the development of skills in working with digital data and understanding the principles of managing educational processes using intelligent technologies. Such results correlate with the results of F. Filgueiras (2023), who examined the impact of artificial intelligence on educational management. The identified need for the development of managerial competencies confirms the relevance of training specialists to work in the context of digital transformation of education. The results were consistent with the study by B. George & O. Wooden (2023), dedicated to the strategic transformation of higher education institutions using artificial intelligence. The established advantages of using intelligent technologies for management activities confirm their role as a tool for improving the effectiveness of strategic planning and organisational development.

International experience has shown that in the USA, Singapore, Finland, and South Korea, the training of education managers is based on the use of artificial intelligence for data analytics, strategic planning, and

support of management decisions, which forms a data-driven approach and digital readiness of educational leaders. Generative artificial intelligence has become an effective tool for creating educational materials, preparing analytical reports, and supporting educational communications. These conclusions were consistent with the results of M. Liu *et al.* (2023), who reached a scientific consensus on the prospects for using ChatGPT in the educational sphere. The data obtained confirmed the potential of generative models for improving educational activities and professional training.

The effectiveness of using artificial intelligence depends on the level of digital readiness of users. This conclusion was consistent with the results of D. Mah & N. Groß (2024), who examined teachers' self-assessment of the use of smart technologies and the need for professional development. The data obtained confirm the need for systematic improvement of digital competencies of all participants in the educational process. Future education managers need knowledge about implementing innovative technologies in the professional environment. Experimental results confirmed the effectiveness of AI-oriented training, since in the experimental group the indicators of professional competence increased from $M \approx 2.87-2.90$ to $M = 3.85-3.94$ ($SD \approx 0.89-0.93$), while in the control group the changes were less pronounced – from $M \approx 2.80-2.88$ to $M = 3.16-3.25$ ($SD \approx 1.00-1.03$), which showed the superiority of the innovative training model. Statistical analysis using the Student's t-test ($t = 4.2-5.6$; $p < 0.05$) confirmed the significance of the differences obtained between the groups, which indicates the influence of artificial intelligence technologies on the development of managerial and digital competencies. Similar conclusions were presented by J. Menzies *et al.* (2024), who described the opportunities and challenges of using artificial intelligence in international business.

The study found that the effective use of artificial intelligence requires compliance with ethical principles. It was established that the integration of artificial intelligence into the educational process contributes to the transition to the data-driven model of education management and improves the quality of training of future managers. The results obtained were consistent with conclusions of A. Mouta *et al.* (2023), who proposed a toolkit for the ethical implementation of artificial intelligence in education. The identified need to ensure transparency, responsibility and control over the use of digital systems confirms the relevance of the ethical dimension of training educational managers. Similar results were demonstrated by S. Narayanan *et al.* (2023), who examined the transformation of medical education under the influence of artificial intelligence.

The identified advantages of automation, personalisation, and data analysis coincide with the results of training education managers, which indicates the universality of the capabilities of intelligent technologies

in various fields of professional education. Thus, the problem of ethical use of digital tools has become important. The results obtained were consistent with the study by A. Nguyen *et al.* (2022), who outlined ethical standards for the use of artificial intelligence in education. The identified need to ensure data confidentiality, the fairness of algorithms, and responsible use of information confirms the relevance of ethical training of future heads of educational institutions. The results also demonstrated the feasibility of forming specialised knowledge about the use of artificial intelligence in professional training. Such conclusions were consistent with the results of W. Park & H. Kwon (2023), who substantiated the need for systematic implementation of education in the field of artificial intelligence. The identified need for the development of digital literacy and algorithmic thinking confirms the prospects of relevant educational programmes.

It was proved that the use of AI technologies provides a comprehensive development of analytical, managerial, and innovative competence, since it allows combining the processing of large amounts of data with modelling of management situations and forecasting results. It was confirmed that educational and professional scenarios with AI integration are an effective tool for developing practical management skills and digital literacy. Such conclusions coincided with the results of M. Sposato (2024), who investigated the specifics of training leaders in the era of artificial intelligence. The established need to combine technological knowledge with strategic management skills confirmed the relevance of updating the content of professional training. The results obtained were consistent with the study by X. Yu *et al.* (2023), dedicated to the use of artificial intelligence in music education. The data obtained confirmed that, regardless of the educational field, intelligent technologies contribute to the personalisation of learning, support for creative activities and improve educational practices. It was established that a positive attitude to the use of artificial intelligence contributes to more effective implementation of digital innovations. This conclusion was consistent with the results of D. Uygun (2024), who examined the views of educators on the use of artificial intelligence in education. The data obtained confirmed that readiness for technological changes is becoming one of the factors for successful integration of intelligent services into professional activities. In particular, the area of analysis is the issue of responsible use of intelligent systems. The results were consistent with the conclusions of G. Uunona & L. Goosen (2023), who developed guidelines for compliance with ethical standards when using artificial intelligence in training.

The identified need for the development of digital responsibility and critical assessment of the results of algorithms confirms the need to include such components in training programmes for education managers.

The results obtained confirm the effectiveness of using artificial intelligence to support educational activities, create educational content, and improve professional competencies. Such conclusions were consistent with the findings of Y. Wang (2023), who demonstrated the capabilities of intelligent technologies when teaching translation. The identified advantages of automated information analysis and training support confirmed a wide range of artificial intelligence capabilities in educational practice. The results showed that the use of artificial intelligence in the training of future education managers contributes to the development of leadership and managerial competencies, improving the effectiveness of educational activities, supporting personalised learning and forming a positive attitude to digital innovations. Simultaneously, the need to integrate ethical principles and develop digital responsibility as mandatory components of professional training in the context of expanding the use of intellectual technologies was confirmed.

■ Conclusions

International experience has shown that the integration of artificial intelligence technologies into the professional training of education managers is developing as an integral system for developing educational leadership. In the United States, Singapore, Finland, and South Korea, training of education managers is based on the use of AI as a tool for data analytics, strategic planning, forecasting educational results, and modelling management decisions. The educational programmes of these countries are focused on the development of a data-driven approach, digital literacy, and the ability to manage change, which ensures the development of competent managers ready to function in the context of digital transformation of education. A comparative analysis of digital artificial intelligence services has shown their systemic role in training future education managers. Generative models, such as ChatGPT, Google Gemini, and Claude, provide support for analytical thinking, creating management texts, and modelling decisions. The integrated Microsoft Copilot and Microsoft 365 Copilot for Education platforms are aimed at automating management processes, processing educational data, and generating reports. Notion AI, GrammarlyGO, and Canva AI tools provide information organisation, communication support, and visualisation of management processes, which together forms a comprehensive digital ecosystem of educational management.

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The results of the pedagogical experiment showed a statistically significant effectiveness of the implemented system. In the experimental group, the average indicators of professional competence development increased to the level of $M = 3.85-3.94$ ($SD \approx 0.89-0.93$), while in the control group they remained lower than $M = 3.16-3.25$ ($SD \approx 1.00-1.03$). The initial values in both groups were comparable ($M \approx 2.80-2.90$). The highest results were recorded in terms of presentation of research results ($M = 3.94$), digital transformation ($M = 3.93$), and data analysis ($M = 3.90$), which indicates the leading role of communication-presentation, digital-transformation, and analytical components in the development of professional competence of future education managers. In comparison, strategic planning ($M = 3.74$) showed slightly lower values, which indicates a relatively slower development of long-term managerial thinking compared to practically oriented digital and analytical skills. Statistical verification confirmed the significance of differences between the groups ($t = 4.2-5.6$; $p < 0.05$), which indicates the effectiveness of using AI technologies in the development of managerial and digital competencies.

The proposed scenarios for the introduction of artificial intelligence in the professional training of education managers provided for the integration of AI-oriented scenarios into educational programmes, the development of practice-oriented learning, and the creation of digital educational environments. The main focus is on building analytical, managerial, and innovation competence through the use of AI for decision-making, forecasting, and change management. This ensures the transition to a contemporary model of data-driven education management and increases the effectiveness of training future heads of educational institutions. Prospects for further research lie in the development of adaptive models of AI-integrated learning considering educational contexts and levels of digital maturity of educational systems.

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Застосування технологій і сервісів штучного інтелекту у професійній підготовці менеджерів у галузі освіти

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■ **Анотація.** Мета полягала в оцінюванні можливостей використання технологій штучного інтелекту в професійній підготовці майбутніх менеджерів. Методологія включала системно-структурний аналіз, порівняльний аналіз та експериментальне дослідження, метод моделювання навчально-професійних сценаріїв, яке було проведено на базі чотирьох закладів вищої освіти України із залученням 120 здобувачів другого (магістерського) рівня освіти. Результати підтвердили ефективність інтеграції технологій штучного інтелекту у професійну підготовку майбутніх менеджерів освіти. Міжнародний аналіз показав, що у Сполучених Штатах Америки, Сінгапурі, Фінляндії та Південній Кореї штучний інтелект використовується як інструмент аналітики освітніх даних, стратегічного планування та прийняття управлінських рішень, що забезпечує розвиток data-driven підходу в освітньому менеджменті. Порівняльний аналіз цифрових платформ засвідчив, що генеративні моделі сприяють аналітичній підтримці та моделюванню рішень, інтегровані системи автоматизують управлінські процеси, а сервіси забезпечують організацію, комунікацію та візуалізацію освітніх даних. Показано, що в експериментальній групі рівень професійної компетентності зріс із $M \approx 2,87-2,90$ до $M = 3,85-3,94$ ($SD \approx 0,89-0,93$), тоді як у контрольній групі підвищення було незначним і становило $M \approx 2,80-2,88$ до $M = 3,16-3,25$ ($SD \approx 1,00-1,03$). Найвище значення мав показник презентації результатів дослідження ($M = 3,94$), дещо нижчим є рівень цифрової трансформації ($M = 3,93$), що свідчить про високий розвиток комунікативно-цифрових умінь у респондентів. Показник стратегічного планування ($M = 3,74$) не належить до найвищих значень, що вказує на відносно слабку сформованість довгострокового управлінського мислення порівняно з практико-орієнтованими цифровими компетентностями. Дані довели, що використання технологій штучного інтелекту підвищує рівень управлінської, аналітичної та цифрової компетентності майбутніх менеджерів освіти

■ **Ключові слова:** цифрові інструменти; аналітика даних; персоналізація навчання; навчально-професійні сценарії; етичні стандарти