(Online) ISSN 2303-4521
Periodicals of Engineering and Natural Sciences *Original Research*
Vol. 13, No. 1, March 25, pp.55-68

Adaptation of the educational process in Ukraine to artificial intelligence technologies: A systematic review

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ABSTRACT

Artificial intelligence (AI) is crucial in transforming the modern educational system. This article analyses the key processes involved in adapting Ukraine's educational system to AI technologies through a systematic review. To achieve this aim, PRISMA guidelines were employed, enabling the identification of the most relevant literature on the subject. The selected academic sources were analyzed using the content analysis method. The findings highlight that the primary objectives of AI integration in education include facilitating personalized learning, enhancing digital skills, automating tasks, influencing motivation, fostering self-regulation and reflection, and improving the analysis of educational data. These objectives support personalized educational programs, the exploration of new digital technologies, critical thinking, and the automated processing of organizational information within education. However, several obstacles have been identified, such as insufficient funding, a shortage of qualified personnel, infrastructure challenges, the lack of legal frameworks regulating AI usage, issues with data accessibility, risks associated with automation, and related ethical concerns. Addressing these challenges will require comprehensive solutions, including increased investment in education and scientific infrastructure, legislative changes, continued incentives for innovation, and educational outreach efforts. The conclusions emphasize the importance of preparing teaching and technical staff to respond to the educational environment's evolving demands adequately.

Keywords: Digitalization, Artificial intelligence, Integration, Challenges, Educational environments, Ukraine

1. Introduction

Artificial intelligence (AI) has become crucial in transforming contemporary educational systems. In today's academic landscape, digital tools play a significant role in learning, highlighting the importance of adapting educational systems to evolving technological conditions. Consequently, integrating AI into education is a timely and pressing subject, mainly when analyzed in the context of global changes within the digital society [1], [2]. This issue holds particular importance as traditional approaches to education no longer align with the rapid technological advancements and the current labor market demands. At the same time, implementing AI creates new opportunities, such as personalized learning, the automation of administrative tasks, and enhanced access to high-quality digital education. Previous studies in this domain have underscored the significant potential of AI in reshaping the educational process. For instance, it has been demonstrated that using intelligent platforms and adaptive learning systems significantly improves the quality of education [2], [3].

However, most contemporary research focuses on global cases, often overlooking the specific challenges and opportunities within the Ukrainian education system. Ukraine's educational processes are adapting to new circumstances in light of the ongoing military conflict. The primary goal of these transformations is to establish

a high-quality, innovative environment where students can develop essential competencies for thriving in the modern world. Simultaneously, researchers would gain access to the necessary resources and opportunities to conduct scientific studies that contribute to the nation's overall innovative development. Thus, the digital transformation of education emerges as a pivotal tool in reshaping Ukraine's educational processes. This highlights the role of AI as one of the critical factors for the innovative advancement of the Ukrainian education system.

The integration of AI into Ukraine's educational process merits further exploration. Firstly, it offers a means to bridge the gap between contemporary societal needs and outdated teaching methods. Secondly, AI has the potential to address specific challenges, such as inequitable access to quality education. Students and educators often spend significant time searching for vital information within various digital systems, which does not always yield optimal results. Therefore, there is a clear need to automate information-gathering processes and develop databases within informational systems that facilitate convenient access to information for all users, including students and educators. This will also support the creation of personalized learning trajectories. Given the vast volumes of data such digital systems process, achieving these objectives is only feasible through AI.

This research also addresses complex, contentious issues related to AI usage. Particular attention should be paid to ethical concerns, the protection of personal data for all participants in the learning process, challenges in implementing automated assessment systems, and the evolving role of educators amidst the automation of education. This analytical review highlights diverse perspectives, ensuring a balanced approach to the subject and avoiding one-sided discussions. The primary focus of the research will be on the conditions necessary for adapting Ukraine's educational process to AI technologies, examined through the lens of various scholarly viewpoints.

The issue of introducing innovative technologies into the Ukrainian education system has recently gained increased attention. This trend is driven by the search for effective methods and technologies that can be utilized during wartime. In the study by Bakhmat *et al.*, the experiences of Ukraine and other countries facing armed aggression in implementing e-learning have been analyzed [4]. Borzenko *et al.* highlighted the role of information technologies in the contemporary educational system, demonstrating the feasibility of integrating innovative methods and forms of interaction into the academic environment [5]. At the same time, Borysiuk *et al.* identified key alternative approaches to optimizing practical training [6].

The issue of incorporating artificial intelligence (AI) technologies has also become a focus of modern researchers. Specifically, Abulibdeh *et al.* underscored the significance of these technologies in education management systems [7]. Adams and Chuah addressed the critical topic of using AI in drafting academic research papers [8]. Asgarov and Mustafayev emphasized the role of AI in optimizing numerous complex processes [9]. Berbets *et al.* examined the importance of neural networks and AI in fostering student creativity, focusing primarily on the Ukrainian education system [10]. Meanwhile, Bobro presented the experiences of EU and US countries in implementing AI in higher education systems [11].

Research has shown that applying AI in education significantly improves learning quality and teachers' work efficiency [12], [13]. For example, current AI systems can automatically analyze students' learning outcomes, identify key areas of weakness, and predict actionable recommendations for improvement [12], [14]. As highlighted in other studies, this allows an enhanced learning process and adaptation to the needs of each participant in the educational environment [15].

According to Khine [16] and Shuliar *et al.* [17], AI-based data analysis facilitates the creation of individual student profiles, enabling personalized educational trajectories and identifying specific topics that require additional focus. Furthermore, such technologies predict student success based on their current performance, grades, and participation in the learning process [18], [19]. Yuskovych-Zhukovska *et al.* characterized AI's primary capabilities and noted its utility in helping educators provide timely support to students facing difficulties [20].

The analysis of academic works has enabled the identification of practical components of modern educational programs, allowing for their optimization and adaptation to meet students' key needs [21], [22]. Recent studies have highlighted the importance of automated assessment, whereby AI performs automated grading and evaluation of key educational tasks [23], [24]. Consequently, scientific studies have demonstrated the pivotal role of computerized systems in assessing large volumes of work while ensuring an impartial (non-subjective) approach to evaluation.

Nevertheless, some issues remain unresolved despite the extensive exploration of various opportunities and directions for using AI in education. For instance, the challenges of integrating AI into the Ukrainian education system have been insufficiently studied. Simultaneously, AI is a relatively new technology for Ukrainian education, and the literature lacks insights into promising practical directions for implementing AI in Ukraine's educational realities. This study addresses these gaps and outlines the key effective strategies for adopting AI in the Ukrainian education system.

The primary objective of this study is to examine the main adaptive processes of the Ukrainian educational system to AI technologies through an analytical review. The key hypothesis suggests that the effective integration of AI into the Ukrainian educational system can significantly enhance its quality and competitiveness. Another hypothesis posits that the effectiveness of AI implementation in education largely depends on the readiness of educators to adopt these technologies and their motivation to explore new methodologies.

Within this study, the following objectives have been identified:

- To explore the main opportunities offered by AI;
- To identify the key challenges in adapting AI within the Ukrainian education system;
- To propose practical approaches for integrating AI usage.

The research questions include:

1. What are the opportunities and objectives for implementing AI in Ukrainian education?
2. What challenges exist in adopting AI technologies in Ukraine?
3. What practical strategies can be proposed for adapting AI usage?

2. Method

2.1. Research design

To present the current state of information on AI in modern Ukrainian education, a systematic review was conducted based on contemporary scientific literature. This analytical review involved identifying, searching, and integrating knowledge from various empirical and review studies. The review is essential to provide a comprehensive understanding of the use of AI in education, as certain aspects remain insufficiently explored in the current scientific discourse. The review adhered to the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) standards, selected due to its ability to incorporate a broad spectrum of educational journals.

The primary search used modern academic databases, including Web of Science and Scopus, alongside additional resources such as Google Scholar and ScienceDirect. These platforms offer extensive compilations of scholarly materials on the selected topic.

2.2. Searching strategy

The study utilized scholarly materials, including journal articles, book chapters, entire books, and conference proceedings. The sampling process adhered to clear inclusion criteria, focusing on:

- Relevance to the research problem: Artificial Intelligence in Ukrainian education.
- Language: English.
- Geographical scope: Studies related to Ukrainian or European education systems (in specific cases, general works on AI in education were included).
- Time frame: Research published between 2020 and 2024, with a few exceptions for significant works predating 2020, particularly those addressing technological aspects of AI implementation.

Table 1. Criteria for inclusion and exclusion of scientific sources

Inclusion criteria	Exclusion criteria
1 The study concerns the modern education system and the implementation of innovative technologies; the paper describes the challenges and opportunities for using digital tools.	The study does not concern the education system or describe the features of using modern, innovative educational technologies.
Cr. 2. The study indicates the possibilities of implementing AI in education and describes its capabilities.	The work does not indicate the possibilities of implementing AI in education; the possibilities of AI are not described.

Inclusion criteria	Exclusion criteria
Cr. 3. Geographic focus: Ukraine and Europe.	The study does not pay attention to the Ukrainian or European education system.
Cr. 4. Time range: from 2020-2024.	The works were published before 2020.
Cr. 5. Different types of research: empirical, theoretical, review, and mixed.	The study does not indicate the type of work, or it is difficult to identify due to the lack of methodology.

Source: Authors' development.

The PRISMA framework was the primary source selection, identification, and relevance verification tool. This approach was chosen because PRISMA facilitates the selection of the most appropriate sources based on predefined inclusion criteria.

Searches were conducted across modern databases, including Web of Science and Scopus, supplemented by platforms like Google Scholar and ScienceDirect. The following terms were used in database search fields:

- Education OR Learning OR Lifelong Learning.
- AND (Artificial Intelligence OR Automated Learning OR Machine Learning OR AI OR Deep Learning).
- AND (Ukraine OR Ukrainian Education System, EU).

These terms were entered into the specified search fields and applied as filters to documents containing them in their titles, abstracts, and/or keywords.

The search generated 6,785 articles. Titles were initially screened, and duplicates (856) were removed. Based on an analysis of abstracts and keywords, 1,123 items were excluded. Subsequently, the inclusion and exclusion criteria were applied (see Figure 1).

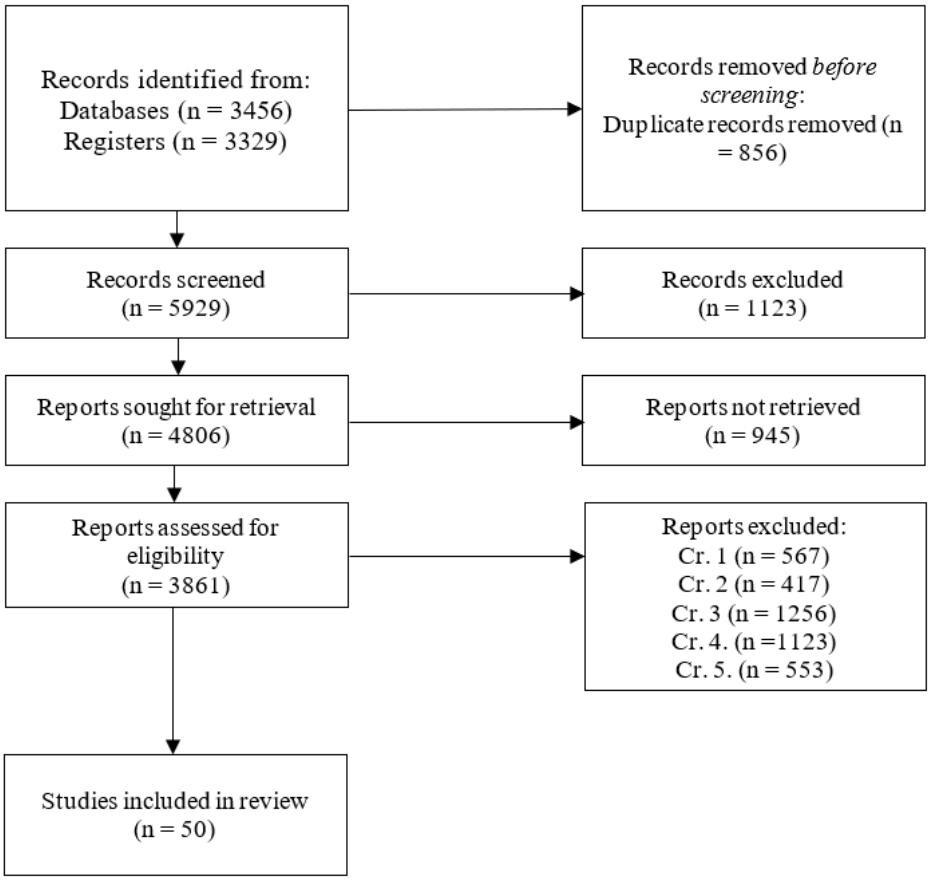

Figure 1. PRISMA flowchart (Source: Authors' development)

2.3. Data analysis

Key data for the study were obtained through data collection and coding for each of the 45 selected studies. The analysis was conducted using Google Sheets, which was chosen for its simplicity and ease of data entry. Information was categorized as follows:

- Author(s).
- Year of publication.
- Research objectives.
- Methods and tools.
- Results.
- Practical conclusions.

Another table provided a more contextual analysis, including:

- Author(s).
- Year of publication.
- Identified AI opportunities.
- Challenges.
- Key conclusions of researchers.

The selected materials were analyzed through inductive and deductive processes, including iterative reading and re-reading, to identify thematic areas. Findings were then aligned with data from other scholars for comparative data analysis.

3. Results and Discussion

Extensive databases and artificial intelligence (AI) have become essential components of education management. In Ukraine, integrating AI into the educational sector has become a significant strategic direction, enhancing learning quality, modernizing teaching methodologies, and fostering digital skills. AI applications in education aim to address multiple tasks that align with society's core needs and contemporary challenges.

Studies have outlined several key areas for implementing AI in education. The primary goal is to create personalized learning environments. AI algorithms enable the development of tailored learning programs, considering core topics, the learner's strengths and weaknesses, and providing adaptive assignments. Another objective is the automation of routine tasks. AI facilitates the automatic assessment of tests and homework and the generation of detailed performance reports for students. Furthermore, AI supports enhancing digital skills and enables data analytics (see Table 2).

Table 2. Key objectives for AI integration in education (Source: Authors' development)

Research aim	Papers	Quantity	Crucial findings
Personalized Learning	Abulibdeh *et al.* [7] Berbets *et al.* [10] Borysiuk *et al.* [6] El Gourari *et al.* [25] Khine [16] Marienko *et al.* [26] Shuliar *et al.* [17] *Bobro et al.* [23] Vlčková [24]	9	Formation of personalized programs Taking into account the pace of learning the material Determining the strengths and weaknesses of the applicant Formation of special adaptive tasks
Digital Skills	Berbets *et al.* [10] Bobro [11] El Gourari *et al.* [25] Karataş *et al.* [15] Khine [16] Shuliar *et al.* [17]	6	It affects students' preparation for working with technology Ability to navigate the modern digital information space Teaching critical thinking and data analysis In some cases, programming and robotics skills

Research aim	Papers	Quantity	Crucial findings
Task Automation	Abulibdeh *et al.* [7] Berbets *et al.* [10] El Gourari *et al.* [25] Haldorai *et al.* [27] Karataş *et al.* [15]	5	Automatic assessment
Engagement	Abulibdeh *et al.* [7] Chen *et al.* [28] Davis *et al.* [12] Kondratenko *et al.* [14] Marienko *et al.* [26] Vlčková [24]	6	Creating high-quality performance reports Tracking student activity Improves student motivation to learn Using AI increases student engagement
Self-Regulation and Reflection	Asgarov and Mustafayev [9] Bulavko *et al.* [29] Chen *et al.* [28] Karataş *et al.* [15]	4	AI systems offer students individual learning trajectories and allow them to track their progress independently.
Learning Data Analytics	Bobro [11] Chen *et al.* [28] Fiialka *et al.* [30] Karataş *et al.* [15] Khine [16] Marienko *et al.* [26] Shuliar *et al.* [17]	7	Determining the effectiveness of educational programs Predicting the success of applicants Identifying problems in learning Optimizing resource costs in educational institutions

Therefore, adapting these technologies to higher education is becoming a noticeable trend in Ukraine. For this reason, the issue of training highly qualified teachers is key to ensuring the sustainable development of the education system. Several important sectors require the integration of AI into higher pedagogical education. This primarily concerns the modernization of curricula. The current implementation of courses in essential technologies should include the basic use of AI for data analysis, training in adaptive platforms, and algorithms for personalizing learning. An equally important sector is the formation of future teachers' digital competencies. This requires forming practical digital literacy standards for teachers considering the competencies of working with AI. In addition, future teachers should be trained in creating and managing digital educational environments, using digital or simulation tools based on AI to form classroom management skills and lesson planning. In Ukraine, the development of these skills is based on the implementation of the project method, the case method, and the involvement of students in projects related to the implementation of AI in the education system.

The adoption of AI in Ukraine offers substantial opportunities but requires specific conditions to succeed. Wider implementation faces several barriers. For instance, AI technologies' development, deployment, utilization, and maintenance necessitate additional funding. Amid wartime, the education and science sector experiences notable underfunding. Additionally, Ukraine's educational system suffers from limited state-supported programs. Research and projects in AI are often inconsistently funded and insufficiently structured to cover all expenses [19].

Another challenge is the shortage of qualified personnel. Integrating AI algorithms requires additional teacher training [2]. Simultaneously, the limited number of AI-focused educational programs and courses restricts students' access to contemporary knowledge. During wartime, Ukraine also faced a significant brain drain, with skilled professionals emigrating for better working conditions and higher salaries.

Infrastructure limitations also play a critical role [31]. Many educational institutions in Ukraine lack access to innovative tools, including virtual reality and simulation technologies. The high cost of computational resources

and cloud services, essential for AI projects, exacerbates the issue. Moreover, the war has highlighted underdeveloped digital infrastructure, particularly in some regions where access to digitalization remains inadequate. This, in turn, limits the implementation of AI technologies.

Unresolved issues concerning security and privacy pose another significant problem. Ukraine lacks a comprehensive regulatory framework for data usage, processing, and AI ethics. This creates challenges in protecting citizens' rights. Additionally, the certification of AI-based products remains unclear, leading to ambiguous procedures for evaluating and implementing AI solutions in state institutions [19].

Public awareness of AI capabilities is another critical factor requiring attention. Many educators remain unaware of AI's potential and perceive it as a threat to privacy. Consequently, the low level of digital literacy among the population creates barriers to adopting innovative solutions.

Several studies emphasize the need for specific conditions to facilitate AI implementation [6], [26]. Among these, the scarcity of localized data emerges as a significant issue. Developing effective AI solutions requires high-quality data, which are not always readily available in Ukraine—ethical concerns also surface, as highlighted in academic sources. One notable risk is the automation of processes, which could result in job losses. Additionally, the lack of dedicated oversight increases the likelihood of discriminatory outcomes in education due to automated systems (see Table 3).

Table 3. Significant challenges in adapting AI to Ukrainian education (Source: Authors' development)

Implementation difficulties	Papers	Quantity	Crucial findings
Insufficient funding for training	Borysiuk *et al.* [6] Khine [16] Khmelnytska and Tkachenko [32] Marienko *et al.* [26] Shuliar *et al.* [17]	6	High cost of technology implementation and support Lack of funding for educational innovation during martial law Limited government support
Lack of qualified personnel	Bobro [11] Mazur *et al.* [33] Karataş *et al.* [15] Khmelnytska and Tkachenko [32] Sieriebriak and Kozhushko [34] Shuliar *et al.* [17]	6	Requires a certain level of digital literacy The low number of additional training programs related to the use of AI Lack of qualified specialists to support the technology
Infrastructural limitations	Berbets *et al.* [10] Haldorai *et al.* [27] Khmelnytska and Tkachenko [32] Sieriebriak and Kozhushko [34]	4	Underdeveloped digital infrastructure Low level of logistical support
Lack of regulation in the legal sector	Mazur *et al.* [33] Kondratenko *et al.* [14] Marienko *et al.* [26] Bobro *et al.* [23]	4	Lack of regulation of security and privacy at the legislative level Certification issues
Low level of awareness	Chen *et al.* [28] Mazur *et al.* [33] Khmelnytska and Tkachenko [32] Przybyła-Kasperek *et al.* [35]	4	Fear of implementing new technologies Scepticism towards innovative solutions

Data access issues	Bobro [11] Karataş *et al.* [15] Marienko *et al.* [26] Shuliar *et al.* [17]	4	Fragmentation of AI implementation sources: High-quality data is needed to form effective AI solutions.
Ethical issues, risks of automation	Khmelnytska and Tkachenko [32] Marienko *et al.* [26] Przybyła-Kasperek *et al.* [35]	3	The risk of automating the educational process Unethical use of AI capabilities

These challenges should be addressed during the adaptation of artificial intelligence (AI) within the Ukrainian education system. Overall, the adaptation process could offer significant prospects for its modernization and optimization. A systematic approach is required to overcome the key identified challenges of integrating AI into Ukraine's education system. This approach should consider technical, organizational, pedagogical, and ethical components.

A critical first step involves improving the digital material and technical infrastructure. This includes ensuring fast and reliable internet access in all educational institutions, mainly rural areas. Additionally, upgrading equipment in modern institutions is necessary. To enable educators to harness the potential of AI effectively, additional professional development should be prioritized [36]. This could be achieved through specialized training sessions and professional qualification courses, equipping educators with knowledge of AI tools, digital platforms, and adaptive technologies.

AI specialists should also provide mentorship support to assist educators in integrating these technologies. Another aspect requiring optimization is the establishment of ethical standards for AI usage. This can be achieved by developing new legal regulations and adopting ethical standards for AI implementation [19].

Many contemporary AI-based platforms primarily operate in English, while platforms with Ukrainian content are scarce. Therefore, a vital solution would be the development of Ukrainian-language educational platforms. This would allow AI technologies to be adapted to Ukrainian students' and educators' linguistic and cultural needs. Figure 2 illustrates a model for adapting AI to the realities of Ukraine's education system, considering the previously identified challenges.

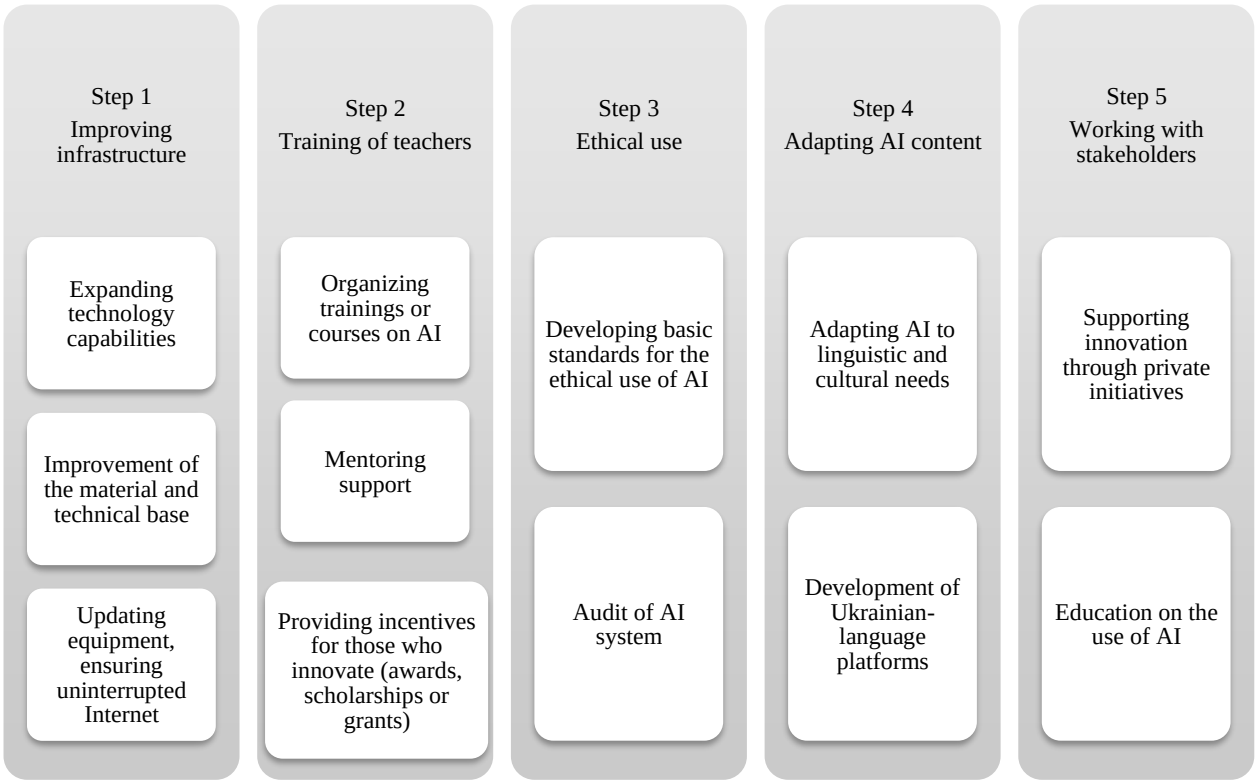

Figure 2. The model of AI integration into Ukraine's educational system (Source: Authors' development)

Therefore, adapting the educational process in Ukraine to AI technologies requires a systemic approach, especially in higher pedagogical education. The method of integrating relevant courses, developing digital competencies of future teachers, and stimulating pedagogical research will contribute not only to the training of a new generation of specialists but also to a significant improvement in the overall quality of education. Overcoming challenges and realizing prospects will allow Ukraine to take a worthy place among the leading countries in education. All innovative solutions should be piloted through experimental projects. This would involve implementing AI in selected educational institutions to test its functionality. Subsequently, results analysis and feedback collection from students, teachers, and parents should be conducted. This process would allow the system to be refined. However, such solutions may have financial challenges for modern educational institutions. Therefore, additional support from the government and private organizations will be necessary. This support could be realized through funding allocations for research, developing AI-based educational programs, and collaborations with the private sector.

4. Discussion

The advancement of digitalization in education introduces new challenges in recognizing the potential of cutting-edge technologies in the learning process. This global trend warrants thorough research and detailed characterization. This article aims to analyze the primary adaptation processes within Ukraine's educational sector to artificial intelligence (AI) technologies through an analytical review. The central hypothesis posits that the effective integration of AI into Ukraine's education system could significantly enhance its quality and competitiveness. Another hypothesis suggests a direct correlation between the level of teacher training and the integration of AI in education.

The research questions focus on identifying the opportunities and objectives of AI integration into Ukrainian education, the challenges encountered in this process, and practical approaches to adapting AI technologies.

The proposed findings indicate that the primary objectives of integrating AI into the educational process include achieving personalized learning, developing digital skills, automating task execution, increasing student engagement (and motivation), fostering self-regulation and reflection, and improving educational data analysis. The results highlight the creation of personalized learning programs, digital technology training, critical thinking development, automated processing of organizational information, increased motivation, learning prediction, and adaptation to the digital educational environment. The findings suggest a broad spectrum of opportunities for AI integration in the learning process. This supports conclusions from other researchers who, through empirical evidence, have demonstrated the universality of AI as a tool in educational applications [36], [38].

However, some researchers argue that drawing definitive conclusions is premature as AI systems are still in the early stages of their evolution in open use, leaving uncertainties about whether current digital capabilities will remain relevant [38]. Setting philosophical aspects aside, it is essential to acknowledge the utility and multidisciplinary potential of AI applications. The determination of prospects will proceed evolutionarily, with the relevance of AI integration attempts increasing alongside the development of corresponding digital systems.

Furthermore, scholars addressing the Ukrainian context note that full digitalization benefits are challenging due to Russia’s aggression, destruction, population displacement, and financial crises [1], [39]. Key challenges include organizing the educational process, the cost of advanced technologies and software, limited investment opportunities in education and research, and insufficient infrastructure. Nevertheless, even in these difficult conditions, researchers agree on the clear benefits of AI in education, suggesting that the primary goals of its utilization can still be achieved [40]. These observations confirm the hypothesis that effective AI integration could significantly enhance the quality and competitiveness of Ukraine’s education system, even during challenging times.

The findings also outline significant barriers to AI integration in education. These include inadequate funding for training, a shortage of qualified personnel, infrastructural challenges, the absence of legal regulations on AI use, data access issues, risks associated with automation, and related ethical concerns. Specific problems include high costs of implementing new technologies, timely software updates, insufficient levels of digital literacy, lack of infrastructure, and legislative gaps. Moreover, skepticism about AI applications, misuse of educational tools, and unresolved safety and privacy concerns in data handling have emerged as pressing challenges.

For example, the lack of regulations governing the security and confidentiality of data usage and ethical considerations in AI applications has become a significant issue. Product certification for AI-based solutions

also leads to uncertainties in evaluation and implementation procedures, especially in public institutions. These findings align with the conclusions of other researchers [31]; [41]. Some researchers prioritize specific challenges while considering others secondary [42]; [43].

The presented findings highlight conditions under which AI applications may prove ineffective, confirming the views of scholars who regard a combination of insufficient digital competencies and reluctance to integrate AI technologies as detrimental to the prospects of AI use in educational institutions [41]. Acknowledging these remarks, it is essential to consider the context of educational process organization. Such an approach validates the hypothesis regarding the direct correlation between teacher training levels and AI integration. As digital technologies evolve, these correlations are expected to deepen, necessitating ongoing training and preparation for educators and technical staff within educational institutions.

The final task involved developing practical recommendations to address the identified challenges. Accordingly, the study highlights the implementation of the following measures: improving infrastructure, providing additional teacher training, refining the legislative framework, adapting AI content to the educational realities of Ukraine, and engaging in further collaboration with stakeholders. Other researchers have explored specific innovative solutions [38], [44]. For instance, limited access to modern digital infrastructure in Ukraine has been emphasized by different scholars, indicating that this area is both promising for implementation and recognized by the scientific community [45]. However, while this study focuses on upgrading equipment, other researchers propose developing digital networks, particularly in remote regions. Scholars have also stressed the need for additional practical training for educators to utilize innovations [46], [47]. This study also points to the necessity of establishing appropriate regulatory frameworks to ensure the ethical use of AI [37], [38], [48]. Similarly, other researchers have emphasized creating clear rules to promote transparency and non-discrimination in AI applications in education [40], [49], [50].

At the same time, the methodology proposed in this study has limitations that will influence the interpretation of the scientific findings. These primarily relate to the features of the PRISMA scientific approach, which involves a specialized selection of scholarly literature. A critical aspect is working with recent scientific sources published within the past five years. On the one hand, integrating AI into the educational process began relatively recently, making such an approach entirely justified. On the other hand, there may be significant hypotheses or theories in older literature that warrant further scholarly reflection. While this limitation does not undermine the core results obtained, future exploration of hypotheses in earlier publications could provide a fruitful direction for subsequent research.

5. Conclusions

The conducted analysis revealed that the primary goals of integrating AI into the educational process include achieving personalized learning, enhancing digital skills, automating tasks, fostering engagement (motivational impact), achieving self-regulation and reflection, and improving educational data analysis. Specifically, this involves developing personalized learning programs, teaching digital technologies, critical thinking, automating the processing of academic and organizational information, increasing motivation, forecasting learning outcomes, and adapting to the digital educational environment. This potential positions AI as an up-and-coming tool for further application despite hypothetical challenges in its development and use.

Several obstacles to integrating AI into the educational process were identified. Chief among these are insufficient funding for education, a lack of trained personnel, challenges with infrastructure functionality, the absence of legislative norms (regulating AI use), issues with data access, risks associated with automation, and related ethical concerns. Thus, there are significant challenges regarding the cost of implementing advanced technologies, timely software updates, required levels of digital literacy, lack of necessary infrastructure, absence of relevant legal acts, skepticism towards AI use, and abuses of such educational mechanisms. For instance, the lack of regulation around security and confidentiality in data use and processing and the ethics of applying AI technologies has emerged as a substantial challenge. Such issues are serious; without addressing these aspects, AI technologies risk becoming entirely ineffective. Moreover, special attention should be paid to training educators and technical staff who must adequately respond to the demands of the educational environment and be prepared to evolve professionally alongside it.

Overcoming these challenges will involve developing comprehensive solutions, including investing in education and scientific infrastructure, implementing legislative changes regulating AI use, further incentivizing

innovation, and conducting outreach activities highlighting AI's advantages and facilitating its integration into the educational process.

Declaration of competing interest

The authors declare that they have no known financial or non-financial competing interests in any material discussed in this paper.

Funding information

No funding was received from any financial organization to conduct this research.

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