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SAFE, ETHICAL, AND RESPONSIBLE USE OF ARTIFICIAL INTELLIGENCE IN UKRAINE'S VOCATIONAL EDUCATION SYSTEM

BEZPIECZNE, ETYCZNE I ODPOWIEDZIALNE WYKORZYSTANIE SZTUCZNEJ INTELIGENCJI W UKRAIŃSKIM SYSTEMIE KSZTAŁCENIA ZAWODOWEGO

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Abstract: The article analyzes the conceptual and practical foundations of the safe, ethical, and responsible use of artificial intelligence in Ukraine's vocational education system. It is established that the implementation of artificial intelligence is fragmented and non-systemic, due to the uneven development of digital infrastructure, varying levels of digital competence among teaching staff, and insufficient regulatory and methodological support. The main directions of artificial intelligence use in the educational process are summarized, including adaptive learning, automation of pedagogical activities, and the assessment of learning outcomes. Key groups of risks are identified: ethical, legal, pedagogical, and technological, related to violations of academic integrity, threats to personal data security, a decline in critical thinking, and unequal access to digital resources. The state of regulatory support for the use of artificial intelligence is analyzed and found to be at a formative stage, requiring further systematization. A set of principles for the safe and responsible use of artificial intelligence is substantiated, including transparency, accountability, fairness, data security, human-centeredness, and governance. Practical recommendations are developed for educational institutions, teachers, and governing bodies regarding the implementation of internal policies, the enhancement of digital competence, and the development of an ethical culture of artificial intelligence use.

Keywords: artificial intelligence, vocational education, academic integrity, digital transformation, ethics of artificial intelligence use.

Streszczenie: W artykule przeanalizowano koncepcyjne i praktyczne podstawy bezpiecznego, etycznego i odpowiedzialnego wykorzystania sztucznej inteligencji w systemie kształcenia zawodowego Ukrainy. Stwierdzono, że wdrażanie sztucznej inteligencji ma charakter fragmentaryczny i niesystemowy, co wynika z nierównomiernego rozwoju infrastruktury cyfrowej, zróżnicowanego poziomu kompetencji cyfrowych kadry pedagogicznej oraz niewystarczającego zabezpieczenia normatywno-metodycznego. Uogólniono główne kierunki wykorzystania sztucznej inteligencji w procesie edukacyjnym, w szczególności uczenie adaptacyjne, automatyzację działalności dydaktycznej oraz ocenianie efektów uczenia się. Zidentyfikowano kluczowe grupy ryzyk: etyczne, prawne, pedagogiczne i technologiczne, związane z naruszeniem rzetelności akademickiej, zagrożeniami dla bezpieczeństwa danych osobowych, obniżeniem poziomu myślenia krytycznego oraz nierównym dostępem do zasobów cyfrowych. Przeanalizowano stan regulacji wykorzystania sztucznej inteligencji, który znajduje się na etapie kształtowania i wymaga systematyzacji. Uzasadniono zestaw zasad bezpiecznego i odpowiedzialnego wykorzystania sztucznej inteligencji, w tym przejrzystość, rozliczalność, sprawiedliwość, bezpieczeństwo danych, podejście zorientowane na człowieka oraz zarządzanie. Opracowano praktyczne rekomendacje dla instytucji edukacyjnych, nauczycieli i organów zarządzania dotyczące wdrażania polityk wewnętrznych, podnoszenia kompetencji cyfrowych oraz rozwoju kultury etycznego wykorzystania sztucznej inteligencji.

Słowa kluczowe: sztuczna inteligencja, kształcenie zawodowe, rzetelność akademicka, transformacja cyfrowa, etyka wykorzystania sztucznej inteligencji.

Introduction

The rapid advancement of digital technologies is profoundly transforming contemporary education systems, with artificial intelligence (AI) emerging as one of the most influential drivers of these changes. In the field of vocational education, AI technologies are increasingly being integrated into the educational process, assessment of learning outcomes (Mosha et al., 2026), as well as managerial (Alfredo et al., 2024) and organizational procedures (Zhao, 2024). These technologies create new opportunities for the personalization of learning (Prasetya et al., 2025), enhance the effectiveness of developing professional competencies (Azizah et al., 2025), and improve the alignment between educational outcomes and labor market needs (Leong, 2025). At the same time, the growing role of AI raises critical issues regarding its safe, ethical, and responsible use within the educational environment (Zhu et al., 2025).

In Ukraine's vocational education system, the process of digital transformation is unfolding under complex societal challenges (Radkevych & Pryhodii, 2025), including the conditions of martial law (Radkevych, 2024), the intensification of European integration processes (Kulynych, 2021), and the need for the recovery and modernization of educational infrastructure (Tykhonova, 2024). These circumstances simultaneously increase the demand

for the adoption of innovative technologies and complicate the development of unified approaches to their regulation. Despite the active implementation of digital solutions, including distance learning platforms (Gurzhii & Pryhodii, 2025) and tools for automating educational processes (Londar et al., 2024), the regulatory and methodological framework governing the use of AI remains insufficiently developed (Osadcha et al., 2023).

A key challenge lies in the absence of a systemic approach to the safe and ethical use of AI in vocational education. In many cases, the implementation of AI occurs without appropriate institutional policies, methodological guidelines, and clearly defined ethical standards (Holmes et al., 2019). This gives rise to a range of risks, including violations of academic integrity due to the automated completion of learning tasks, potential breaches of learners' personal data, and reduced transparency in educational and assessment processes (Zawacki-Richter et al., 2019). Moreover, excessive reliance on AI may negatively affect the quality of workforce training by diminishing the development of critical thinking, practical skills, and professional responsibility (Selwyn, 2022).

A distinct category of risks concerns personal data protection and cybersecurity (Huang, 2023), as contemporary AI systems often require substantial volumes of user data. In the absence of adequate safeguards, this creates threats of unauthorized access and data breaches. Ethical challenges are also highly relevant, particularly those related to algorithmic bias, unequal access to digital resources, and fairness in educational assessment (Holmes et al., 2022).

The aim of this article is to analyze the conceptual and practical foundations of the safe, ethical, and responsible use of AI in Ukraine's vocational education system, as well as to identify key challenges and directions for its implementation.

The study is guided by the following research questions: (1) what are the key opportunities and risks associated with the use of AI in vocational education; (2) to what extent are the regulatory, ethical, and pedagogical approaches to governing its use in Ukraine developed; and (3) which principles can ensure the safe and responsible integration of AI into educational practice.

Methods

This study employs a mixed-methods approach that combines qualitative analysis with elements of systematization and comparative synthesis (Zhou et al., 2024). Such a methodology enables a comprehensive examination of the issues surrounding the safe, ethical, and responsible use of AI in Ukraine's vocational education system, taking into account both theoretical foundations and practical challenges of implementing relevant technologies.

The primary research methods include an analysis of scholarly sources (Chigbu et al., 2023), which made it possible to determine the current state of research on the use of AI in education and to identify key opportunities and risks associated with its application in vocational training. A comparative analysis (Gabriel et al., 2025) of international and national practices in AI use allowed for an assessment of the development of regulatory, ethical, and pedagogical approaches across different education systems, as well as the identification of gaps in the domestic context.

Content analysis (Drisko & Maschi, 2015) of regulatory and legal documents was employed to examine the extent to which issues of academic integrity, personal data protection, and the digital transformation of education are regulated in Ukraine. The generalization of pedagogical experience (Zawacki-Richter et al., 2019) made it possible to analyze practices of implementing digital technologies in vocational education institutions and to identify common challenges associated with their use.

A distinct role in the study was played by the use of AI tools, in particular ChatGPT and Gemini, which were applied as supportive instruments for searching and systematizing scholarly literature, refining formulations, ensuring academic style, formatting references in accordance with APA 7 standards, and improving English translations of academic texts. The use of these tools did not replace the researcher's analytical work but rather served to support the quality of scholarly writing and presentation.

The source base of the study comprises publications from international scientific databases (Scopus, Web of Science, Google Scholar), regulatory and legal acts of Ukraine, analytical reports of international organizations in the field of digital education, as well as research on AI ethics. Sources were selected based on criteria of relevance (primarily from 2019-2026), scientific validity, and methodological rigor.

The limitations of the study are associated with the rapid development of AI technologies, which leads to the continuous updating of empirical data, as well as with the uneven implementation of digital technologies across vocational education institutions in Ukraine.

Literature review

Contemporary research demonstrates that AI is gradually becoming an integral component of the digital transformation of education, significantly reshaping approaches to the organization of the learning process (Zawacki-Richter et al., 2019; Mosha et al., 2026). The main areas of its application include adaptive learning, automation of educational processes, and intelligent assessment of learning outcomes (Holmes et al., 2019; Prasetya et al., 2025).

AI-based adaptive systems enable the personalization of learners' educational trajectories by taking into account their prior knowledge, pace of learning, individual educational needs, and learning styles, thereby enhancing the effectiveness of competency development (Alfredo et al., 2024). Automation encompasses both administrative and pedagogical functions, including lesson planning, allocation of teaching workload, grading of assignments, and support for digital learning platforms (Londar et al., 2024; Mosha et al., 2026). This allows for the optimization of teachers' work and enables them to focus more on individualized interaction with learners (Holmes et al., 2019; Selwyn, 2022).

Another important area is the use of AI algorithms for assessing learning achievements, which ensures efficiency, scalability, and, to some extent, increased objectivity of knowledge evaluation (Zhao, 2024; Darvishi et al., 2022). At the same time, such approaches generate a number of challenges, particularly regarding algorithmic transparency (Iyer et al., 2025; Sanderson et al., 2023a), the validity of assessment outcomes (Zhu et al., 2025; Holmes et al., 2022), and potential errors in machine learning models (Gao et al., 2024; Sanderson et al., 2023b), which require further scientific and methodological reflection as well as appropriate regulation.

The ethical dimension of AI use in education is grounded in the core principles of transparency, fairness, and accountability, which define the framework for the responsible use of digital technologies in the learning process (Nguyen et al., 2023; Floridi & Cowls, 2019). Transparency implies the clarity and explainability of decision-making algorithms, particularly in cases of automated assessment of learning outcomes, where both learners and educators need to understand the logic underlying the results (Iyer et al., 2025; Sanderson et al., 2023a).

Fairness is associated with the need to prevent discrimination and unequal treatment of participants in the educational process, which may arise from algorithmic biases caused by poor-quality, incomplete, or non-representative training data (Zhu et al., 2025; Gao et al., 2024). Accountability involves a clear allocation of responsibility among AI system developers, educational institutions, and users for the consequences of their application (Danilevskyi et al., 2025; Sanderson et al., 2023b).

The scholarly literature also emphasizes the risks of excessive technological dependence (Selwyn, 2022), which may lead to a decline in critical thinking (Kasneci et al., 2023), professional autonomy (Holmes et al., 2022), and independence of both learners and educators (Kasneci et al., 2023; Selwyn, 2022; Holmes et al., 2022). This underscores the need for a balanced approach to the integration of AI in education.

Issues of security and personal data protection are central in the context of AI implementation in education, as the use of digital platforms involves the

processing of substantial volumes of sensitive information about learners and teaching staff (Huang, 2023; Khalifeh et al., 2026). The main threats include unauthorized access to personal data, data breaches, uncontrolled or repeated use without proper user consent (Zhu et al., 2025), as well as an insufficient level of cybersecurity in educational information systems (Londar et al., 2024; Mosha et al., 2026; Mustafa et al., 2024).

Additional risks are associated with data centralization and transfer to third parties, which may complicate control over their use (Mustafa et al., 2024; Zhu et al., 2025; Khalifeh et al., 2026). In international practice, particular attention is paid to the regulatory governance of these processes, notably through the General Data Protection Regulation (GDPR) of the European Union, which establishes high standards for the collection, processing, storage, and protection of personal information (Huang, 2023; Nguyen et al., 2023).

At the same time, ethical codes for AI use are being developed, defining principles of data minimization, access restriction, and accountability for data processing within the educational environment (Holmes et al., 2022; Nguyen et al., 2023).

The emergence of generative AI models is significantly reshaping traditional understandings of academic integrity in contemporary education (Kasneci et al., 2023; Selwyn, 2022). New challenges are associated with the possibility of automatically generating texts, completing written assignments, preparing reports and essays, and even producing elements of research materials without adequate authorial contribution from the learner (Kasneci et al., 2023). This substantially complicates conventional mechanisms for verifying the independence of learning activities and for accurately assessing learners' actual knowledge and skills (Kasneci et al., 2023; Darvishi et al., 2022).

As a result, there is a growing need to reconsider approaches to the assessment of learning outcomes (Zhao, 2024; Holmes et al., 2022), with a shift toward more competency-based and practice-oriented models of evaluation (Prasetya et al., 2025; Leong, 2025). The scholarly literature also emphasizes the importance of developing digital literacy among participants in the educational process (Alfredo et al., 2024; Mosha et al., 2026), as well as establishing clear rules and policies for AI use that ensure a balance between innovation and adherence to the principles of academic integrity (Nguyen et al., 2023; Zhu et al., 2025).

An analysis of the scholarly literature (Zawacki-Richter et al., 2019; Mosha et al., 2026; Gabriel et al., 2025; Khalifeh et al., 2026) indicates that the use of AI in vocational education has not yet been studied in a sufficiently systematic and comprehensive manner, resulting in a significant research gap in this field. Most existing studies focus primarily on general or higher education levels (Zawacki-Richter et al., 2019; Holmes et al., 2019; Zhao, 2024; Mosha et al., 2026), whereas

the specific characteristics of vocational education require deeper investigation and conceptualization (Prasetya et al., 2025; Azizah et al., 2025; Leong, 2025).

This applies both to the development of pedagogical models for integrating AI into the educational process (Alfredo et al., 2024; Prasetya et al., 2025) and to the analysis of ethical, legal, and regulatory aspects of its application (Zhu et al., 2025; Nguyen et al., 2023). At the same time, vocational education plays a crucial role in the formation of practical competencies required by the modern labor market, which further underscores the significance of the issue under study (Radkevych & Pryhodii, 2025).

Particular attention should be paid to the development of methodological approaches for the safe and effective use of AI in training qualified specialists, as well as to defining the conditions for its integration into educational programs in accordance with the principles of ethics, security, and academic integrity.

Results and discussion

An analysis of the current state of AI implementation in Ukraine's vocational education indicates its predominantly fragmented, uneven, and non-systemic nature. The level of AI integration largely depends on the institutional capacity of individual educational institutions (Radkevych, 2024; Shevchenko, 2023), the level of development of digital infrastructure (Kabinet Ministriv Ukrainy, 2024; World Bank, 2022), as well as the digital competence of teaching and administrative staff (European Commission, 2022). As a result, a significant disparity has emerged between institutions that actively implement digital innovations and those that are only beginning this process or are limited to basic digital tools (OECD, 2021).

In most cases, the use of AI in Ukraine's vocational education is limited to the application of generative models for the preparation of teaching and methodological materials, the creation of test items, the automation of assessment processes, and the support of distance and blended learning (Pryhodii & Gurzhii, 2025; Radkevych & Pryhodii, 2025; Palamar & Naumenko, 2024). Such tools are primarily used as auxiliary means to enhance the efficiency of teaching activities rather than as components of a comprehensive educational strategy (Radkevych et al., 2025a).

In some vocational education institutions, there is a gradual introduction of adaptive learning platforms that enable the individualization of learners' educational trajectories (Gurzhii & Pryhodii, 2025). Chatbots and virtual assistants are also beginning to be used for consultations (Zadorina et al., 2025), supporting the learning process and providing timely feedback (Londar et al.,

2024). However, these practices are largely experimental or initiative-driven and have not yet been widely implemented.

Typical practices of AI use include the individual application of digital tools by teachers for lesson preparation, the development of methodological materials, presentations, and learning tasks (Vasyliiev, 2025). From the learners' perspective, the use of generative systems for completing written assignments, searching for information, and preparing academic tasks is widespread (Radkevych et al., 2025b). However, such practices are often not regulated by internal institutional policies (Akademiia statei, 2026), which creates risks of uncontrolled use of technologies, a decline in academic integrity, and ambiguous interpretations of the acceptable boundaries of AI use in the educational process.

The study identifies four main groups of risks associated with the use of AI in Ukraine's vocational education: ethical, legal, pedagogical, and technological. Their interconnected nature indicates the need for a systemic approach to managing AI implementation within the educational environment.

Ethical risks are primarily related to violations of academic integrity, particularly the use of generative models to complete individual assignments without adequate authorial contribution from learners (Kasneci et al., 2023; Selwyn, 2022). In addition, the issue of algorithmic bias may lead to biased assessment outcomes and discriminatory practices (Zhu et al., 2025; Gao et al., 2024).

Legal risks include the insufficient regulation of personal data processing, the lack of clearly defined responsibility for the outcomes of AI system use, and the absence of effective regulatory mechanisms to oversee their implementation in educational institutions (Danilevskyi et al., 2025; Nguyen et al., 2023).

Pedagogical risks manifest in the potential decline of learners' independent thinking, the development of excessive dependence on technology, reduced motivation to learn, and the simplification of approaches to task completion (Holmes et al., 2022; Kasneci et al., 2023; Selwyn, 2022; Mosha et al., 2026).

Technological risks are associated with insufficient cybersecurity of educational platforms, potential technical failures, and unequal access to high-quality digital infrastructure, which is particularly relevant for regions with limited resources (Mosha et al., 2026; Londar et al., 2024).

The regulatory framework for the use of AI in education in Ukraine is currently in a stage of development and formalization (Ministerstvo osvity i nauky Ukrainy, 2025). At present, national regulations are being shaped to comprehensively govern the implementation, use, monitoring, and control of AI technologies in the educational process (Serhiienko & Franchuk, 2024). Existing legal and regulatory acts are largely general in nature, oriented toward the digitalization of education as a whole, and do not adequately account for

the specific features of vocational education, particularly its practice-oriented approach to training specialists (Verkhovna Rada Ukrainy, 2025).

Moreover, there is a notable fragmentation of policies at the level of individual educational institutions, where issues related to AI use are often regulated through local decisions or remain outside the formal regulatory framework altogether (Spivakovsky et al., 2023). The absence of unified approaches leads to significant disparities in the level of technology implementation, varying standards of academic integrity, and inconsistent practices in ensuring personal data protection (Ministerstvo osvity i nauky Ukrainy, 2025). This situation complicates the development of a coherent digital educational ecosystem and highlights the need for a comprehensive national policy on the use of AI in education (Zhyla, 2025).

Contemporary research in the field of AI in education demonstrates the gradual formation of a coherent, multi-level system of ethical, legal, pedagogical, and technological principles that define the safe and responsible use of AI in the educational environment. This system is aimed at minimizing potential risks, increasing trust in digital technologies, and ensuring the preservation of the human-centered nature of education in the context of rapid digital transformation.

The core ethical and cognitive-legal principles include data transparency (Nguyen et al., 2023), which ensures the clarity of algorithmic decisions and the logic of AI system functioning; explainability (Danilevskyi et al., 2025), which enables users to interpret model outputs and enhances trust; accountability (Iyer et al., 2025) and responsibility (Danilevskyi et al., 2025), which define a clear distribution of roles and responsibilities among developers, educational institutions, and end users of AI technologies.

Particular importance is attached to the principles of fairness and bias mitigation, which are aimed at preventing algorithmic distortions, model bias, and ensuring equal access of all learners to educational resources and opportunities (Danilevskyi et al., 2025). In this context, the principles of privacy (Danilevskyi et al., 2025) and data security (Sanderson et al., 2023) are also essential, as they regulate the protection of personal information, prevent its unauthorized use, and ensure compliance with ethical and legal standards of data processing.

The technological foundation of AI systems is based on the principles of reliability (Sanderson et al., 2023b), robustness (Sanderson et al., 2023a), data quality (Gao et al., 2024), as well as monitoring and auditability (Nguyen et al., 2023). These principles ensure the stability of algorithmic performance, reproducibility, controllability, and the timely detection of errors or deviations in system functioning.

The human-centered dimension of AI use is reflected in the principles of human-centered AI (Nguyen et al., 2023), human oversight (Sanderson et al., 2023b), inclusiveness (Nguyen et al., 2023), and well-being (Sanderson et al.,

2023b). These emphasize the primacy of the human role in the educational process, the necessity of preserving pedagogical interaction, and the prevention of the full replacement of human agency by automated systems.

The final element of this framework is the principle of governance (Nguyen et al., 2023), which ensures the regulatory, institutional, and organizational oversight of AI use in education, creating the conditions for its safe and effective integration into the educational process.

For vocational education institutions, a priority task is the development and implementation of internal AI use policies that clearly regulate the permissible scope of its application within the educational process. Such policies should address issues of academic integrity, personal data protection, transparency in AI use, and the accountability of all participants in the educational process (Nguyen et al., 2023; Holmes et al., 2022). An important direction is also the introduction of educational modules on digital ethics, which would foster responsible behavior in the digital environment (Zhu et al., 2025). In addition, it is necessary to ensure the systematic professional development of teaching staff, particularly in the use of AI as a pedagogical tool (Mosha et al., 2026; Alfredo et al., 2024).

For teachers and learners in vocational education, it is important not only to master the technical aspects of working with AI tools but also to develop critical thinking skills in their use (Kasneci et al., 2023; Selwyn, 2022). The integration of AI into the learning process should be carried out as a supportive tool aimed at enhancing the quality of education, personalizing learning pathways, and optimizing pedagogical activities. At the same time, educators must adhere to the principles of academic integrity and cultivate these values among learners.

For learners, the development of digital literacy is essential, encompassing not only technical skills but also an understanding of the ethical aspects of AI use (Alfredo et al., 2024; Mosha et al., 2026). It is important to foster the ability to critically evaluate outputs generated by AI and to recognize responsibility for their use in academic activities.

For educational authorities, it is advisable to develop comprehensive national standards and guidelines for AI use in education, ensure the establishment of an appropriate regulatory framework, and support the development of digital infrastructure (Radkevych, 2024; Londar et al., 2024). Coordination across different levels of educational governance is also crucial to ensure a unified approach to AI integration within Ukraine's educational system.

The obtained results indicate that Ukraine is currently at a stage of active, yet non-systemic, implementation of AI in vocational education, which creates both new opportunities and significant challenges. A comparison with international experience shows that countries in the European Union and North America have already developed more coherent and structured approaches to regulating AI use,

including the establishment of ethical codes, personal data protection standards, and institutional policies for the integration of digital technologies in education (Zawacki-Richter et al., 2019; European Commission, 2022; UNESCO, 2023).

The interpretation of the findings suggests that the main barriers to AI implementation in Ukraine are complex in nature and are associated not only with technological limitations but also with an insufficient level of regulatory support, the absence of unified approaches, and the limited readiness of educational institutions for systemic transformation. At the same time, an important factor is the need to enhance the digital competence of both educators and learners.

At the same time, there is considerable potential for integrating the proposed principles into Ukraine's vocational education system. Their implementation can contribute to the development of a safer, more ethical, and more effective educational environment that responds to the challenges of digital transformation, enhances the quality of workforce training, and ensures alignment with European standards in education development.

Conclusion

The study has synthesized the theoretical and practical aspects of AI use in Ukraine's vocational education system. It has been established that AI implementation remains fragmented and non-systemic, is accompanied by a range of ethical, legal, pedagogical, and technological risks, and is constrained by insufficient regulatory support. At the same time, the main areas of AI application in the educational process have been identified, including adaptive learning, the automation of pedagogical activities, and the support of learning outcomes assessment.

The aim of the article - to analyze the foundations of the safe, ethical, and responsible use of AI in Ukraine's vocational education - has been achieved through a comprehensive examination of the current state of AI implementation, the identification of key risks, and the substantiation of core principles guiding its use. The proposed principles - data security, academic integrity, human-centeredness, and accountability - constitute a conceptual framework for the further development of the digital educational environment.

The scientific novelty of the study lies in the systematization of approaches to AI use specifically within the context of vocational education, which made it possible to identify sector-specific challenges and to formulate a comprehensive vision for addressing them. The practical significance of the findings lies in their applicability to the development of educational policies, institutional regulations, and the professional training of educators.

Future research should focus on the development of models for integrating AI into the educational process, the empirical evaluation of its effectiveness, and a more in-depth analysis of the impact of AI on the formation of learners' professional competencies in the context of digital transformation.

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