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DOI: https://doi.org/10.46502/issn.1856-7576/2024.18.01.13

Cómo citar:
Boiko, A., Shevtsova, N., Yashanov, S., Tymoshchuk, O., & Parzhnytskyi, V. (2024). The impact of the integration of artificial intelligence on changes in the education process of Ukraine: prospects and challenges. Revista Eduweb, 18(1), 180-189. https://doi.org/10.46502/issn.1856-7576/2024.18.01.13

The impact of the integration of artificial intelligence on changes in the education process of Ukraine: prospects and challenges

El impacto de la integración de la inteligencia artificial en los cambios en el proceso educativo de Ucrania: perspectivas y desafíos

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Recibido: 02/12/23
Aceptado: 27/01/24

Abstract

The purpose of the article is to analyse the status of artificial intelligence in the development of Ukrainian education in the context of socio-cultural instability. The positioning of innovative elements of modern education depends on the level of use of their potential by participants in the educational process. The research methodology is focused on the analysis of scientific discourse and the use of synergistic approaches to assess the scale and intensity of artificial intelligence in the Ukrainian educational space. The results of the study indicate a reorientation of the status of artificial intelligence from an exclusive element of educational activity to the level of an auxiliary component of the educational process. The demand for and feasibility of using artificial intelligence in Ukrainian education are key concepts that require a thorough scientific study. Thus, artificial intelligence has acquired the potential to transform the Ukrainian educational space.

Keywords: artificial intelligence, educational innovations, technologization, Ukrainian education, digitalization.

Resumen

El objetivo del artículo es analizar el estado de la inteligencia artificial en el desarrollo de la educación ucraniana

en el contexto de la inestabilidad sociocultural. El posicionamiento de los elementos innovadores de la educación moderna depende del nivel de uso de su potencial por parte de los participantes en el proceso educativo. La metodología de investigación se centra en el análisis del discurso científico y el uso de enfoques sinérgicos para evaluar la escala y la intensidad de la inteligencia artificial en el espacio educativo ucraniano. Los resultados del estudio indican una reorientación del estatus de la inteligencia artificial desde un elemento exclusivo de la actividad educativa al nivel de un componente auxiliar del proceso educativo. La demanda y la viabilidad del uso de la inteligencia artificial en la educación ucraniana son conceptos clave que requieren un estudio científico exhaustivo. Así, la inteligencia artificial ha adquirido el potencial de transformar el espacio educativo ucraniano.

Palabras clave: inteligencia artificial, innovaciones educativas, tecnificación, educación ucraniana, digitalización.

1. Introduction

Education in Ukraine is currently undergoing a double transformation. Firstly, the educational system is changing its internal foundations both in terms of function and purpose. Secondly, education is being strongly influenced by external factors (pandemic, war, economic turmoil). Under such conditions, the education sector needs progress drivers that can demonstrate high efficiency in a short time and ensure the sustainable development of the education system in difficult times. Usually, such a factor was human potential, when the efforts (quantitative or qualitative) of the participants in the educational process helped to balance the development of education. However, the current realities in Ukraine, associated with the massive migration outflow of teachers and students, highlight the need for other mechanisms. This potential is undoubtedly possessed by innovative information and digital technologies that can provide organisational, pedagogical, educational, methodological, scientific, and cognitive clusters of educational activity. Artificial intelligence is one of the tools of an innovative format that will ensure educational development in the difficult conditions of Ukrainian realities.

Digitalisation, having demonstrated its effectiveness in other areas of social and domestic activity, is gradually being integrated into the educational space (Nehrey et al., 2020). At the international level, scenarios for human-artificial intelligence interaction in the educational environment are currently being developed (Zinchenko et al., 2021). These strategies are based on the paradigm of sustainable educational development. The Ukrainian experience is unique, as it allows us to analyse the activity of artificial intelligence in education in times of instability and crisis.

The educational system in Ukraine is evolving in a dynamic socio-cultural environment. The COVID-19 pandemic, full-scale hostilities on the territory of Ukraine - these events have led to dramatic transformations in the design of education. First of all, the format of the educational process has changed, moving from traditional academic dimensions to the online space. Under such conditions, the need to use information and digital technologies to create an alternative learning environment has become more urgent. At the same time, innovative design using such elements as artificial intelligence also shapes the new content of education. That is, artificial intelligence, designed to improve the educational process, transforms it, which is a cause for concern among the scientific community. For Ukrainian education, which has suffered the devastating impact of socio-cultural force majeure factors, artificial intelligence can be a lifeline (in the context of learning organisation and design). However, artificial intelligence may cause a larger (semantic) destruction of the purpose of education.

The spread of artificial intelligence in educational activities has become an urgent issue in the modern scientific and pedagogical discourse. The use of artificial intelligence in the Ukrainian education system has not yet become widespread, but the first attempts to adapt innovative digital technologies to educational activities have been made, and their results require a thorough analysis, given the socio-cultural realities

in which they were carried out. Artificial intelligence is intended to become a driving force for Ukraine's socio-economic recovery.

The purpose of the research is to analyse the potential of artificial intelligence in the context of sustainable educational development and in the context of the instability of the educational system. The objectives of the article are to identify scenarios for the introduction of artificial intelligence in Ukrainian education in the short and long term.

2. Literature review

The scientific and educational discourse on the innovativeness of the educational process is developing rapidly, adding more and more new elements of educational activity. The artificial element has become one of the key factors in the use of technological and digital arsenal in the educational system. The intensity of the introduction of artificial intelligence in educational activities has raised many discussions about the feasibility of using such a resource (Zinchenko et al., 2021). Scientists are raising the issue of both the organisational and technological nature of the functioning of artificial intelligence in education (Mintii et al., 2021) and the humanitarian and ideological aspects of its use (Yakovleva et al., 2021). In general, artificial intelligence is gradually gaining ground in national educational systems, forming a unique innovative design of the learning environment (Krasheninnik et al., 2022).

The current study's literature review focuses on analyzing the works of Ukrainian scientists and educators who work directly with artificial intelligence tools in the educational process. This is how we form a vision of the practical results of applying innovative technologies in education. Among the key issues being studied in the segment of artificial intelligence in Ukrainian education are the following:

- training of pedagogical specialists (digital literacy) in the context of the development of digitalisation of education (Byrko et al., 2022);
- the role of artificial intelligence in enhancing the cognitive activity of students (Kharkivska et al., 2022);
- interdisciplinary principles of artificial intelligence in education and science (Tsekhmister, Chalyi & Chalyy, 2009);
- the communicative potential of artificial intelligence in the interaction of participants in the educational process (Kulichenko & Polyezhayev, 2020);
- standardisation and quality of education under the control of artificial intelligence parameters (Tsekhmister, Konovalova & Tsekhmister, 2022);
- creative aspects of using innovative technologies (Dobrolyubska et al., 2024);
- artificial intelligence as a factor in the formation of professional competences (Tsekhmister et al., 2022).

"The use of e-technologies in education is no longer an innovation, but becomes a vital necessity for the functioning of the educational system and the activities of educational institutions" (Sych, Khrykov & Ptakhina, 2021). Such positioning of artificial intelligence and other innovative technologies in Ukrainian education is fully consistent with the socio-cultural challenges faced by participants in the educational process. The use of artificial intelligence tools in the scientific and educational spheres will facilitate the introduction of innovations and inventions that will accelerate the modernisation of the national economy (Dovgyi et al., 2020).

The use of such a topical phenomenon as artificial intelligence has practical application specifics and is positioned in the global educational dimension (Kornytska et al., 2023) and in the national context of educational development (Nehrey et al., 2020).

The dichotomy in the use of artificial intelligence in the education system is relevant in the context of the balance of academicism (Bobrytska et al., 2020) and creative innovation (Kyrychenko, 2020). Hanaba,

Mysechko & Bloshchynskyi (2020) propose a synergistic approach to addressing the proportionality of tradition and innovation by directing the potential of artificial intelligence to interact with classical teaching and learning elements.

3. Methodology

The study of innovative elements in an educational system under the influence of force majeure involves the use of different methodological approaches. The current study focuses on the synergistic approach, which aims to unify the existing results of the introduction of artificial intelligence in scientific works and identify the features of the functioning of artificial intelligence in the educational process.

The article offers a qualitative review study with an analysis of scientific literature on the problem of the status of artificial intelligence in Ukrainian education. The scientometric databases of Google Scholar, Springer, Taylor & Francis, and ResearchGate were used to search for scientific research. The keywords that were relevant in the selection of scientific sources were: artificial intelligence, Ukrainian education, innovative development. In developed countries, the active introduction of artificial intelligence resources in education has been taking place over the past few years, while in Ukraine this process has been actualised even later. Therefore, the literature analysis is based on studies of recent years, some of which only identified the prospects for implementation and potential applicability in Ukrainian education, but did not describe the results of use.

The combination of general scientific (analysis, systematisation), scientific and pedagogical (pedagogical observation, pedagogical generalisation), and philosophical and scientific methods (synergistic approaches) helps to achieve the goals of scientific research. The use of synergistic methodological principles has made it possible to reconcile the positions of traditional education with innovative contexts, one of which is artificial intelligence. The methodological focus on interaction rather than confrontation provides a holistic characterisation of the phenomenon of artificial intelligence in education and its prospects in this area.

The basis of the methodological study was a comparative analysis, which characterises the features of the content and format of educational design that uses artificial intelligence. The methodological basis of the research was an analysis of the literature that examines the conditions for integrating artificial intelligence into the Ukrainian education system and the first results of the introduction of artificial intelligence in Ukrainian education.

Special scientific and pedagogical methods are based on the results of pedagogical activity that captures trends in educational development caused by the use of artificial intelligence. Pedagogical observation and generalisation make it possible to analyse such elements of artificial intelligence in education as the scale of use, the intensity of involvement, effectiveness, etc.

4. Results and discussion

Under any circumstances, education responds to global civilisational features of development (Kornytska et al., 2023). The processes that are characteristic of modern society require tools for working with information, technology, and digital elements. Artificial intelligence skilfully combines all innovative characteristics. For Ukraine, in its current civilisational position, it is of existential importance to become a country that is able to attract advanced innovative resources in all spheres of public life. Education is one of the key markers of a community's readiness for transformation and engagement in the sustainable development paradigm. Therefore, the use of artificial intelligence is inevitable in educational activities. The sooner the emphasis is placed on the positive and negative aspects of artificial intelligence in education, the sooner the integration of Ukrainian education and public life in general into the highly developed Western model of civilisational progress will take place.

Artificial intelligence has become a hot topic in the educational environment, as its potential is gradually filling the educational activity of all its participants (teachers, students, administration, stakeholders). When the problem is concentrated in the context of Ukrainian education, which has been subjected to negative external influences, artificial intelligence is of great interest to researchers in terms of the level of vulnerability of the educational environment. On the one hand, researchers are aware that innovative elements such as artificial intelligence are vital for the functioning of the educational system in Ukraine as a whole. On the other hand, even in sustainable social organisations that are guided by the principles of sustainable development, artificial intelligence poses obvious threats. When the use of such an ambiguous element as artificial intelligence is applied in the unstable Ukrainian educational environment, the threats increase significantly. Given the vulnerability of the educational system, artificial intelligence, whose potential and impact (especially negative) are not studied and understood, can become a threat not only in the human dimension (deterioration of the quality of the educational process for its participants) but also in the existential dimension (loss of the purpose and value of the educational system).

Therefore, the Ukrainian educational space has become an interesting platform for researching scenarios for the introduction of artificial intelligence in the educational system. It is proposed to consider the use of artificial intelligence in key elements of educational activity in the context of sustainable development (educational systems in developed countries) and in the context of the crisis impact of external factors (Ukrainian educational space) (see Table 1).

Table 1.
Comparative analysis of the use of artificial intelligence in the educational paradigm of sustainable development and in the crisis educational system

Education cluster	Education system sustainable development highly developed countries	The Ukrainian educational system in constant change
Learning environment	Artificial intelligence performs a heuristic function, providing a strategy for progress and development	Artificial intelligence is focused on ensuring the stabilisation function of education, accompanying learning activities in difficult force majeure conditions
Methodological arsenal	The methodological arsenal of artificial intelligence is focused on an innovative educational ecosystem based on technology and digital space	The methodological principles are designed to ensure the functioning of a practical innovative learning environment
Pedagogical excellence	Artificial intelligence and pedagogical skills form a synergy to create effective strategies for educational development	Artificial intelligence is used in a pragmatic context to meet the current needs of the teacher in supporting the digitalisation of the educational process
The activity of the student	Artificial intelligence as a manifestation of the educational ecosystem determines the overall strategy of the educational and cognitive activity of the student	Artificial intelligence becomes a source and translator of information or conclusions on specific educational issues

Source: authors' own development

Artificial intelligence is significantly changing the design of learning. The introduction of adaptive learning principles is a direct consequence of the use of innovative technologies that use computer algorithms and tools in a bulk process. It is noted that such an educational landscape is used differently for different scientific models (Krasheninnik et al., 2022). While the use of computer algorithms is appropriate and

effective for technical or natural sciences, this methodology is no longer in demand in the humanities or creative sciences cluster.

Given the need to organise the educational process in Ukraine in an online and distance learning format (Mintii et al., 2021), there is a growing need for tools that will help speed up the processing, analysis, and dissemination of educational information (Kvitka et al., 2020).

One of the main achievements of artificial intelligence in education is to increase the level of personalisation of education and opportunities for the development of an individual learning process (Yuskovych-Zhukovska et al., 2022). In this aspect, artificial intelligence resources act as a kind of intermediary between the teacher and the student to create a favourable individualised learning environment. The traditional format of education does not allow for individualised learning due to a lack of time and opportunities, systematising and unifying education standards for all. Artificial intelligence provides opportunities for autonomy in the educational process, in which the role of the teacher is transformed into a coordinating activity.

Total digitalisation and the use of information technology tools such as artificial intelligence require an appropriate level of digital literacy among participants in the educational process (Kraus et al., 2021). Digitalisation in education is gradually turning from a popular trend into a familiar format of learning activity. Information and digital competence is becoming a requirement for pedagogical professionals to achieve better learning outcomes (Chernenko, 2021). Such realities require advanced training of teachers in the possibility of professional activity in the digital space. For the Ukrainian educational environment, such professional development is relevant, as it is implemented through self-organisation and does not require significant organisational, logistical, and financial efforts. The process of using artificial intelligence does not cause resistance or lack of skills to use this resource on the part of students. The functionality of artificial intelligence allows for the rapid use of such tools as machine learning, deep learning, cloud technologies, Data Science, Big Data, and neural networks (Valko et al., 2022).

The active use of information and technology potential carries certain risks for creative dimensions based on concepts such as "talent", "creativity", etc. There are threats of artificial intelligence absorbing these elements of human potential. At the same time, the creation and updating of educational content and the use of technological learning methods are fully consistent with the principles of creative forms of educational activity (Berbets et al., 2021). A solution to this contradiction is proposed by Bobrytska, Reva, Protska, & Chkhalo (2020), who define artificial intelligence as a tool that will help students achieve academic achievement.

Artificial intelligence in the educational paradigm is also used in the organisational and administrative cluster. In particular, in the financial and business sectors (Osetskyi et al., 2021). Artificial intelligence in education is making a real revolution in the organisational and administrative segment. Artificial intelligence is becoming the basis for intelligent management in education (Karpenko et al., 2019). For Ukrainian education during martial law and post-war reconstruction, this aspect will be especially relevant, as migration processes will lead to the loss of intellectual resources. There will be a question of alternatives and replacement of problematic areas of the educational sector. The speed of the recovery of Ukrainian society will depend on how prompt and complete this replacement is. Therefore, a separate niche will be created for artificial intelligence with clearly defined organisational and administrative issues in education. Learning Management System using artificial intelligence plays a special role in the integration of educational trends of today. Innovative technologies take into account the expectations of students regardless of the country (Smyrnova-Trybulska et al., 2022). That is, if there is an effective educational experience in a particular country, pupils or students from another country can use this experience in their learning and acquisition of knowledge and skills with the help of artificial intelligence. A specific feature of artificial intelligence is the interdisciplinary functionality of its resources. Artificial intelligence can translate materials, adapt them for a specific consumer, concretise and abstract individual elements, etc.

Controversies over the use of artificial intelligence in the education system also arise in the legal field (Stefanchuk et al., 2021). As Ukraine seeks to join the values of Western society, which primarily values the rule of human rights and freedoms, all legal norms must be fully observed. The Legal Tech methodology (Palkova & Agapova, 2021), which is designed to provide legal support for the use of artificial intelligence in education, can serve as a model for harmonising technological and legal norms of artificial intelligence.

The scientific and pedagogical discourse has not yet been divided into the classic two camps of support and opposition to the use of artificial intelligence in education, as the level of practical implementation of artificial intelligence resources in Ukrainian education has not yet reached the appropriate scale. Therefore, discussions about artificial intelligence are situational in nature as the level of application in certain segments of educational activity increases. At the same time, if we consider the prospects of artificial intelligence in the educational system, the potential consequences of this process are full of various forecasts.

The current study analyses two strategies for positioning artificial intelligence in the Ukrainian educational system. On the one hand, Kovaliuk & Kobets (2021) insist on the formation of an innovative educational ecosystem in Ukrainian education that will regulate the standards for the use of artificial intelligence and other technological and digital resources. A different opinion is held by (Skoromnyi et al., 2021), who emphasise the need to preserve traditional educational design based on substantial experience and to use innovative trends to strengthen the existing educational paradigm. A distinction should be made between the concepts of "informatisation and technologisation of education" and "informatised and technologized education" (Romanchenko et al., 2021). Kharlamova, Stavytskyy & Komendant (2022) provide additional arguments for preserving the traditional format of educational activity, but with the active use of artificial intelligence, noting that the Ukrainian education system is not ready in terms of material and technical resources for a complete transition to an innovative format and the creation of a new digital ecosystem. In general, artificial intelligence will be protected from being banned until the risks it poses become critical. At the moment, the benefits of artificial intelligence resources are clearly greater than the real (not potential or hypothetical) negative effects (Yakovleva et al., 2021).

The problem of using artificial intelligence resources in education is associated with a certain substitution of concepts. Artificial intelligence is being actively implemented in everyday life and is gradually becoming associated with a tool for improving and optimising life. However, educational goals are not limited to indicators of usefulness or convenience, having much broader target characteristics. Therefore, the integration of artificial intelligence into the educational sphere cannot be implemented according to the principles of its integration into the socio-cultural everyday space. However, the use of artificial intelligence has certain specific educational goals that focus on improving the processing of educational information, the accuracy of answers, and the visualisation of learning (Fiialka et al., 2023). In particular, Kovalchuk, Maslich & Movchan (2023) suggest that artificial intelligence should be considered solely as a tool for improving professionalism through digital literacy. For Ukrainian education, these characteristics are important in the short term, as post-war reconstruction will require quick and effective solutions.

The results of the current study correlate with the statement that the national education system (when considered in an autonomous dimension with the actualisation of exclusively internal potential) can be competitive only if the human and technological potential is synergised (Hanaba et al., 2020). If we consider the benefits of artificial intelligence exclusively through the prism of the educational sector, it is obvious that Ukrainian education has acquired the principles of flexibility (Barvinok & Pudło, 2023) and mobility, which is the best response to the challenges of the times. Only the integration of the efforts of the educational community, government institutions, and civil society (Kovaliuk & Kobets, 2020) will create an environment in which artificial intelligence will have positive dimensions and development prospects in the education system. As the practice of using artificial intelligence in other areas of social activity (engineering, financial sector, medicine) shows, its effectiveness is possible only when using interdisciplinary approaches.

It is inappropriate to apply consumer practice of everyday use of artificial intelligence in education, as this format does not ensure the achievement of educational goals.

5. Conclusion

Thus, artificial intelligence has become a relevant tool in the Ukrainian educational system and requires an analysis of its current status and forecasting of its future application. In short-term educational strategies, artificial intelligence performs a practice-oriented operational function of supporting the educational process and preventing the loss of the principle of continuity and accessibility of education. For the long-term perspective, there is a need for a more holistic description of the use of artificial intelligence in Ukrainian education. Given that Ukraine continues to actively integrate into the principles of sustainable educational development, which is typical for Western societies, the correlation of norms for the use of artificial intelligence resources must meet all the requirements of a developed democratic society. This means that artificial intelligence will perform pragmatic functions in education to ensure a high level of quality and will comply with the norms of civil society (without violating the legal and moral and ethical principles of educational development). Therefore, it is important for Ukrainian education to maintain the dynamics of practical implementation of innovative elements and plan strategies to reconcile the principles of artificial intelligence with the fundamental principles of the purpose of education.

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