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The Role of Digitalisation in the Educational Process in the Creation and Functioning of Artificial Intelligence

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Abstract: *This article examines the impact of digitalisation on education, particularly the integration of artificial intelligence technologies within the educational framework. It highlights the swift adoption of AI and the corresponding expectations placed on all stakeholders involved in the learning process. It is essential for educational institutions to recognise and adapt to these digital changes, as training the workforce and fostering a progressive society are vital for a nation's innovative growth. The article also identifies key elements related to how digital technologies influence the educational structure. It highlights a range of potential challenges that educational organisations may face during the transformation process. The article explores the main areas and directions of artificial intelligence application in education and, using examples from other social sectors, sheds light on the potential risks associated with it.*

Keywords: *digitalisation; implementation; adaptive learning; educational process; digital technologies.*

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1. Introduction

The rapid spread of digital technologies across all spheres of society means that society cannot keep up with these changes, assess all the advantages and disadvantages of this process, or foresee the related prospects and horizons. What seemed like science fiction yesterday will soon become reality. The same is true for education: not long ago, few considered the presence of artificial intelligence in education, but the situation has changed.

It can be said that artificial intelligence occupies a specific niche in the educational process. Therefore, it is important to analyse the development prospects of this process and, first and foremost, to explore the functions AI can serve today and in the future. Will it become a reliable assistant and tool in the hands of teachers, or will it evolve into a “disruptive” technology that significantly reshapes the field of education?

Many domestic and foreign researchers have studied the aspects of digitalization in the educational process and the functioning of artificial intelligence. According to Shevchenko et al. (2023), digital technologies are not only advanced innovations but also a serious burden that comes with their development, one that falls heavily on the shoulders of teachers.

Furthermore, the entire educational infrastructure is evolving. Innovations like online platforms, distance learning systems, online courses, and other digital tools (such as VR technologies) are reshaping the traditional “teacher-as-learner” model. Consequently, the implementation of artificial intelligence technologies in this field further complicates an already ambiguous picture. However, an “ostrich strategy” of avoiding complex situations is not justified. While AI in education is a complex phenomenon, it is crucial to understand it to harness its opportunities and recognise the potential risks it may introduce into the educational process. This is what makes the research in this article relevant.

This article aims to examine the key trends, transformative processes, and effects of global digitalisation on the education sector and its framework. It seeks to evaluate the potential of artificial intelligence to take over teaching roles, investigate the main applications of AI in education, and analyse its function as either a beneficial tool or a challenge to conventional educational methods.

2. Artificial Intelligence as a Consequence of the Digitalisation of the Educational Process

The process of digitalising educational institutions includes utilising a range of software, applications, and digital tools for online learning. This digital transformation encompasses adjustments in both educational and organisational practices, such as revising educational materials and assessment approaches, enhancing teaching methods and skills, improving learning technologies, fostering information technology and data management expertise, and reorganising educational resources along with overall institutional functions.

The COVID-19 pandemic that began in 2020 led to a significant surge in digitalisation within education, particularly through the expansion of distance learning, which highlighted the practicality and success of this teaching approach. Additionally, the movement towards online education is still on the rise, as shown by the wide variety of educational programs available for students to earn official diplomas and certificates.

Any process that influences the core of societal life presents various challenges. To begin with, digitalization is costly and relies on government funding, but not all institutions can offer adequate financial backing, resulting in varying standards of education. Additionally, enhancing faculty qualifications is unattainable without creating specialised training programs focused on modern information and educational techniques. Finally, not everyone supports the necessity and importance of the shift toward digital education, as effective learning often requires direct interaction between mentor and student.

Artificial Intelligence is a cutting-edge technology that should be utilised to support a country’s strategic national interests. The application of AI technologies in education aims to

enhance its quality by adapting the educational process to the needs of students and the labor market, systematically analysing academic performance indicators to optimise career guidance and identify gifted children early, and automating knowledge assessment and analysis of learning outcomes.

AI can fully take on these tasks. Digital transformation is also evident in education. Digital technologies and electronic information-educational environments have become essential tools for educational institutions, enabling them to effectively implement curricula during the pandemic when universities operated in a "remote" format.

Digital technologies allowed productive use of the self-isolation period and became one of the means of significantly enhancing the effectiveness of measures to counter the spread of the coronavirus pandemic (Yahodzynskyi, Tymoshenko, & Kozynets, 2023). Moreover, digital technologies helped soften the social shock experienced by society at the time: interaction with students on digital platforms and the ability to see each other lessened the negative effects of isolation.

According to Striuk (2023, pp. 170-174), "this is due to the fact that the educational process is built on example and persuasion and cannot be fully carried out by another person". Digital technologies can only supplement but not replace personal interaction between teacher and student. In the most modern educational institutions equipped with AI technologies, the role of the facilitator should not replace the role of the teacher, especially when the facilitator's role is assumed by artificial intelligence.

However, the topic of education gained renewed relevance in the context of digitalisation. Today, it is increasingly clear that total digitalisation of the educational process disrupts the unity of teaching and upbringing, a fundamental principle of education. While the learning process as a whole can be carried out through digital technologies (although it remains incomplete without the emotional engagement that fosters high-quality knowledge acquisition, the development of systems thinking, and the intellectual growth of students), the process of upbringing in a digitalised environment is virtually impossible.

3. Why Can't Artificial Intelligence Replace Teachers?

Certainly, artificial intelligence has a vast memory capacity. Its structure demonstrates an ability to mimic high-level mental processes (intellectual behaviour, thinking, creativity, and emotional reactions) that can be performed by bio-computers and neuro-computers based on biological elements and neural networks. But what is it that machines cannot do?

Aktay (2022) believes that programs are incapable of empathy and creativity. This quality puts humans in a unique position compared to computer programs: a robot can never replace a person in creative professions that require the ability to develop new ideas and ideal image systems, in professions that demand strategic thinking, and in work related to empathy and compassion, which machines cannot exhibit. Thus, machines are unable to teach qualities and inclinations most strongly expressed in the learner. This is the essence of adaptive learning, whose goal is to create learning paths tailored to the specific abilities of the student.

Today, adaptive learning is mainly represented by courses on platforms like Knewton, MyLab, Plario, ALEKS, Stepik, Logiclike, children's and teens' programs for logical thinking development, the self-study project for university entrance exams "Examer," educational HR management programs (Competentum, iSpring, and e-MBA), as well as language learning (Skyeng, Lingualeo, and Websoft) and programming and design (Geekbrains and Netology).

What positive effects can adaptive learning have on education? First and foremost, it enables individualised learning aimed at developing skills most evident in students. According to Karplyuk (2019), "identifying these characteristics through comprehensive tests is a crucial preparatory part of the program. When designing a learning curve, the program considers the level of brain development structures that determine individual behaviour".

ALEKS is an innovative adaptive platform that revolutionises the learning process. The platform uses intelligent algorithms to create a personalised learning path for each student. Students who have used ALEKS demonstrated significant improvement in their performance on exams such as the SAT or ACT. Thanks to ALEKS' personalised approach, students were able to prepare for exams more effectively and spent less time studying. Data analysis revealed that students using ALEKS gained a better understanding of complex mathematical concepts.

Knewton is one of the leading adaptive learning platforms that harnesses the power of artificial intelligence to create a personalised learning experience for every student. Each learner receives a study program tailored to their needs and learning pace. Through continuous customisation, the system helps students achieve their goals faster. The personalised approach enhances students' motivation to learn. The system not only aids in memorising facts but also promotes a deeper understanding of the subject. Its intuitive user interface allows students to focus entirely on learning.

Supporters of this system, such as Androshchuk et al. (2022), note that "certain primary brain structures specialise even before birth (e.g., auditory, tactile, and motor skill recognition); thus, optimising learning should consider these developmental stages". The primary task of adaptive learning is to accurately determine what this person will do most effectively after 25 years, once major brain structures have formed, even the prefrontal cortex (Androshchuk et al., 2022).

In other words, adaptive learning makes the path to achieving certain goals shorter and makes professional skills more successful. This technology appears essential in modern society, but only when a person is viewed as someone with professional skills.

Therefore, adaptive learning is a technology aimed at effectively realising professional education goals. It's not just about making learning more harmonious, but also that adaptive learning functions as a management system, largely defined by the amount of collected and aggregated personal data.

According to Sheremet et al. (2019), this is directly tied to another threat posed by digital technology implementation in the education system: the creation of an educational digital footprint, a specific identifier that automatically updates throughout the digital passport owner's life. This digital footprint is a necessary condition for adaptive learning, containing data on development progress, educational experience, and recommendations for further growth.

These data become accessible within the proctoring system (the person overseeing exams at a university), which observes students during all types of assessments, tracking factors like unauthorised persons in the room, unusual noises, eye direction, room temperature, and more, which may count as violations. Two main proctoring options are usually supported: automated proctoring, where the system assigns a trust score, and live proctoring, where an observer is physically present at the exam.

This process carries risks, made real by the digitalisation of education. One concern is the analysis of intelligence and skill heritability in educational big data. Proponents of adaptive education openly discuss the necessity of limiting specialisation, rather than trying to develop everyone equally in every area of behavioural activity.

"Thus, through these technologies, education becomes not a means to expand each person's opportunities, but a mechanism for social segmentation, based on the primary division of society into those with an 'acceptable' education and those capable of accelerated learning" (Christensen, 2015, p. 265).

Firstly, it's essential to dispel the myth that AI in education is a robot in the classroom or a virtual projection on a computer screen that replaces a real teacher (a common image many people associate with AI in education, as surveys show). Although this is a misconception, it reflects a general perception and partly explains the negative reaction toward using AI for teaching various subjects.

It's important to understand that AI isn't a humanoid robot but a technology, software, or a series of programs interconnected in a network to define and execute specific algorithms. What's

the difference between AI and regular software? The primary distinction is that AI technology is designed to function similarly to human intelligence: collecting facts, analysing, making choices, and making decisions.

With the advancement of technology and the increasing use of digital tools in education, the issue of protecting students' data is becoming increasingly relevant. Regulating this process is crucial to ensuring trust in educational institutions and safeguarding students' rights. One of the most influential documents in this field is the EU General Data Protection Regulation (GDPR). The GDPR sets high standards for personal data protection, including student data. The processing of personal data must have a legal basis and be transparent to data subjects (students). Only personal data necessary for a specific purpose should be collected.

Personal data must be accurate and updated as needed. They should not be stored longer than necessary for the purpose for which they are processed and must be handled in a way that ensures their security. The GDPR is a significant milestone in the development of personal data protection legislation. Its principles can serve as a foundation for developing national laws and internal policies within educational institutions.

Here, it's essential to emphasise that AI technology is neutral; only its objectives give it value. This neutrality also appears in education, where AI can either assist (teachers and students) or potentially harm the educational process by generating biased outcomes, causing public concern.

An example of useful AI tools aiding teachers includes attendance tracking and personalised learning path development for students with special needs (e.g., those on the autism spectrum). Conversely, an example of AI's negative impact on education was the controversy over grade calculation, selection, and university admissions for UK school leavers in August 2020.

The public reacted strongly due to a problematic algorithm used during the 2020 pandemic to assess applicants. This algorithm was biased against private school students in comparison to their public school counterparts, particularly affecting those from lower-income families and reducing their chances of admission. Studies revealed that the final scores produced by the AI were, on average, 15% lower than the scores given by teachers.

A dedicated commission that looked into the matter found more than 100.000 instances of unlawful grade reduction affecting students leaving school. Although this was a singular occurrence, it emphasises the important matter of academic assessment. For the majority of students, this situation is crucial, and for those applying in the future, it often represents a key moment, making the effective operation of AI in these cases essential.

When discussing the role of AI in education, several noteworthy trends emerge. A look at international practices reveals that significant applications of AI in education encompass:

- Digital Learning Management Systems - Google Classroom, Moodle, and Blackboard.
- Educational Mobile Apps (e.g., Castle Quiz, allowing students to check their knowledge across subjects like literature, math, chemistry, and physics).
- Massive Open Online Courses (MOOCs) - Coursera (a leader in this field), EdX, and Udacity.
- Digital Resources for Psychosocial Support - apps for emotional therapy for autism, digital platforms with psychological-pedagogical programs to support at-risk students.
- Online Collaboration Tools (Skype and Zoom) for all educational process participants.

While many are still being refined, it's important to highlight projects such as Geekie, Knewton, and Smart Sparrow. These systems have proven effective, with data showing that students using them achieve 12% better results in certain subjects than those who do not.

According to Chaka (2023), this review of AI technology applications in education demonstrates an extensive range (in terms of goals, stated functions, and target audience), meaning there are products aimed at broad audiences for various tasks, like Google Classroom.

Then there are more specialised, targeted products. However, what unites them is educational process optimisation. On the one hand, they can be useful tools for routine tasks (e.g.,

attendance tracking, test checking, and homework management); on the other hand, AI can substantially support all aspects of education, especially students.

The scope of possibilities is vast: aiding in selecting available courses on online platforms according to student profiles, training essential skills via mobile apps, rapid access to knowledge bases based on academic profiles, and top-level individualised support.

According to Malykhin, Aristova, and Dyka (2020), all of this illustrates the advantages and prospects for AI technology application and development in education. However, a crucial question arises: is AI in education becoming a "disruptive" technology, and why does this concern exist? Disruptive technologies—a relatively new term—refer to innovations that fundamentally reshape segments of society and sectors of the economy.

Undoubtedly, artificial intelligence can be considered one of these technologies due to its rapid spread and the profound changes it brings to social institutions. However, it's essential to monitor how and at what level it's implemented across different societal segments, where ethical issues and competent development orientation are critical (Alhumaid et al., 2023).

The use of big data in education opens new opportunities for personalising learning and optimising the educational process. However, it also raises important ethical questions regarding potential societal segmentation. Algorithm developers must ensure transparency and clarity to avoid bias, establish clear rules and standards for collecting, storing, and using student data, guarantee equal access to quality education for all students regardless of their social or economic background, and preserve the role of teachers in the educational process. Teachers can respond individually to each student, help them overcome challenges, and strike a balance between personalised learning and social interaction, enabling students to develop both academic and social skills.

It is worth noting that the initial impersonality of AI was considered a significant advantage of the technology, as it emphasised the absence of the "human factor." It was assumed that introducing subjective elements into decision-making played a negative role in some social practices, and AI would solve this problem, as it is expected to be characterised by absolute impartiality.

The education sector is undergoing significant changes due to the integration of digital technologies. However, to fully realise the potential of digital learning platforms, we must understand how our brain interacts with these technologies. Neuroscience research provides valuable insights into the processes occurring in the student's brain during learning on digital platforms. The human brain is designed to process visual information. Bright graphics, animations, and videos help capture students' attention and enhance material retention. Active engagement in the learning process stimulates the brain and promotes a deeper understanding of the material. Immediate feedback on task performance helps students adjust their actions and reinforce new knowledge. Each student has unique brain activity, meaning the learning effectiveness may depend on individual traits such as learning style, motivation level, and more.

Neuroplasticity, the brain's ability to change and adapt throughout life, means that its structure and functions can evolve due to experience, learning, and practice. Adaptive systems select tasks that are sufficiently challenging to stimulate the brain but not so difficult as to cause overload. This approach ensures optimal neural activation and promotes the formation of new synapses. Every student has strengths and weaknesses. Adaptive systems allow students to focus on aspects of the material that require additional attention, enhancing learning efficiency. Constantly changing tasks prevent the brain from falling into a routine and ensure high levels of concentration, fostering the development of strong neural connections. Immediate feedback on task performance helps the brain consolidate new knowledge and avoid errors.

Initially, AI's impersonal nature was seen as an advantage, as it was believed that removing subjective factors in decision-making would be beneficial. However, AI also carries certain risks for society. Thus, AI is both a breakthrough and a disruptive technology in this sense.

As Attwell et al. (2020) suggest, "varied studies in this area are essential, from large-scale surveys of all education stakeholders—teachers and students—to determine their attitudes and

experiences with AI programs, conducting expert interviews with IT and education professionals, and actively gathering feedback and monitoring AI-based products in the educational process".

Leaders in this field include countries such as the United States, which boasts a strong scientific base and major technology companies that actively invest in developing AI solutions for education, and China, which is rapidly advancing in AI and widely integrating innovative technologies into education.

South Korea is making significant investments in education and actively leveraging AI to enhance the quality of learning. Singapore has ambitious plans to transform its education system through AI. The United Arab Emirates (UAE) has made AI a national priority and actively incorporates it into all areas of life, including education.

This approach will not only prevent mistakes like the UK's AI-driven grade miscalculation in 2020 but also channel AI in education toward becoming a constructive assistant for teachers rather than a disruptive technology.

4. Conclusion

The importance of this article lies in highlighting that the presence of artificial intelligence (AI) in education is a reality that, to varying degrees, affects all participants in the educational process. However, it is essential to emphasise several key points.

Applied research shows an ambivalent attitude towards AI among both educators and students—there is neither unconditional acceptance nor outright rejection but a cautious approach concerning expectations for this technology's expansion. This attitude depends on various factors: the rapid pace of AI integration into society, the additional workload it places on teachers in their professional roles, and the myths surrounding AI (including concerns about mass unemployment, the potential for AI to dominate society, depersonalisation of societal processes, and the possibility of robots replacing people in key positions).

The article demonstrates that analysing AI's role and functioning in education requires an interdisciplinary approach. This approach should include examining individual AI-based educational products, programs, and platforms as well as conducting social research to gather insights and sentiments from educational participants—teachers and students alike. Continuous monitoring of the development and implementation of new AI-driven educational tools is necessary.

The article analyses the main trends, transformational processes, and the degree of impact that global digitalisation has on the structure and domain of education. It explores whether AI can replace teachers and examines the primary areas where AI is applied in education.

However, AI's implementation in education also raises several ethical issues, such as the potential for societal segregation based on intellectual abilities, the storage of a student's digital footprint that could be used for manipulation, and the construction of educational trajectories based on positive outcomes in mastering specific knowledge blocks.

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