Digital Transformation of Education Based on Artificial Intelligence

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Abstract – **The digital development of the modern world requires the formation of a cognitive model of education based on artificial intelligence and the development of approaches to the analysis of smart education, which is its basis. The cognitive model of education based on artificial intelligence emphasises the importance of deep learning, a deep understanding of educational digital concepts, and the formation of values and culture necessary to address the challenges of modern development. The development of a cognitive model of education is aimed at developing critical and reflective thinking, improving cognitive skills and active learning, including online learning.**

Keywords – **Digitalization of education, artificial intelligence, digital technologies, information and digital transformation, cognitive model.**

1. Introduction

The relevance of the research topic is that with the advent of the Fourth Information and Technology Revolution, the Internet, digitalisation, and artificial intelligence have been introduced into education.

The 21st century is the age of global integration and rapid development of digital technologies, which rapid development not only has a profound impact on the economy, trade, healthcare, education, but even changes people's lifestyle. Today, digital technologies have become an integral part of our daily lives, and the trend of digital development is irreversible. The invention of the computer and the Internet is an extension of human intelligence that requires the expansion of cognitive abilities. The digitalisation of education is an unprecedented change in information technology and a new leap in the transformation of nature that has moved civilisation to a new level. Digitalisation of education contributes to the progressive and continuous process of development, as digital technologies have had a revolutionary impact on education. The use of digital technologies allows for the rapid dissemination, storage and reproduction of human knowledge, the growth rate of which has become extremely rapid. The emergence of the Internet has overcome the limitations of time and space, and has been an effective way to narrow the education gap and promote equality in education. The Internet an important means for knowledge sharing, has created a world without boundaries, and is an inevitable choice for the realisation of universal and lifelong learning. Digitalisation of education includes vast knowledge resources and is an important platform for the development of human civilisation. The Internet and new technologies support new applications of learning models. Digitalisation of education is reflected in the cloud-based education platform, in which the platform use of the Internet and telecommunications network is implemented. Digitalisation of education means a system of active use of digital technologies, in-depth development and widespread use of digital resources, cultivation of innovative technologies in accordance with the requirements of the digital society and acceleration of the implementation of education modernisation in all aspects of education.

Digitalisation of education is the process of comprehensive and deep use of modern digital technologies in education to promote the development of knowledge. It means the process of widespread use of modern information technologies in education, development of educational resources, optimisation of the educational process, improvement of digital literacy, and promotion of the process of education modernisation. The implementation of education modernisation is inseparable from digitalisation, and the latter should serve the modernisation of education; modern digital technologies should be widely and deeply used in all sectors of the education system in the context of the smart values formation [2].

The purpose of the study is to conceptualise the digitalisation of education in the context of the introduction of artificial intelligence. To achieve this goal, it is necessary to 1) analyse the digitalisation of education as a factor in improving educational technologies; 2) identify digital educational innovations in the context of global challenges; 3) substantiate the factors of digitalisation as factors of increasing the effectiveness of cognitive models of education.

2. Literature Review

Digitalisation of education is the process of using modern digital technologies and tools to improve learning, access to knowledge, and communication in the educational environment. It may include the use of computers, tablets, smartphones, software, online courses, web resources, and other digital resources.

The literature review facilitated an in-depth examination of the merits and drawbacks associated with the evolution of digital education through the incorporation of artificial intelligence. This analysis laid the groundwork for the creation of a cognitive education model. We drew upon various sources related to digital transformation, smart education, and the general trend of digitalization.

We examined European experiences in modernizing education, with a focus on digital transformation, but found that these studies did not address the cognitive model of education we aim to create [1].

Our investigation also built on the early approaches to smart education analysis, which we found in the literature [2]. We utilized methodological principles discussed in prior work as our methodological basis [3].

To understand the broader context of digitalization, we explored literature discussing the impact of social networks on students' social competence, training teachers for distance education, and the evolution of digital technology from 4G to 5G within the challenges of digital globalization [5], [17], [18].

A number of monographs have been prepared in Ukraine that address the problems of implementing smart education to varying degrees making it possible to study the foreign experience of educational transformations. We also considered the insights from sources highlighting the challenges posed by artificial intelligence, particularly its potential impact on work, human relationships, and civilization [8]. The work of Russell Stewart [12] played an important role stating that artificial intelligence is a powerful tsunami that threatens not only work or human relationships, but also the entire civilisation, as well as Kelly Kevin's work [7], which focuses on the development of digital technologies and artificial intelligence that facilitated the development of the cognitive model of education.

3. Research Methodology

The formation of the concept of education digitalisation in the context of threats and new global challenges can be analysed by the following methods: 1) Data science - analysis and processing of data in digital form; 2) development of digital technologies as megatrends data-mining, including in-depth data analysis aimed at expanding and personalising data on digital technologies for further development of the educational process; 3) use of big-data methods (graph method and topological analysis) to analyse digital educational innovations in the context of global challenges; 4) improvement of the agile method of creative smart digitalisation technologies as a factor in improving the effectiveness of cognitive models of education using the most modern methods; 6) use of scrum methodology to analyse the phenomenon of digitalisation and its components in order to acquire know-how, digital skills, and meet the requirements for successful training of talented and engaged professionals within the framework of project management and business execution methodology, in particular in the development and implementation of education projects. Scrum is based on Scrum Six Sigma, Kanban, software engineering, Six Sigma, quality management, DevOps, leadership, management, project management. Scrum is a framework used to implement an agile method; 7) implementation of deep (machine) learning models in education that improve the concept of creative digital technologies. We are interested in a meta-analysis that includes the results of many studies aimed at identifying the most influential factors that contribute to improving learning. The meta-analysis uses an indicator of the impact effect to compare different factors in the educational process. Meta-analysis includes factors such as teacher confidence, feedback, high teacher expectations, and teacher-student collaboration [16].

Meta-analysis as a methodology can be useful when introducing digital technologies into the learning process, helping to understand how they can affect the quality of learning and student achievement. The meta-analysis methodology includes the following types of techniques: 1) the flipped classroom methodology, which involves the use of an online platform that provides free educational materials and lessons in video format, video lessons to study new material at home, and classroom lessons to solve problems and do practical exercises; 2) the methodology of integrating digital technologies into the learning process, which emphasises the importance of changes in teaching approaches and the use of technology as a means to engage students in order to improve their academic performance; 3) methodology of an interactive programming environment for students, which emphasises the importance of learning computational thinking and programming from a young age, as well as developing creative skills through the use of digital tools, combining the influence of various factors on the learning process in the context of social, economic and educational transformations in the digital age [14].

4. Results and Discussion

In the early 2000s, the widespread use of mobile phones with microphones, cameras, accelerometers, and GPS provided a new level of access for artificial intelligence systems to people's everyday lives. Crossing a certain threshold marked the beginning of the Internet of Things (IoT). Eventually, thanks to the improvement of perception functions, AI robots left the factories for the unstructured, chaotic world where there is so much to see for their cameras [12]. The centre of development has moved from academic research laboratories to large corporations. Nevertheless, conceptual breakthroughs are needed to reach the human level of AI.

4.1. Digitalisation of Education as a Factor in Improving Digital Technologies in the Age of Artificial Intelligence

The digitalisation of education in the era of artificial intelligence means: 1) to include the improvement of digital literacy in educational goals and to form competitive specialists who adapt to the digital society; 2) to apply digital technologies effectively for teaching, research, and the use of educational digital resources. The main content of education digitalisation is the informatisation of learning, which means making teaching methods scientific and predictive, digitalising education, and modernising teaching methods.

Digitalisation of education requires the integrated use of modern information technologies based on computers, multimedia, big data, artificial intelligence and network communications in the educational process to promote educational reform and adaptation to the new requirements of the information society, forming various humanitarian technologies of influence on the individual [15].

Digital technologies are means of achieving human goals, integration of digital practices and components, a set of devices used in education - Internet technologies, online learning space, big data, artificial intelligence. According to Russell Stewart [12], it is digital technologies that have changed production and lifestyles, contributed to the transformation of all spheres of life, but more than one breakthrough is needed to turn the downward spiral into an upward one. The digitalisation of education is aimed at performing a certain type of tasks that are nowadays called "empowerment". In the digital era, interaction and cooperation between different participants in the value network is the main way to achieve mutual benefit and form a new digital culture encoded in information. Digital innovations are those that use new information technologies to create a new path or opportunity, which requires the transformation of methods and forms of learning. Digitalisation of education is an integral part of modern education, as it allows for greater learning opportunities and creates new forms of learning and interaction between participants of the educational process. Digital technologies can be used to improve various aspects of learning, such as data collection and analysis, lesson organization, and access to materials, etc. Digital technologies are an important component of the use of IT in education, allowing creation of a virtual environment for learning and interaction between participants in the educational process. Digital resources allow learning anytime and anywhere, and e-textbooks are more interactive and can be saved and updated. Online tests allow students to assess their knowledge and receive feedback in real time, enabling teachers to collect, analyse and store data on the learning process and student learning outcomes. Online communities and virtual platforms allow students to actively discuss issues and develop creative competencies and skills, especially after the COVID-19 pandemic crisis, when new trends in training have emerged [13].

The digitalisation of education is facilitated by the use of platforms for communication and exchange of ideas, new ideas and resources, cloud services and applications for storage, sharing and collaboration, allowing students and teachers to easily access resources from any device through the Internet connection. In the field of virtual reality applications, education and training has become an innovative industry.

A full-fledged VR classroom requires not only hardware support (including an all-in-one VR machine, computer, monitor), content (supporting courses), but also a solution that combines software and hardware, which requires students to develop cognitive, reflective, and philosophical thinking. The use of digital applications and platforms that facilitate collaboration between students, teachers and researchers, and the creation of virtual environments for research, experimentation and practice, provides students with access to the necessary equipment and resources. The use of blogs and wiki platforms for collaboration, sharing knowledge and ideas, and documenting research and project results is aimed at maximising the reward system. The use of audio and video materials as additional learning resources that can be listened to or viewed by students on their own schedule provides access to electronic stimulation. The use of mobile devices, such as smartphones and tablets, to access learning materials, communicate and interact in distance learning provides flexibility, convenience and mobility for both students and teachers, which forms the concepts of digital transformation of e-learning [1]. These and other digital technologies play an important role in shaping the concept of digitalisation of education, helping students and teachers to collaborate, learn, exchange ideas and resources. This opens up the possibility of providing access to learning materials and research from a variety of sources. The development of digital technologies has contributed to the transformation of traditional educational concepts, models and methods, as well as the transformation of methods and forms of learning that lead to an intellectual outcome. This change is mainly reflected in the fact that artificial intelligence has made significant progress in solving problems and developing effective algorithms, creating a solid theoretical basis in three aspects: 1) the mode of learning has changed according to the characteristics of screening and fragmentation in the Internet+ era, learning overcomes the limitations of time and space, is more selective and autonomous; 2) changes in learning models lead to changes in teaching, learning and assessment, as the way students learn has changed from traditional one-way knowledge transfer to "interactive" education; 3) the impact of digital technologies on education is manifested in the transformation of educational concepts (e.g., flipped classrooms, new academies, cloud schools); 4) there has been a change in the existing teacher-student relationship, in management models and teaching methods, which has given rise to attempts to provide the machine with the ability to find solutions on its own.

Thanks to digitalisation, higher education is undergoing profound changes. Thirty years ago, colleges and universities were mainly engaged in learning-based activities in a closed campus environment, today the opening of campuses has forced colleges and universities to move from the edge of the economy and society to the centre. Over the past 30 years, higher education has undergone significant changes in terms of environment, conditions, structure, composition and subjects, which poses serious challenges to the ideas, educational concepts and methods of managing higher education in schools and training. Higher education needs to adapt to these changes and actively change concepts, because there is a risk of exceeding the human intelligence. A set of applications is the highlight of the programmes, including broadcast control applications, automatic live broadcasting, and multi-person interaction applications in a large space. When using virtual reality educational equipment, real-time interaction between teachers and students is required. Thus, the popularisation of VR education faces the problem of insufficient usability of software equipment and deep mastery of cognitive and digital technologies by pupils and students. The Internet era is an era of deep integration of digital technologies and education, based on the use of formal logic as a basis for knowledge and reasoning. The traditional classroom is gradually becoming a learning club, a place where students do their homework and answer questions collectively; lecturers are in the cloud; classrooms are in the cloud, schools are in the cloud; teachers become consultants in the club, and the time for direct conversations with students is increasing. The Internet era is an era of true news freedom, full political democracy, the era of sophisticated and popular tastes. The digitalisation of education as a factor in improving educational technologies in the age of artificial intelligence is the most prominent symbol of this great era. Scientists, researchers of operations and control theories have created various algorithms for solutions in the context of conceptualising smart philosophy and smart technologies as a postmodern project of non-linear development [3].

4. 2. Digital Educational Innovations in the Context of Global Challenges

The digitalisation of education, especially in the context of new technologies such as 5G and artificial intelligence, is a major factor in the impact of technology on profound changes in education, affecting educational goals, learning content, and teaching methods.

Digital educational innovations in the context of global challenges of education modernisation include three main elements: 1) the problems faced by the current development of informatisation of basic education; 2) how technology can expand educational opportunities; 3) how it can affect the quality and balanced development of basic education. The continuous advancement of the digitalisation of education requires institutions to have a deep understanding of the changes brought about by technological education and its role in learning. The digitalisation of education aims to change the ecology of education informatisation, which should be deeply integrated into education and learning. Digital educational innovations will inevitably conflict with the educational structure in the era of educational informatisation 1.0. Therefore, the problem arose - how to cope with these contradictions in order to promote the modern development of digitalisation of education in the context of academic and digital transformation of education. Kevin Kelly has predicted that decentralisation, distribution and self-organisation are the ultimate destiny and result of information and communication technologies that are shaping our future [7]. Artificial intelligence, 5G, and blockchain technologies are turning prophecies into reality through the accumulative generation of new concepts. Digital education will also become increasingly self-organised, diversifying teaching methods, providing more personalised learning resources, and making learning more creative and intelligent. Therefore, the reform of higher education should move towards project-based, situational and STEAM learning, so that students can engage in a variety of interactions through digitalisation. Projects such as robots, virtual reality, artificial intelligence, and programming can be implemented to develop interdisciplinary thinking, problem solving, and cognitive collaboration skills. In particular, the creation of STEAM courses in combination with regional and rural features, the construction of project-oriented, localised and normalised STEAM courses, and the integration of the latest information technology advances contribute to the development of digital education and the cultivation of professionals.

According to the characteristics of the digital education era, digital competences of teachers and students should improve the system of professional training assessment in the context of challenges and opportunities of technological progress in the European Union [11].

Our actions are organised into complex hierarchies with dozens of levels of abstraction. These levels and actions are a key element of our civilisation and are passed down through generations in language and practice.

Firstly, the education cloud platform should open up all supply and demand interfaces so that any system can access the platform, so that the education information supply system can meet the needs of all users and at the same time can better collect data. Second, education in the 5G era will enter a new stage of development. New core technologies, such as big data and artificial intelligence, will gradually change the source of information, the decision-making process in education, and the roles of teachers and students in the traditional education sector. Third, digital education will create a new assessment system. Big data-based education assessment will need to identify the relationship between teaching load and learning quality, contribution to learning, physical and mental health, teachers and students, and to depict digital portraits of students from multiple dimensions. In the era of artificial intelligence, digital innovations are at the forefront of technological progress and have a significant impact on educational paradigms, concepts, models, and various spheres of life. Machine learning and deep learning can be distinguished, which allow computers to learn from data and perform tasks necessary to solve certain problems. They are used in many industries, including image processing, speech recognition, recommendations, forecasting, and many others. Digital innovations are having a significant impact on education, providing new opportunities for learning, collaboration and access to knowledge in the context of the interaction between the digital person and society [5].

Table 1. Digital innovations in education

№	The impact of digital innovation	Content and direction of development
1.	Interactive e-platforms and learning management systems	Enable students and teachers to access online learning material, assignments, tests and resources, and provide progress tracking, assessment and feedback
2.	Using virtual and augmented reality	Allows creation of immersive learning environments where students can interact with virtual objects, simulations and virtual laboratories, which helps to improve understanding of complex concepts and practical skills.
3.	Mass open online courses	Provide an opportunity for mass learning via the Internet, allowing you to gain knowledge and skills in various fields using video lectures, assignments and forums.
4.	Adaptive learning systems	Use machine learning algorithms to individualise the learning process, analyse students' skills, achievements and needs, and provide assignments, recommendations and support.
5.	Digital tools that allow you to create and use multimedia materials	Video lessons, audio recordings, interactive presentations and graphic materials make learning more interesting, accessible and help visualise complex concepts.
6.	Using social media for educational purposes	Can provide a platform for collaboration, knowledge sharing and the creation of virtual learning communities, facilitate discussion of materials and collaborative problem solving.
7.	Interactivity and gamification in education, which are becoming increasingly popular	Digital tools allow users to create game elements that encourage active learning and stimulate student motivation.
8.	Using data analytics in education	It help collect, analyse and interpret data on student progress, achievements and needs, enabling teachers to make informed decisions about improving the learning process and individual student support.

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Thus, digital innovations in education open up new opportunities for learning, increase the accessibility, and efficiency of the educational process. Here are some practical recommendations for implementing digital innovations in education. In order to do this, it is necessary to provide adequate infrastructure, such as fast Internet, computers, tablets, projectors and other technological devices necessary for the use of digital tools, and pay attention to information security and personal data protection. It is necessary to ensure that students are actively involved in the development of digital tools giving them opportunities for active participation in the learning process using digital tools, encouraging them to conduct independent research, work together and exchange ideas through digital platforms that will lead to a stable digital economic space [8].

4.3. Digitalisation Factors as Determinants of Increasing the Effectiveness of Cognitive Education Models

The authors of the study developed digitalisation factors specifically for higher education institutions.

The factors of university digitalisation reflect the five main areas of digital competence development of universities and include: DI_1 - production process; DI_2 - information structure; DI_3 - level of research work; DI_4 - satisfaction with digital services; DI_5 - economic indicators of digitalisation. The integral assessment of the level of digitalisation of the university is proposed to be carried out using the type criterion:

$$DI_{univ} = \sum_{k=1}^{5} \omega_k DI_k$$

where DI_{univ} - is an integral assessment of the level of digitalisation of the university; DI_k - is the main directions of development of the university's digital competences; ω_k - is the weight of each direction of development of the university's digital competences ($\sum \omega_k = 1$).

Consider in more detail the identified digitalisation factors and the corresponding indicators.

The "production process" (DI_1) in the framework of the assessment of education digitalisation is interpreted as the process of training qualified personnel and can be characterised by a group of indicators that describe the availability of digital training programmes, professional development programmes, pre-university courses, etc. The assessment of this factor can be presented in the form of:

$$DI_1 = \sum_{i=1}^{7} \mu_i Q_i$$

where μ_i - is the weight of each indicator ($\sum_{i=1}^{7} \mu_i = 1$); Q_1 - Moodle platform courses, % of the total number of courses at the university, $\mu_1 = 0,2$; Q_2 - number of courses on the platform coursera. Org platform, $\mu_2 = 0,1$; Q_3 - number of courses on the udemy.com platform, $\mu_3 = 0,1$; Q_4 - number of courses on the prometheus.org. ua platform, $\mu_4 = 0,1$; Q_5 - additional education (professional retraining, advanced training, pre-university training), $\mu_5 = 0,1$; Q_6 - availability of a faculty or department in the field of digital transformation, $\mu_6 = 0,3$ (the indicator takes on the value of 1 if there is a faculty or department, 0 if not); Q_7 - availability of educational YouTube channels of the university, $\mu_7 = 0,1$.

The factor "information infrastructure" (DI_2) assesses the availability of resources that provide access to the necessary information and interaction between different categories of participants in the educational process. The influence of this factor can be determined on the basis of a group of indicators that reflect the coordination of interaction between participants, information technology, and digital services. The assessment of this factor can be presented in the form of:

$$DI_2 = \sum_{i=8}^{16} \mu_i Q_i$$

where μ_i - is the weight of each indicator ($\sum_{i=8}^{16} \mu_i = 1$); Q_8 - university website, internal websites, electronic class schedule, $\mu_8 = 0,1$; Q_9 - university application in Google Play, $\mu_9 = 0,1$; Q_{10} - university application in the AppStore, $\mu_{10} = 0,1$; Q_{11} - personal accounts (applicant, student, teacher), $\mu_{11} = 0,1$; Q_{12} - 3D-tour of the university, $\mu_{12} = 0,1$; Q_{13} - number of computers per student, $\mu_{13} = 0,1$; Q_{14} - cost of machinery and equipment (not older than 5 years), $\mu_{14} = 0,1$; Q_{15} - availability of university data centre, $\mu_{15} = 0,1$; Q_{16} - Wi-Fi coverage area, % of the total university area, $\mu_{16} = 0,1$; Q_{17} - availability of electronic document management at the university, $\mu_{17} = 0,1$.

"The level of research work" (DI_3) - this factor will be assessed using the following indicators: the number of publications in the electronic library, the number of business incubators and technology parks, centres for the collective use of scientific equipment and the availability of electronic resources that provide access to scientific citation databases, etc. The assessment of this factor can be presented in the form of:

$$DI_3 = \sum_{i=17}^{22} \mu_i Q_i$$

where μ_i - is the weight of each indicator ($\sum_{i=17}^{22} \mu_i = 1$); Q_{17} - is the number of publications in the electronic library, $\mu_{17} = 0,1$; Q_{18} - is the number of own journals, $\mu_{18} = 0,1$; Q_{19} - is the number of own journals indexed in Scopus and WoS, $\mu_{19} = 0,2$; Q_{20} - number of business incubators and technology parks, $\mu_{20} = 0,3$; Q_{21} - number of publications in journals indexed in Scopus and WoS, $\mu_{21} = 0,2$; Q_{22} - availability of access to citation databases, $\mu_{22} = 0,1$.

A necessary factor of digitalisation is "Satisfaction with Digital Services" (DI_4), i.e. an assessment of the quality of digital services. It is proposed to accept the usability of the university's applications, website and Moodle as an assessment. The assessment of this factor can be presented in the form:

$$DI_4 = \sum_{i=23}^{26} \mu_i Q_i$$

where μ_i - is the weight of each indicator ($\sum_{i=23}^{26} \mu_i = 1$); Q_{23} - is the rating of Google Play digital services, $\mu_{23} = 0,25$; Q_{24} - is the rating of AppStore digital services, $\mu_{24} = 0,25$; Q_{25} - is the rating of the usability of the university website, $\mu_{25} = 0,25$; Q_{26} - is the rating of the usability of Moodle, $\mu_{26} = 0,25$.

The fifth factor of digitalisation is the reflection of economic indicators of university digitalisation (DI_5) by means of monetary contributions to the development of digital and research competences of the university.

The assessment of this factor can be presented in the form of:

$$DI_5 = \sum_{i=27}^{30} \mu_i Q_i$$

where μ_i - is the weight of each indicator ($\sum_{i=27}^{30} \mu_i = 1$); Q_{27} - is investment in digital services, $\mu_{27} = 0,25$; Q_{28} - is research and development, $\mu_{28} = 0,25$; Q_{29} - is revenue from digital services, $\mu_{29} = 0,25$; Q_{30} - is online tuition fees, $\mu_{30} = 0,25$.

A separate value of the digitalisation factor is calculated for each subsystem. The calculation of the indicators that make up the factor is carried out by dividing the value of the indicator by the highest value of the indicator from the group of selected universities:

$$Q_i^j = \frac{q_i^j}{\max_j(q_i)}$$

where Q_i^j - is the digitalisation index for the i -th indicator at the j-th university; q_i^j - is the actual value of the i -th indicator at the j-th university.

4.4. The Use of Artificial Intelligence in Education

Artificial Intelligence (AI) is a branch of science and technology that deals with the creation of programmes and systems that can perform tasks that were previously considered exclusively to be human. Artificial intelligence includes such areas as machine learning, deep learning, neural networks, expert systems, natural language, and others. Artificial intelligence is used to create computer programs and systems that can recognise images, understand speech, analyse large amounts of data, make decisions, and much more. These technologies are used in various industries, including medicine, finance, transport, industry, science, and many others.

Artificial intelligence meets the requirements of educational learning scenarios, allowing to see different opportunities and implement the process of digital transformation of education. In today's environment, the evolution of technology is accelerating, new paradigms are being formed, fresh pathways are being built, and novel learning models are being launched that are determined by the combination of human and machine. Generative artificial intelligence contributes to rethinking the role of technology in education, is a new digital technology that will be combined with innovative mechanisms to have a revolutionary impact on the development of education in a time when there is a crisis of the metaphysical foundations of the individual's existence in the global society [9].

Future education should focus on three aspects: 1) the transformation of educational concepts, the destruction of standard education and the way it is taught, the promotion of evolution from "industrialised education" to "smart education" and the implementation of personalised learning; 2) educational changes in organisational methods, moving out of classrooms, disciplines and campuses, which forms a new educational paradigm 3) in innovative educational operational mechanisms and implementation of data-driven educational decision-making, creation of a group intelligence decision-making system based on human-machine interaction,

as well as in helping governments, schools and society to manage shared governance as a factor of social responsibility of governments [4].

Despite its innovation, artificial intelligence is far behind human intelligence and cannot be compared to teachers, who are irreplaceable. Human learning is an ongoing interactive process and elements such as face-to-face conversation, emotional connection, and the exchange of ideas between teachers and students are irreplaceable. Artificial intelligence can implement automatic transaction processing, and includes a huge scope for intelligent processing of unstructured information.

There are four areas of introduction to artificial intelligence technologies:

1) to know the principles of artificial intelligence, such as understanding the basic functions to implement its mechanisms;

2) to expand learning opportunities in order to use artificial intelligence for learning, improve subject matter abilities, and teaching skills;

3) to optimise teaching to reveal the actual impact of artificial intelligence on education and teaching.

Teachers can conduct thematic teaching and research activities in the AI system, share their experience of application and use. The teacher can not only contribute to the construction of students' knowledge system, but also promote the overall development of students. In the age of intelligence, it is necessary to use artificial intelligence technologies rationally. Artificial intelligence technology can quickly provide comprehensive and effective dialogue content based on massive Internet data, sometimes even seeming to exceed the level of response of teachers.

Firstly, teachers using artificial intelligence show that as human-machine collaboration will become a major development trend in the future, the advantages of teachers and artificial intelligence should be fully exploited to improve learning efficiency. The powerful features of AI have put enormous professional pressure on teachers, but it would be a bit of an exaggeration to say that technology will replace teachers.

As technology advances, teachers in the future will have to take on three roles: 1) the role of a physician who can conduct personalised diagnostic sessions for students; 2) the part of a coach who teaches students; 3) the management role that mobilises students' initiative through emotional support and innovative experiences.

Second, the relationship between teachers and AI technology has its advantages and disadvantages. Although AI technology has powerful algorithms and computing power, it is up to teachers to cultivate students' innovative thinking and form emotional values. Teachers should actively introduce new concept of smart learning based on AI and learn how to use its technology to help do some repetitive and mechanical work.

AI needs to be used wisely. In primary and secondary schools, it is necessary to develop appropriate use plans according to different learning goals, learning tasks, teaching methods, specific conditions of students, which are recommended to be used reasonably. On the positive side, there are two aspects that deserve to be recognised: 1) the ability to use AI technology to solve problems (even homework), which is a kind of information literacy; 2) although AI is not sufficiently developed at the moment, it shows the potential of an intelligent learning assistant that can effectively improve students' learning experience and cognitive development [10].

AI can be detrimental to students' knowledge construction and learning abilities. To avoid such problems, we need to work in three areas: 1) to develop new technologies; 2) to strengthen the advanced design of regulatory systems to limit the occurrence of problematic situations as much as possible; 3) to introduce the ethics of educational technologies.

As the needs in education are constantly changing, the use of technology can put forward new requirements for technical means to create technical means suitable for educational scenarios.

AI-enabled education has fostered the cross-integration of different disciplines, brought out growth points for new disciplines, and promoted innovation and the development of interdisciplinary knowledge. Therefore, universities should actively explore the construction of "artificial intelligence +" interdisciplinary subjects, pay special attention to "education + artificial intelligence" research and teaching to adapt to the new educational ecology of the digital era. With the rapid development of technology, we should pay attention to the evolution of the "digital divide" and even the "artificial intelligence divide", which demonstrate the conditions of higher education institutions in Ukraine [6].

Table 2. Artificial intelligence (AI) as a factor in the development of society and global digitalisation: advantages and disadvantages

Contents of the artificial intelligence (AI) function	Advantages of artificial intelligence	Disadvantages of AI
1. Artificial intelligence as a source of high performance	High efficiency, reliability, replacement of people for more dangerous work.	Ability to innovate is low due to lack of fixed measurement standards.
2. Artificial intelligence is good at exhausting mechanical work	AI is highly reliable, less likely to make mistakes than humans, and more efficient.	In the field of innovation, due to the lack of fixed measurement standards and output models, artificial intelligence does not cope well with innovation.
3.The cost of artificial intelligence	The cost is relatively low in the long run, and it can significantly save labour costs, as less physical labour and more intellectual labour is required.	For ordinary companies, the cost is too high and the threshold for use is too high.
4.Using artificial intelligence	The key issue is data mining to help businesses make informed decisions.	Artificial intelligence as a threat to humanity's existence.
5.Improving workplace efficiency through AI	People will be surrounded by IoT devices that can speed up complex tasks and perform everyday tasks.	AI systems may fail.
6.Artificial intelligence as a means of providing many automated services for people	These services can be smart that will improve the environment.	The ability of artificial intelligence machines to process large data sets quickly and accurately is crucial for many intelligent technologies and environments.
7.Artificial intelligence for decision-making in the workplace	The speed and effectiveness of some AI applications make them attractive to executives looking to gain more business advantage.	The use of artificial intelligence to manage employees will lead to the fact that the work of managers will become increasingly isolated, destroying human functioning.
8.The future of workplaces	Artificial intelligence will actually lead to long-term job growth.	Decision-making software raises some concerns
9.Artificial intelligence can truly eliminate human error in the process	AI saves time and labour costs, and thus reduces human error.	The biggest disadvantage of artificial consciousness is that it will completely destroy human functioning.

5. Conclusions

In summary, digital technologies have many benefits that can help in various areas of life. They allow for the fast and efficient processing, storage and transmission of large amounts of information, which allows people to work faster and more efficiently, reducing time and effort; access to information from anywhere with internet access, people can work from anywhere and at any time; quick problem solving and error reduction, e.g. software tools can help find and correct errors in text; digital technologies allow people to work from anywhere, which is convenient for working from home or work in the office. Digital technologies are an important part of building a digital society, playing a fundamental, leading and general role in driving the modernisation process. It is necessary to guide the public to understand that AI is just a wave of a new round of technological revolution, and there will be more technological breakthroughs in the future. Achieving education reform and technological innovation in the same direction, communication and integration is the main issue of the time. To provide teachers with sufficient training and support to use digital tools. To research different digital tools and platforms to find the most appropriate ones for your teaching purposes. To use interactive presentations, video tutorials, graphics, e-books and other tools that promote active student engagement and the formation of a culture of algorithmic, digital and reflective learning.

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