

# FOREIGN EXPERIENCE IN IMPLEMENTING DIGITAL EDUCATION IN THE CONTEXT OF DIGITAL ECONOMY TRANSFORMATION

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**Abstract.** The relevance of the *research* topic is that the study of foreign experiences in the implementation of digital education in the context of digital economic transformation is of great importance. In the context of digitalisation, developed countries are implementing digitalisation policies to promote the digital transformation of education, focusing on improving digital literacy and digital competence. *The purpose* of the study is to conceptualise the foreign experience of implementing digital education in the context of digital economy transformation. This study *aims* to examine the global implementation of digital education as a social and economic phenomenon. This study focuses on exploring the impact of the digital economy on the transformation of digital education. The research will focus on: (1) reflections on the concepts of digitalisation of education in advanced countries such as the USA, Japan, India, South Korea, Australia, the UK, Germany and China; (2) definition of connotations and attributes of the digital economy; (3) identification of smart education as a condition for the transformation of the digital economy. According to the study, advanced countries are adopting smart education concepts as a crucial step towards digitalising education to achieve a balance in developing high-quality education, enhancing its quality, expanding opportunities, and promoting the formation of lifelong digital competencies. It is concluded that the promotion of higher education as a "smart digital transformation reform" contributes to the creation of a new educational environment in the digital age, providing convenient channels for obtaining digital resources. Informatisation of education as a factor of digital transformation has created new opportunities, provided students with intelligent data for learning, given a new impetus to education reform, facilitated large-scale individualised learning, and formed innovative concepts for implementing smart education as an extension of the capabilities of digital technologies and the impact of the digital economy on the transformation of digital education.

**Key words:** digital education, transformation of the digital economy, informatisation, smart education, digitalisation of international education.

**JEL Classification:** A20, B20, O10, P50, Z10

## 1. Introduction

The digital transformation of education refers to the use of modern information technologies to support educational innovations in teaching methods, management models and guarantee mechanisms that facilitate the educational process. In the context of the new era, the digital transformation of education pays more attention to people-centredness and builds a system of digital educational ecology. It enhances

the role of technology, promotes the deep integration of new technologies and education, and contributes to the creation of a learning society in which everyone can learn, everywhere and at any time. Universities must respond to the general trend of digital development and cultivate innovative talents to meet the needs of future social development, with equal emphasis on knowledge and skills to meet the challenges of educational reform and development. The pace of

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digitalisation in international education is accelerating. Intellectual transformation and digital transformation are important contents of the new higher education infrastructure. The basis is to improve the integration of information technology applications and the intelligence of management and service information systems, the need to promote higher education as a "smart digital transformation reform" to ensure scalable successful experience of digital transformation of education. There are still challenges in promoting the new infrastructure of higher education, such as the lack of reference standards for building the smart education concept. Based on the above, the government has increased investment and created a special fund to support universities for "smart digital transformation".

The purpose of the study is to conceptualise the foreign experience of implementing digital education in the context of the transformation of the digital economy. The object of the study is the international experience of implementing digital education as a social and economic phenomenon. The subject of the study is the impact of the digital economy on the transformation of digital education.

Research objectives: 1) to reflect on the concepts of digitalisation of education in the advanced countries of the world (USA, Japan, India, South Korea, Australia, United Kingdom, Germany, China); 2) to find out the connotations and attributes of the digital economy; 3) to define smart education as a condition for the transformation of the digital economy.

## 2. Literature Analysis

The digitisation of education is a government policy aimed at improving the ICT (information and communication technology) environment in educational institutions. ICT in education includes personal computers, electronic whiteboards, wireless local area networks and digital textbooks.

The necessary theoretical, conceptual and pragmatic foundations were the works of foreign authors on flexible management by Appelo Jürgen "Management 3.0. Agile management. Leadership and team management" (2019); Martin Robert "Pure Agile: Back to Basics" (2021); Bostrom Nick "Superintelligence. Strategies and Dangers of Smart Machines" (2020); Amy Webb "How IT giants and their smart machines can change humanity" (2020); Gary Hemel, Mikel Zanini "Humanocracy. Building companies that put people first" (2021); Diamandis Peter & Kotler Stephens "The future is closer than it seems. How technology is changing business, industry and our lives" (2021); Dixon Patrick "The Future of (Almost) Everything. How the world will change in the next hundred years" (2021). For example, S. Bhutani and J. Paliwal formulated the model "5Cs of Inclusive

Sustainable Growth", the essence of which was to characterise the digital technologies necessary for the transition to sustainable development (Kubatko, Kovalev, 2022).

In Ukraine, a number of monographs have been prepared that address, to varying degrees, the problems of implementing smart education: "Education of Ukraine under martial law (2022): management, digitalisation, European integration aspects: Book of Abstracts of the IV International Scientific and Practical Conference (electronic scientific publication), October 25th (2022).

In this study, the authors also rely on the work of Nikitenko Vitalina, Voronkova Valentyna, Kozar Yurii, Oleksenko Roman, Yanchevskiy Oleksandr, Korobko Igor "Digital Healthcare in the Context of Challenges and Opportunities of Technological Progress in the Countries of the European Union" (2023).

The methodological basis was the work of Valentyna Voronkova, Vitalina Nikitenko, Vlada Bilohur, Roman Oleksenko, Taras Butchenko "The conceptualisation of smart-philosophy as a post-modern project of non-linear pattern development of the XXI century" (2022).

The work of Meadows Donella, Randers Jorgen and Meadows Dennis played an important role. "The limits to growth. 30 years later" (2018), in which the Club of Rome pays great attention to the evolution from the simple computer model World3 to the growth model of 2052. The analysis of digitalisation processes is reflected in Kelly Kevin's analysis "Unstoppable. 12 technologies shaping our future" (2018). In the context of the digital development of ICT, the formation of new thinking – systemic, expert, reflective, philosophical – plays an important role, as presented in the work of Altrade Dagogo "New Thinking. From Einstein to Artificial Intelligence: Science and Technology that Changed the World" (2021), as well as the formation of a data science approach, the importance of which is developing in the context of the exponential development of technology, which is vividly presented in O'Neill Kate's work "BIG DATA. Weapons of mathematical destruction. How Big Data Increases Inequality and Threatens Democracy" (2020); Michio Kaiku's "Physics of the Future. How science will influence the fate of humanity and change our everyday lives in the 21st century" (2017).

## 3. Research Methodology

The leading methods for studying the impact of the digital economy on the transformation of digital education in a technologically advanced society are the following: 1) agile methodology, which is based on thinking in terms of complex systems, mobility

and adaptability of society to the environment in conditions of uncertainty, instability, information scarcity, crisis, flexibility of organisational structures that can promote sustainable development (Meadows, Randers, Meadows, 2018); 2) synergistic method, which is based on self-organisation and the search for the point of attractor (attraction); 3) data-oriented approach, which is based on the analysis of data on the use of information flow, information content and information structure. In the process of analysing software requirements, different development methods are formed according to different emphases of information domain analysis. The data flow-oriented development method focuses on the analysis of information flows and uses data flow diagrams to represent information flows; while the data structure-oriented development method focuses on the analysis of information structures and uses data structure diagrams to represent information structures; 4) the axiological method, which proposes the concepts of "value-based use of information resources" and the formation of values of the digital culture of smart education based on the value of self-identity. Methods of general philosophical orientation – analysis and synthesis, abstraction, concretisation, historical and logical, cross-cultural, statistical analysis – played an important role. All this made it possible to formulate the concept of the impact of digital technologies on the development of smart education in a technologically advanced society (Martin Robert, 2021). Innovative digital applications are gradually expanding the functions of a single platform of educational resources into a rich learning community and intelligent data mining, creating a new ecology of benign development. It should be noted that promoting the development of quality education through digital transformation is a long-term task. Only by adhering to innovative iteration and sustainable development can universities continue to create a more efficient and flexible new education ecology (Appelo Jürgen, 2019).

#### 4. Reflections on the Concepts of Digitalisation of Education in Advanced Countries

Consider the reflection of the concepts of digitalisation of education in the advanced countries of the world – the USA, Japan, India, South Korea, Australia, the UK, Germany and China.

The **United States** is the world's leading proponent of education for the future. They are changing the infrastructure, curriculum and teaching of education through informatisation, and are constantly deepening research into digital literacy to take education reform to a deeper level. The main actions can be roughly summarised as follows:

1) Promotion of modernisation and iteration of education through informatisation. Since 1996, the federal government has issued a National Education Technology Plan (NETP) every four to five years to systematically promote the development of educational infrastructure. The latest edition of the National Education Technology Plan has drawn up a comprehensive plan to develop personalised learning, promote technology-supported learning, improve leadership in educational informatics, and introduce personalised assessment in terms of integrated technology education (Buhaichuk, Nikitenko, Voronkova, 2023).

2) Deepening research on digital literacy. Led by think tanks such as the 21st Century Learning Alliance (P21), the US education sector has changed the definition of student literacy from the 3Rs (reading, 'riting and 'rithmetic) to the 4Cs (critical thinking, creativity, communication and collaboration). The US has developed cooperation with China to introduce the 5Cs based on the 4Cs (cultural understanding and heritage).

3) In-depth curriculum and teaching reform in the context of digitalisation. The American Centre for Curriculum Development (CCR) has consistently published reports on curriculum reform, such as "Four-Dimensional Education" and "Artificial Intelligence in Education: Potential and Prospects", which are full of new content.

4) Development of STEM education and comprehensive talent development in the digital age. Since 2018, the federal government has launched a new round of STEM education planning (the "North Star Plan"), and both the government and opposition have promoted STEM education, increased funding, strengthened inter-agency collaboration, and promoted and focused on developing "computer literacy" among teachers and students. At this stage, the strategic priorities of the United States in the field of digitalisation of education are: broadband access; digital literacy accelerators; blockchain in education; artificial intelligence. Silicon Valley, also known as the Mecca of IT companies, is home to world-renowned IT companies. In the United States, despite some differences from state to state and school to school, programming, etc. is included in the school curriculum as computer science. It is used on a daily basis, for example, by using Google to do homework.

**Japan** has established an "Information Talents for Society 5.0" concession. In light of current and future social changes, the Japanese government proposed the concept of "Society 5.0" in the Fifth Science and Technology Basic Plan launched in 2016, specifically referring to a social system that fully integrates virtual and real space. The concept is a new form of society that achieves economic development

and solves social problems, and is human-centred. In 2020, Japan revised the Basic Law on Science and Technology and renamed it the Science and Technology Innovation Basic Law. In March 2021, the Japanese government launched a new "Basic Plan for Science and Technology Innovation", which details the vision of Society 5.0, focuses on the digital transformation of education, and systematically promotes STEM education. Education reform in Japan aims to develop students' ability to learn and survive in the era of Society 5.0 through information education. In line with the ongoing reforms, the Japanese government has launched a five-year plan (2018-2022) aimed at improving the information infrastructure environment in schools. The plan emphasises the use of advanced technologies, such as artificial intelligence, to build a school information environment in the era of Society 5.0, thereby improving students' information literacy, promoting personalised learning, and cultivating students' awareness of active learning and collaboration, as well as their ability to identify and solve problems. As part of the reform, information literacy was redefined as three core skills that students should have, along with language skills, problem solving and problem discovery. In other words, Japan is more than 10 years behind the US in developing its ICT environment. In the 2020s, which is seen as the age of artificial intelligence and machine learning, this delay will be fatal. In order to catch up with the world, Japan needs to introduce ICT equipment as soon as possible to improve the current situation. There is a lack of human resources capable of implementing ICT education: programming skills, IT literacy and skills in producing materials for interactive teaching (Voronkova, Nikitenko, Bilohur, Oleksenko, & Butchenko, 2022). The concept of the GIGA School is to create a place where all children can receive the best possible education in a rapidly changing modern society. Society 5.0: a movement to solve various social problems through digital innovations such as artificial intelligence and virtual reality.

**India.** Smart education in India has been promoted as part of the Digital India strategy. At present, the process of digitisation in India is ahead of most countries and regions of the world and has provided a large number of digital engineers for the digital development of global industries. Surveys show that more than 30% of engineers in Silicon Valley and 7% of executives in high-tech companies are of Indian origin. The Modi government launched the Digital India strategy in 2015, which aims to move India towards a digital society and knowledge economy in three ways: 1) building digital infrastructure; 2) digital public services; 3) digital education for citizens. In higher education, the Indian

government has partnered with the IT industry and Indian software and services companies to build a "digital talent pool". The concept includes increasing investment in training digital talent, promoting collaborative learning between government, industry, universities and research institutes, and adding new degree programmes in data science, big data analytics and other areas. In basic education, primary and secondary schools in India have fully implemented the Smart Classroom plan (Webb Amy, 2021). Tablet computers, laptops, virtual reality, the internet and interactive projectors have entered the classroom. The Smart Classroom has transformed the way people learn and is beginning to make digital learning a reality. India's National Council of Educational Research and Training (NCERT), in response to the Ministry of Human Resource Development's (MHRD) ePathshala initiative, is developing educational e-resources for display and distribution, including textbooks, audio, video and journals, which will be hosted on the official website of the Central Institute of Educational Technology (CIET) to provide online educational services to all of India. India is one of the most advanced IT countries in the world. In fact, India is making efforts in ICT education at the national level. The teaching of high-level programming using LOGO as computer science has been introduced in classes from primary school to high school in the country (Svrydenko, Nesterova, & Dielini, 2022). It is difficult to say because the education system differs from state to state, but basically programming is taught as part of mathematics from the age of 6 (third grade of primary school in Japan).

**South Korea.** South Korea has adopted the concept of a "people-centred intelligent learning environment of the future". Under the influence of the epidemic, South Korea has further strengthened the development of innovative talents while creating an smart educational environment. In the new curriculum reform plan, the "2022 curriculum" has been revised to emphasise the importance of information literacy and information education, and to focus more on students' self-selection and integration of subject education. In terms of promoting the informatisation of education, South Korea has been systematically implementing an education informatisation plan every five years since 1996, in synchrony with the United States. For more than 20 years, South Korea's informatisation of education has gone through various stages, such as building information infrastructure, adapting to the knowledge economy for distance learning, strengthening research and development capabilities, developing and applying digital learning materials, and creating personalised learning. The Sixth Education Informatisation Plan (2019–2023),



which is currently being implemented, aims to create a future smart education environment, promote sustainable innovation in education informatisation, implement individualised education services using ICT, and build a digital infrastructure for the exchange of education information. Four management areas (including 13 key policy tasks) are being implemented to create a "people-oriented intelligent education environment". It has also promulgated the "Law on Promoting Education Informatisation" and established a monitoring and performance system to ensure the effective implementation of education informatisation. South Korea is promoting sustainable innovation in education informatics to create an smart education environment of the future.

**Australia.** Australia has developed a blueprint for a future education strategy. In 2021, the Australian government launched the Digital Economy Strategy 2030, which aims to realise the vision of "building a leading digital economy and society by 2030". The strategy rests on three pillars: 1) developing the digital economy; 2) developing new technologies; and 3) setting limits to digital growth by requiring all Australians to be digitally literate by 2030. As a result, all parts of Australia are accelerating the pace of informing education. The Australian Capital Territory, for example, has launched the second phase of its Future Education Strategy 2021 implementation plan, which aims to further support Capital Territory schools to enhance learning through modern, evidence-based, student-centred data to personalise educational provision to meet learning needs and support teachers in the teaching process. Another example is South Australia's Digitalisation Strategy (2022–2025), which aims to "harness digital technology to deliver a world-class education in K-12 schools and help young people thrive in the digital world". The vision for the future of education is one of digital teaching and learning where all students have an excellent digital learning experience; schools at all levels are data-driven and continuously improving; and all teachers have the technology and skills they need to be productive. Digital capabilities, services, programmes and policies for education systems are being developed to deliver world-class services, programmes and policies. Australia has strengthened the development of digital literacy to help realise its national vision. Accordingly, various places have accelerated the progress of digitisation in education. For example, the Australian Capital Territory launched the second phase of its Future Education Strategy implementation plan in 2021 to ensure data is available to tailor educational products to meet learning needs and support teachers to deliver high quality teaching (Hemel, Zanini 2021). In Australia, the ICT curriculum has been left to state policy, such as the division of the school year

in each state. Now there is a system for thoroughly learning programming, for example, using YouTube as a teaching material in public institutions, which are the equivalent of Japanese kindergartens for 4-5-year-olds, and experimenting with robots in primary school after digital learning.

**United Kingdom.** The UK has developed an approach to unlocking the potential of educational technology. In April 2019, the UK Department for Education published a policy, *Unlocking the Potential of Educational Technologies*, which clarifies the current and future vision of educational technology development. The vision included supporting the education sector to develop and adopt technology to increase efficiency and remove barriers to education, contribute to improved educational outcomes and support the development of a vibrant EdTech business sector in the UK. To this end, the UK has launched the EdTech Framework for Change, which is divided into three steps: 1) clarifying the vision of information technology in education; 2) assessment and professional development of teachers in primary and secondary schools; 3) creating information tools, improving digital literacy of teachers and students, ensuring data security and improving public procurement of services and other measures to overcome technical and institutional barriers and make full use of technology (Nesterova, Dielini, Shynkaruk, & Yatsenko, 2020). On this basis, digital technologies in education should be promoted, the effective use of informatisation in education should be facilitated, and a sequence of iterations should be implemented to accelerate educational innovation. By studying international experiences in different countries, it can be concluded that digital technologies promote comprehensive, multi-level and three-dimensional changes in the education system, focusing on the continuous iteration of teaching, curriculum and assessment modified by digital technologies, emphasising personalised learning and professional teaching by educators. Key challenges include how to develop individual skills in future education, how to meet the needs of future social development, how to use science to better support teaching, and how to advance education through cognitive science. The concept introduces the education of the future, which aims to improve not only technological educational tools and programmes, but also the content, means, methods of teaching and assessment of education, which are undergoing profound changes. The role of education as a driver of social development is becoming more prominent and its strategic position is growing. In 2014, there was a major overhaul of compulsory education in the UK, changing it from "ICT" to "computer science". Primary schools in the UK have computer science classes twice a week, where students learn about

algorithms, etc. Almost all classrooms are equipped with electronic whiteboards or whiteboards and projectors to facilitate learning. This is the result of the UK's nationwide effort to improve the environment for ICT education, and is recognised globally (Diamandis & Kotler, 2021).

**Germany.** The concept of the Digital Education Initiative in Germany aims to improve individual digital skills. In 2016, the Federal Ministry of Education and Research launched the Digital Knowledge Society strategy, which focuses on digital education, digital infrastructure, digital and international integration and development, and proposed the strategic goal "Digital Education World 2030". In 2016, the Joint Conference of the Ministers of Education and Cultural Affairs of the German Federal States published the strategy "Education in a Digital World", which includes recommendations on curricula, implementation of teaching and curriculum development, teacher training, further education, infrastructure and equipment, education management and campus management systems. In 2021, Germany started the construction of the National Digital Education Platform to implement digital education. As one of the key projects of education modernisation, the concept aimed to provide a broader digital access portal and support services for innovative teaching and learning (Kelly Kevin, 2018).

**China.** At the beginning of the 21st century, digital industrialisation and industrial digitalisation are advancing globally, and the era of digital economy, characterised by the widespread use of data elements and digital technologies, has arrived. In 2020, the scale of China's digital economy will reach 39.2 trillion CNY, maintaining a high average annual growth rate, and the digital economy in the national economy will grow even more. The concession proposed to promote the development of the digital economy, strengthen the overall construction structure of digital China, build a digital information infrastructure, a national integrated system of large-scale data centres, promote the large-scale application of 5G, and promote the digital transformation of industries (Bostrom Nick, 2023). The development of smart cities and digital villages will accelerate the development of the industrial internet, expand digital industries such as integrated circuits and artificial intelligence, and improve key software and hardware innovation technologies and supply capabilities. China's economic policy is based on digital economy management, developing data element markets, unleashing the potential of data elements and improving application capabilities to better promote economic development and enrich people's lives. The digital economy has a high level of innovation, strong penetration and wide scope. It is not only a new point of economic

growth, but also a reference point for the transformation and upgrading of traditional industries and an important engine for building a modern economic system. In the face of the greatest changes in the world in a century, the question is how higher education can better take advantage of the digital economy, the new opportunity offered by the global technological revolution and industrial transformation, to contribute to the transformation of the quality, efficiency and performance of the economy, the development of which is crucial to building a new development model. Understanding the high-quality development of digital China is of great practical importance. By the end of 2021, the Internet access rate in primary and secondary schools across the country will reach 100%, and 99.95% of schools will have an export bandwidth of 100MB or more. An effective mechanism for expanding the coverage of high-quality information technology resources has been basically established, the information literacy and application skills of teachers and students have been greatly improved, and large-scale online learning has been introduced to combat the epidemic and ensure the continuity of education (Dixon Patrick, 2021).

## 5. Meaning and Attributes of the Digital Economy

The digital economy is divided into two parts: 1) digital industrialisation; 2) industrial digitalisation. Digital industrialisation refers to the main sectors of the digital economy, including the production of computer communications and electronic equipment, telecommunications, broadcasting, television and satellite services, the Internet and related services, software and information technology systems, which are the basis for the development of the digital economy. Industrial digitalisation is the use of digital technologies and data resources to increase production and improve the efficiency of traditional industries. It is the integration of digital technologies and the real economy.

The main characteristics of the digital economy are as follows:

- 1) Data-driven, as data capital replaces physical capital as a key factor of production, supports value creation and economic development, which is the most important feature of the digital economy. Data capital refers to integrated information assets ("Big Data") derived from circulating data, which contain vast amounts of information, using analytics and processing technologies. Using data to identify potential consumer needs is key to developing new business models and innovative products and services (Michio Kaiku, 2017).
- 2) Implementation of innovations. With the development of a new generation of information

technologies, the innovation process is moving away from the linear rule of the chain from knowledge accumulation through research to application; the boundaries of the innovation stages are gradually being smoothed out, each stage is interacting, and the innovation process is gradually being integrated.

3) Digital (network) platforms. In the digital economy, various digital platforms are emerging at an accelerated pace. With the open ecosystem as the carrier, various links such as production, distribution, service and consumption are gradually integrated into the platform, promoting the organic combination of online and offline resources, the creation of many new business models and formats, and the formation of a platform economy. These three new functions are going through the whole process of digital economy development, becoming the main driving force of the digital transformation of the economy, which has huge potential for industrial development and broad application prospects, accelerating the promotion of Big Data and digital education concepts.

## 6. Smart Education as a Condition for the Transformation of the Digital Economy

The modern demands of the digitalisation of education call for the development of smart learning as a condition for the transformation of the digital economy, which requires accelerating the promotion of smart education, smart reform and digital transformation. With the further development of the digital economy, higher education will face increasing demands. On the one hand, the development of the digital economy requires the support of a professional and efficient talent training system in the digital economy; on the other hand, the development of digital technologies in turn changes the basic model of higher education and promotes continuous innovation in education. Therefore, digital information technologies should be used to promote the reform of smart education, build a digital social platform, create a system of employment and entrepreneurship services using digital technologies, and apply information technologies to implement the concept of student employment and entrepreneurship (Nesterova, Dielini, & Zamozhskiy, 2019).

The digital transformation of education is a special stage of the intelligent informatisation of education, which continues to use digital, network and smart technologies to transform the education system. The informatisation of education has made significant progress, and the role of informatisation in promoting education reform has become increasingly prominent. Faced with the urgent need to develop quality education, the complexity and uncertainty of the new generation of information technology revolution represented by artificial intelligence, the digital

education reform has entered a deep zone, and the process of integrating technology and education is still facing challenges. Technology and education are gradually demonstrating a new model of deep integration. Faced with a series of reform tasks, such as comprehensive education reform, the implementation of new curricula for compulsory education, it is necessary to promote the digital transformation of education and further promote the quality development of education.

In terms of "5G+smart education", the promotion of 5G in scenarios such as smart classrooms, campus security, education management and student assessment should be strengthened to enhance the ability of 5G to support education and teaching reform.

First, in terms of "artificial intelligence + smart education", to accelerate the emergence of application scenarios based on supply and demand links, and actively promote applications such as online classrooms, virtual classrooms, virtual simulation learning, new teaching materials and smart campuses. In terms of "blockchain + smart education", a blockchain-based education management and application platform, innovative intellectual property protection and tracking, and authentic and reliable storage and tracking of digital files should be created (Altrade Dagogo, 2021).

Second, strengthen digital literacy and skills, and help teachers and students adapt to digital development and change. Strengthen the construction of new smart education infrastructure, focusing on information networks, platform systems, digital resources, smart campuses and innovative programmes to provide basic guarantees for the development of digital literacy and skills of teachers and students. Improve the mechanism of digital literacy and skills development, and introduce relevant digital literacy and skills content into the teaching of various subjects. Establish a system for assessing students' digital literacy and skills, develop intelligent assessment tools, and conduct assessments of students' digital literacy and skills based on pilot projects (O'Neill Kate, 2020).

Third, optimise the public service system of smart education and promote the digital transformation of regional education. Strengthen the construction of the national smart education platform for public services, improve the supply of resources, cross-domain exchange and collaborative innovation functions, further expand the scale of resource application, promote data integration, and continuously expand facilities. Fourth, build a new ecology of smart education and create an international calling card for the development of quality education. Local governments and universities should actively promote the development of smart campuses and next-generation learning



environments in terms of information infrastructure, digital education resources and platforms, and all stakeholders should strengthen cooperation based on smart education strategies (Oleksenko, 2013).

Smart education as a prerequisite for the transformation of the digital economy relies on digital transformation to improve citizens' access to education. Telecommunications infrastructure is a cornerstone of digital transformation, and governments should focus on increasing investment in network and communications infrastructure, better coordinating technical support for schools, and maintaining and expanding the policy-innovation nexus to promote innovative education. Universities should strengthen digital literacy training to ensure effective learning, professional development and support for educators, including distance and blended learning, psychosocial support for students, and monitoring and management of self-development, so that all children and young people can learn and master digital skills. Government and social institutions should prioritise the challenges of diversifying distance learning according to different circumstances and needs. Develop high-quality, free and relevant learning content with social protection measures for the most vulnerable. "The best international experience of leading education systems shows that such tasks are solved through the use of the latest educational technologies, including digital ones" (Hrynevych, Morze, Boyko, 2020).

From the perspective of the digitalisation of society, higher education should contribute to economic growth, increase labour productivity and improve the level of social human capital, thereby facilitating technological change, business creation and business innovation. Since the 2000s, countries around the world have accelerated the expansion of smart education, with market demand for technological innovation and talent at different stages of development driving its structural changes. It is worth noting that the interactive process of adapting the structure of higher education disciplines to the needs of economic and social development is not a simple logical connection of unambiguous correspondence. For example, the digital transformation of agriculture requires not only talent in agriculture, but also experts in digital technologies, biochemistry, economic management and other fields. An innovative achievement that creates significant social value is likely to be the result of a joint contribution from many fields, such as the humanities, social sciences, natural sciences or applied sciences. This trend is even more pronounced in the digital age. The digitalisation of education depends on the objective conditions and current trends in the development of the information society, the most important of which are the development of artificial

intelligence, the development of machine learning, the creation of neural networks and the mobility of information and communication activities of users in the information space (mobility) (Bykov, Pinchuk, 2019).

A higher education system with a rich educational offer can adapt to the complex situation of diverse knowledge and skills requirements, varied educational approaches and different educated groups. This requires universities to move from linear convergence to multidimensional differentiation and to form a system of lifelong learning. A comprehensive smart education system built in this way will not only include high-level, comprehensive, research-oriented universities with a mission of basic research in the context of the development of advanced digital technologies. The continuous development of science and technology is the source of the digital economy. Smart education in the digital economy should focus on the development of digital knowledge, and integrate the promotion and development of digital skills at various levels into the education process in colleges and universities. In addition to continuing to promote the development of computing, big data, artificial intelligence and other information technology specialties directly related to digital industrialisation, the needs of various talents, such as industrial digitalisation and management modernisation, should be taken into account. A deep understanding of the potential impact of combining new-generation information and communication technologies with traditional industries, such as smart manufacturing, "5G + industrial internet", "artificial intelligence + smart medical care", large-scale online learning, requires researching and summarising the general digital knowledge of relevant industries and digital skills, improving the content of digital transformation education and skills to help students of different majors understand digital development (Leonov, 2022).

Countries should strengthen digital literacy training to ensure effective learning, professional development and support for educators, including distance and developmental learning, psychosocial support for students, and a focus on monitoring and managing self-development. Strategic efforts for the digital transformation of education should focus on a good opportunity to accelerate the digital transformation of education. COVID-19 has become a catalyst for digital transformation and building a strong education system for the future. The global education model and the post-epidemic education system are interconnected with technology, so the digital transformation of education has a relatively stable and significant perspective in the digital era.



## 7. Conclusions

The most widespread of these are digital technologies, including Big Data, artificial intelligence, the mobile Internet, cloud computing, the Internet of Things and blockchain technology. Smart education has completely changed the calculation, processing, storage, transmission, distribution, recovery and processing of information, giving rise to a new factor of production, which in turn has changed the organisational form of human economic and social activity. It is necessary to strengthen key core technologies, such as breakthroughs in R&D and iterative applications in the field of high-quality chips and key core software. It is necessary to strengthen the innovation capabilities of the industrial internet, artificial intelligence and blockchain, and to strengthen advanced technologies such as quantum information, advanced computing and future networks. Only by consolidating the technical foundation and mastering the underlying technology will countries be able to control the digital economy to accelerate the creation of a high-quality and sustainable digital cultural content ecosystem. Foreign experience in

implementing digital education in the context of the transformation of the digital economy in various countries has shown that the digitisation of education has moved from a tactic for developing education to a strategy for transforming education and strengthening overall national strength. Each country has its own experience in promoting the digital transformation of education and is constantly improving in terms of upgrading digital educational resources, educational institutions, improving the quality of education and modernising education. Smart education is on the rise and is innovative. Systematic, strategic and comprehensive have become the characteristics of smart education digitalisation, and have a profound impact on education reform. One of the aspects of ICT education is to develop an individual who is able to independently select and use the right and appropriate information from such an abundance of information; to develop creativity. However, ICT education is considered to be able to train students' autonomy, thinking skills and creativity because it mainly involves interactive active learning sessions between teachers and students.

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