

Digitalization of Education of the Future— A Trend or a Requirement of the Time?

Nadiya Ivanenko
Oxford University

Anatolii Rud
Podillia State University

Antonina Hurbanska
Kyiv National University of Culture and Arts

Yuliia Cheban
Mykolayiv National Agrarian University

Svitlana Syrtseva
Mykolayiv National Agrarian University

The article substantiates the need to introduce innovative digital technologies in the future education system as a natural response to changes in the socio-economic sphere of social being. Particular attention is paid to the source of the active use of digital technology - digitalization, the concept of electronic functionality is formulated. The authors highlighted the main trends in the development of digital education and assumed that these dynamics will only grow in the future. The article reflects the main trends in the development of digital education, analyzes their strengths, and considers reservations about their implementation. The authors managed to present the digital transformation of the educational process as a global trend aimed at creating a new information society functioning in an innovative digital environment.

Keywords: digitalization, modern education, innovative technologies, distance education, MOOC

INTRODUCTION

Currently, in pedagogical science, considerable attention is paid to improving methods and technologies of education due to the need to train highly qualified specialists in all areas of activity in the dynamically changing economic and social conditions. Reforming and modernizing education in higher education is inextricably linked with the use of information and communication technology training, which creates conditions for new areas of research means of the educational process.

Digitalization affects both the content of education and its organization. These processes have ambiguous consequences for the positioning of universities and teaching labor. Necessary competencies

are often acquired outside the walls of educational institutions because educational programs often fail to keep up with the dynamics of technology. Teachers are transformed from carriers of knowledge and skills into guides who help navigate knowledge bases. Digital educational technologies of the future must rely on a high level of digital competence of students and teachers (Liubarets, Bakhmat, Kurylo, Spitsyna & Biriukova, 2022).

The use of digital technologies in the process of education and professional development of a teacher can help create a common educational space where teacher and student meet to achieve common goals in mastering information, solving problems, and exploring scientific phenomena. Digital educational space becomes an effective method of professional growth and development of a teacher. Digital education promotes individualization and personalization of the learning process, which has such advantages as maximum attention to differences in professional and cognitive activities of the teacher, stimulation of the use of original teaching methods and various electronic tools in teaching, and they, in turn, promote objective assessment and, if necessary, correction and editing of preliminary learning outcomes (Skakun, 2021).

Both external and internal factors can explain the need for the formation of a digital education space. The demand of modern society for an educational system capable of rapid transformation, which in turn is explained by the globalization processes in education, is a manifestation of external reasons for the organization of innovative educational space. The internal prerequisites for the digitalization of education include such factors as the use of personality-centered training programs, high-quality of computer support of the educational process with the obligatory use of advanced information technologies.

Wide and intensive development of computer-based, first of all online, educational programs radically changes the process and format of education. It is a serious challenge for pedagogical science in terms of educational process content and its organization. These challenges require serious reflection. It is not only a question of recording lectures and preparing electronic versions of textbooks. It is about the “depressurization” of education, moving beyond university classrooms and laboratories (Sydoruk, Bakhmat, Poberezhets’, Misenyova & Boyarova, 2022).

Digital technologies are radically changing the content of academic disciplines and the form of their presentation. It is not only the already familiar electronic presentations or the use of videos. Direct connections to electronic databases, news, forums, etc. are possible. The use of social networks in conducting practical lessons is possible. With the use of telecommunications and messengers’ participation of a leading specialist or expert in the class is possible. Increasingly, publishers specializing in educational literature are adopting electronic versions of textbooks and manuals.

Some popular courses now have hundreds of thousands of students. And universities and individual instructors are actively entering the MOOC market (Massive open online courses) - the already established international form of distance education with open access to the Internet. The development of free online education by the world’s top universities is a serious challenge to small regional universities. Students who study at traditional educational institutions are increasingly supplementing their education with online courses by necessity or by choice (Zancajo, Verger & Bolea, 2022).

The role of the teacher, the content of his work under the conditions of digitalization changes significantly. His task becomes not so much the development of the course, the content of lectures and practical classes, as their regular updating following new theoretical concepts and developments, as well as new technologies, practices, empirical data, publications of scientific and educational literature, tracking electronic resources and databases, where all these materials are presented. It must also keep abreast of educational programs and services offered by other universities.

The rapid development of information technology and the spread of the global Internet, called informatization, has actualized the problem of educational development. Informatization refers to regulating the relations caused by the search, receipt, transmission, production, and dissemination of information using information technology. Akour & Alenezi (2022) see informatization as a process in which social, technological, economic, political, and cultural mechanisms are not simply connected but fused.

From a technological point of view, the informatization of the learning process of the future is understood as technical and technological equipment of labor activity in the production of educational products and organization of the learning process. From another point of view, informatization can be seen as a process that affects all spheres of human activity and influences the individual himself/herself. Informatization of the educational process of the future is represented by the action of implementing information technologies in educational activities. The foundation for the development of informatization of education is the computerization of learning, which gave rise to a new direction in innovative pedagogy (Tsekhmister, Konovalova & Tsekhmister, 2021).

Informatization of education is taken as a targeted activity for the development and implementation of information and communication technologies in different areas:

- in the educational process of preparing citizens for life and activity in the modern information society;
- management of the education system to improve the efficiency and quality of process management;
- in methodological and scientific-pedagogical activities to improve the quality of teachers' work (Ridei, 2021).

Informatization of education is taken not only as a process but also as a field of pedagogical science focused on providing the sphere of education with methodology, technology, and practice of creation and optimal use of scientific-pedagogical, educational-methodical, software and technological developments in order to implement the didactic capabilities of information and communication technologies. At the same time, the informatization of education is considered as a transfer-integrative field of scientific knowledge.

TRENDS IN THE DIGITALIZATION OF EDUCATION OF THE FUTURE

Information technologies in the context of the informatization of education are a set of systematically organized means of transmitting and distributing information, software, hardware, and organizational and methodological support, aiming to meet the needs of students in obtaining educational services and resources. The tendency of education informatization in the conditions of society globalization caused the appearance of a new type of education called open education. Open education refers to the ideology of content formation based on creating banks of free information modules, which are the basis for the design of new educational courses.

Tendencies of informatization of education and integration of educational technologies become objects of pedagogical science research: - the process of informatization of education is studied as a natural step of pedagogical informatics development; education is considered as a social process of personality formation, requires informatization, and acquisition and assimilation of knowledge in education are studied based on the model of “data - information – knowledge” relations. The process of informatization of education includes socio-cultural activities, allowing promptly get acquainted with the latest scientific data and technological innovations, timely update their professional knowledge, contributing to the radical transformation of society and socio-cultural structures that emphasizes the complex orientation of informatization as a process (Shkola et al., 2022).

The relevance of Doroshenko et al. (2023) findings to the digitalization of education is profound. Their study highlights the necessity of embracing digital technologies to adapt to and thrive within the socio-economic transformations dictated by global changes. This aligns with the primary thesis of our analysis, which posits that the future education system must inherently incorporate innovative digital technologies. The shift towards a digital education system is identified as a natural response to the evolving demands of the socio-economic environment, reflecting a broader trend towards digitalization observed across various sectors of society.

Moreover, Doroshenko et al. (2023) delve into the importance of developing new types of institutions and competencies in the digital era, a notion that is directly applicable to the realm of education. The emergence of digital education necessitates the creation of new educational frameworks and the development of competencies that can navigate and leverage the potential of digital tools effectively. This

perspective is instrumental in understanding the digital transformation of education not merely as a trend but as an essential requirement for fostering an information society that operates within an innovative digital ecosystem.

By examining the philosophical justification for integrating digital technologies in education, Melnyk (2022) highlights the potential for digital innovation to coexist with, and even enhance, humanitarian educational principles. This coexistence is framed within several outcomes: the replacement of humanitarian elements by technological advancements, the preservation of humanitarian knowledge as a global socio-cultural regulator, and a balanced integration of hard and soft skills within the educational milieu. The relevance of Melnyk's (2022) findings to the discourse on digital education is profound. As digital technologies continue to permeate the educational sector, the challenge lies in ensuring that these innovations do not overshadow the humanitarian principles that form the cornerstone of education. Instead, Melnyk (2022) advocates for a synergistic approach that leverages the strengths of digital innovation while maintaining a commitment to humanistic education values. This approach resonates with the core argument of your article, emphasizing that the digital transformation of education should not be viewed merely as a trend but as a critical evolution in response to the demands of a modern, digital civilization. By advocating for a balanced integration of digital technologies and humanitarian principles, Melnyk (2022) not only supports the argument that digital education is a necessity but also outlines a pathway for achieving a harmonious educational future.

Digitalization as a Driver of Open Education

In professional pedagogy, open education is considered primarily in terms of methodological support. Researchers also pay attention to the organizational and managerial features of this definition. The global goal of open education is to prepare students to participate in public and professional activities in the information society. The implementation of open education is determined by the following principles: accessibility (mastering the chosen educational program is carried out without restrictions and barriers); individualization (every student has the right to choose his educational trajectory, his educational plan); distance (mastering the educational program regardless of the location of the student); continuity (creating conditions for continuous education, continuous professional development).

The principles of open education may be implemented under the conditions of a new educational informational and educational environment, which integrates electronic information resources; electronic educational resources; a set of information and communication technologies, and appropriate technological means. The informational and educational environment is a set of information and technological means and rules of their work, aimed at the implementation of educational activities. The necessity of providing individual unlimited access to the student's electronic information and educational environment with special technical and software tools. Such a set of software and hardware tools and methods of their communication within the information and educational environment is called information and communication technologies (Petrov, Radev, Dimitrov & Simeonidis, 2022).

Digitalization and the Formation of a New Educational Environment

In pedagogical practice, the concept of information and educational environment is defined as an anthropocentric relevant information infrastructure designed to reveal the creative potential and talents of the student and teacher, electronic information resources, electronic educational resources, a set of information technologies, communication technologies, and appropriate technology. The information and educational environment is understood as a systematized set of pedagogical (educational and methodological), organizational, informational, and technical conditions aimed at the educational process and its participants, electronic information resources, electronic educational resources, a set of information technologies, communication technologies, and appropriate technological means. Information and the educational environment from the position of a systematic approach is considered as an organized set of information, technical, educational, and methodological support, in which the main component is the subject of the educational process (Teplická, Kádárová & Hurná, 2022).

Such researchers as Bader, Oleksiienko & Mereniuk (2022) note that the created information and educational environment should reflect the priority of educational pedagogical goals in relation to the information technologies themselves in their implementation in the educational process. The functioning of each element of the educational process in the information and educational environment is carried out within its electronic prototype model: electronic information resources, electronic educational resources, a set of information technologies, communication technologies, and appropriate technological means. The information and educational environment is perceived through the study of it as an active factor influencing the participants of the educational process: electronic information resources, electronic educational resources, a set of information technologies, communication technologies, appropriate technological means included in the information and educational environment. The implemented information and educational environment has the function of professional and personal development of the teacher, and the development of the environment itself is going from a closed state to an increasingly open one with a gradual transfer of the educational process to the global information environment of society while maintaining the educational goals, objectives, guidelines and directions (Høydal & Haldar, 2022).

The Path to Globalization Through the Creation of Digital Education Tools

Implementing the trend of informatization of education allows you to create a powerful single center of world education, which will be the foundation of open education. The trend of informatization of education and the implementation of information and educational environment has caused the attention of researchers to educational activities from the perspective of information and communication technologies and actualization of e-learning, which is mentioned as E-learning in the work of Grybauskas, Stefanini & Ghobakhloo (2022). E-learning was a means of implementing open education in constructing information and educational environments. E-learning is understood as the organization of educational activities with the use of the information contained in databases and used in the implementation of educational programs, providing its processing, as well as information and telecommunication networks, providing transmission of the specified information through communication lines, the interaction of students and teaching staff. Also in defining e-learning, its multimedia content is noted, which allows us to define e-learning as an educational process implemented with the help of the Internet and multimedia technologies.

E-learning is an important component of the educational process. This is confirmed by the fact that the legal framework regulating it is e-learning in the educational process is developing. E-learning is a means of implementing open education and a new form of learning. At the same time, e-learning tools become a tool for the implementation of e-learning as a new form within the framework of information and educational environment. Such means catalyze a change in the principles of learning by introducing technical foundations into pedagogy, giving them new educational content. That is why e-learning becomes an innovative form of educational technology development (Sapiński & Ciupka, 2021).

E-learning tools are software tools for educational purposes, which reflect a particular subject area, to a greater or lesser extent, implement the technology of its study, and provide the conditions for implementing various types of learning activities. Here, electronic learning means can be understood the electronic editions containing the systematized material from the corresponding scientific and practical area of knowledge, providing creative and active mastering of knowledge, abilities, and skills in the given area. Means of electronic learning should be distinguished by a high level of execution and artistic design, completeness of information, quality of methodological tools, quality of technical performance, clarity, consistency, and consistency of presentation. The means of electronic learning cannot be reduced to the paper version without the loss of didactic properties. According to this logic, e-learning tools may have the following characteristics:

1. Means of e-learning should be represented by a set of graphic, text, digital, speech, music, video, photo, and other information.
2. In the structure of e-learning tools can be distinguished information sources, tools for creating and processing information, controlling structures.

3. E-learning tools containing systematized material in the relevant scientific and practical field of knowledge, which provides a creative and active mastery of knowledge, skills, and abilities in this area (Gumenyuk, Frotveit, Bondar Horban & Karakoz, 2021).

E-learning tools are also understood as those that implement the capabilities of information technology: provide information using multimedia technology; provide feedback to the user during interactive interaction, monitor learning outcomes and progress; automate the processes of information and methodological support for the educational process and organizational management of the institution. Such logic of consideration of e-learning means adapting the personal qualities of the teacher, who is the main user of e-learning means in implementing open education. The teacher becomes not just a user of the tools but also inherits the functions of the administrator, which allow taking into account the author's approach to the implementation of educational disciplines, filling them with additional functionality, focused on adapting students to work with the tools, taking into account the characteristics of the teacher.

DIDACTIC DIGEST OF FUTURE DIGITAL EDUCATION TECHNOLOGIES

Adaptive Learning and Academic Control

Adaptive learning is dynamic, based on data analysis of building an individual trajectory that takes into account the readiness, abilities, goals, motivation, and other characteristics of the student. The main principle of adaptive learning is that students, starting education with different levels of experience, knowledge, skills, and abilities by mastering individual trajectories, achieve the same learning outcomes defined by the educational program. Implementing adaptive learning programs in a digital learning environment is a valuable tool for teachers and students, as it allows them to achieve the required learning outcomes in a shorter time by recommending the most appropriate content for each student in terms of complexity.

Adaptive digital learning systems provide a personalized learning experience for the individual student, "tailoring" it to the strengths and weaknesses of individual students. The reproduction of adaptive learning programs is provided by the use of artificial intelligence and digital technology. Implementation of adaptive learning is possible on electronic educational platforms that have several basic systems and elements for adaptive learning. For example, the best-known adaptive learning platform in the world consists of the following basic systems:

1. Data collection system - collects and processes huge amounts of data on students' knowledge and skills:
 - an adaptive ontology that captures the relationships between individual concepts, which are then integrated into the necessary taxonomies, goals, and algorithms for student interaction;
 - modeling tools that process data in real time and analyze them in parallel for further use.
2. Inference system - data transformation and inference generation based on all collected data:
 - psychometric tools that assess student knowledge and skills, content parameters, learning effectiveness, etc. With each new level, the information about the student becomes many times more accurate;
 - learning strategy tools that assess students' sensitivity to changes in teaching, assessment, pace of learning, etc.;
 - feedback tools that integrate all data and feed it back into the data collection system.
3. Personalization System - Uses the power of whole system data to find the best strategy for everyone who learns in the study of each concept being taught:
 - recommendation tools that give the student ranked suggestions of what they should do next, balancing learning goals, strengths, weaknesses, attraction, etc.;
 - predictive analytics tools that provide metrics such as the degree and likelihood of achieving the goals set by the teacher (e.g., what is the probability that the learner will

pass the upcoming test at 70% completion), the expected grade, the level of knowledge and skills, etc.;

- unified learning history tools: a student's account that allows you to link together the learning experience gained in different programs using different learning formats (Bader, Oleksiienko & Mereniuk, 2022).

In the system of adaptive learning the analogy of an oral exam, where the teacher sequentially asks questions, finding out the level of knowledge of the listener, is adaptive testing - technology of testing students, where each subsequent question is selected automatically, based on the answers to previous questions and a predetermined level of complexity. The main difference of adaptive testing from the classical tests is dynamic (in real-time), rather than the static determination of the list of given questions. The trajectory by which a student takes the tests is individual. The choice of the next question is determined by the personal characteristics of each individual student, rather than the general rules.

Distance Education

Distance learning is learning that takes place using distance learning technologies, that is, technologies implemented with the use of information and telecommunication networks in the indirect (at a distance) interaction of the teacher and the student. Distance learning does not require the personal presence of the student and provides access to educational resources:

- regardless of the location of the subjects of the educational process;
- at a convenient time for these subjects, including without breaking from work or from the main place of education (Zhong & Zheng, 2022).

An important element of distance learning is interactive communication between teachers and students, providing feedback, which increases the pedagogical effectiveness of learning. Completing a distance learning course and successful final certification provides a diploma or other document on creating an established pattern.

Modern distance learning is based on the use of the following main elements:

- information transmission medium;
- methods that depend on the technical medium of information exchange.

Various digital tools can be used in the process of distance learning:

1. Chat sessions are training sessions that are conducted using chat technology. Conducted simultaneously, all participants have simultaneous access to chat.
2. Web-exercises - remote conferences, seminars, business games, laboratory works, workshops, and other forms of training sessions conducted through telecommunication and other Internet capabilities. Web forums differ from chat classes in the possibility of longer (multi-day) work and asynchronous interaction between students and teachers.
3. Teleconference - a training session, the participants of which are geographically distant from each other is carried out with the use of telecommunication means. Divided into audio conferences (using voice) and video conferences (using video communications).
4. Webinar or online seminar - a type of web conference, holding online meetings or presentations over the Internet. During a web conference, each of the participants is on their own computer, and communication between them is maintained via the Internet with the help of a downloaded application installed on each participant's computer, or through a web application. Webinars are a type of web conferencing, which involves a predominantly "one-way" broadcast of the speaker and minimal feedback from the audience. Webinars can be general and include voting and polling sessions, which provides full interaction between the audience and the presenter. In some cases, voice communication may be through a separate device, such as a speaker phone. Webinars may have a function of anonymity or user invisibility, so that participants in the same conference may not be aware of each other's presence.
5. Web conferencing is a technology and toolkit for organizing online meetings and real-time collaboration over the Internet. Web conferencing allows to make online presentations, work with documents and applications, and look through web-sites, video-files, and images

synchronously. Each participant is at his or her own workplace (Bondar, Humeniuk, Batchenko, Horban & Honchar, 2021).

A new format of distance learning is “live virtuality” - this is distance learning in real-time with the teacher’s participation. Unlike traditional webinars and videoconferences, this format uses interactive learning technologies, allowing the use of a full range of interactive tools (whiteboard, chat, video, software sharing, etc.). These webinars are similar to conventional classroom-based training sessions, except that participants attend the session remotely and interact via an Internet connection - they can hear each other, see the teacher on the screen and ask him questions. During the learning process, the instructor can interact with the whole group and with each listener, and each listener fully interacts with the instructor and the whole group.

Augmented Reality

Augmented reality is a physical environment with direct or indirect addition of the physical world to digital data in real-time using digital devices and software to them. It is part of mixed or hybrid reality, which is defined as the consequence of combining real and virtual worlds to create new environments and visualizations where physical and digital objects coexist and interact in real time. The result of entering into the field of perception any sensory data in order to supplement the information about the environment and improve the perception of information. The fundamental difference between virtual (VR) and augmented (AR) realities is that VR constructs a new artificial world, while AR only introduces individual artificial elements into the perception of the physical world (Antón-Sancho, Vergara & Fernández-Arias, 2022).

Business Simulations

Simulation is an interactive learning event, reproducing (simulating) real processes, places, or situations. Simulation involves creating risk-free spaces in which students practice specific skills and experience the consequences of making decisions that require a certain level of risk. There are two main varieties of business simulations, desktop and electronic, involving IT technology in the simulation (Table 1).

**TABLE 1
TYPES OF BUSINESS SIMULATIONS**

	Tabletop	Digital
<i>Technical side</i>	Simplicity and clarity.	Ability to use a large number of indicators and achievement slices, to complicate or simplify the game depending on the level and preparedness of the audience.
<i>Conditions of performance</i>	Ability to conduct regardless of the conditions.	The necessity of the Internet and hardware.
<i>Role of the teacher</i>	High requirements for the level of qualification.	Requirements for qualifications are lower than in the case of tabletop strategy.

In modern education business simulation and business game take forms of game modeling, including digital learning, e-learning, computer-assisted learning, podcasting, project-based learning, which represent the maximum effect of “simulation”, that is simulation of real situations and contexts. Simulation differs from a business game in the degree of approximation to a real situation: while the situation in a simulation must be known, the situations can be imaginary in a business game.

Virtual Reality

Virtual reality is the objects and subjects of the synthetic world created with the help of information and communication, computer technology, and transmitted to a person through his senses: vision, hearing, smell, touch, and others. A person can interact with virtual reality with partial and full immersion. Virtual reality simulates both action and reactions to action. With digital technology, virtual realities can be designed specifically to interact with humans for specific reasons, creating experiences that cannot otherwise be created (Bondar, Humenchuk, Horban, Honchar & Koshelieva, 2021).

Properties of virtual reality:

- generativity: is produced by another reality external to it;
- relevance: it exists here and now;
- autonomy: it has its own laws of being, time, and space;
- interactivity: can interact with other realities but possessing independence.

The main principle of using virtual reality in digital education is the relevance of use: virtual reality tools in education should provide additional value that other traditional ways of learning cannot provide. Virtual reality is mainly used in education as a special information space, where the student can get certain information, make contacts, elements of scientific and educational, and project activities. The developing effect of didactic programs in virtual reality is determined by the three-dimensional image of recognizable objects, a wide opportunity to perform actions with objects (animation), the effect of presence, interactivity of the situation, the implementation of visualization of abstract models of learning technology (Table 2).

A topical example of combining virtual reality and learning technologies is the virtual classroom, a distance learning technology in which students and teachers have the opportunity for mutual communication, transfer, and analysis of information using the Internet or corporate information systems. Virtual classrooms for individual programs can be combined into virtual campuses, and participants can enter different virtual classrooms on a class schedule. The virtual classroom simulates all types of face-to-face format activities and can add analytical tools that are used in e-learning (data sharing, feedback, assessment, and analytics, etc.). Both integrated electronic platforms and different solutions for individual functions can be used to implement virtual classroom technology.

TABLE 2
THE ADVANTAGES OF APPLYING VIRTUAL REALITY IN THE EDUCATIONAL PROCESS

Benefits for educational purposes			
Engagement	Interactivity	Immersion	Focus
Due to the effect of presence VR transforms the educational process, making it much more interesting.	Training simulators with interactive scenarios in 3D allow you to practice different business cases in practice.	Unlike online simulators, the degree of conventionality in VR is minimal. The employee is in a three-dimensional space and interacts with believable avatars and objects rather than flat pictures on the screen.	VR provides complete isolation from external stimuli, as well as the ability for the teacher to control the focus of the student.

CONCLUSION

Currently, pedagogical science is searching for an effective model for further development. It should be noted that the digitalization of the educational process is caused, above all, by the transformation of socio-economic relations arising against the background of the development of digital technology and modern innovative telecommunication technologies. The fundamental source of the active use of innovative technologies in the education system is its digitalization, which, in turn, is caused by the intrusion of digital technologies and telecommunication systems into human life, contributing not only to the recording, processing, transmission but also to the creation of knowledge, skills, and abilities in the form of Artificial

Intelligence. Consequently, a significant part of the new solutions in the education system will be implemented through educational services based on e-learning technologies (E-Learning). Parallel to the traditional classroom education system, a new transnational educational market of e-learning (E-Learning) is emerging, which can quite quickly replace many elements of traditional educational systems and introduce new standards. In the next twenty years, a new design model for the development of educational services can be successful only if a cloud of interacting composite educational solutions emerges, enabling the functions of a hybrid educational system based on the comprehensive use of artificial intelligence in the knowledge domain. Digitalization of the learning system and the involvement of educational best practices in the future will help educate students and improve and professionally develop within the educational institution. At the same time, digitalization contributes to the rejection of many routine technical elements in the education system and increases the efficiency of its functioning.

REFERENCES

- Akour, M., & Alenezi, M. (2022). Higher education future in the era of digital transformation. *Education Sciences*, 12(11), 784.
- Antón-Sancho, Á., Vergara, D., & Fernández-Arias, P. (2022). Influence of country digitization level on digital pandemic stress. *Behavioral Sciences*, 12(7), 203.
- Bader, S., Oleksienko, A., & Mereniuk, K. (2022). Digitalization of future education: Analysis of risks on the way and selection of mechanisms to overcome barriers (Ukrainian experience). *Futurity Education*, 2(2), 21–33. <https://doi.org/10.57125/FED/2022.10.11.26>
- Bondar, I., Humenchuk, A., Horban, Y., Honchar, L., & Koshelieva, O. (2021). Conceptual and innovative approaches of higher education institutions (HEIs) to the model of training A successful specialist formation during a covid pandemic. *Journal of Management Information and Decision Sciences*, 24(3), 1–8.
- Bondar, I., Humeniuk, T., Batchenko, L., Horban, Y., & Honchar, L. (2021). State regulation of the development of educational and scientific process in higher education institutions. *Journal of Management Information and Decision Sciences*, 24(2), 1–10.
- Doroshenko, T., Orlenko, O., & Harnyk, O. (2023). Mechanisms for ensuring the development of the future economy in the context of global changes. *Futurity Economics & Law*, 3(2), 132–150. <https://doi.org/10.57125/FEL.2023.06.25.09>.
- Grybauskas, A., Stefanini, A., & Ghobakhloo, M. (2022). Social sustainability in the age of digitalization: A systematic literature review on the social implications of industry 4.0. *Technology in Society*, 101997.
- Gumenyuk, T., Frotveit, M., Bondar, I., Horban, Y., & Karakoz, O. (2021). Cultural diplomacy in modern international relations: The influence of digitalization. *Journal of Theoretical and Applied Information Technology*, 99(7), 1549–1560.
- Høydal, Ø.S., & Haldar, M. (2022). A tale of the digital future: Analyzing the digitalization of the Norwegian education system. *Critical Policy Studies*, 16(4), 460–477.
- Liubarets, V., Bakhmat, N., Kurylo, L., Spitsyna, A., & Biriukova, O. (2022). Formation of Transversal Competences of Future Economists in the Conditions of Digital Space. *Journal of Higher Education Theory and Practice*, 22(14). <https://doi.org/10.33423/jhetp.v22i14.5536>
- Melnyk, O. (2022). Analysis of modern digital civilization in the context of dominant paradigms of humanitarian education development: attempts of philosophical reflection. *Futurity Philosophy*, 1(3), 63–77. <https://doi.org/10.57125/FP.2022.09.30.05>
- Petrov, P., Radev, M., Dimitrov, G., & Simeonidis, D. (2022). Infrastructure Capacity Planning in Digitalization of Educational Services. *International Journal of Emerging Technologies in Learning (iJET)*, 17(3), 299–306.
- Ridei, N. (2021). Analysis of professional competencies in the characteristics of the teacher of the future: Global challenges of our time. *Futurity Education*, 1(1), 22–32. <https://doi.org/10.57125/FED.2022.10.11.3>

- Sapiński, A., & Ciupka, S. (2021). Pedagogical discourse in higher professional education of the future. *Futurity Education*, 1(1), 4–13. <https://doi.org/10.57125/FED.2022.10.10.1>
- Shkola, O.M., Otravenko, O.V., Donchenko, V.I., Zhamardiy, V.O., Saienko, V.G., & Tolchieva, H.V. (2022). The influence of tae-bo on the development of motor potential of students of medical and pedagogical specialties and its efficiency in the process of extracurricular activities. *Wiadomości Lekarskie*, 75(4 p1), 865–870. <https://doi.org/10.36740/WLek202204121>
- Skakun, I. (2021). Digital competencies of the teacher of the future. *Futurity Education*, 1(2), 39–48. <https://doi.org/10.57125/FED/2022.10.11.18>
- Sydoruk, L., Bakhmat, N., Poberezhets', H., Misenyova, V., & Boyarova, O. (2022). *Formation of future economist professional competence in adaptive-digital environment conditions of higher educational institution.*
- Teplická, K., Kádárová, J., & Hurná, S. (2022). The new model of the engineering education using digitalization and innovative methods. *Management Systems in Production Engineering*, 30(3), 207–213.
- Tsekhmister, V.Y., Konovalova, T., & Tsekhmister, Y.B. (2021). Distance learning technologies in online and mixed learning in pre-professional education of medical lyceum students. *Journal of Advanced Pharmacy Education and Research.*
- Zancajo, A., Verger, A., & Bolea, P. (2022). Digitalization and beyond: The effects of Covid-19 on post-pandemic educational policy and delivery in Europe. *Policy and Society*, 41(1), 111–128.
- Zhong, J., & Zheng, Y. (2022). Empowering future education: Learning in the Edu-Metaverse. In *2022 International Symposium on Educational Technology (ISET)* (pp. 292–295). IEEE.