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DIGITALIZATION OF EDUCATIONAL AND SCIENTIFIC PROCESSES IN THE UKRAINIAN PUBLIC DISCOURSE (1991 – 2023)

*Abstract. **The purpose of the research** is to carry out a comprehensive study on the educational and scientific processes digitization features in Ukraine and its reflection in the Ukrainian public opinion in the context of educational reforms and socio-political processes in our country. **The methodology of the research** is based on the principles of historicism, systematicity and objectivity in the approach to covering the events of the past based on a comprehensive study of sources and scientific literature. General scientific (systematization, typology, retrospection) and special historical (problematic chronological, historical comparative, critical analytical, biographical) methods have been used to solve the tasks. **The scientific novelty** consists in the fact that the digitalization of the educational and scientific process was considered through the prism of the public reaction to the innovations of central authorities and its attempts to modernize the educational sphere in line with the leading European trends in education and science for the first time in the Ukrainian scientific opinion. **The Conclusion.** It has been stated that the process of the educational sphere digitalization in Ukraine started at the turn of the 20th and 21th centuries, although during this period there was a lack of (a) proper material*

and technical base in secondary and higher education and (b) qualified personnel capable of working in a new educational paradigm. It has been noted that the society was not ready for the revolutionary transformations in education, which were based on digitalization and tended to the post-Soviet model of organizing the educational process. It has been emphasiyed that only during the last decade, especially during the coronavirus pandemic, digital technologies (cloud technologies) became the part of an everyday life at secondary and higher schools, and on a level with traditional education, society begun to use non-traditional and innovative products (electronic textbooks, distance-learning courses, electronic libraries, etc.).

Key words: *Ukraine, digitalization, education, science, public discourse, computerization, information and communication technologies, innovations, educational process.*

ЦИФРОВІЗАЦІЯ ОСВІТНЬО-НАУКОВИХ ПРОЦЕСІВ В УКРАЇНСЬКОМУ СУСПІЛЬНОМУ ДИСКУРСІ (1991 – 2023)

Анотація. Мета статті полягає у комплексному дослідженні особливостей цифровізації освітньо-наукових процесів в Україні та її відображенні в українській суспільній думці уконтексті освітніх реформ та суспільно-політичних процесів у нашій державі. **Методологічну основу** роботи становлять принципи історизму, системності й об'єктивності у підході до висвітлення подій минулого на основі комплексного вивчення джерел та наукової літератури. При розв'язанні поставлених завдань використано загальнонаукові (систематизації, типологізації, ретроспекції) та спеціально-історичні (проблемно-хронологічний, історично-порівняльний, критично-аналітичний, біографічний) методи. **Наукова новизна.** Чи не вперше в українській науковій думці цифровізацію освітньо-наукового процесу розглянуто крізь призму суспільного реакції на новації центральних органів влади та її спроб модернізувати освітню сферу у руслі провідних європейських трендів в освіті та науці. **Висновки.** Констатовано, що процес цифровізації освітньої сфери в Україні започатковано на зламі XX – XXI століття, хоча у цей період відчувалася нестача (а) належної матеріально-технічної бази у середній та вищій школі та (б) кваліфікованих кадрів, здатних працювати у новій освітній парадигмі. Зазначено, що суспільство не було готове до революційних перетворень в освіті, які ґрунтувалося на цифровізації та тяжіло до пострадянської моделі організації освітнього процесу. Відзначено, що тільки упродовж останнього десятиліття, особливо у період пандемії коронавірусу, цифрові технології (хмарні технології) глибоко увійшли у повсякдення середньої та вищої школи, а на рівні з традиційною освітою суспільство почало користуватися нетрадиційною та інноваційними продуктами (електронні підручники, дистанційні курси, електронні бібліотеки тощо).

Ключові слова: Україна, цифровізація, освіта, наука, суспільний дискурс, комп'ютеризація, інформаційно-комунікативні технології, інновації, навчальний процес.

The Problem Statement. The educational and scientific sphere of Ukraine is undergoing a period of digitalization – due the computerization of the educational process and scientific activity there is a gradual increase of digital technologies. The above-mentioned process is being accepted by the Ukrainian society in different ways, but the obvious progress of the Ukrainian education and science provides the proof regarding the irreversibility of the processes. Owing to digitalization, the Ukrainian education is developing along the European lines with the tendency inherent in the European secondary schools to develop personalized educational trajectories at secondary schools and to merge education, science and practice in higher education.

The digitalization of the educational process is depicted in the socio-scientific discourse of the modern Ukrainian state as mostly: a modern requirement of the information society (Nikolaiesku & Shynkarova, 2022); the new reality of Ukraine (Sosnin, 2019); the pledge of the national security of Ukraine (Liakhotskyi & Liakhotska, 2019); a leading vector of training of specialists of the 21st century (Demianchuk & Bodnaruk, 2022) and the others.

The above-mentioned epithets of digitalization require an in-depth study of the nature of this phenomenon, its introduction into the educational process at all levels, and society reaction to innovative trends in education in recent years.

The Analysis of Recent Research and Publications. Some Ukrainian scholars (historians, political scholars, teachers) tried to find answers to the tasks set before the author of the article in the direction of much broader thematic niches (for example: "Innovative Technologies in the Modern Educational Space" (Yefremova, 2020), "Social, Economic and Educational Transformations in the Digital Age" (Leonov, 2022), "Digital Transformation of Open Educational Environments" (Bykov & Pinchuk, 2019), "Modernization of Education in the Digital Dimension" (Modernizatsiia osvity, 2019), "Digitization of Education is an Imperative of the Times" (Tsyfrovizatsiia osvity – imperatyv chasu, 2021), "Innovative Technologies for Teaching Computer Science Disciplines" (Medvedeva & Tiahay, 2021), "Digital Technologies in Education: Modern Experience, Problems and Prospects" (Tsyfrovi tekhnolohii v osviti, 2022) та ін.). There is no comprehensive study in the Ukrainian historical and pedagogical scientific opinion for the time being, which would be devoted to highlighting the educational and scientific sphere digitalization issue in Ukraine in the vision of the Ukrainian public opinion. The latter thesis actualizes the research and served as the basis for writing the article.

The Results of the Research. There are two periods, which could be distinguished in the digitization of the educational and scientific sphere of Ukraine: 1) the first period of 2002 – 2010 is characterized by a wide use of computing equipment, computers and software against the background of a dialogic human computer interaction, which opened up new opportunities in the educational sphere; 2) the second period includes the 2010 – till present: is characterized by the use of modern computers, high-speed storage devices of large capacity, the use of special social networks / services in educational activities in the educational and scientific process, as well as the use of innovative information and telecommunication technologies, multimedia technologies and virtual reality systems, etc. (Lytvynova, Marienko, Nosenko, Sukhikh & Yatsyshyn, 2022).

Numerous scholars trace the beginning of the "digital revolution" to 2002 not only in Ukraine, but also on the European continent in general, when the amount of digital data stored in the world exceeded the total amount of analogue data for the first time (Apalkova, 2015). However, the educational and scientific sphere digitalization of Ukraine was not so common until 2010, which caused misunderstanding among a significant part of society (Holovaha & Makyeev, 2022, p. 132). The scientific and pedagogical workers at secondary and higher schools were often accused of the excessive conservatism, inability to prepare students for a real life, outside the walls of educational institution, inefficient models of learning and teaching, inability to adapt to changes quickly (Holovaha & Makyeev, 2022, p. 132). The scholars noted the following: "Such point of views on education are quite typical of the post-industrial world, in which changes are taking place instantaneosly" (Holovaha & Makyeev, 2022, p. 132).

The central authorities tried to respond to society's requests in the educational and scientific sphere. In particular, Law of Ukraine No. 537-V "On the Basic Principles of the Development of the Information Society in Ukraine for 2007 – 2015" dated January 9, 2007 (Zakon Ukrainy, 2007) was adopted in order to accelerate the information society development in Ukraine, in which considerable attention was paid to the educational and scientific sphere improvement issue in terms of training a person for work in the information society (Ivanova, 2020). The lawmaker stated the following: "One of the main conditions for

a successful implementation of the Basic Principles is the provision of training, education, and professional training of a person to work in the information society" (Zakon Ukrainy, 2007). Taking the above-mentioned into account, it was considered appropriate:

– to develop the national scientific and educational space, which will be based on the union of various national multipurpose information and communication systems;

– to develop methodological support for the use of computer multimedia technologies in the teaching of school subjects and disciplines, taking into account in the education systems of students of pedagogical higher educational institutions and the retraining of teachers in the specifics of information and communication technologies (ICT) work;

– to ensure the priority of the ICT specialists training;

– to improve curricula, open new specialties from the latest ICT, implement the principle of "lifelong education";

–to create distance learning systems and ensure on their basis the effective implementation and use of ICT at all educational levels of all forms of education;

– to provide educational institutions and scientific institutions with modern economic and effective ICT tools and vital information resources at the appropriate level;

– to ensure free access to ICT and information resources, especially in rural and hard-to-reach areas;

– to increase computer literacy of population, in particular pensioners, low-income people, people in need of social assistance and rehabilitation, peasants, on the basis of cooperation between a private sector of economy and local self-government bodies;

– to ensure development of the national scientific and educational information network and information resources in the main fields of knowledge, its connection, in particular, to European scientific and educational networks (Zakon Ukrainy, 2007).

According to the Decree of the Cabinet of Ministers of Ukraine No. 988-r "On the Approval of the Concept of State Policy Implementation in the Reform of General Secondary Education "New Ukrainian School" for the period until 2029" issued on December 14, 2016 (Rozporiadzhennia Kabinetu Ministeriv Ukrainy No. 988-r, 2016) it is recommended introduce ICT elements into the educational process (Rozporiadzhennia Kabinetu Ministriv Ukrainy № 988-r, 2016). The concept included the National Educational Electronic Platform (NEEP) creation in 2017 – 2018 in order to store electronic courses and textbooks, the development of electronic textbooks, distance learning courses according to educational programs, a distance learning system for improving qualifications of teachers (Rozporiadzhennia Kabinetu Ministriv Ukrainy № 988-r, 2016).

According to the Concept, electronic textbook, as well as auxiliary technical means of electronic platform, were offered to be introduced in the format of an experiment. However, as it was stated by a scholar M. Karpenko, offered electronic textbooks became only versions of paper textbooks in Portable Document Format (PDF) (Karpenko, 2020). The above-mentioned format did not use the multimedia capabilities of digital information transmission (interactivity, dynamic iconography, video content, etc.) (Karpenko, 2020).

Unfortunately, the NEEP project was not implemented (the platform was supposed to collect interactive educational materials for pupils, educational materials for teachers (methodical materials, video lessons, recommendations), pieces of advice for parents on their communication with school staff, etc.)) although there was provided 54 million hrn. in the 2018 state budget of Ukraine (Karpenko, 2020). As a result, the Chief Consultant of the Department of Humanitarian Policy and Civil Society Development of the Center for Social

Studies of the National Institute of Strategic Studies, A. Ishchenko considered it expedient to create the National Platform for Digital Education (NDPE) as one of the main means of the digitalization of education, since the implementation of the previous stage – the National Educational Electronic Platform creation and implementation failed (Ishchenko, 2020).

In addition, according to A. Ishchenko, "along with the digital educational content, digital educational services should play a key role in the modern educational process – as well as properly standardized and tested means and tools for organizing the educational process and using modern multimedia content in it" (Ishchenko, 2020). First of all, these are means of vertical (a teacher-student) and horizontal (a student-student) interaction (exercises, tests, projects), tools for working in small and large groups, aimed at "developing skills and abilities of the 21st century and ensuring constant control of educational successes, ensuring the necessary differentiation of the educational process and individual educational trajectories adjustment in time" (Ishchenko, 2020).

The Decree of the Cabinet of Ministers of Ukraine No. 67-r issued on January 17, 2018 approved the "Concept for Development of Digital Economy and Society of Ukraine for 2018 – 2020" (Rozporiadzhennia Kabinetu Ministeriv Ukrainy No. 67-r, 2018), in which it was noted that digitalization is saturation of a physical world with electronic and digital devices, means, systems and establishment of electronic communication exchange between them, which in fact enables the integral interaction of the virtual and physical, i.e. creates a cyber-physical space (Rozporiadzhennia Kabinetu Ministriv Ukrainy № 67-r, 2018). Hence, digitalization became a recognized mechanism of the economic growth due to the ability of technologies to have a positive influence on the efficiency, effectiveness, cost and quality of economic, public and personal activities (Ivanova, 2020).

The concept formulated the basic principles of digitization, in particular, it should: provide every citizen with equal access to services, information and knowledge provided on the basis of information, communication and digital technologies; be aimed at creating advantages in various spheres of an everyday life; it should be carried out through the mechanism of economic growth by increasing efficiency, productivity and competitiveness from the use of digital technologies; it should promote development of information society and mass media; focus on international, European and regional cooperation with the aim of integrating Ukraine into the EU, entering the European and world markets; it should be accompanied by an increase in the level of trust and security, etc (Ivanova, 2020).

The central authorities carried on pondering over the creation of a truly functioning digital education system as a significant priority of the state policy of Ukraine and were reflected in other strategic documents: Regulations on the Unified State Web Portal of Digital Education "Diia. Digital Education", Regulations on the National Educational Electronic Platform, the State Strategy for Regional Development until 2027, the Strategy for the Development of Higher Education in Ukraine for 2021 – 2031, etc. (Nikolaiesku & Shynkarova, 2022). The Committee of the Verkhovna Rada of Ukraine on Digital Transformation, the Institute of Digitalization of Education of the National Academy of Pedagogical Sciences of Ukraine (NAPN of Ukraine), later on – the Ministry of Digital Transformation of Ukraine, non-state institutes, etc. worked on solving the educational and scientific sphere digitization issue of Ukraine actively (Apalkova, 2015).

Chief focus should be on the work of the Directorate of Digital Transformation of the Ministry of Education and Science of Ukraine, which worked on: providing educational institutions with broadband Internet access, computer equipment and STEM laboratories; development

of digital competence of educators; digitization and automation of management activities in the field of education and science; implementation of electronic queues for preschool and general secondary education institutions; introduction of comprehensive tools for assessment by educational institutions of their level and state of digital development; modernization of existing capacities of Ukrainian e-infrastructures, etc (Za tsyfrovizatsiieiu, 2021).

The coronavirus pandemic, which numerous scholars considered to be a driver of educational innovations, made significant adjustments to the process of digitalization of the educational and scientific sphere of Ukraine (Karpenko, 2020). "For the Ukrainian educational system, this test became a kind of incentive that opened a window of new opportunities, acting as a catalyst for long-overdue modernization changes in national education", M. Karpenko noted in this regard (Karpenko, 2020). Under the conditions of the pandemic, traditional forms and methods of education were cancelled, and the entire educational process was moved to a virtual space (Holovaha & Makyeev, 2022). "Certainly, not all educational institutions were ready for this", the educators noted. – On the one hand, there was a lack of powerful computers and network equipment, on the other hand, insufficient digital competence, methodical and psychological unpreparedness for the new format of education, lack of experience in "total" online teaching and communication were indicated. A lot of difficulties arose during the teaching of natural, technical and creative disciplines, defense of qualification works" (Holovaha & Makyeev, 2022).

At the same time, there were launched diverse educational initiatives, in particular the projects "Learning without Borders", "Kindergarten Online", "Informative Online Meetings for Children and Teenagers", etc. new tools for distance and mixed learning were developed and implemented (webquests, cooperation posters, online olympiads and competitions) (Holovaha & Makyeev, 2022). The so-called smart schools began to appear, that is, those that use IT technologies in their direct work. In the majority of cases, the above-mentioned schools related to the development of a popular direction of STEM education (S – science, T – technology, E – engineering, M – mathematics), within which the students were suggested using innovative technologies in learning process (Holovko, 2020). Consequently, the project "Digital Agenda for Ukraine 2020" ("Digital Agenda for Ukraine 2020"), which was presented by the Cabinet of Ministers of Ukraine, determined the main priority positions for the development of the information society in our country on the basis of integration into global processes of "digitalization" (Apalkova).

The central authorities promoted the launch of the first Ukrainian online platform the "All-Ukrainian School Online" (VSHO), which scholars considered to be "a high-quality and lightning-fast response to the challenges of the pandemic, which isolated millions of Ukrainian children and teachers at home" (Osvita – naiprybutkovisha investytsiia, 2023). Owing to VSHO, the Ukrainian teachers mastered the tools of distance learning (nowadays, VSHO stores more than 3,5 thousand video lessons on 18 basic school subjects for students of grades 5 – 11, about 3 million Ukrainians from over 80 countries use the platform) (Osvita – naiprybutkovisha investytsiia, 2023).

The government of Ukraine focused on the national online educational platform for a digital literacy "Diia. Digital education", which consisted of five courses for different target audiences and has the form of the series, under the conditions of the coronavirus pandemic. The Ministry of Digital Transformation created an overview educational series "Quarantine: Online Services for Teachers" aimed at setting up communication between the teachers and the students for the period of distance learning (Uriad zapustyv osvitnii serial, 2020) (it was

about algorithms and communication between the teachers and the students for the period of distance learning, as well as a set services and the specifics of their use for teachers, including Google Classroom, Microsoft Teams, Cisco Webex, Zoom, Class Dojo, Classtime, Viber, etc.) (Uriad zapustyv osvitnii serial, 2020). In addition, the Cabinet of Ministers of Ukraine initiated the creation of a free electronic magazine, a self-assessment tool SELFIE for educational institutions, the "Internet Subvention", owing to which approximately 5,000 schools were connected to the high-speed Internet (Fedorov, 2021).

In the spring of 2021, as part of the initiative, which was called the "Laptop for Every Teacher" (implemented by the Ministry of Education and Science of Ukraine, the Ministry of Digital Transformation of Ukraine), it was planned to purchase more than 60,000 laptops for Ukrainian teachers (from the state budget, 980 million hrn. was allocated for the purchase of equipment) (Fedorov, 2021). The computer equipment could be purchased by local self-government bodies, using part of "New Ukrainian School" subvention, as well as with the funds from local budgets (Fedorov, 2021).

Thus, during the coronavirus pandemic, digitization of educational and scientific process was aimed at ensuring the continuity of learning process, i.e. life-long-learning, as well as its individualization based on the advanced-learning-technologies. The scholars made the following conclusion: "There is no established definition of this term yet, but it includes the use in education of significant data on the process of mastering certain disciplines by individual students and, in many ways, automatic adaptation of educational process based on them; the use of virtualization, augmented reality and cloud computing and many other technologies" (Osoblyvosti tsyfrovizatsii, 2019).

During the period of 2019 – 2022, the scholars of the Institute of Digitization of Education of National Academy of Sciences of the Ukrainian Academy of Pedagogical Sciences conducted a large-scale study aimed at identifying the educational resources, electronic learning tools that were in the greatest demand among teachers of general secondary education institutions, and found out the state of the educators' readiness to use digital tools in order to ensure distance learning to students. The total number of teachers, who were involved in the survey was 54,254 from all regions of Ukraine (Bykov, 2022).

The educational trainings, seminars and webinars were organized and held for school teachers, teachers of professional (vocational technical), professional pre-higher and higher education institutions, in which more than 4,5 thousand people took part (Bykov, 2022). Mass educational trainings and webinars were held for the pedagogical workers under the conditions of the pandemic in order to increase the level of digital competence: "Office 365 Marathon", "The Problems and Prospects of the Primary School Educational Environment Development based on Smart Kids Technology", "Distance Education: Preparation Checklist", the "All-Ukrainian Online Conference on Distance Education and Educational and Research Work in Educational Institutions", "The Computer Modeling in the Educational Process of General Secondary Education Institutions", "Designing a Cloud-Oriented Methodical System for Training Teachers of Natural and Mathematical Subjects to Work in Scientific Lyceums", "The Scholars of the National Academy of Sciences of Ukraine – for the Ukrainian Teachers", "Digital Competence of the Modern Teacher of the New Ukrainian School" and the others (Bykov, 2022).

As part of primary school reform, the Academy of Smart People was created by the National Academy of Sciences, in which 600 teachers were able to improve their intellectual competence in the use of electronic educational game resources, the organization of distance

learning, the use of digital services, and the improvement of skills in working with digital equipment (Bykov, 2022). In 2021, the scholars of the National Academy of Sciences of the Ukrainian Academy of Pedagogical Sciences launched the creation of the informational analytical and search reference system, which was called "The Ukrainian Electronic Encyclopedia of Education", which should ensure the formation and systematization, unification and maintenance of the conceptual and terminological apparatus of Pedagogy and Psychology in an up-to-date state (Bykov, 2022).

The National Institute of Strategic Studies, which during the pandemic offered to the Ministry of Education and Science of Ukraine, with the involvement, as needed, of the resources of Institute for Modernization of the Content of Education and the Ministry of Digital Transformation of Ukraine did not remain aloof from the digitalization process of education:

– to ensure the monitoring of the use of digital technologies in the educational process during the quarantine in order to accumulate experience of successful and unsuccessful practices with their further analysis and use of the obtained results in the formation and implementation of effective educational policy;

– to resume work on the National Educational Electronic Platform creation as soon as possible;

– to prepare new normative documents regarding the standards of electronic textbooks and requirements for their examination;

– to consider the possibility of creating a division of digital and distance (online) education in the Ministry, the function of which will be formation of state education policy in the relevant directions for an effective modernization of the national education system;

– to speed up work on the regulatory and legal support of mechanisms for recognizing learning outcomes obtained through non-formal and informal education (Karpenko, 2020).

An online survey conducted by scholars of the Institute of Information Technologies and Teaching Aids of the National Academy of Sciences of Ukraine in the period from March 27 to April 4, 2020 showed that 61% of teachers were actively engaged in self-education to ensure and organize distance learning (the main demand is for author's lessons on the YouTube channel – 72,9%, materials for educators on EdEra – 42,3% and Prometheus – 32,5%) (Ovcharuk & Ivaniuk, 2023). The webinars, online courses and master classes, online conferences, online seminars and projects were considered to be the most efficient forms of the professional development by the pedagogical workers. On the bright side, the teachers began to master new online tools and search for learning platforms that were convenient for themselves and their students, allowing for group distance learning (Ovcharuk & Ivaniuk, 2023).

The International Programme for the Assessment of Educational Achievements PISA-2018 analysed the level of readiness of the State Educational Institutions for implementation of digital education in January of 2021. Hence, it was found out that 70% of teenagers went to schools where digital technologies were not enough and they were not powerful, in addition, the availability of software was not enough for quality learning (according to the Institute of Educational Analytics, 9% of technology in Ukrainian schools – defective, and almost half of the computers in all schools are older than 5 years) (Fedorov, 2021).

At the same time, 75% of the school Principals reported that their schools had efficient resources in order to help teachers learn how to use the information technology (Chy zabezpecheni shkoly Ukrainy, 2021). The majority of school Principals noted that the teachers were encouraged to use the digital technology and had enough time and technical capabilities

to prepare lessons using the digital technology. However, 50% of the school Principals stated that the educational process in their schools was hindered by a lack of a computer equipment, more than 70% of the Principals pointed to low quality or unsatisfactory computer equipment (Chy zabezpecheni shkoly Ukrainy, 2021).

In general, almost 96% of the Heads of the educational institutions reported that they discussed with the teaching staff the possibilities of using the digital technology for the educational purposes regularly (Chy zabezpecheni shkoly Ukrainy, 2021). Hence, almost 60% reported that their teachers had a set time for meetings in order to discuss digital learning issues. Only 33% of the Heads of the educational institutions reported that they had special programs to increase the cooperation of the teachers on issues of the digital technology (Chy zabezpecheni shkoly Ukrainy, 2021).

Taking into account the sociological materials, the implementation of digitization in the educational and scientific process in Ukraine was fragmentary, which was also confirmed by the results of other sociological studies (Kucherak, 2020). Hence, when the respondents (primary school teachers of general secondary education institutions of Ivano-Frankivsk City Council) answered the question: "Do you use innovative technologies in your work?", the results of the poll were the following: 10 answered "no" (13,5%) and 64 answered – "yes" (86,5% (Kucherak, 2020, p. 93). At the same time, difficulties arose when formulating an answer to the question of which innovations were used (22 respondents (29,7%) could not answer the above-mentioned question) (Kucherak, 2020, p. 93).

Due to the full-scale invasion of the Russian Federation on the territory of Ukraine on February 24, 2022, new challenges for the digitalization of the educational and scientific sphere in Ukraine were posed. The day before, in accordance with Decree of the Cabinet of Ministers of Ukraine No. 286-r "On Approval of Strategy for Development of Higher Education in Ukraine for 2022 – 2032" issued on February 23, 2022 (Rozporiadzhennia Kabinetu Ministriv Ukrainy № 286-r. 2022), the above-mentioned Strategy was approved, which put forward the idea that institutions of higher education (HEIs) "move to new digital learning models and create conditions in order to ensure the competitiveness of educational and research activities" (Rozporiadzhennia Kabinetu Ministriv Ukrainy № 286-r, 2022). According to the Strategy (Stratehiia, 2022), a course was established in order to intensify cooperation between Ukraine and the European Union in the field of higher education, in particular regarding:

– reforming and modernization of the higher education system;

– promoting convergence in the field of higher education within the framework of the Bologna Process;

– improving the quality and importance of higher education;

– deepening the cooperation between institutions of higher education;

– expanding the possibilities of higher education institutions;

– activation of the mobility of students, scientific, scientific and pedagogical, pedagogical workers (Semeniako, Briukhovetska & Bokhonko, 2023, p. 184).

In view of the Strategy, it is possible to formulate digitalization tasks, which must be set before the higher education institutions: providing training and upgrading the qualifications of the teaching staff of the higher education institution regarding the use of digital technologies in educational activities; the digital technologies implementation in the educational process; providing the possibility of collective use of the digital resources and free access to them in cloud services; ensuring an increase in the level of motivation for the professional use of

digital technologies by the teachers and the students; the creation of innovative development conditions through the introduction of digital technologies; provision of information and consulting services regarding the use of digital and cloud technologies with unlimited resources; accumulation, systematization and distribution of information on the use of digital and cloud technologies by the institution of higher education (Osoblyvosti tsyfrovizatsii, 2019).

On July 27, 2022, the Verkhovna Rada of Ukraine adopted the Law of Ukraine "On Amendments to Certain Laws of Ukraine Regarding the Functioning of Integrated Information Systems in the Field of Education" (Proekt Zakonu, 2022). The former Minister of Education and Science Serhii Shkarlet noted the following: "AICEM could simplify the teacher's work with school documentation, paper reporting, and would also provide support and gradual transfer of key management processes in the field of preschool, general secondary, out-of-school and professional (vocational-technical) education into electronic format. An important innovation is also the fact that, on the basis of the system, the registration of children of preschool and school age, participants of the educational process and subjects of educational activities is envisaged (Tsyfrova transformatsiia osvity: pryiniato Zakon, 2022).

According to the adopted Law, a digital interaction between education management bodies of all levels, institutions and participants of the educational process was launched in Ukraine, which will be implemented on the basis of the software and hardware complex "Automated Information Complex of Educational Management" (AICEM). (Tsyfrova transformatsiia osvity: pryiniato Zakon, 2022). Owing to the information interaction, the participants of the educational process could make management decisions quickly and qualitatively, form and implement educational policy, in particular, on issues of distribution and redistribution of interbudgetary transfers from state and local budgets, ordering textbooks, documents on education, enrollment, expulsion, transfer of education recipients (Tsyfrova transformatsiia osvity: pryiniato Zakon, 2022).

V. Umanets noted the following: "Nowadays, digitalization is not a goal, but a means of realizing various functions of life, including the educational process". Taking into consideration the above-mentioned factor, Deputy Prime Minister for Innovation, Development of Education, Science and Technology M. Fedorov announced plans to digitize the education system and implement a number of innovations in the spring of 2023. He initiated four vectors of work in the field of education:

– the fight against bureaucracy in educational institutions;

– digitalization of education (expansion of "Diia" to the educational direction and development of online systems for education);

– development and implementation of a strategy for the development of innovations;

– development of miltek – a cluster related to military technologies (Andreieva, 2023).

The scientific community of Ukraine joined the digitization of the educational and scientific sphere of Ukraine. In particular, the Resolution of the Presidium of the National Academy of Sciences of Ukraine dated April 19, 2023 No. 177 and the Resolution of the Presidium of the National Academy of Sciences of Ukraine dated December 22, 2022 No. 1-2/14-238 approved the Programme of Joint Activities of the National Academy of Sciences of Ukraine and the National Academy of Pedagogical Sciences of Ukraine in 2023 –2025, in particular, it is planned to hold the V, VI, VII All-Ukrainian open scientific and practical online forum "Innovative Transformations in Modern Education: Challenges, Realities, Strategies", All-Ukrainian scientific-practical conference "STEM – the World of Innovative Opportunities", webinar "Artificial Intelligence: Educational Integration", scientific-practical seminar

"Modernization of Educational Programmes for Training Students of Higher Education in the Context of Global and National Challenges" (Prohrama spilnoi diialnosti, 2023).

There were published a series of collective and individual monographs in recent years, which were devoted to certain aspects of the educational and scientific sphere digitalization of Ukraine. We would like to single out the following thorough scientific works: "Innovative Technologies in Modern Educational Space" (Yefremova, 2020), "Social, Economic, and Educational Transformations in the Digital Era" (a responsible editor S. V. Leonov) (Sotsialni, ekonomichni ta osvitni transformatsii v tsyfrovu epokhu), "Digital Transformation of Open Educational Environments: (ed. V. Bykov, O. Pinchuk) (Tsyfrova transformatsiia vidkrytykh osvitnikh seredovyshch), "Modernization of Education in Digital Dimension" (scientific editors N. Morse, O. Buynytska) (Modernizatsiia osvity v tsyfrovomu vymiri), "Digitalization of Education is an Imperative of the Time" (a general editor V. Kremin) (Tsyfrovizatsiia osvity – imperatyv chasu), "Innovative Technologies for Teaching Computer Science Disciplines" (Medvedeva & Tiahay, 2021), "Digital Technologies in Education: Modern Experience, Problems and Prospects" (Vasylieva & Petrushenko, 2022) та ін.

The analytical centre "Cedos" pays considerable attention to the problems of domestic education under the wartime conditions. The results of the centre's specialists work (designated by them as monitoring the impact of the war on education in Ukraine) are reflected in such articles as "Education and War in Ukraine (February 24 – April 1, 2022)", "Education in the Occupied Territories of Ukraine (February 24 – April 30, 2022))", "Multi-subject test instead of external examination. What the applicants should await?" etc. (Holovaha & Makyeev, 2022).

The general public, scholars singled out crucial results of recent years after analysing the state of digitization of education and science, in particular:

− creation of a computer-technological platform for open education at all its levels – from preschool to postgraduate and lifelong education, based on the use of cloud computing technologies;

− improvement of technical equipment with computer systems of educational institutions, offices, laboratories, workshops, libraries;

− updating the pedagogical technologies, methodological support and content of distance and electronic learning based on the use of ICT;

− introduction of new forms of organization of the educational process, forms and methods of training (e-learning, mobile learning, joint learning, smart learning, STEM education, open online courses, mixed learning, social learning) based on cloud-based technologies, Web 2.0 technologies and electronic social services networks;

− creation and development of a computer-oriented educational and scientific environment based on national integrated electronic system-wide software and hardware tools, educational and scientific resources;

− implementation of open educational systems based on the wide use of electronic scientific and educational resources, scientometric bases of open journal systems and electronic libraries;

− development of comprehensive scientific research on the issues of informatization of education;

− formation and development of information culture and IC competences (Lytvynova, Marienko, Nosenko, Sukhikh & Yatsyshyn, 2022, p. 45).

Achievements and problems in the field of digitalization of the educational and scientific space of Ukraine were discussed at scientific conferences (eg: I International Student

Scientific Conference "Digitalization of Science and Modern Trends in its Development" (March 26, 2021, Dnipro) (Persha Mizhnarodna, 2021), II All-Ukrainian Scientific and Practical Conference "Transformation of the Ukrainian Society in the Digital Era" (March 23, 2023, Odesa) (Transformatsiia, 2023), V International Scientific and Practical Conference "Innovations in Education: Realities and Prospects of Development (May 11, 2023, Ternopil) (Innovatsii v osviti, 2023), The 1st All-Ukrainian Scientific and Practical Conference "Digital Transformation of Education and Science" (March 2–3, 2023, Kharkiv) (Tsyfrova transformatsiia osvity i nauky, 2023), International Scientific and Practical Conference "Education as a Factor in Formation of Creative Competences under the Conditions of a Digital Society", November 27–28, 2019, Zaporizhzhia (Osvita yak chynnyk, 2019) and the others), round tables discussions (e.g.: "Distance Learning in Higher Education Institutions: Models, Technologies, Perspectives" (April 26, 2021, Lviv) (Dystantsiine navchannia u ZVO, 2021), "Scientific and Methodological Principles of Informational and Analytical Support for Digital Transformation of Education and Pedagogy under Martial Law" is dedicated to the All-Ukrainian Science Festival (May 17, 2023, Kyiv) (Naukovo-metodychni zasady, 2023) and the others), scientific and practical seminars (e.g: "Digital Competence of a Modern Teacher of the New Ukrainian School: 2021" (March 2, 2021, Kyiv) (Tsyfrova kompetentnist suchasnoho vchytelia, 2021) and the others), webinars (for example: "Digitalization of Professional Education in the Conditions of Modern Challenges" within the XVIII All-Ukrainian scientific and practical (reporting) conference "Scientific and Methodological Support of Professional Education and Training" (March 29, 2023, Kyiv) (Tsyfrovizatsiia profesiinoi osvity, 2023)).

In April – June 2022, the Ukrainian Association of Education Researchers organized at least three large-scale events with international participation, at which both domestic and foreign scholars, in particular, discussed the problems of digitalization of education in Ukraine (forum "Education of the Ukrainian Children in Lithuania: Search for Solutions Based on of Research" (April 28, 2022), a round table discussion "Education and Educators in Conditions of War" (May 5, 2022), conference "The Ukrainian Education and Educational Research under the Conditions of War" (June 28) (Ukrainske suspilstvo v umovakh viiny)). The All-Ukrainian marathon "Digitalization of Education: Practical Experience to Overcome Educational Losses" (Dosvid tsyfrovizatsii osvity obhovoryly na trydennomu onlain-marafoni) was held on April 10-12, 2023. The issue considered were dedicated to the work of a teacher in a cloud-oriented environment, educational innovations, artificial intelligence and augmented reality. The event was held within the framework of the Programme of Joint Activities with the Ministry of Education and Culture of Ukraine by the Institute of Digitalization of Education of the National Academy of Sciences of Ukraine and the "Institute of Modernization of the Content of Education" of DNU (Dosvid tsyfrovizatsii osvity obhovoryly na trydennomu onlain-marafoni, 2023).

The importance of scientific forums, which were devoted to problematic issues in the field of digitization of the educational and scientific process in Ukraine, is difficult to overestimate, since specific offers for improving state policy in this niche were formed based on the results of their work. Thus, for example, the participants of the International Scientific and Practical Conference "Education as a Factor in the Formation of Creative Competences under the Conditions of a Digital Society" (November 27-28, 2019, Zaporizhzhia) (Mizhnarodna naukovo-praktychna konferentsiia) aimed at the further development of digital competences, the conference participants recommended the following:

– to develop digital competences, which are formed today during the teaching of almost all disciplines;

– to develop the digital infrastructure of higher education institutions with the aim of forming digital competencies as the main drivers of innovative mechanisms for implementing the concept of digital society and digital personality;

– to unite scholars in order to develop the most modern concepts, methods and approaches in the formation of creative digital competences;

– to develop promising scientific directions in order to obtain new knowledge about digital society, digital man, digital worldview, digital education;

– to form the concept of a digital society and digital education, the main stages of the development of means of accumulation and dissemination of information technologies as a factor of technological transformations in Ukraine (Mizhnarodna naukovo-praktychna konferentsii).

The Conclusion. The process of educational and scientific sphere digitization emerged in Ukraine at the turn of the 20th and 21st centuries, which found a strong echo in the Ukrainian public opinion. A rapid development of the digital technologies, the Internet users growth in our country (the number of respondents, who use the Internet at home increased by about 60 times since 2001 (Bakirov, 2021)), deformed the established human activities, contributed to changes in the educational process at all levels. The central authorities in Ukraine adopted a number of legal acts that contributed to the digitalization of education and science in the last decade, as they were adapting to global trends and trends in the field of education and also provided the golden opportunity for our secondary and higher education to compete with the others on the world market of educational services decently.

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