







Digital transformation in education: Navigating its impact amidst war



Oleksandr Kaplia^a   | Elvira Ostapenko^b  | Yevheniia Tanko^c  | Svitlana Kaleniuk^d  |
Andriy Dulibskyi^e 

^aInterregional Academy of Personnel Management, Kyiv, Ukraine.

^bDepartment of Foreign Languages, Faculty of Finance, Kyiv National Economic University named after Vadym Hetman, Kyiv, Ukraine.

^cDepartment of Foreign Languages, National Technical University "Kharkiv Polytechnic Institute", Kharkiv, Ukraine.

^dDepartment of Ukrainian Language and Literature, Faculty of Philology, Mykolaiv V.O. Sukhomlynskyi National University, Mykolaiv, Ukraine.

^eFootball Department, Faculty of Physical Culture and Sports, Lviv State University of Physical Culture named after Ivan Boberskyj, Lviv, Ukraine.

Abstract It has been proved that in the perspective, the way out of the digital crisis will be conditioned by the development and approbation of new models of organizing scientific and educational activities adapted to the implementation in an open information and educational environment in the conditions of war. It will also be determined by design of information systems ensuring the collection and processing of data on educational systems and processes in times of war; development of an advanced model of research activities in the sphere of pedagogical education, which ensures high productivity of all educational and research practices in the context of digital transformation of the educational space in the conditions of war; development of psychological and pedagogical support of educational activities at all stages of lifelong learning, taking into account the psychological features and mechanisms of influence of digital learning on representatives of students' different categories in the context of the typology developed in the theory of generations (baby boomers, generation Y, generation Z, generation alpha, or iGen) in the conditions of war; a comprehensive analysis of all pros and cons of digitalization of educational environments, as well as forecasting potential risks and situational limitations of the application of digital educational technologies in the context of an interdisciplinary approach from the perspective of various social and humanitarian disciplines – psychology, pedagogy, philosophy of education, sociology of sciences, etc. It has been pointed out that further analysis of the tendencies, features and challenges of the digital transformation of pedagogical education may be useful not only in the context of developing pedagogical science and practice but also in the broader civilizational aspect, if one considers digital transformation as a global process at the stage of establishing the information society in the conditions of war.

Keywords: digitalization of education, digital transformation, software functionality, wartime posture, education authority

1. Introduction

The main objective of the education sector is and will continue to be to guarantee the quality of education at all levels, both during and after the armed conflict. Therefore, it is quite reasonable to conduct scientific studies in education and implement their results in practice, introduce innovative technologies, and provide educational institutions with new teaching aids, scientific, methodological and educational literature. An important step towards reforming Ukraine's education system is the implementation of the State Standard of Basic Secondary Education, which was developed in accordance with the Concept of the New Ukrainian School. An essential component of experimental activities is ongoing monitoring of its results. The analysis of the first year of approbation of the State Standard of Basic Secondary Education proved that the experiment is quite successful, despite the difficult situation in the country.

Innovation in education is considered an implemented novelty in the content, methods, techniques and forms of educational activities and personal development (as methods, technologies), in the content and forms of organizing the management of the educational system, as well as in the organizational structure of educational institutions, in the means of teaching and training and in approaches to social services in education. This significantly improves the quality, efficiency and effectiveness of the educational process. Therefore, pedagogical innovation in accordance with the features of the latest processes in education should cover particular theoretical blocks of concepts and principles, namely: the creation of new things in the system of education and pedagogical science, the perception of new things by the social and pedagogical community, application of pedagogical innovations, a system of recommendations for theorists and practitioners on how to comprehend



and manage innovative educational processes in education. The effective organization of innovations in an educational institution depends on the development of its potential, the teaching staff's professional competence to work in the conditions of search, the establishment of scientific, methodological and logistical support for innovative changes (Sliusarevskiy, 2022; Ovcharuk et al., 2019; Nychkalo, 2019; Kremen & Liashenko, 2021; Ivanova et al., 2020; Ivanova, 2020; Demianenko et al., 2020; Bykov, 2020; Terziev, 2020).

The concept of "digital transformation" has been used in the social sciences and humanities since the late 1990s and early 2000s, when the phenomenon of social networks began to spread, and the use of personal computers and gadgets intensified. Initially, the term "digital transformation" was used to refer to business and management (Patel et al., 2000). Then, in light of the digitalization of all life's aspects, the need for the digital transformation of the education sector, the modernization of which takes place at the intersection of educational and management processes, became obvious. The field of pedagogical education is no exception: researchers consider digitalization in this area as a modernization process.

When talking about the substantive basis of our research, we will proceed from four primary components on the basis of which the analysis of scientific and pedagogical literature was conducted, namely:

- basic issues and problems on the topic under consideration: they structure the field of discussion, and determine the range of possible reactions, models, and strategies, i.e., they are the systemic basis for the entire presentation;
- main ideas, author's standpoints and interpretations that form a theoretical and methodological way of solving basic issues and problems;
- practical implications, systems and technologies: this content component includes various applied phenomena (consequences) of theoretical positions; this also includes the development of individual programs, activities, and educational modules that ultimately determine the specifics of the digital transformation of the pedagogical education system;
- references and bibliographic descriptions, systematized by thematic and functional principle.

We have identified a range of basic themes that often engage the attention of researchers in this area during the analyzed chronological period. It has turned out that the following issues are being covered especially actively by the authors:

- global challenges of the digital revolution and their impact on changing the content and forms of educational activities through the introduction of digital technologies;
- changes in students' social-communicative, cognitive and personal psychological features under the influence of the digital environment;
- changing the functions of the teacher in the digital information and educational space, acquiring new roles;
- changing the content, forms and methods of teacher training in the digital era, the emergence of new educational and information and communication practices in the system of teacher education;
- updating the management of teacher education in light of digital transformation;
- identifying the advantages and disadvantages of the global digitalization of the education system, assessing the risks of digitalization and identifying possible ways to prevent them (Siafriadin, 2021; Sharma, 2017; Purwantiningsih, 2019; Patel et al., 2000; Nikolic et al., 2020; Misra, 2019; Macgilchrist, 2018; Klasnja-Milicevic, 2021; Ghosn-Chelala, 2018; Fanreza, 2018; Bates, 2019; Azwandi et al., 2019) etc.

The purpose of the academic paper was implemented in the following aspects:

- to identify the major directions of digital transformation of pedagogical education in Ukraine and abroad;
- to indicate the most promising areas of research on digital transformation in pedagogical education.

2. Literature review

In their scientific work, Nikolic, et.al. (2020) elucidate the plethora of duties that teachers perform in the era of digital technologies, thereby broadening the notion of the teacher's role in the contemporary educational setting. They indicate that a modern teacher must perform various functions, such as informing students about new technologies and information resources, promoting the development of their skills and abilities, creating a stimulating environment for independent learning, promoting reflection on their own learning, implementing an effective communication process, mobilizing students for active participation in educational activities, promoting research activities, and evaluating students' educational achievements.

Features of the impact of the digital age on education were considered in the work of Macgilchrist (2018). For the author, the issue of individual human existence has always been at the center of humanitarian problems; however, the digital society has increased the importance of person-oriented education and contributed to the creation of a new educational reality, characterized by such trends as the involvement of new subjects in the learning process.

In addition, Terziev, et.al. (2020) considered the possibility of updating the forms of management of educational activities. The authors point out that in the conditions of rapid technological development and changes in society, traditional forms of management of educational activities are losing their effectiveness. The authors draw attention to the need to update management approaches, taking into account the modern challenges and opportunities offered by digital technologies. They offer the use of innovative management methods and tools, such as digital platforms for data collection and analysis, virtual

learning environments, electronic document management systems, etc. This approach makes it possible to organize the educational process more effectively, providing convenient access to information and promoting the development of innovative pedagogical practices.

In turn, Klasnja-Milicevic, & Ivanovic (2021) noted that the success of learning depends significantly on the initiative and independence of both the teacher and the students. The authors emphasize the importance of self-organization and autonomous forms of learning that contribute to the development of creativity and individual skills. They also note the great importance of individualizing learning and using personalized approaches for each student.

The results of the study conducted by Ghosn-Chelala (2018) emphasize the importance of using the subjective and personal resources of students in the process of adaptive learning, which indicates the stimulation of internal potentials and individual abilities for successful learning and adaptation to the educational environment.

3. Methods

In the research on the influence of digitalization on the pedagogical sphere and its relevance during the war, several general scientific methods were utilized. These methods include:

Comparative Method: The comparative method was employed to analyze the impact of digitalization on the pedagogical sphere before and during the war. By comparing different educational systems, approaches, and practices, researchers could identify the changes and advancements brought about by digitalization.

Analytical Method: The analytical method was utilized to break down complex educational phenomena related to digitalization during wartime. Researchers analyzed various aspects of digital pedagogy, such as the use of online learning platforms, educational apps, or virtual classrooms, and assessed their effectiveness, challenges, and potential benefits.

Historical Method: The historical method was employed to examine the historical development and evolution of digitalization in the pedagogical sphere. Researchers studied the timeline of technological advancements in education and how they have been shaped by historical events, including periods of war. This method allowed for a comprehensive understanding of the context and long-term implications of digitalization.

Experimental Method: The experimental method was used to conduct controlled experiments or studies to measure the impact of digitalization on teaching and learning during the war. Researchers might have designed and implemented innovative educational interventions, incorporating digital tools and technologies, to assess their effectiveness in wartime conditions.

Literature Review Method: The literature review method involved a comprehensive analysis of existing academic literature, research studies, and publications related to digitalization in education during wartime. Researchers synthesized and critically evaluated previous works to identify trends, knowledge gaps, and areas requiring further investigation.

By employing these general scientific methods, was gain insights into the influence of digitalization on the pedagogical sphere during the war and understand its relevance in adapting educational practices to challenging circumstances.

4. Results

Let's consider the key general theoretical aspects of the digital transformation of pedagogical education, which are revealed by modern authors. An analysis of the scientific literature on the research topic shows that, in general, changes in pedagogical education in the era of digital transformation in the Russian pedagogical community are similar to global challenges and tendencies described by foreign researchers. At the same time, international tendencies in the development of pedagogical technologies are focused mainly on the digital format of expression and correspond to global ideas of sustainable development.

Changes in the field of pedagogical education have involved various aspects of the educational activities of higher educational institutions:

- the content of education;
- implementation of educational technologies;
- the structure of managing the educational process;
- assessment activities.

One of the main directions of updating pedagogical education is related to transforming the technological sphere under the influence of the global environment's challenges. Global challenges include fundamental changes in digital technologies and communications, knowledge and information (the "information explosion"), as well as inevitable changes in human behavior, psyche and mental processes related to these factors. The primary vector here is determined by replacing the traditional opposition of "natural" and "cultural" with a more complex interaction between "human", "technological" and "social", as well as the transformation of "evolution" into "techno-evolutionary processes", which makes it possible to reformulate the problem of the relationship between "human" and "information" in the educational process. It is obvious that information processes are faster and more dynamic than social processes. In this regard, the limits of the intensification of educational activities are determined mainly by students' psychological capabilities (Kocherov et al., 2023; Bondarenko et al., 2022).

At the same time, the formation of a child's social functions in a heterogeneous stratified society is possible only in the presence of another person, primarily an adult. Consequently, interpersonal, inter-human relations are crucial. Along with this, the teacher faces the task of preventing the risks of digitalization, including as follows: the threat of early formation of a technocratic type of thinking and the difficulties of socialization associated with it; the danger of replacing normal virtual reality in the students' minds; cognitive dissonance caused by the need for free or forced immersion in large amounts of information; unequal access to digital resources for different categories of students; decreased level of social and emotional intelligence; the danger of losing individuality due to prolonged communication in social networks; decreased motivation for certain types of activities – communicative, educational, cognitive, physical activity; reducing the need for independent knowledge acquisition and management, etc. (Yuldashev et al., 2022; Ovsienko et al., 2023). Various methods are used to prevent such risks, including motivating teachers to quickly master information and telecommunication technologies; establishing new norms of educational communication etiquette in the process of communication in the digital environment; optimal solution of technical and organizational problems that suddenly arise; overcoming the inertia of teachers' thinking who are committed to traditional forms of education and are not ready for remote communications; thorough analysis by teachers of the negative experience of using digital technologies in the educational process; systematic, scientifically-based choice of technologies; timely and high-quality solution of methodological problems, etc. (Elbrekht et al., 2022; Byrkovych et al., 2023).

The reassessment of professional values is another area of updating the content of education for future educators in the conditions of war. The issue of values is a painful nerve of any social transformation, since they combine the rules of behavior of human civilization, objectified in social norms, while values are the basis of most individual human actions. The influence of society's digitalization on the evolution of the pedagogical profession's ideals and teachers' activities is one unique story that is taking place in our eyes. According to the latest research, the digitalization of the pedagogical profession is not so much an external, technological improvement, but a value challenge addressed to teachers regarding the perception of students' values (Klochan et al., 2021). The new digital context of the pedagogical profession is also related to a new configuration of stakeholders (significant partners and interested parties of a new type of education) and requires, first and foremost, a new system of educational and humanitarian practices. In contrast to traditional ideas about practice as a normative stage of testing theoretical ideas, the current target function of pedagogical practices is related to the formation of teachers' and students' readiness for innovative activities in education, especially in information and educational environments; with the transformation of the teacher's attitude from a carrier of a fixed amount of knowledge to a social subject who has the ability and willingness to model new social relations and systems (Rostoka et al., 2023; Panhelova et al., 2023).

After particular digital transformations, the methodological content of a teacher's work in wartime posture is also changing. The very meaning of the concept of "learning task" changes in the digital environment. The task transforms from an external standard enforced by the teacher into an internal issue, a challenge that appears when a person explores the information environment. Accordingly, solving an educational task turns out to be not so much an objective process based on a single algorithm but an individual chain of interaction with resources and other subjects of the digital environment. Thus, the learning task turns out to be the unit on the basis of which individual educational and cognitive activity is organized in the digital environment, while the process of designing learning tasks is directly related to the individual features of the information behavior of both students and teachers (Kryshtanovych et al., 2022).

Naturally, the entire system of pedagogical knowledge is inevitably transformed in the digital information and educational environment (the so-called open pedagogy, the purpose of which is to organize an open information and educational environment creating optimal conditions for acquiring knowledge in an open information society). The distinctive features of open pedagogy are as follows: entering the informal sphere of sharing knowledge and experience; inclusion of learning in massive online courses (MOOCs); the participation of tutors, content curators, coaches, experts, and ultimately the achievement of much deeper integration of the educational process and real-life situations (compared to traditional forms of education) (Akimov et al., 2021).

Within the framework of the proposed transformation, the teacher's readiness to hold the whole potential set of meanings, techniques and practices related to the inclusion of all participants in the educational process in the information space begins to play a fundamental role in the pedagogical profession. However, the most dramatic changes take place in the comprehension of the essence of the teaching profession and the process of mastering it, and in the awareness of teachers' new professional roles during the wartime posture. A change in the pedagogical reality and life space of students is observed; the value and semantic content of school and university education is transformed; the boundaries of the educational space are expanded; social and cultural meanings of education are changing, virtual and augmented reality technologies are being used, etc. In turn, new roles and new opportunities involve changing the teacher's self-perception (teacher, tutor, mentor, facilitator, moderator, digital designer and psychologist in one person); they help overcome the functionality and fragmentation of individual psychological and executive actions in favor of the processes of professional and personal formation, creative self-development and self-determination.

5. Discussions

We agree with the statement of Nikolic, et.al. (2020) on the responsibilities of the modern teacher in the context of digital technologies. This study details various aspects of the teacher's role, including informing students about new technologies and information resources, facilitating their development of skills, creating a stimulating learning environment, and supporting reflection and effective communication. We also agree with the effectiveness of mobilizing students for active participation in the learning process, stimulating research activities and evaluating learning achievements. The authors' conclusions emphasize the need to understand and perform various functions of a teacher for the effective implementation of digital technologies in educational practice.

We like Macgilchrist's (2018) opinion on the impact of the digital age on education. The author draws attention to the change of emphasis on humanitarian problems; in particular, he notes the increase in the importance of person-oriented education in the conditions of a digital society. The paper notes the emergence of a new educational reality that involves new participants in the educational process.

We partially agree with Terziev et.al. (2020) because their study considers the possibility of updating the forms of management of educational activities in the context of rapid technological progress and social changes. However, we believe that the adaptation of management practices to modern challenges and opportunities should be focused not only on the introduction of digital tools, but also on preserving the human factor in the educational process. A personal approach to each student, promoting the development of critical thinking and creativity, as well as providing an effective communication environment, are, in our opinion, also important components of successful education management in the era of digitalization.

Furthermore, we partially concur with Klasnja-Milicevic and Ivanovic (2021) as their research highlights the significance of initiative and autonomy for both teachers and students in the learning process. However, we believe that in addition to self-organization and autonomous forms of learning, it is also necessary to take into account collective aspects, promoting the development of cooperation and teamwork among participants in the educational process.

We agree with the opinion of Ghosn-Chelala (2018) regarding the importance of using the subjective and personal resources of students in the process of adaptive learning. In our opinion, this emphasizes the importance of developing internal potentials and individual abilities for successful learning and adaptation to the surrounding educational environment.

6. Conclusions

Thus, it can be summarized that in the perspective, the way out of the digital crisis will be conditioned by solving the following complex tasks:

- Development and approbation of new models of organizing scientific and educational activities adapted for implementation in an open information and educational environment in the conditions of war;
- Design of information systems that ensure the collection and processing of data on educational systems and processes during the wartime posture;
- Development of an advanced model of research activities in the field of pedagogical education ensuring high productivity of all educational and scientific practices in the context of digital transformation of the educational space in the conditions of war;
- Development of psychological and pedagogical support of educational activities at all stages of ongoing education, taking into account the psychological features and mechanisms of influence of digital learning on representatives of different categories of students in the context of the typology developed in the theory of generations (baby boomers, generation Y, generation Z, generation alpha, or iGen) in the conditions of war;
- A thorough analysis of all pros and cons of the digitalization of educational environments, as well as forecasting potential risks and situational limitations of applying digital educational technologies in the context of an interdisciplinary approach from the standpoint of various social and humanitarian disciplines – psychology, pedagogy, philosophy of education, sociology of sciences, etc.

It is believed that further analysis of the tendencies, features and challenges of the digital transformation of pedagogical education may be beneficial not only in the context of developing pedagogical science and practice but also in a broader civilizational aspect if we consider digital transformation as a global process at the stage of establishing the information society in the conditions of war. The research results can be used in the process of updating the content of pedagogical education in the system of training future teachers at pedagogical higher educational institutions and pedagogical colleges, as well as in the context of university-type pedagogical education. The research may be useful for educational researchers, teachers and administrators of the system of pedagogical education and training, as well as anyone interested in the challenges and strategies of modernizing national education

Ethical considerations

Not applicable.

Conflict of Interest

The authors declare no conflicts of interest.

Funding

This research did not receive any financial support.

References

- Akimov, O., Karpa, M., Parkhomenko-Kutsevil, O., Kupriichuk, V., & Omarov, A. (2021). Entrepreneurship education of the formation of the e-commerce managers professional qualities. *International Journal of Entrepreneurship*, 25(7).
- Azwandi, A., Harahap, A., Syafrudin, S. (2019). Training ICT-Enhanced Teaching-Learning as Model of Teacher Professional Development in Bengkulu. *Jurnal Pengabdian Masyarakat Ilmu Terapan (JPMIT)*, 1(1).
- Bates A. W. (2019). *Teaching in a Digital Age: Guidelines for Designing Teaching and Learning*. 2nd ed. Vancouver: Tony Bates Associates Ltd.
- Bondarenko, S., Makeieva, O., Usachenko, O., Veklych, V., Arifkhodzhaieva, T., & LERNYK, S. (2022). The legal mechanisms for information security in the context of digitalization. *Journal of Information Technology Management*, 14, 25-58. <https://doi.org/10.22059/jitm.2022.88868>
- Bykov, V. Yu. (2008). *Models of organizational systems of open education: a monograph*. Kyiv.: Atika. <https://lib.iitta.gov.ua/845/>
- Bykov, V. Yu. & Pinchuk, O. P. (2019). *Digital transformation of open educational environments* (Dedicated to the 20th anniversary of the Institute of Information Technologies and Learning Tools of the National Academy of Pedagogical Sciences of Ukraine). Kyiv: IE Yamchynskiy O.V. <https://lib.iitta.gov.ua/720740/>
- Bykov, V. Yu., Burov, O. Yu., Hurzhii, A. M., Zhaldak, M. I., Leshchenko, M. P., Lytvynova, S. H., Luhovyi, V. I., Oliinyk, V. V. Spirin, O. M., & Shyshkina, M. P. (2019a). *Development of theoretical fundamentals of informatization of education and practical implementation of information and communication technologies in the educational sphere of Ukraine*. Zhytomyr: Zhytomyr State University named after I. Franko. <https://lib.iitta.gov.ua/716848/>
- Bykov, V. Yu., Burov, O. Yu., Hurzhii, A. M., Zhaldak, M. I., Leshchenko, M. P., Lytvynova, S. H., Luhovyi, V. I., Oliinyk, V. V. Spirin, O. M., & Shyshkina, M. P. (2019b). *Theoretical and methodological fundamentals of informatization of education and practical implementation of information and communication technologies in the educational sphere of Ukraine*. Kyiv: Komprint. <https://lib.iitta.gov.ua/718652/>
- Bykov, V.Y., & Yatsyshyn, A.V. (2019). *Digital transformation of education and science: theory and practice* (Dedicated to the 20th anniversary of the Institute of Information Technologies and Learning Tools of the National Academy of Pedagogical Sciences of Ukraine). Kyiv: IE Yamchynskiy O.V. <https://lib.iitta.gov.ua/718758/>
- Bykov, V.Yu., Lytvynova, S.H, Burov, O.Yu., Slobodianyuk, O.V., Pinchuk, O.P., Sokoliuk, O.M., Dementievska, N.P., Hrybiuk, O.O., Bohachkov, Yu.M., & Ukhan, P.S. (2020). *Computer modeling of cognitive tasks for the formation of students' competencies in natural and mathematical subjects*. Kyiv: Pedagogichna Dumka. <https://lib.iitta.gov.ua/722871/>
- Bykov, V.Yu., Pinchuk, O.P., Lytvynova, S. H., Burov, O.Y., Bohachkov, Y.M., Hrybiuk, O.O., Sokoliuk, O.M., Slobodianyuk, O.V., Konevshchynska, O.E., Ukhan, P.S., Dementievska, N.P. & Yaskova, N.V. (2018). *Formation of the information and educational environment for teaching high school students on the basis of electronic social networking technologies*. Kyiv: Pedagogichna Dumka. <https://lib.iitta.gov.ua/712171/>
- Byrkovych, T., Humenchuk, A., Kobyzcha, N., Akimova, L., Grinberg, L., & Akimov, O. (2023). Economic effectiveness of state policy in reforming higher library and information education in Ukraine. *Economic Affairs (New Delhi)*, 68(1), 599-616. <https://doi.org/10.46852/0424-2513.1.2023.28>
- Demianenko, V.M., Marienko, M.V., Nosenko, Y. H., Semerikov, S.O., & Shyshkina, M.P. (2020). *Adaptive cloud-oriented system of training and professional development of teachers of general secondary educational institutions*. Kyiv: Pedagogichna Dumka. <https://lib.iitta.gov.ua/723245/>
- Elbrekht, O., Bakhov, I., Sytnik, T., & Radzievska, I. (2022). Theory and practice of interaction of subjects of the system of supplying textbooks to educational institutions in the USA. *Relacoes Internacionais no Mundo Atual*, 3(36) <https://doi.org/10.21902/Revrima.v3i36.5729>
- Fanreza, A. (2018). The Quality of Teachers in Digital Era. *Advances in Social Science, Education and Humanities Research. 5th International Conference on Community Development (AMCA 2018)*, 231.
- Ghosn-Chelala, M. (2018). Exploring Sustainable Learning and Practice of Digital Citizenship: Education and Place-Based Challenges. *Education, Citizenship and Social Justice*, 14.
- Information and communication technologies in education: a dictionary. Kyiv: CP Komprint. <https://lib.iitta.gov.ua/718706/>
- Ivanova, S.M., Demianenko, V.M., Dudko, A.F., Kilchenko, A.V., Labzhynskiy, Y.A., Luparenko, L.A., Novitska, T.L., Novitskiy, S.V., Spirin, O.M., Tkachenko, V.A., Shynenko, M.A., Yaskova, N.V., & Yatsyshyn, A.V. (2020a). *Open electronic scientific and educational systems in research activities*. Kyiv: Pedagogichna Dumka. <https://lib.iitta.gov.ua/722957/>
- Ivanova, S.M., Yatsyshyn, A.V., Luparenko, L.A., Dudko, A.F., Novytska, T.L., Kilchenko, A.V., Yaskova, N.V., Novytskiy, S.V., & Labzhynskiy, Y.A. (2020b). *The use of electronic scientific and educational systems in the process of training and advanced training of scientific and scientific-pedagogical workers*. Kyiv: Pedagogichna Dumka. <https://lib.iitta.gov.ua/722956/>
- Klasnja-Milicevic, A., Ivanovic, M. (2021). E-learning Personalization Systems and Sustainable Education. *Sustainability*, 13.
- Klochak, V., Piliaiev, I., Sydorenko, T., Khomutenko, V., Solomko, A., & Tkachuk, A. (2021). Digital platforms as a tool for the transformation of strategic consulting in public administration. *Journal of Information Technology Management*, 13, 42-61. <https://doi.org/10.22059/JITM.2021.80736>
- Kocherov, M., Dzhyhora, O., Dykha, M., Lukianova, V., Polozova, V. (2023). Mechanisms of Post-War Economic Recovery in Ukraine: The Role of the International Community. *Economic Affairs (New Delhi)*, 68(2), 1311-1321.
- Kremen, V. H. (2021). *National report on the state and prospects of education development in Ukraine: monograph (To the 30th anniversary of Ukraine's independence)*. Kyiv: KONVI PRINT. <https://doi.org/10.37472/NAES-2021-ua>
- Kremen, V. H., & Liashenko, O. I. (2019). *Information and digital educational space of Ukraine: transformation processes and development prospects*. Kyiv. <https://lib.iitta.gov.ua/718707/>
- Kryshchanovych, M., Akimova, L., Akimov, O., Parkhomenko-Kutsevil, O., Omarov, A. (2022). Features of creative burnout among educational workers in public administration system. *Creativity Studies*, 15(1), 116-129. <https://doi.org/10.3846/cs.2022.15145>

- Macgilchrist, F. (2018). The "Digital Subject" of Twenty-First-Century Education: On Datafication, Educational Technology and Subject Formation. *Routledge Handbook of Cultural Studies in Education*. N.Y.: Routledge.
- Misra, P. K. (2019). Equipping Teacher Educators for Digital Teaching and Learning: Promises, Practices, Challenges, and Strategies. *Handbook of Research on Faculty Development for Digital Teaching and Learning*. Meerut: Chaudhary Charan Singh University.
- Nikolic, I., Bandur, V. R., Martinovic, D. D. (2020). The Role of Teachers in the Digital Age School. *Sociological Review*, 54(1).
- Nychkalo, N. H. (2019). VIII Ukrainian-Polish: Polish-Ukrainian Forum "Education for Peace / Edukacja dla pokoju": October 8-10, 2019, Pereiaslav-Khmelnytskyi, Ukraine. *Bulletin of the National Academy of Pedagogical Sciences of Ukraine*, 1(1). <https://doi.org/10.37472/2707-305X-2019-1-1-3-1>
- Ovcharuk, O.V., & Ivaniuk, I.V. (2022). *Results of the online survey "Readiness and needs of teachers to use digital tools and ICT in quarantine: January-February 2022: analytical report*. Kyiv: IEC of the National Academy of Pedagogical Sciences of Ukraine. <https://lib.iitta.gov.ua/730808/>
- Ovcharuk, O.V., Hrytsenchuk, O.O., Ivaniuk, I.V., Kravchyna, O.E., Leshchenko, M.P., Soroko, N.V., & Malytska, I.D. (2019). *Development of teachers' information and communication competence in a cloud-based learning environment: a methodological manual*. Kyiv: Litera LTD. <http://lib.iitta.gov.ua/717978/>
- Ovsiienko, L., Rakityanska, L., Kulyk, O., Pet'ko, L., Turchynova, G., Zavadzka, T. (2023). Development of Multicultural Education: Tasks, Tools and Project Solutions. *TEM Journal*, 12(3), 1451-1461. <https://doi.org/10.18421/TEM123-25>
- Panhelova, N., Panhelova, M., Pyvovar, A., Ruban, V., Kravchenko, T., Chuprun, N. (2023). The Influence of the Integrated Education Program on the Psycho-Physical Readiness of Children for School Education. *Sport i Turystyka*, 6 (3), 63-82. <https://doi.org/10.16926/sit.2023.03.04>
- Patel, K., McCarthy, M. P. (2000). *Digital Transformation: The Essentials of E-Business Leadership*. 1st ed. N. Y.: McGraw-Hill.
- Purwantiningsih, A., Suharso, P. (2019). Improving Teacher Professionalism toward Education Quality in Digital Era. *Journal of Physics. Conference Series*, 1254(1).
- Rostoka, M., Guraliuk, A., Ahalets, I., Pahuta, M., Yurzenko, V. (2023). Information and analytical resources in the systems of technological and vocational education. *AIP Conference Proceedings*, 2889 (1), <https://doi.org/10.1063/5.0172782>
- Sharma, M. M. (2017). Teacher in a Digital Era. *Global Journal of Computer Science and Technology (G)*, 17(3).
- Sliusarevskiy, M.M. (2022). The social-psychological state of Ukrainian society in the context of a full-scale Russian invasion: urgent challenges and responses: Scientific report at the meeting of the Presidium of the National Academy of Pedagogical Sciences of Ukraine on April 21, 4(1). <https://doi.org/10.37472/v.naes.2022.4124>
- Syafryadin, N., Wardhana, D. E. Ch. (2021). Bunga Febriani R. Digital Training for Increasing English Teachers' Professionalism at Junior High School. *Journal of Education and Learning (EduLearn)*, 15(1).
- Terziev, V., Pushova, L., Dimitrovski, R., Georgiev, M. (2020). Change Management and Digital Age Training. *International E-Journal of Advances in Social Sciences*, 6(16).
- Yuldashev, O. K., Khomiachenko, S. I., & Yuldashev, S. O. (2022). Organizational and legal model of competency-based education as a means of the transition to innovative economy. *Danube*, 13(2), 107-118. <https://doi.org/10.2478/danb-2022-0007>