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Problems of digitalization in institutions of higher education

Problemy cyfryzacji w instytucjach szkolnictwa wyższego

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Abstract. Today, digitalization of higher education has become a vital necessity for quality education of students. With the help of digitization, it is possible to significantly expand the competencies of students and teachers. This process is influenced by certain circumstances, the most important of which are technical and technological capabilities and a complex of problems that arise in the event of an imperfect or even non-existent digitalization strategy of the organization. A strategy that can be implemented involves the development of a clear plan of action, it is broken down into stages, its goal is achievable, and intermediate goals are simple and clear; problems should, if possible, be foreseen and methods of their leveling should be calculated in advance. The article considers three alternative directions of digitalization of higher education, tentatively named: "Intensive technological adaptation", "Balanced digitalization" and "Innovative digital transformation". Each of these directions requires specific aspects of implementation. The objects of influence of digitalization in the institution of higher education are: educational and administrative procedures; scientific research; international cooperation and student life. Ivan Franko Lviv National University has developed a long-term digitalization strategy, however, after an acute force majeure situation (the COVID-19 pandemic) arose, there was a need to accelerate the introduction of digitalization, online learning platforms, distance and blended learning; it was implemented in the shortest possible time. After the emergence of an acute armed conflict on the territory of Ukraine, the need for further digitization only intensified, today it concerns not only the educational process, but also the possibility of preserving traditional values and cultural heritage, expanding research opportunities and international cooperation. The use of interactive and practical elements of education (discussions, seminars, laboratory classes and workshops) remains very important, you should not completely abandon live communication.
Keywords: institution of higher education, effectiveness of the educational process, digitalization

Abstrakt. Obecnie cyfryzacja szkolnictwa wyższego stała się istotną koniecznością w celu zapewnienia wysokiej jakości edukacji studentów. Dzięki cyfryzacji możliwe jest znaczne poszerzenie kompetencji uczniów i nauczycieli. Na proces ten wpływają pewne okoliczności, z których najważniejszymi są możliwości techniczne i technologiczne, oraz zespół problemów pojawiających się w przypadku niedoskonałej lub wręcz nieistniejącej strategii cyfryzacji organizacji. Prawdziwa strategia polega na opracowaniu jasnego

planu działania, jest podzielona na etapy, jej cel jest osiągalny, a cele pośrednie są proste i jasne; należy w miarę możliwości przewidzieć problemy i z wyprzedzeniem obliczyć sposoby ich niwelowania. W artykule rozważono trzy wariantywne kierunki cyfryzacji szkolnictwa wyższego, nazwane roboczo: „intensywna adaptacja technologiczna", „zrównoważona cyfryzacja" i „innowacyjna transformacja cyfrowa". Każdy z tych kierunków wymaga określonych aspektów realizacji. Obiektami oddziaływania cyfryzacji w uczelni są: procedury dydaktyczne i administracyjne; badania naukowe; współpraca międzynarodowa i życie studenckie. Innowacje w technologiach edukacyjnych prowadzą do pojawienia się nowych interaktywnych platform i narzędzi do nauki. Wirtualna i rozszerzona rzeczywistość, interaktywne kursy online, materiały multimedialne i symulacje sprawiają, że proces edukacyjny jest bardziej interesujący i wciągający. Narodowy Uniwersytet im. Iwana Franki we Lwowie opracował długoterminową strategię cyfryzacji, jednakże po zaistnieniu sytuacji siły wyższej (pandemia COVID-19) pojawiła się potrzeba przyspieszenia wprowadzenia cyfryzacji, platform nauczania online, nauczania na odległość oraz mieszanych form uczenia i zostało to wdrożone w możliwie najkrótszym czasie. Po wybuchu ostrego konfliktu zbrojnego na terytorium Ukrainy potrzeba dalszej cyfryzacji tylko się nasiliła. Obecnie dotyczy to nie tylko procesu edukacyjnego, lecz także możliwości zachowania tradycyjnych wartości i dziedzictwa kulturowego, poszerzenia możliwości badawczych i międzynarodowej współpracy. Bardzo ważne pozostaje wykorzystanie interaktywnych i praktycznych elementów edukacji (dyskusje, seminaria, zajęcia laboratoryjne i warsztaty) i nie należy całkowicie rezygnować z komunikacji na żywo.
Słowa kluczowe: uczelnia wyższa, efektywność procesu edukacyjnego, cyfryzacja

Introduction

Digitization plays a significant role in the organization of the higher education process, because it provides new opportunities and solutions for improving the quality of education, accessibility, efficiency and innovation. Digital platforms allow students, regardless of their geographic location, to receive quality education without leaving home. This is especially relevant for those who, due to physical, financial or other limitations, cannot participate in a traditionally organized educational process. It is possible to organize online courses or mass open online education for them, which are available for free or for a nominal fee. This contributes to the spread of knowledge and education at the global level. However, the digitalization of education can face a number of problems and challenges. Some of them are common to the educational process in almost all countries, others are specific to individual states or regions for objective and subjective reasons.

A survey of teachers (mobile messengers, viber groups, oral surveys of listeners, students, questions in chat rooms during real-time conferences, etc.) to clarify the urgent needs for the development of professional competence in the conditions of digitalization (Ryabova, 2020), showed that the first priority is the demand for:

- development of conceptual foundations of the digital content of education;
- determination of the contents of training, essential characteristics of integral competence, as well as general and special skills of teachers (what exactly needs to be taught);
- search for methods of optimal interaction of participants in the educational process with innovative digital technologies (choice of platforms and means of electronic communication, etc.) and mechanisms for their provision;

- determination of effective technologies for managing the processes of forming and providing digital educational services and ensuring their quality;
- substantiation of the mechanism of using the Internet as a communication platform to increase learning motivation and interactive interaction of participants in the educational process, which ensures the effectiveness and productivity of mastering the content of education (this demand is one of the priorities).

Literature verification

Arnesh Telukdarie and Megashnee Munsamy i point out that the fourth industrial revolution, the digitization of industry, is driving business landscape and associated skills development, including tertiary education. Universities and institutions of higher learning have evolved into technological hubs, developing and delivering skills for the future (Telukdarie, Munsamy, 2019, p. 716). Competency-based education, or as it is also called performance-based education, serves as a foundation for newcomers because it provides specific behavioral criteria (Korthagen, 2004, p. 78). Untung Rahardja views blockchain education as a challenge to the academic digitization of higher education and points out that the main advancement of blockchain technology is the unbreakable digital transaction ledger, which can record almost any type of value exchange. They open up new possibilities when paired with other cutting-edge technologies like the internet of things and big data (Rahardja, 2022, p. 62). E-learning is an evolutionary concept, not a revolutionary concept since it has been introduced and practiced in previous decades as well (Rosak-Szyrocka, Żywiołek, Zaborski et al., 2022). Laura Márquez-Ramos notes that three different types of activities are carried out in higher education institutions, which together form the components of the trilemma of higher education. These include traditional academic activities (research and teaching) and those aimed at transferring knowledge beyond academia (industry-oriented activities). Wider use of digital technologies as a result of replacing face-to-face meetings with digital interaction or digitization is leading to transformations in higher education; universities are faced with new challenges, but they also have new opportunities (Márquez-Ramos, 2021, p. 630). Eurydice noted the importance given to this field in the countries of the world, he described the control of national ICT strategies regarding digital and media literacy, as well as electronic skills in educational institutions (Eurydice, 2012, p. 9). Guy Le Boterf proposes to consider digitalization from the point of view of three concepts of competence: the combinatorial model of competence; professional navigation; collective competence (Boterf, 2000). The OECD defines digital competence is more than just knowledge and skills. It involves the ability to meet complex demands, by drawing on and mobilizing psychosocial resources (including skills and attitudes) in a particular context

(OECD, 2005, p. 4). In general, the views of most researchers can be divided into two groups: the first believes that "digital competence" is fundamentally different from "digital literacy", the second – that these are identical concepts (Adeyemon, 2009; Delfino, 2011; Baird, Henninger, 2011; Krumsvik, 2008; Jones-Kavalier, Flannigan, 2008; O'Brien, Scharber, 2008). To avoid confusion, the article will use the approach of the second group, which the authors consider more appropriate.

Research methodology

The study of digitization implemented by higher education institutions was conducted taking into account which technologies are integrated into various aspects of education. The following methods were used:

- The method of comparative analysis was used to identify problems that are similar in different higher education institutions. This provided an opportunity to gain insight into best practices, to consider both positive and negative results;
- Quantitative data analysis was used to determine the impact of digitization on such indicators as student engagement, learning outcomes, and teachers' satisfaction with the course of the educational process;
- Retrospective or longitudinal studies covering a rather long (in the context of such a "young" field as digitalization of higher education) period of time to track the evolution of digitalization. These studies have made it possible to identify trends, changes in attitudes and the impact of individual initiatives;
- Conducting a comprehensive review of publications in this field, scientific works and case studies. This work helped to contextualize the findings and identify gaps in the research.

A combination of several methods helped to form a comprehensive understanding of how higher education institutions respond to the challenges and opportunities provided by digitalization.

Digitization of higher education

The essence of digitization of higher education

Digitization of higher education institutions in many countries, including Ukraine, plays an important role in the modern educational process. Digital competence of teachers and students is necessary for successful digitization. Students usually learn various technical innovations very quickly. As for teachers, as Alberto A.P. Cattaneo (Cattaneo, Antonietti, Rauseo, 2022) rightly notes, they respond differently to the

need for digitalization development, everything depends on personal characteristics (age, gender, attitude to the use of information technologies, etc.) and contextual factors (availability of infrastructure, support from the institution's management higher education).

The combinatorial model of general competence (Boterf's first concept), which can be successfully applied to the digitalization of higher education institutions, determines that professional competence is the result of the mobilization of a set of resources (knowledge, know-how, experience, emotional and physiological resources, relational and informational networks, etc.) through an action implemented in a work situation. Therefore, digital competence should be defined more as knowing how to act in different situations than knowing exactly how to do it. Boterf's second concept – professional navigation – means that digitalization provides the conditions under which everyone can become the pilot of their career path. As for collective competence (Botherf's third concept), it is the result of interaction between individual competences (Boterf, 2000).

It is widely believed (Ilomäki, Paavola, Lakkala, Kantosalo, 2016) that the following components must be present for effective digitization of higher education:

- technical skills to use digital technologies;
- productive use of digital technologies in the educational process;
- attitude towards the introduction of digital technologies as a natural phenomenon;
- the presence of motivation in all actors of the digitalization of education process.

Factors influencing digitization in higher education

At the current stage, the digitalization of the educational process is most affected by the limitation of technical and technological capabilities, as well as problems related to the implementation of the main strategic educational aspects.

Learning with new technologies differs from traditional experiential learning, which does not involve the use of technology: process and progress, personal growth and skills, relationships and team experience, and results and effectiveness (Mayer, Schwemmle, 2023).

Technological capabilities should be understood as the presence or absence (poor development) of technical infrastructure and access to modern technologies. This category of problems includes the availability of high-speed Internet, computer equipment, smartphones and tablets, as well as the necessary software for the organization of training and administrative needs. Increasing access to innovative technologies allows the higher education institution to introduce distance and mixed learning through online platforms, create virtual libraries, virtual laboratories and other tools for improving the educational process.

The digital transformation strategy of an enterprise or institution is usually aimed at (Matt, Hess, Benlian, 2015; Shaughnessy, 2018):

- increased earnings;
- increasing productivity (efficiency);
- introducing innovations to create new values;
- building a positive image of the brand and new products.

For a higher educational institution, all these areas are also extremely relevant. Successful digitization of a higher education institution requires the development of a realistic strategy focused on the integration of digital technologies into the educational process and administrative procedures. First of all, it is necessary to formulate the goal of digitalization and develop a plan of measures, set intermediate goals, and define for each of the stages the tasks to be completed. After that, you can already choose the tools that will be used to ensure this activity.

The strategy must take into account the need for additional education, training and retraining of students, teachers and administrative staff. To organize this process, it will be necessary to carry out extensive preparatory work to determine the existing level of knowledge and skills of users in the field of computer technologies. This will avoid the organization of unnecessary training events and, accordingly, ensure the optimal use of such a valuable resource as time.

Employees are an asset of any organization, including institutions of higher education, accordingly, the success or failure of the organization largely depends on the efficiency and productivity of employees. Training significantly increases labor productivity (Sultana, 2013, p. 579). Research conducted on teacher productivity shows that training and retraining significantly increase teacher productivity and therefore need to be trained/retrained on a regular basis (Thecla, 2016, p. 36; Sohail, Nabaz, 2019).

Higher education institutions (HEIs) are progressively computerized to deal with substantial academic and operational information. With the increase in enriched information systems (IS) comes the potential hazard of malicious exposure to internal and external threats. This academic sector is advancing in the implementation of technical security controls; however, behavioral influence is still a challenge in the information security domain. Information security policies (ISPs) are generally designed and developed to control employees' working behavior, yet compliance with these documents is near to non-existent (Hina, Selvam, Lowry, 2019). Therefore, it is important to consider aspects of data security and privacy, as the introduction of digital technologies significantly increases the risks in this area.

These two factors (technological and technical capabilities and strategizing) are closely related. The availability of technologies facilitates the integration of digital learning methods and administrative decision-making, which in turn has a positive effect on the quality of education and the efficiency of higher education institutions.

Taking into account the specifics of the educational environment in most countries of the world, including Ukraine, the successful digitization of higher education institutions requires close coordination of strategic plans with technical aspects.

Predictive scenarios of digitization of higher education

Based on the identified key factors, it is possible to predict three alternative scenarios for the successful digitization of higher education in Ukraine for the coming decade.

Scenario 1: Intensive technological adaptation

In this scenario, the country actively invests in the creation of modern technical infrastructure and provides access to technology for educational institutions. Within 10 years, universities are fully transitioning to digital learning platforms, that is, almost all educational materials become available online. Teachers and students actively use virtual laboratories, video conferences for classes and remote testing. Students are able to choose their own learning pace using personalized educational platforms. Universities are focusing on developing courses for digital literacy and information security.

Scenario 2: Balanced digitalization

In this scenario, the country seeks to find a balance between technological integration and the preservation of traditional teaching methods. Universities implement digital technologies where it is most effective, for example, in the field of distance learning or automation of administrative processes. At the same time, traditional forms of education and personal interaction of students with teachers are preserved. The training of teachers in the use of digital tools in the educational process is being strengthened. The strategic emphasis is on making education more accessible and relevant, taking into account the needs of the labor market.

Scenario 3: Innovative digital transformation

In this scenario, the country goes beyond the simple introduction digitization of educational processes, and begins to apply advanced technologies such as artificial intelligence and virtual reality to create new methods of learning and research. Universities are implementing virtual classrooms and educational works, educational materials are created with the help of AI (artificial intelligence) to adapt to the individual needs of students. Research is being conducted in the field of educational innovations and their impact on society.

Of course, in reality, most likely, a hybrid scenario will be introduced, which will include elements from different scenarios. It is important to take into account the needs, cultural characteristics and resources of each country when developing digitalization strategies.

Discussion

Objects of influence of intensive digitization in a higher education institution

In general, the intensive digitization of the university may have the following possible impacts:

1) Impact on educational processes. The introduction of digital technologies causes changes in learning formats and teaching methods. Online courses, webinars, e-textbooks and other electronic resources are becoming more accessible to students. The individualization of education is increasing.
2) Impact on administrative procedures. Digitization simplifies and optimizes almost all administrative tasks (student registration, class schedule, documentation management, payment of tuition fees, scholarships, employee wages, etc.).
3) Impact on scientific research. Digital tools and databases greatly simplify and speed up research activities. Access to online publications, databases, and modern data analysis tools helps improve the quality of research.
4) Impact on international cooperation. Digital technologies provide the higher education institution with active interaction with other universities, research institutes and organizations around the world. This promotes the exchange of knowledge and experience, and also provides many opportunities for the development and implementation of international projects.
5) Impact on student life. Implementation of digital solutions makes student life more comfortable and convenient. Electronic libraries, online class registration, virtual public spaces and other technologies increase students' opportunities for effective team building activities and provide more opportunities to expand knowledge and share experiences and information.
6) Impact on forms of education: according to students, most types of interactive learning activities improve interaction with peers, teachers and/or experts, especially during the joint construction of new information (Hite, Jones, Childers, 2024).

However, the final results of the implementation of digitization in a higher education institution depend on many factors:

- university strategies;
- support from the administration and teachers;
- readiness of students to use new technologies.

Digitization in a higher educational institution, Ukraine

One of the leading higher educational institutions of Ukraine – the Ivan Franko National University of Lviv (LNU) was selected for consideration.

The Ivan Franko National University of Lviv is a classic institution that is faithful to traditions and quickly adapts positive innovations in the field of education. Thanks to this, the University occupies a very high position in international and Ukrainian rankings.

Like all of Ukraine, LNU found itself in a situation of acute force majeure caused by the COVID-19 pandemic, which posed a danger to the health and lives of students and teachers. There was a need for the urgent introduction of distance and mixed learning. This was preceded by the mass closure of connections between countries (international airports, border checkpoints), the cancellation of large-scale events, forced self-isolation, the introduction of quarantine in various institutions, including kindergartens, schools, institutions of higher education and other institutions, i.e. everywhere, where it was possible to organize the work of employees at home.

The Regulation on distance learning was approved by the Ministry of Education and Science of Ukraine in 2013. Before the pandemic, this Regulation was implemented only in individual cases by decision of the academic council of the educational institution and was approved by a special order (MESU, 2013). In 2020, changes were made to the Regulation, as individual and mass training are different and require different approaches and different technical support.

In the shortest possible time, Ivan Franko Lviv National University organized training using the Teams online platform. It should be noted that before this platform became operational, the educational process was not interrupted, although it was associated with a number of problems of a different nature. Among them, a significant place was occupied by the problem of technical support, namely, the provision of all participants in the educational process with the necessary equipment, high-quality access to the Internet, etc. In addition, communication between the teacher and students was carried out online using Zoom, Skype and other platforms. Teams was launched thanks to the efforts of the Center for Network Technologies and IT Support of LNU (hereinafter – CIT).

The computer center was created as a problem research laboratory at Lviv University on June 26, 1959. In the spring of 1991, it was transformed into an information and computing center, and since 2015 – the CIT. Digitization of the educational process depends on specific strategic decisions made by the leadership of LNU, while taking into account the needs of all members of the university community as much as possible and applying an integrated approach to digital transformation.

As of 2023, the CIT is one of the best equipped and largest laboratories of the University. The equipment of the CIT includes more than 80 units of modern computer equipment such as IVM, connected in a local network with the possibility of expansion to 100 workplaces, computers for collective use. This equipment is the basis for the operation of 3 display classes with a total of 64 workplaces. All personal computers of the CIT and most faculties are connected to the corporate network using fiber-optic communication. Since January 1996, the communication

node with the worldwide information and search network INTERNET has been functioning. The university network currently has more than 500 email subscribers, 26 departments, divisions and laboratories work in dial-up mode directly in the INTERNET network (PPR protocol), 29 local computer networks (approx. 2000 workstations) provide for direct work in the network Internet according to the TSR/IR protocol (LNU, 2023). In the conditions of distance learning, the organization of the educational process takes place using the information system "Dekanat". With its help, students can see their current academic performance, check the class schedule, choose a "free choice" discipline, etc.

Today, part of the students went abroad, and another part – those who lived in the dormitory – returned home. High-quality distance education made it possible for students and teachers of LNU not to stop their studies even in conditions of force majeure (Russian aggression): reliable information and communication methods of conducting interactive online courses, virtual lectures, webinars, seminars and practical classes were introduced; on-line reception of exams and tests is carried out; interaction between teachers and students, as well as between students and student groups, improved significantly (Kaplenko, Kulish, Hraboevetska et al., 2023). Balanced digitization made it possible to integrate modern technologies into the educational process. Students got flexible access to learning materials and resources. In addition, digitalization provides students with access to information about all activities organized by various active groups and public organizations, not only LNU, but also other higher educational institutions and organizations.

It is very important to preserve the traditional values and cultural heritage of LNU. Digitization is also used in this process, thanks to which the history of the university is not only documented and preserved, a virtual tour of the university is available, and anyone who wants to can get acquainted with the history of its creation and development.

Digital systems of LNU allow more efficient management of administrative tasks, such as student registration, accounting of grades, class schedule and other processes, simplifying them and reducing the number of possible errors.

Conclusions

The process of digitalization of education is accompanied by various problems, some of which are common to most higher education institutions.

The implementation of information and communication technologies requires solving basic technical issues, such as the availability of a stable Internet, the existence of an appropriate information and communication infrastructure and software that is compatible with existing equipment and platforms.

Low quality or ineffective use of online content negatively affects the educational process. Therefore, the offered materials/information should be accessible, relevant, useful, high-quality, interactive and relevant.

For objective reasons, not all students and teachers have the same access to appropriate equipment and high-speed Internet. Because of this, there is inequality in terms of learning opportunities and access to educational resources. This is especially relevant for students studying abroad who do not have access to a traditional library and other stationary resources.

Accordingly, too wide adoption of new technologies can lead to critical dependence on them. After all, in case of technical failures or problems with access to online resources, the educational process is disrupted.

Assessment of students' knowledge is not always qualitative in the online environment, therefore adaptation of new assessment methods to new forms of education is necessary.

Online education significantly limits interpersonal communication between teacher and student and student and student. This can negatively affect the development of many cooperation and communication skills. Accordingly, digitalization requires a revision of pedagogical approaches and methods, a change in the culture of communication and evaluation.

The problem of cyber security is becoming more and more urgent. Maintaining the confidentiality of personal information of students and teachers in the online environment requires continuous improvement of special measures to protect against abuse.

Teachers and students may resist the introduction of new technologies, for example, out of a reluctance to deviate from traditional teaching methods or because of insufficient skills in using new methods and tools. This determines the necessity for training and retraining of employees of a higher educational institution and students. Innovations in the field of IT occur constantly, so such training should be constant, since the teacher cannot lag behind the students he teaches in the skills of using tools of the online environment. Accordingly, the organization of training is a long and resource-intensive process.

There are also specific problems of introducing digitization into the educational process, which are inherent in a higher educational institution only under certain conditions. For example, the organization of distance and mixed learning in higher education institutions under conditions of force majeure. Today, higher education institutions of Ukraine, including LNU, have encountered many problems, most of which have arisen due to the martial law and hostilities in Ukraine. There has been a general decline in the standard of living in the country and inflation, which, in turn, creates difficulties for the technical organization of the educational process for students and teachers, in particular, it concerns providing them with appropriate equipment of the required level. In addition, many difficulties arose related to the implementation of administrative procedures.

REFERENCES

[1] Adeyemon, E., 2009. Integrating digital literacies into outreach services for underserved youth populations, *Reference Librarian*, Vol. 50(1), pp. 85-98.

[2] Baird, C., Henninger, M., 2011. Serious play, serious problems: Issues with eBook applications, *Cosmopolitan Civil Societies: An Interdisciplinary Journal*, No. 3(2), pp. 1-17.

[3] Boterf Le, G., 2000. *Compétence et navigation professionnelle*, Paris: Editions d'Organisation.

[4] Cattaneo, A.A.P., Antonietti, C., Rauseo, M., 2022. How digitalised are vocational teachers? Assessing digital competence in vocational education and looking at its underlying factors, *Computers & Education*, Vol. 176.

[5] Center of network technologies and IT support. 2023. Website of Lviv National University. https://itcentres.lnu.edu.ua/cit/ (access: 11.09.2023).

[6] Delfino, M., 2011. Against BibliOblivion: How modernize scribes digitized an old book, *Computers & Education*, Vol. 57, pp. 2145-2155.

[7] Eurydice, 2012. *Key Data on Learning and Innovation through ICT at School in Europe 2011.* European Commission. Retrived May 29, 2012, http://eacea.ec.europa.eu/education/eurydice/documents/key_data_series/129EN.pdf (access: 20.09.2023).

[8] Hina, S., Selvam, D.D.D.P., Lowry, P.B., 2019. Institutional governance and protection motivation: Theoretical insights into shaping employees' security compliance behavior in higher education institutions in the developing world, *Computers & Security*, Vol. 87.

[9] Hite, R.L., Jones, M.G., Childers, G.M., 2024. Classifying and modeling secondary students' active learning in a virtual learning environment through generated questions, *Computers & Education*, Vol. 208.

[10] Ilomäki, L., Paavola, S., Lakkala, M., Kantosalo, A., 2016. Digital competence – an emergent boundary concept for policy and educational research, *Education and Information Technologies*, Vol. 21(3), pp. 655-679.

[11] Jones-Kavalier, B., Flannigan, S.L., 2008. Connecting the digital dots: Literacy of the 21st century, *Teacher Librarian*, Vol. 35(3), pp. 13-16.

[12] Kaplenko, H., Kulish, I., Hrabovetska, O., Stasyshyn, A., Dubyk, V., 2023. Functioning of a higher educational institution under force majeure circumstances: A case study of Ivan Franko National University of Lviv, *Problems and Perspectives in Management*, Vol. 21, No. 2.

[13] Korthagen, F., 2004. In search of the essence of a good teacher: Towards a more holistic approach in teacher education, *Teaching and Teacher Education*, No. 20, pp. 77-97.

[14] Krumsvik, R., 2008. Situated learning and teachers' digital competence, *Education & Information Technologies*, Vol. 13(4), pp. 279-290.

[15] Márquez-Ramos, L., 2021. Does digitalization in higher education help to bridge the gap between academia and industry? An application to COVID-19, *Industry and Higher Education*, Vol. 35(6), pp. 630-637.

[16] Matt, C., Hess, T., Benlian, A., 2015. Digital transformation strategies, *Business and Information Systems Engineering*, Vol. 57(5), pp. 339-343.

[17] Mayer, S., Schwemmle, M., 2023. Teaching university students through technology-mediated experiential learning: Educators' perspectives and roles, *Computers & Education*, Vol. 207.

[18] Ministry of Education and Science of Ukraine. Order *"On approval of the Regulation on distance learning"* dated April 25, 2013, No. 466, https://zakon.rada.gov.ua/laws/show/z0703-13#Text (in Ukrainian) (access: 7.09.2023).

[19] O'Brien, D., Scharber, C., 2008. Digital literacies go to school: Potholes and possibilities, *Journal of Adolescent & Adult Literacy*, Vol. 52(1), pp. 66-68.

[20] Rahardja, U., 2022. Blockchain Education: as a Challenge in the Academic Digitalization of Higher Education, *IAIC Transactions on Sustainable Digital Innovation (ITSDI)*, No. 4(1), pp. 62-69.

[21] Rosak-Szyrocka, J., Żywiołek, J., Zaborski, A., Chowdhury, S., Hu Y.-C., 2022. Digitalization of Higher Education Around the Globe During COVID-19, *IEEE Access*, Vol. 10, pp. 59782-59791.

[22] Ryabova, Z., 2020. *Profesiyne zrostannya pedahohiv v umovakh tsyfrovoyi osvity* [Professional growth of teachers in the conditions of digital education]. Informatsiyni tekhnolohiyi i zasoby navchannya [Information technologies and teaching aids], No. 6, pp. 369-385.

[23] Shaughnessy, H., 2018. Creating digital transformation: Strategies and steps, *Strategy and Leadership*, Vol. 46(2), pp. 19-25.

[24] Sultana, M., 2013. Impact of Training in Pharmaceutical Industry: An Assessment on Square Pharmaceuticals Limited, Bangladesh, *International Journal of Science and Research*, Vol. 2(2), pp. 576-587.

[25] Sohail, Kh., Nabaz, N.A., 2019. The impact of staff training and development on teachers' productivity, *Economics, Management and Sustainability*, Vol. 4 (1), pp. 37-45.

[26] Telukdarie, A., Munsamy M., 2019. *Digitization of Higher Education Institutions*, [in:] 2019 IEEE International Conference on Industrial Engineering and Engineering Management (IEEM), Macao, China, 2019, pp. 716-721.

[27] Thecla, A.Y.E., 2016. Teachers' perception of the impact of training and retraining on teachers' productivity in Enugu State, Nigeria, *Journal of Research in Business and Management*, Vol. 4(3), pp. 33-37.

[28] The Organisation for Economic Co-operation and Development, 2005. *The definition and selection of key competencies. Executive summary*. The DeSeCo Project, http://www.oecd.org/dataoecd/47/61/35070367.pdf (access: 5.09.2023)