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*Implementation of Information and Educational Environment  
of Higher Education Institution in Ukraine during the  
COVID-19 Pandemic*

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Wdrażanie środowiska informacyjno-edukacyjnego uczelni w Ukrainie podczas pandemii  
COVID-19

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ABSTRACT

The article considers the positive experience of responding to the threats of the COVID-19 pandemic by the higher education institutions of Ukraine, which for many years have implemented various opportunities of information and communication technologies by building an information and educational environment. Such an environment covers software and hardware, pedagogical and administrative blocks, which allow implementing high-quality professional training adapting to global challenges and requirements that are changing dynamically. Forced and sudden transition to distance learning has confirmed the feasibility of creating a safe and comfortable information and educational environment, integrated into the education system, providing access to all necessary information systems, databases and educational content, adapted to the needs and knowledge of each student, implementing developmental learning on the basis of interactivity. This is a complex scientific and pedagogical, educational and methodological, organizational and managerial, technical and technological task, which involves updating the technological base of the institution and a reasonable transition to innovative pedagogical technologies. Ensuring the quality and continuity of training of future professionals, in particular during the pandemic, these measures require additional investment in technical support and in-service training of research and teaching staff, as well as the establishment of effective administrative and managerial activities.

**Keywords:** remote teaching; information and educational environment; COVID-19 pandemic; online learning; higher education

## CHALLENGES IN THE EDUCATION SYSTEM DUE TO THE COVID-19 PANDEMIC

Since 2019, governments around the world have been taking steps to prevent the SARS-CoV-2 coronavirus, an acute respiratory syndrome that causes the severe COVID-19 disease. Given the unprecedented severity and uncertainty of the crisis caused by the coronavirus pandemic and its likely continuation over a long period of time, the education system has faced global challenges, most notably the massive announcement of regional quarantines and severe nationwide restrictions (lockdowns). One of the ultimate demands due to the need in increasing social distancing to reduce the spread of the virus was, in particular, the closure of full-time study in educational institutions. Under these circumstances, ministries of education and regional administrations have been forced to initiate a number of new strategies to assist educators in their work on the continuous implementation of academic tasks (Darling-Hammond, Hyler, 2020). In order to guarantee the right of children and youth to education, in Ukraine, as well as in other countries, the transition to remote learning in education institutions of all levels and profiles was promptly organized.

The problems that have arisen in the education system as a result of the so-called “corona crisis” have been strongly felt in countries with different levels of economic development (Adnan, Anwar, 2020; Melnyk, Pypenko, Maslov, 2020; Toquero, 2020). The primary task of the education departments was to “provide financial and technical support, to develop a legal framework” (Merfeldaite, Prakapas., Railienė, 2020) for the implementation of online education at all levels. Simultaneously, according to research, in some countries methodological materials and disseminated recommendations for teachers were promptly developed (Lepp, Aaviku, Leijen, Pedaste, Saks, 2021), while in others educators were left without proper normative and didactic support, forced to master the “new pedagogy of virtual learning” on their own (Pressley, 2021).

Unfortunately, a significant number of educational process participants, including higher and vocational education, have encountered problems related to the lack of effective ICT solutions for online learning, psychological and technological unpreparedness for remote interaction, lack of administrative coordination of teachers and students during the sudden implementation of institutional e-learning (Kakepoto, Talpur, Memon, Halepoto, Bux Jalbani, 2021; Nenko, Kybalna, Snisarenko, 2020). The policy of higher education institutions, which is not adapted to widespread ICT implementation, has led to difficulties in student training during the pandemic (Chaudhary, 2020), significant technical problems in remote learning, imperfect assessment of learning outcomes, primarily due to the lack of skills in using digital tools.

In our opinion, most of these and other difficulties have been avoided only by those educational institutions that have for many years widely implemented in

their activities various opportunities of information and communication technologies (ICT), including Internet services. Significant development in pedagogical interaction in e-learning and online learning made it possible to use this capacity quite successfully during the forced transition to remote work during quarantine. In particular, higher education institutions in Ukraine have successfully used previously created virtual learning environments (VLE, usually based on the Moodle platform), as well as remote conference tools that allow online meetings (Zoom, Microsoft Teams, Skype). However, it should be noted that even the most e-learning-ready institutions have shortcomings related to the reduction of direct communication between teachers and students, additional workload on teaching staff, drastic reduction in the number of educational, cultural and sports events, lack of full student life, etc. (Nenko, Orendarchuk, Rudenko, Lytvyn, 2021). Undoubtedly, this is detrimental to effective professional training and education. Significant obstacles caused by the pandemic identified key areas that require urgent actions in the educational sector. In particular, the appropriate implementation of educational work in this period requires the availability of additional electronic devices and a stable connection to the World Wide Web (Kirsch, Engel de Abreu, Neumann, Wealer, 2021). In addition, educators need to have ICT competencies, be ready to work online, set and test educational tasks, and organize effective communication with students (Bonal, González, 2020). The need for appropriate teacher training has been “critical” (Pressley, 2021). Besides, it is advisable to significantly modernize didactic and psychological models of education, improve teaching and education methods, technologies for designing and using digital educational content (Ahmed, Bhuiyan, Helal, Banik, 2020; Panev, 2021). According to a review of the scientific works, the attention of researchers is now focused on many organizational, technological, psychological and pedagogical problems faced by educational institutions. There is no doubt that even after overcoming the pandemic crisis, e-learning and virtual interaction will remain an integral part of the education system. Thus, the urgency of the problem we are considering is due to the priority challenges during the COVID-19 pandemic and the need for urgent solutions to optimize ICT resources and implement effective, multifaceted e-learning in higher education.

#### PEDAGOGICAL PROBLEM OF CREATING INFORMATION AND EDUCATIONAL ENVIRONMENT. ITS FEATURES, TASKS AND DIFFICULTIES CONNECTED WITH DESIGN AND USAGE IN HIGHER EDUCATION

Analysis of pedagogical innovations in the context of today's requirements shows that the further development of education systems is closely linked to the development and application of computer-based technologies. Within this

methodology, leading scientists in the field of informatization of education emphasize that the digitalization of institutions, the introduction of electronic devices, the widespread use of ICT should be considered as factors that “upturn” the whole content and methods of teaching, simultaneously transforming medical, physiological, ethical and other features of educational work (Bykov, Lytvynova, Luhovyi, 2019; Hurevych, Gordiychuk, Konoshevsky, Konoshevsky, Shestopal, 2011, p. 47). The following didactic concept is the basis for the use of computer-oriented tools and digital resources in the higher education institutions: the educational process is based on the independent activities of students; their cognitive activity is active; vocational training is personality-oriented and ultimately individualized. It requires conditions that would contribute to the disclosure of the abilities of future professionals and provide personalized access to the necessary educational information (Hrebenuk et al., 2012). From these points, the means of achieving educational goals, as well as solving problems during the COVID-19 pandemic is the systematic integration of ICT in all areas and types of training, education and professional development of professionals. The aim is to successfully implement ICT not only in the hardware and software complex, but in the social and pedagogical environment of professional training (Hurevych et al., 2011, p. 7). That is, each institution of higher education faces a leading task – to design and apply in practice the information and educational environment (IEE). Its purpose is to provide didactically appropriate electronic educational resources, information services, information and communication systems and technologies, as well as to update the forms and methods of educational and professional programs, use of electronic management tools and administration of the institution, etc. Given the dynamic transformation of the education system, this requires a balanced, adequate public policy in the field of training of highly qualified specialists (Nychkalo, 2008, pp. 4–5).

A number of scientists are working on the concepts of the IEE: V. Bykov, Y. Zhuk, A. Hurzhii, R. Hurevych, V. Kremen, M. Koziar, V. Lapinskyi, O. Lytvynova, N. Morze, I. Robert, S. Semerikov, Y. Tryus, M. Shyshkina, as well as S. Britten, C. Weber, J. Karaliotas, J. Clayton, M. Mariano, L. Miranda, J. Moore, P. Newhouse, C. Tella, E. Henner, S. Schaefer, etc. Methodologically important are the features of the model representation and educational application of the concepts of “space” and “environment” revealed by scientists (Kremen, Bykov, 2013). Currently, the educational environment is considered as a pedagogical innovation, resource, tool for solving educational problems, technology of indirect influence, the field of formation and development of personality, active factor, organizational and pedagogical conditions of individual development and more. Numerous studies of the functions, structure, design and optimization of the educational environment of institutions of different levels are conducted. In particular, the USOS system – a comprehensive IT tool for managing university education was created and actively used in the Republic of Poland (USOS, 2021).

Our article aims to consider the constructive impact of the IEE of higher education institutions on the professional training process during the COVID-19 pandemic and offer recommendations for its content, implementation and further improvement in various aspects and activities of the institution, especially in terms of education. In our opinion, the IEE will accelerate the introduction of new technologies of teaching, education, intellectual, moral, psychological, aesthetic, physical, professional and creative development, increase the effectiveness and accessibility of educational programs and teaching materials, as well as improve the results of practical training. Regardless of the profile of training, the IEE is aimed at quality training of future professionals, taking into account their individual characteristics and needs, the requirements of the labor market and employers.

First of all, consider some challenges and problems connected with designing and using IEE tools in higher education, namely:

- lack of regulatory approaches to the design of the IEE for comprehensive improvement of the leading areas of the institution; undeveloped common methods and rules for working with ICT tools and resources,
- insignificant quantity, unsatisfactory quality and weak integration of software, hardware and resources; inconsistency of hardware and software means of higher education institutions with the tasks facing the specialists in the informational society,
- unsystematic use of ICT opportunities in the training of specialists in modern educational and professional programs; lack of electronic educational and methodological resources for professional training of various profiles,
- high cost of creating and maintaining the IEE, lack of ICT staff in higher education institutions to design, maintain and improve the IEE,
- unsatisfactory means of quality control of electronic educational resources and computer-oriented pedagogical technologies,
- unwillingness of some students to actively use the opportunities of the IEE in education and training,
- lack of direct work in higher education institutions to increase the ICT competence of research and teaching staff,
- underdeveloped forms, methods and means of automation in the management of the institution, the unwillingness of administration representatives to use digital methods of organizational work,
- lack of an effective mechanism for generalizing and disseminating best practices in the use of ICT in educational institutions, scientific and methodological institutions (Raikovska, Tykhonchuk, 2016, p. 93),
- unpreparedness of certain units and subdivisions of institutions for the rapid implementation of IEE resources and technologies,
- low efficiency of using high-tech software used in the IEE in higher education institutions,

- lack of a targeted comprehensive program of informatization and creation of information and educational environment in higher education (Hurevych et al., 2011, p. 117).

We believe that a significant part of the difficulties arise due to the fact that the formation of the IEE is still approached without taking into account all areas of ICT implementation in higher education institutions. Scholars consider the information and educational environment, mainly as a set of electronic hardware and software and organizational and methodological support designed to meet only the needs of students in information resources and services of an educational nature (Kademiia, Koziar, Tkachenko, Shevchenko, 2009, pp. 6–7). Instead, in our view, the information educational environment of higher education institutions should be built according to the structural scheme, which includes software and hardware (technological subsystem), pedagogical (education subsystem) and administrative (management and accounting subsystem) blocks.

#### THE STRUCTURE AND FUNCTIONS OF THE IEE OF HIGHER EDUCATION INSTITUTIONS

A number of functional and structural components are distinguished among the elements of the IEE (Figure 1), which are combined into different modules: planning and management; scientific and methodological support; educational process; information support; educational process and creative activity; research and development activities; specialized and professional support, etc. This construction is aimed at ensuring proper organizational and pedagogical conditions and improving the education system of higher education institution, namely: use of the latest pedagogical technologies; use of modern equipment and software packages; expanding the base of the electronic library and repository; filling and updating the virtual educational environment in all disciplines.

The architecture of the information and educational environment of the higher education institution allows the connection and use of the maximum set of necessary electronic resources and services, the optimal organization of educational and other activities of the institution. The IEE covers teachers, students, administration; integrates the activities of departments, administration offices and units in all components, areas and levels of the future professionals' training. Its scientific and methodological capacity is suitable for dynamic use, rapid readjustment, correlation and continuous improvement. The IEE provides a set of organizational and managerial, legal, educational and other relations of participants in the educational process through information interaction focused on the needs of students (implements student-centered higher education), and provides for the operational distribution of powers between all parties and subjects (Koval, 2019, p. 286).

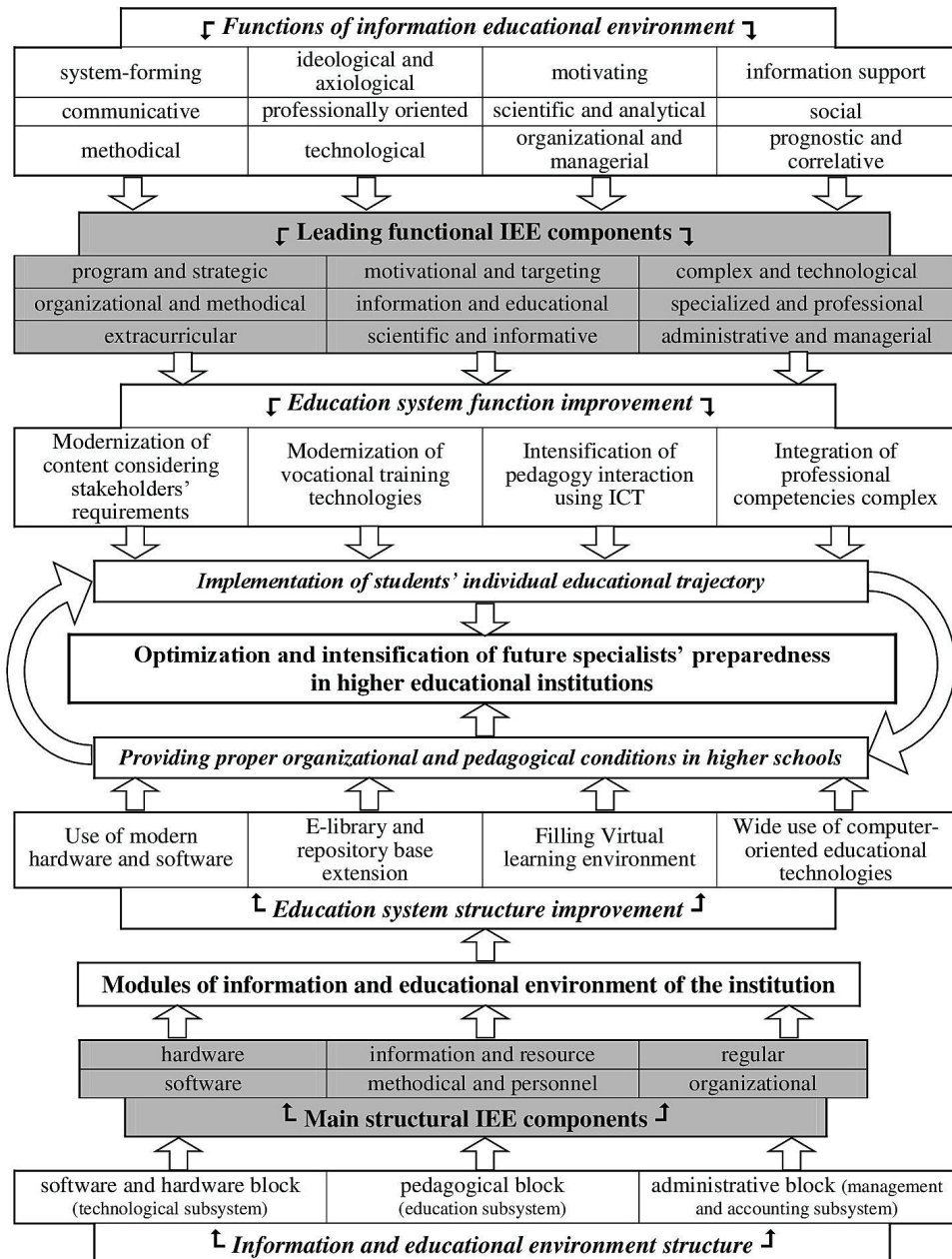


Figure 1. Structural and functional scheme of the IEE of a higher education institution  
 Source: (Koval, 2019, p. 283).

In detail, the implementation of the IEE, aimed at high-quality execution of government orders and requirements of stakeholders covers the following areas:

- development and expansion of the functionality of the central automated management system of the institution,
- informatization of pedagogical interaction through the use of multimedia resources, electronic simulators, prototyping, modeling, scanning and three-dimensional printing, testing and control systems,
- creation of a digital training course database in the virtual educational environment of the institution, maintenance of an online library of general scientific and specialized educational resources,
- electronic service for design and research activities, organization of professional competitions, and certification,
- creation and placement of web pages for teachers, administration, specialized councils, scientific publications, scientific schools, specialized services on the higher education institution website,
- electronic support of selective courses, individual educational programs, career guidance resources,
- electronic support and monitoring of educational documentation (journals, individual student cards and credit-examination information),
- automation of conducting and forming reports on educational, financial, economic and other activities,
- support for group use of social networks for the professional development of teachers and students, involvement in professional communities and information systems of the labor market,
- connection of all units of the institution to national and international educational networks (*Strategy and Concept...*, 2019).

#### PRACTICAL SUGGESTIONS AND RECOMMENDATIONS FOR THE IMPLEMENTATION OF THE IEE OF HIGHER EDUCATION INSTITUTIONS

For successful implementation of the IEE of the institution during the pandemic COVID-19 we recommend (Koval, 2019, pp. 348–349):

- development and implementation of the higher education institution development program, which considers the IEE as a system that integrates innovative pedagogical technologies and resources of the institution,
- designing the structure of the IEE of the higher education institution considering the leading methodological approaches, the necessary organizational and pedagogical conditions and global trends,
- optimization, development and improvement of IEE components on the basis of continuous, step-by-step student training,



- continuous strengthening and modernization of the material and technical base in order to effectively solve the problems of the institution,
- proper ICT competence of all staff; organized IT training for future specialists, advanced training of scientific and pedagogical staff,
- providing scientific and pedagogical research to improve the quality of vocational training by means of the IEE; scientific schools operating in the institution, expanding the search for promising areas of ICT use in order to advance implementation in the IEE,
- constant expansion of mutually beneficial cooperation with stakeholders to identify reserves for the development of the IEE and diversify sources of funding for comprehensive informatization of the institution (*Strategy and Concept...*, 2019).

One of the main tasks in the process of modernization of education is to keep a balance between the introduction of new technologies and providing the stable operation of all areas of the institution. Various stakeholders (governing bodies, inspections, administration, research and teaching staff responsible for the implementation of educational programs) should be involved in the development of the institution informatization concept. The plan for the integration of ICT through the formation of the IEE in the educational process and other activities should be comprehensive. Investments in equipment and software must be accompanied by investments in the management of the institution and be linked to all educational and professional programs and the comprehensive target program for the development of higher education institution. This means that the general concept of informatization of the institution must be considered comprehensively and continuously adjusted to ensure the achievement of the intended results of training.

The generalization of the Ukrainian experience in implementing the IEE of higher education institutions, in particular during the COVID-19 pandemic, suggests that training specialists in the IEE is one of the effective ways to improve the educational process, increase motivation, enhance cognitive activity and professional orientation of students' proficient development.

The maximum impact on the quality of training occurs if:

- the IEE is designed as an open system that integrates intellectual, cultural, program, methodological, organizational and technical resources,
- the cybernetic approach is applied to the design and creation of educational, scientific and organizational structures of the IEE,
- teachers effectively participate in the formation and filling of the IEE; students are given the opportunity to actively participate in the design of educational trajectories, resource selection, and feedback,
- IEE capacity is aimed to develop a set of competencies for future professionals, including soft skills through the implementation of contextual, problem-based and developmental learning,

- IEE tools ensure the availability of high-quality education and, at the same time, are aimed at ensuring the integrity of training participants (Rakhmanov et al., 2021).

The use of information and educational environment in higher education during pandemic threats has confirmed that education policy and response to COVID-19 are vital and long-term (Darling-Hammond, Hylar, 2020; Nenko et al., 2021; Wan, 2020). The obtained results testify to the effectiveness of scientific and methodological decisions aimed at technological, psychological and pedagogical, organizational and managerial support of the institution in this difficult time. The proposed recommendations are appropriate for all levels of the education system of different profiles.

## CONCLUSIONS

The pandemic and related crisis highlighted the shortcomings of the current education system, including the need to increase the use of the latest electronic tools and technologies in higher education, enabling full-fledged training to meet global challenges and rapidly changing needs. Emergency and unpredictable transition to remote learning has confirmed the feasibility of creating in higher education institutions a safe and comfortable informational and educational environment integrated into the educational system that provides access to all necessary informational systems, databases and educational content, adapts to the needs and level of preparedness of each student, promotes contextual, problem-based, developmental learning based on interactivity and cooperation in general, ensuring the competitiveness of graduates. At the same time, the creation of the IEE is a complex scientific, pedagogical, educational, methodological, organizational, managerial, technical and technological task, which involves updating the technological base of higher educational institution and reasonable use of innovative pedagogical technologies. This requires additional investment in technical support and training of research and teaching staff, the establishment of administrative and managerial activities and control over all aspects of pedagogical interaction.

According to scholars and practitioners, the scale of the educational changes caused by COVID-19 is not only unprecedented, but not yet fully predictable. On the one hand, the pandemic has opened opportunities for the implementation of digital innovations that have proven their resilience under forced constraints. They have ensured the continuing work of the institutions and are likely to facilitate the resumption of work after the end of quarantine measures. On the other hand, the challenges that have arisen show the need for further research on scientifically sound pedagogical strategies at the level of higher education and the educational system in general. Scientists, experts, governments, methodologists and educators need to work closely together to build a productive environment where

electronic resources, tools and technologies are suitable for high-quality, affordable and competitive higher education.

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#### ABSTRAKT

W artykule opisane zostały pozytywne doświadczenia ukraińskiego szkolnictwa wyższego wynikające z reagowania na pandemię COVID-19. Uczelnie wyższe już od wielu lat realizują różne możliwości technologii informacyjno-komunikacyjnych poprzez budowanie środowiska informacyjno-edukacyjnego. Środowisko to obejmuje bloki programowo-techniczne, pedagogiczne i administracyjne, które pozwalają realizować wysokiej jakości szkolenia zawodowe dostosowujące się do globalnych wyzwań i dynamicznie zmieniających się wymagań. Wymuszone i gwałtowne przejście na kształcenie w trybie zdalnym potwierdziło sens stworzenia bezpiecznego i komfortowego środowiska informacyjno-edukacyjnego, zintegrowanego z systemem edukacyjnym, zapewniającego dostęp do wszystkich niezbędnych systemów informacyjnych, baz danych i treści edukacyjnych, dostosowanego do potrzeb i poziomu przygotowania każdego studenta, realizującego uczenie się

rozwojowe w oparciu o interaktywność. Jest to złożone zadanie naukowo-pedagogiczne, edukacyjno-metodologiczne, organizacyjne, techniczne i technologiczne, które polega na aktualizacji bazy technologicznej instytucji i rozsądnym przejściu na innowacyjne technologie pedagogiczne. Środki te gwarantują jakość i ciągłość kształcenia przyszłych specjalistów, w szczególności podczas pandemii. Co istotne, wymagają one dodatkowej inwestycji w obszarze wsparcia technicznego, a także szkoleń kadry naukowo-dydaktycznej oraz ustanowienia skutecznej zarządczej administracji.

**Słowa kluczowe:** nauczanie zdalne; środowisko informacyjno-edukacyjne; pandemia COVID-19; kształcenie online; szkolnictwo wyższe