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Transformation of the Pedagogical Process in Higher Education during the Quarantine

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Abstract---The introduction of quarantine restrictions in the world has led to restrictions on many industries of both economic and social spheres of life. Education has not become an exception. The need to level the large number of students necessitated the search for alternative ways of organising educational and pedagogical processes. This is especially an issue for higher education institutions. Higher education institutions train specialists for many sectors of the economy and a significant break in the educational process due to quarantine restrictions could lead to a real collapse of the higher education system. This necessitates the search for ways to transform the pedagogical process in higher education institutions and the introduction of alternative mechanisms and methods of organising the educational process. The purpose of the study was to investigate the ways of transformation of the pedagogical process in higher education during the quarantine. A systematic algorithm for studying the transformation of the pedagogical process in conditions of quarantine and quarantine restrictions in higher education has been developed. The advantages and disadvantages of distance learning technologies of higher education have been identified. The main features of such

remote technologies as Moodle, Google Classroom, and Zoom are analysed.

Keywords---distance learning, information technologies, institution of higher education, internet technologies, pedagogical process, quarantine restrictions.

Introduction

Due to the spread of the COVID-19 pandemic in the higher education system, the existing (classical) higher education system, as well as pedagogical processes and educational tools, require transformation, because it has become impossible to conduct classes in classrooms. The only solution to this problem was the transition to remote forms of education. On March 11, 2020, the Cabinet of Ministers of Ukraine decided to impose quarantine for all types of educational institutions. In pursuance of the resolution of the Cabinet of Ministers of Ukraine No. 211 dated 11.03.2020, on March 12, 2020, all higher education institutions switched to distance learning. This decision was the impetus for all institutions of higher education to make decisions on the introduction of distance learning technologies in their work. Most higher education institutions (HEI) completed the pedagogical process of the 2019-2020 academic year in conditions of strict quarantine restrictions, not allowing students to classrooms, and sessions, defence of bachelor's and master's theses, took place with the use of remote technologies (Conole et al., 2004; Shulman, 2000).

By the Decree of the President of the Russian Federation No. 239 "On measures to ensure the sanitary and epidemiological well-being of the population in the territory of the Russian Federation in connection with the spread of a new coronavirus infection (COVID-19)" dated 02.04.2020, Russian schools were put in remote work mode. A "Teleschool" was established for students, classes were held live on Mosobr TV. To conduct lessons, teachers used video conferencing with the use of services such as Zoom, Skype, and others. During the online classes, teachers introduced students to new learning materials (Petrenko, 2015; Moore et al., 2011; Shulga et al., 2021). The Moscow e-school remains a popular resource for distance learning. With the help of this resource, teachers upload tasks and tests for students to the electronic diary, check them and give grades that parents can see in the electronic diary. On September 8, 2020, Vladimir Putin signed a law amending the Federal Law "On Education in the Russian Federation" (Federal Law..., 2020). The amendments allow the transition to distance learning in case of a state of emergency, high alert or extraordinary situation. According to the new law, in these situations, the implementation of educational programmes, as well as the state final certification "is carried out with the use of e-learning, distance learning technologies, regardless of restrictions provided in federal educational standards or in the list of professions, areas of training, specialties, implementation of educational programmes on which it is not allowed with the use of only distance educational technologies, if the implementation of these educational programmes and the state final certification without the use of these technologies or the postponement of terms of study is impossible".

The new school year started on September 1, 2020 and according to the quarantine zoning, each higher education institution had to decide how to organise the pedagogical process depending on the fact that the quarantine zoning of the regions of Ukraine is reviewed every two weeks. Carrying out the educational process in the classroom, conducting classes remotely or developing a mechanism of the pedagogical process that could take into account all the possible risks of organising a combined type of pedagogical process has become a priority for HEI. Most institutions of higher education have decided to take remote technologies as a basis for building a new (transformed) pedagogical process, because development of a clear mechanism of their application will contribute to the smooth implementation of training and educational processes (Markova et al., 2017; Khoshnevis, 2004).

Speaking of the main criteria used in the introduction of various educational technologies is its effectiveness and ability to assimilate educational information by graduates. Studies in the United States have indicated that the effectiveness of distance learning in the educational and pedagogical process shows that distance learning exceeds the effectiveness of the existing system (57% of respondents in the education system), and 33% believe that in the near future classrooms will be completely replaced by remote ones (Mirkholikovna, 2020).

It is worth considering how foreign specialists and practitioners of pedagogical activity approach the organisation of the pedagogical process in terms of its transformation into technologies of distance educational process. There are almost no scientific articles covering the organisation of the educational process in the conditions of quarantine in the world space, therefore it is important to investigate the processes of organisation of the distance form of education and its application in the free economic zone in the conditions of quarantine restrictions. Literature review

In article (Provodnikova, 2019), the authors present the main criteria of distance learning, as well as the main differences between the conventional extramural form of study and distance learning. The authors also identified the benefits of distance learning for higher education. The study (Babin, 2017) covers the advantages of distance education in the classroom. Furthermore, the study investigates the issues that can be encountered by teachers and the HEI administration in the organisation of the educational process, which include the issues of insufficient competence and literacy of teachers in the application of information technology.

Scientific article (Vitenko et al., 2017; Hysa et al., 2021) is aimed at considering the issue of distance learning in the field of internationalisation of higher education institutions and their integration into the world educational space, where high hopes are currently laid on distance education as a progressive way of teaching citizens. Sakulina (2018) analyses the methods of distance learning. She notes that the effective combination of information technology in the distance learning system will contribute to the achievement of high pedagogical results, because elements of individual approach will be used, as well as the selection of educational material and teaching aids. Similar approaches are described in the

studies of Khanna (2017), Kademija (2016), Kabak (2016), Datsenko & Suzanska (2017), Ignatiev et al. (2017), Thistoll & Yates (2016).

Jianbo Wen & Wei Zhang have given a deeper insight into the cognitive nature of the learning process, the study of uncertainties, risks and problems of distance learning (Wen et al., 2019). The authors propose a model that allows to consider one of the most important parameters of the educational process, namely the motivation seekers of higher education, and also allows to consider the system of distance learning as a system of multi-purpose optimisation of educational and pedagogical process. In his scientific work, Shahmoradi (2018) notes that the development of specific skills and technical features is the way to the successful introduction of remote technologies in the pedagogical process of higher education. The solution to this problem is proposed by creating an IT infrastructure, documents (standards) and applying the experience of the world community.

The study (Boronenko et al., 2019) aims to consider the modelling of the interrelations between the various institutions of higher education and their structural units in the organisation of distance learning. Building an appropriate model will facilitate the cooperation of higher education institutions at the national, regional, and local levels, as well as enrich the potential of educational organisations, including resources, which in turn will improve the quality of higher education. Nosovec' (2017) analyses the functions and role of the teacher in the system of distance learning. The author highlights the basic competences and practical skills that a teacher must have to successfully conduct classes remotely. It is noted that the professional and pedagogical, technical and psychological readiness of the teacher are the main criteria for the success of distance learning. The main functions of a teacher in the system of distance education are: teaching, psychological and pedagogical; methodical, research, and organisational and managerial.

One of the most popular distance learning mechanisms is the Moodle platform. The author's team (Dmytrenko et al., 2013) considered the main features of this resource, functionality, technical capabilities, and features of content. It was established that Moodle allows to organise all types of classes that are held without the mandatory involvement of materials and equipment of classrooms. Thus, summing up, higher education institutions require transformation of the pedagogical process under quarantine restrictions. This is an important and relevant issue, because the pedagogical and educational processes are ongoing. Both traditional and distance systems of higher education have their features and unconditional advantages. For traditional education, the most important feature is live communication between teacher and student, for distance education - a free schedule, maximum access to educational materials, less stress due to a comfortable environment during training, chosen by the students. However, during the quarantine period, all these benefits change and need to be adapted (Buhalis, 1998; Hussein et al., 2016). Accordingly, the purpose of the study was to investigate ways to transform the pedagogical process in higher education during quarantine and the development of recommendations for the implementation of the educational process in appropriate conditions.

Materials and methods

The study was based on theoretical research methods, namely the analysis of literary sources where the principles of organisation of various forms of educational and pedagogical process are considered. The main ideas and theories of system, technological, and activity approaches became the methodological basis of the study, which contributed to the development of the system algorithm (Figure 1), the study of the transformation of the pedagogical process in quarantine, and quarantine restrictions in education.

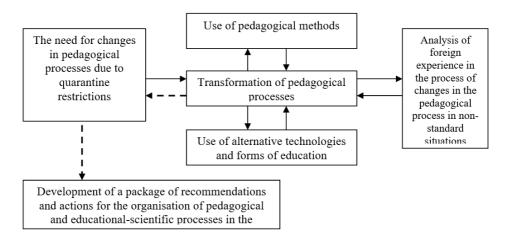


Figure 1. System algorithm of research of transformation of pedagogical process in the conditions of quarantine and quarantine restrictions in higher education

Literary and information sources on the ways of organising the pedagogical process, the use of various software packages for conducting classes in distance form, as well as on the forms of possible control of the educational process in distance form were used as research materials. Notably, the transformation of the pedagogical process in the HEI in quarantine should take place in full interaction between learning technologies and existing teaching methods. Figure 2 and Table 1 demonstrate the classification and characteristics of teaching methods, respectively (Korotun, 2016; Tri et al., 2021).

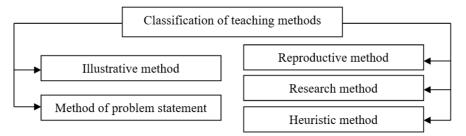


Figure 2. Classification of teaching methods

Table 1 Characteristics of teaching methods

No.	Method name	Method description
1	Illustrative method	Studying allows students to acquire knowledge in lectures, from educational and methodical literature, through an on-screen textbook. By perceiving and comprehending the facts, students' conclusions remain within the framework of reproductive thinking
2	Research method	The method allows knowledge seekers to independently study the literature, sources, and perform actions of a search nature, by using the analysis of educational material, setting tasks and objectives, oral or written guidelines of the teacher
3	Heuristic method	The pedagogical process is aimed at solving the tasks either under the guidance of the teacher or by the students themselves based on working with electronic textbooks and educational literature
4	Method of problem statement	The method is based on a cognitive task, which is formulated before the lesson by the teacher of the relevant discipline, and at the lesson together with students searches for a way to solve the problem. The main advantage of the method is the maximum involvement of students in the learning process
5	Reproductive method	Students reproduce the acquired knowledge after viewing certain educational material in the form of texts, figures, diagrams, etc.

Considering the transformation of the pedagogical process in the conditions of quarantine restrictions for higher education institutions, first of all, remote technologies should be considered as the first alternative to the conventional (classroom) form. Table 2 demonstrates the most notable technologies of remote education (Berg, 2013).

Table 2 Features of learning technologies

No.	Technology name	Technology description
1	Internet technology	A method of remote transmission of information based on
		the use of global and local computer networks to ensure
		access of students to information educational resources
		and to form a set of methodological, organisational,
		technical, and software tools for implementing and
		managing the learning process regardless of its location
2	Telecommunication	The technology typically uses satellite data and broadcast
	technology	media, as well as global and local area networks, to enable
		students to interact with the teacher and with each other
		and to provide students with access to informational
		educational resources in the form of digital libraries, video
		lectures, and other learning tools
3	Case technology	The technology is based on the presentation of
		informational educational resources in the form of
		specialised sets of educational and methodological

Results and discussion

In accordance with the purpose set within the framework of this study, below is a transformed system-process model of the pedagogical process in the HEI during quarantine (Figure 3).

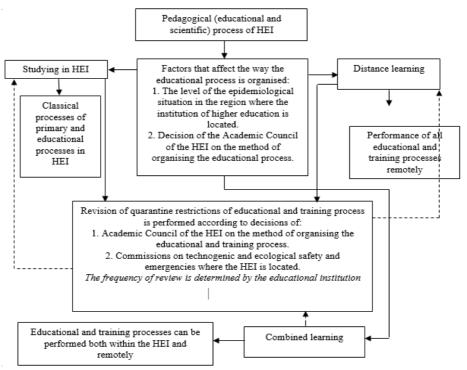


Figure 3. Transformed system-process model of pedagogical process in HEI during quarantine

As can be seen from Figure 3, the transformed systemic process model for a higher education institution makes provision for the organisation of the educational and pedagogical process in three formats. The first is a conventional format of the educational process. It is used if the quarantine restrictions allow classes to be held within the walls of the HEI. The conventional format of the pedagogical process does not require a detailed description. The second format is a combined format of the pedagogical process (Granell et al., 2016; Li et al., 2020). It is used when a higher education institution, in accordance with the orders and recommendations of central and local authorities, as well as on the conclusions of the commission on technogenic and environmental safety and emergencies, can make its own decisions on organising the pedagogical process both directly in higher education institutions and for its boundaries, i.e. to apply a remote format for the organisation of pedagogical and educational processes.

The combined format can have many organisational schemes, depending on the features of the specialties in which students study, the need to involve HEI

laboratory bases in the educational process, the number of students in academic groups, the specific features of organisation of the educational process at a particular year of study, the specific features of studying at different higher education levels (bachelor's, master's, or doctoral degree). Most importantly, one has to consider the possibility of maximum learning of educational material through the use of remote technologies, etc. The third format involves the organisation of pedagogical and educational process with the use of remote technologies. The decision to organise the pedagogical and educational process is made remotely by the HEI management based on the orders and recommendations of central and local authorities, as well as on the conclusions of the commission on technogenic and ecological safety and emergencies. The organisation of distance learning has many differences from the conventional form, and therefore requires more detailed analysis within the framework of the study (Rayuwati, 2020; Delgado et al., 2019).

Distance technologies in education make provision for a set of educational and pedagogical tools, specific educational platforms and software packages (e.g., Moodle, Zoom, Google Classroom, etc.), which allow students to acquire knowledge outside HEIs, and receive diplomas of the same value as well as with the conventional form of education. Remote technologies should allow full interaction in the system "HEI – teacher – student", i.e. allow the student to obtain a sufficient level of knowledge, skills, abilities, and competences for further professional activity in the chosen specialty, and the teacher, in turn, to provide knowledge, to control the level of its mastering, to carry out the corresponding modular tests and attestation sessions.

Theoretical features of the introduction of distance education were considered by scientists Gavrilova & Katasonova (2017), and the most noteworthy is the framework of concepts that they proposed and their systematisation of existing definitions. Scientific article (Bukhkalo et al., 2020) covers the theoretical and methodological aspects of the implementation of the distance learning system in Ukraine, and also forms the main strategic directions of the implementation of distance learning. Such areas include models for monitoring and controlling the quality of educational services provided to graduates upon distance learning. Researcher V. Donets and his team (Donets et al., 2018) provided recommendations for the implementation of an information system of electronic resources for distance learning "e-learning". The team of authors has created a full-fledged computer programme with a graphical interface that allows the user to quickly adapt to learn the material remotely. An important issue in the system of distance learning is the control of the level of knowledge (Kuzmina, 2017), as well as the implementation of independent work by higher education students (Havrylyshyn et al., 2019).

All remote technologies and their related information products are quite specific in use and have their specific features. Under quarantine conditions in higher education institutions, the use of such technologies is accelerated and it is important that teachers have answers to questions and a full understanding of what technologies are and how to use them to get the maximum effect, namely the high quality of educational services. Based on the above, the study proposes a system of distance learning in higher education for the period of quarantine and

quarantine restrictions (Figure 4). The algorithm shown in Figure 4 can be represented in the form of systemic interrelations between the main participants in the learning process, the main elements of the pedagogical process and information and software resources used to ensure it (Table 3).

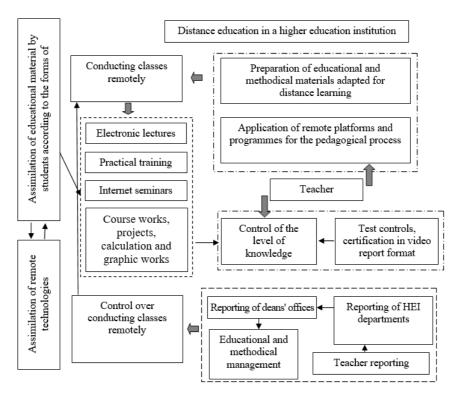


Figure 4. The system of organisation of distance learning in a higher education institution for the period of quarantine and quarantine restrictions

Proceeding from the transformed system-process model of the pedagogical process in the HEIs during quarantine (Figure 3) and the system of distance learning in HEIs (Figure 4), it is necessary to investigate what software tools can be used by teachers in conducting various elements of pedagogical and educational processes in HEIs (Table 3). Analysing the transformed system of organisation of the pedagogical process in the HEI during the quarantine period, namely the distance system, it is necessary to pay special attention to the control over whether classes are scheduled and how many students contact the teacher. For distance education in normal conditions, the matters of schedule and attendance are quite conditional, because usually students themselves determine the time when it is convenient for them to study the material. The transformed system of pedagogical process proposed in this study should, through the implementation and application of distance technologies, reflect the conventional system of education as much as possible. After all, under the conditions of revision of quarantine restrictions (Figure 1), HEIs can switch to a regular or combined system of education and, admittedly, such transitions should be smooth and avoid destruction of the educational and pedagogical process in HEIs. Such control should be carried out by a permanent body of organisation and control of the educational process, namely the educational and methodological management in close cooperation with the departments. Informing on attendance and the percentage of students enrolled in classes can be performed by reporting both electronically and in writing. The reporting chain is determined by HEIs.

It is also important that teachers strictly adhere to the technologies of creating electronic educational and methodological complexes. The scientific article (Starykh, 2018) presents the details of the steps of creating educational and methodical materials, different options for providing students with educational material (form), depending on the specific features of training, specialty, year of study, and other important features of the educational process. All the main components of the electronic educational and methodical complex are also presented.

Table 3

The use of information and software resources in performing tasks of various forms within the framework of distance learning in higher education

No.	Forms of distance learning	Information and software
		resources
		Email, Google Drive, Moodle,
1	Electronic lectures	Zoom, Webex, Hangouts Meet,
		Google Classroom
2	Practical training	Email, Google Drive, Moodle,
	Practical training	Microsoft Office
3	Internet seminars	Zoom, Webex, Hangouts Meet,
3		Google Classroom
4	I. 1 1	E-mail, Google Drive, Google
4	Independent work of students	Classroom, Moodle, INTERNET
5	Theses, projects, calculation and graphic	Email, Google Drive, Moodle,
	works	Microsoft Office
6	Test control as a form of intermediate,	Moodle
	modular, and final control	
	Other forms of final certification (exams,	M 11 7
7	tests, state exams, defence of qualifying	Moodle, Zoom, Webex, Hangouts
	papers)	Meet

For the process of communication with students during the remote form of organisation of the pedagogical process, systems of "live" online communication should be used, namely a variety of messengers. Among the most popular are Viber, Telegram, WhatsApp, Imo, etc. These applications can be installed on computers, tablets and, most importantly, phones. Apart from communication in the mode of "teacher-student" messages, they allow to organise group communication, video calls, and group video calls. This functionality helps to effectively organise the consultation process in the study of disciplines of educational plans.

Conducting classes in remote mode is very well suited for the organisation of lectures, and almost not suitable for laboratory classes (except for specific

specialties related to information and computer technology). Practical and seminar classes can also be conducted at a fairly high level. Some of the information and software resources listed in Table 3 are publicly available and understandable to most users today. This is primarily the INTERNET, which is used by students to search for information when performing individual tasks and independent work, as well as the software product Microsoft Office. Teachers as well as students will not have problems with embracing them for the educational process.

Before a more detailed consideration of the distance learning technologies (Moodle, Google Classroom, video system Zoom), which are quite specific for perception by both the teacher and the student, it is worth addressing the advantages and disadvantages of distance learning technologies for higher education. This list of advantages and disadvantages is presented in Tables 4-5.

Table 4
Advantages of distance learning technologies for higher education seekers

No.	Advantages of distance learning technologies		
1	Free studying schedule		
2	Free choice of place to study		
3	Optimal pace of processing and assimilation of educational material		
4	Ability to process and assimilate educational material in a comfortable		
	emotional state		
5	Possibility of processing and mastering educational material without		
	separation from the main place of work		
6	More convenient access to teachers of a particular discipline		
7	Ability to provide knowledge of higher quality		

Table 5
Disadvantages of distance learning technologies for higher education

No.	Disadvantages of distance learning technologies		
1	Low level of motivational component		
2	Low level of computer literacy		
3	Dependence of the educational process on information technology		
4	Lack of sufficient basis for the development of student		
	communication skills		
5	Lack of sufficient basis for the development of practical skills of the		
	student		

Information and software resources for distance learning, such as Zoom, Moodle, and Google Classroom, are quite extensive and multifunctional in terms of technical and functional features. And most importantly, before the introduction of quarantine in Ukraine and Russia, these products were known to a very small number of teachers in the educational environment, and even more so to students. Therefore, it is important to consider the main features of the above programmes and determine in general how to work with them. Zoom combines cloud video conferencing, simple Internet conferencing, group chat in conference rooms based on the platform. Next, the study considers the benefits of video

conferencing on the Zoom platform in the learning process of different pedagogical disciplines.

- Creation of video conferencing and online classes with the ability to exchange messages in chat, as well as saving classes for viewing to those students who were not present at classes.
- Breakout function, rooms or session halls, for pair or group work during the lesson. The essence of this function is that couples or groups are in a separate session room and do not have the opportunity to hear others. For the teacher this function gives the chance to distribute students by rooms, to visit a particular room, to close a room and to return students to the general room.
- Sending links to educational materials, tests, tests by variants (the function allows to send links to both groups and a particular student) in the chat.
- The screen sharing function allows to show presentations, videos and other materials from the teacher's screen to students' screens.
- The commenting function allows to publish fragments of text/diagrams/drawings to draw the attention of students to a task that the teacher sends to perform, for example, "Connect the drawing and the term that describes it".
- Transfer of control of the cursor of the teacher to the student and on the contrary, allows to see how the student understood a subject/material/task in the mode "here and now", and promptly correct their mistakes.
- Interactive board allows to display all the necessary information on the subject.
- Next, the study considers the distance learning platform Moodle (Modular Object-Oriented Dynamic Learning Environment) in more detail.

The Moodle distance learning resource is a modular object-oriented dynamic learning environment, also called a learning management system (LMS), a course management system (CMS), a virtual learning environment (VLE) or simply a learning platform that provides teachers, students and administrators with a very developed set of tools for computer-based learning, including distance learning. Moodle can be used in student education, advanced training, business education, both in computer classes of the institution, and for independent work at home.

In the study (Starykh, 2018) the team of authors presented the main functional features of filling the Moodle distance learning platform with learning material. The authors note that the use of Moodle is extremely relevant for the presentation of educational material in the system of information and Internet technologies for learning, and also contributes to achieving a high level of learning quality, due to a high level of understanding of educational material. The use of the platform in the educational process increases the interest in studying the discipline and positively impacts its efficiency. The Moodle platform can include:

- discipline study programme;
- lecture material;
- material for practical and seminar classes;
- materials for individual lessons and independent work;

- control questions to test knowledge;
- tests for the implementation of current control of the level of knowledge, modular controls, and certification of students;
- video and audio materials, presentations, many interactive materials and detailed 3D-models.

Google Classroom is a platform that helps teachers and students communicate and organise their learning. Google Classroom allows to create tasks, comment and monitor their performance, set grades. Students can complete assignments with the use of Google Drive, Documents, and Gmail. The offer supports Google Calendar, so it can remind of uncompleted tasks. Functionality for teachers includes the ability to assign tasks, monitor their implementation and collect works. Google Classroom has an interface with 38 language options. Therefore, in conditions of strict quarantine, the application can be an excellent solution for students and teachers in terms of organising the educational process in higher education. The Google Classroom cloud-based platform combines useful Google services organised specifically for learning. Its basis allows the following:

- to create an individual class (course);
- to organise student enrolment in the course;
- to provide students with access to the necessary educational material;
- to provide tasks to perform;
- to evaluate tasks;
- to organise communication between all participants.

Notably, the Google Classroom platform is very well suited for practical classes, individual lessons and independent work of students in the format of distance learning.

Conclusions

Thus, in accordance with the requirements of the higher education system during the quarantine period, the transformation of the pedagogical process is an extremely important process. Quarantine restrictions encourage higher education institutions to find optimal ways to implement the educational process. As a result, foreign experience in the introduction of technologies and processes of distance learning in higher education institutions was analysed. The system algorithm of research of transformation of pedagogical process in the conditions of quarantine and quarantine restrictions in higher education is constructed. A transformed system-process model of the pedagogical process for a higher education institution during the quarantine period is proposed. A system of organisation of distance learning in a higher education institution for the period of quarantine and quarantine restrictions has been developed. The main information and programme resources that will be effective in performing tasks of various forms within the framework of distance learning in higher education are identified. The advantages and disadvantages of distance educational technologies of the applicant of higher education are determined. The main features of such remote technologies such as Moodle, Google Classroom, and Zoom are analysed. Further development of the study is seen in the construction of detailed schemes

of organisation of the combined form of pedagogical process, as well as in the development of targeted programmes for retraining and improving the competence of teaching staff in higher education on the practical use of software and information resources for effective distance learning.

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