METHODOLOGICAL ASPECT OF USING DISTANCE LEARNING PLATFORMS IN THE EDUCATIONAL AND RESEARCH ACTIVITIES OF FUTURE HIGHER EDUCATION STUDENTS

ASPECTO METODOLÓGICO DO USO DE PLATAFORMAS DE ENSINO À DISTÂNCIA NAS ATIVIDADES DE EDUCAÇÃO E PESQUISA DE FUTUROS ESTUDANTES DO ENSINO SUPERIOR

Olha Tytarenko
Poltava National Pedagogical University named after V.G. Korolenko
Poltava, Ukraine
ookirosir@gmail.com

Yuliia Sribna
Poltava National Pedagogical University named after V.G. Korolenko
Poltava, Ukraine
usribna75@gmail.com

Tetiana Borysova
Kamianets-Podilskyi Ivan Ohiienko National University
Kamianets-Podilskyi, Ukraine
borisovakpkm@gmail.com

Valerii Tytarenko
Poltava National Pedagogical University named after V.G. Korolenko
Poltava, Ukraine
are1lav@ukr.net

Valentyna Tytarenko
Poltava National Pedagogical University named after V.G. Korolenko
Poltava, Ukraine
valentinatitarenko48@gmail.com

Yevhen Kulyk
Poltava National Pedagogical University named after V.G. Korolenko
Poltava, Ukraine
e-kyluk@ukr.net

Andryi Tsyna
Poltava National Pedagogical University named after V.G. Korolenko
Poltava, Ukraine
ajut1959@gmail.com

Resumo. O artigo identifica os pré-requisitos pedagógicos para o uso do sistema de ensino a distância (EAD) para alunos no ambiente educacional (as condições pedagógicas determinam os motivos da transição do sistema clássico para o ensino a distância; os pré-requisitos sociais são expressos no desenvolvimento da sociedade e ciência pedagógica, a necessidade de resolver os problemas do próprio sistema educacional no ambiente educacional). Os autores também identificaram as especificidades da aprendizagem do aluno no sistema de ensino a distância no ambiente moderno de conhecimento intensivo (o foco do processo educacional no desenvolvimento de habilidades de pesquisa, projeto e inovação). A pesquisa envolveu a elaboração e experimentação de um modelo pedagógico de educação a distância no ambiente educacional baseado em abordagens sistêmicas, sinérgicas, cibernéticas, orientadas para a personalidade e baseadas em competências. Este modelo inclui as seguintes componentes: finalidades e objetivos de utilização; meios para alcançá-los; resultados e resultados das atividades, conteúdo da atividade pedagógica, tecnologias e recursos disponíveis. Os autores fundamentaram as etapas de modelagem de um sistema de ensino a distância do aluno no ambiente educacional (etapa de concepção de um modelo pedagógico de EAD, etapa de funcionamento da EAD (etapa de informação e suporte técnico, etapa de preenchimento da plataforma de EAD com conteúdo educacional, a etapa de implementação e desenvolvimento progressivo), a etapa de avaliação dos resultados do EAD). O artigo define os critérios e indicadores para avaliar o nível de formação de competências dos alunos na modalidade de ensino a distância no ambiente educacional. Identifica e fundamenta as condições pedagógicas para implantação do sistema de ensino a distância no ambiente acadêmico. O artigo também revela as condições pedagógicas para a implementação do sistema de ensino a distância no ambiente educacional (foco do processo educacional na formação de habilidades de atividades de pesquisa, projeto e inovação; interação com parceiros externos e internos no processo de pesquisa , atividades de projeto e inovação; disponibilidade de um sistema de monitoramento dos resultados das atividades de projeto e inovação em todas as etapas de sua implementação) pode ser implementado no ensino de alunos de setores intensivos em ciências em outras universidades. O artigo identifica os pré-requisitos pedagógicos para o uso do sistema de ensino a distância (EAD) para alunos no ambiente educacional (as condições pedagógicas determinam os motivos da transição do sistema clássico para o ensino a distância; os pré-requisitos sociais são expressos no desenvolvimento da sociedade e ciência pedagógica, a necessidade de resolver os problemas do próprio sistema educacional no ambiente educacional). Os autores também identificaram as especificidades da aprendizagem do aluno no sistema de ensino a distância no ambiente moderno de conhecimento intensivo (o foco do processo educacional no desenvolvimento de habilidades de pesquisa, projeto e inovação). A pesquisa envolveu a elaboração e experimentação de um modelo pedagógico de educação a distância no ambiente educacional baseado em abordagens sistêmicas, sinérgicas, cibernéticas, orientadas para a personalidade e

baseadas em competências. Este modelo inclui as seguintes componentes: finalidades e objetivos de utilização; meios para alcançá-los; resultados e resultados das atividades, conteúdo da atividade pedagógica, tecnologias e recursos disponíveis. Os autores fundamentaram as etapas de modelagem de um sistema de ensino a distância do aluno no ambiente educacional (etapa de concepção de um modelo pedagógico de EAD, etapa de funcionamento da EAD (etapa de informação e suporte técnico, etapa de preenchimento da plataforma de EAD com conteúdo educacional, a etapa de implementação e desenvolvimento progressivo), a etapa de avaliação dos resultados do EAD). O artigo define os critérios e indicadores para avaliar o nível de formação de competências dos alunos na modalidade de ensino a distância no ambiente educacional. Identifica e fundamenta as condições pedagógicas para implantação do sistema de ensino a distância no ambiente acadêmico. O artigo também revela as condições pedagógicas para a implementação do sistema de ensino a distância no ambiente educacional (foco do processo educacional na formação de habilidades de atividades de pesquisa, projeto e inovação; interação com parceiros externos e internos no processo de pesquisa , atividades de projeto e inovação; disponibilidade de um sistema de monitoramento dos resultados das atividades de projeto e inovação em todas as etapas de sua implementação) pode ser implementado no ensino de alunos de setores intensivos em ciências em outras universidades .

Palavras-chave: Instituição de Ensino Superior; Ensino à Distância; Conteúdo Educacional; Avaliação da Eficácia da Aprendizagem

Abstract. The article identifies the pedagogical prerequisites for the use of distance learning (DL) system for students in the educational environment (pedagogical conditions determine the reasons for the transition from the classical to the distance education system; social prerequisites are expressed in the development of society and pedagogical science, the need to solve the problems of the education system itself in the educational environment). The authors also identified the specifics of student learning within the distance learning system in the modern knowledge-intensive environment (the focus of the educational process on the development of research, project, and innovation skills). The research involved the elaboration and experimental testing of a pedagogical model of distance learning in the educational environment based on systemic, synergistic, cybernetic, personality-oriented, and competence-based approaches. This model includes the following components: aims and goals of use; means of achieving them; results and outcomes of activities, content of pedagogical activity, technologies, and available resources. The authors have substantiated the stages of modeling a student's distance learning system in the educational environment (the stage of designing a pedagogical model of DL, the stage of DL functioning (the stage of information and technical support, the stage of filling the DL platform with educational content, the stage of implementation and progressive development), the stage of evaluating the DL results). The paper defines the criteria and indicators for assessing the level of student competencies formation within the distance learning system in the educational environment. It identifies and substantiates the pedagogical conditions for implementing the distance learning system in the academic environment. The article also reveals the pedagogical conditions for the implementation of the distance learning system in the educational environment (the focus of the educational process on the skills formation of research, project, and innovation activities; interaction with external and internal partners in the process of research, project and innovation activities; availability of a system for monitoring the results of project and innovation activities at all stages of its implementation) can be implemented in the teaching of students in science-intensive sectors in other universities.

Keywords: Higher Education Institution, Distance Learning, Educational Content, Assessment of Learning Effectiveness

INTRODUCTION

Being in an educational environment, the higher education institution (HEI) student experiences a strong need to acquire modern knowledge. The development of information technologies in all fields of science contributes to constant changes in both the content of educational knowledge and educational technologies. There arises a need to create a dynamic system that allows changing the content and teaching technologies in HEIs at any time (Dystantsiina Osvita [Distance Education]). Such a system can include distance learning based on using distance learning platforms.

Over the past few decades, distance learning has become a global educational and informational culture phenomenon. It significantly impacts the nature of education in academic environments in many countries worldwide. The development of various educational services to provide distance education technologies is taking place worldwide. It is characterized by the following:

- a huge number of students;
- involved educational institutions;
- infrastructure size and complexity;
- funding scales;
- integration of scientific services, etc.

As distance education technologies intensively infiltrate all levels of the modern education system, they are a leading tool for improving the education system in higher education institutions. They are used to

change its goals and content and to improve its quality and accessibility for different categories of people (Ismail, Mahmood, & Abdelmaboud, 2018).

The scientific and pedagogical literature analysis and the study of the practice of using distance learning technologies in higher education institutions have shown that the results of a student's education in the educational environment depend on various factors. The most significant impact on the learning outcomes is directly exerted by educational, scientific, innovative, project, and communication activities in unity and interconnection. However, this aspect is currently weakly and fragmentarily reflected in the implementation of distance educational technologies at universities.

Educational standards most often declare the necessity of training students for such activity types as:

- design and technology;
- organizational and managerial;
- innovative;
- production and technological;
- analytical and research activities.

At the same time, distance learning technologies incorporate the untapped potential for preparing students for the mentioned activities. This potential stimulates cognitive activity, develops independent learning ability, fosters team collaboration and communicative skills, and cultivates educational motivation in the modern informational environment.

A series of studies have been conducted that explore the methodological and technological aspects of distance learning. The studies by Hurzhii, Hlazunova & Voloshyna (2020), Rumble (1989), Shtefan & Borzenko (2015), Wedemeyer (1981), and many others are dedicated to this issue. Various aspects of using distance learning technologies in students' training have been investigated by Shylina H.A. (2016), Swanson & Holton (2005), and Wu, Tennyson & Hsia (2010). Scientific and methodological principles, as well as psychological and pedagogical aspects of diagnosing and assessing the effectiveness of using distance learning systems, have been examined in the papers by Slobodianiuk, Myslitska, Zabolotnyi & Kolesnykova (2020) and Venton & Pompano (2021).

The scientists like Lytvynova, Spirin & Anikina (2015), Milman (2020), Rice (2022), and Unger & Meiran (2020) provide definitions of distance learning and compare them with traditional learning. Based on these definitions, the following can be accepted as working: "Distance learning is education at a distance, through the use of information and communication technologies."

In the works by Banas & Emory (1998), Nozawa (2011), and Perraton (1988), the development of distance learning systems is analyzed based on both domestic and international experience.

The researchers distinguish three main stages:

1) The first period – the implementation of correspondence education based on distance learning technologies.
2) The second period – widespread use and identification of its capabilities.
3) The third (contemporary) period – the establishment of "open type" educational institutions and the use of network learning opportunities.

Several studies (Akdemir & Koszalka, 2008; Henritius, Löfström & Hannula, 2019; Ögeyik, 2022) explore the use of Web 2.0 technologies in teaching and the experiences of students in various fields using technologies like wikis, blogs, social repositories, and social offices. Specific researches focus on using social media by educators in their teaching and professional activities (Bozkurt et al., 2015; Daqian, Ting, Hao, 2020; Kristen, Diane, Catherine & Andrew. 2023).

At the same time, an analysis of the scientific and pedagogical literature, an analysis of the activities of higher education institutions, and speeches by participants in international and all-Russian conferences showed that the existing potential for using distance learning technologies in the educational environment is partially realized.

The research aims to theoretically and methodologically justify the pedagogical conditions for using distance learning platforms in higher education learners' educational and scientific research activities.

The study hypothesis includes the assumption that distance learning in the educational environment will be significantly improved if:

a) The theoretical approaches to the informatization of the student's distance learning system in the educational environment are defined;

b) The essence, goals, tasks, forms, and methods of the student's learning process in the modern educational environment using distance learning systems are clarified;
c) A pedagogical model of distance learning for students in the educational environment is developed;
d) The criteria for diagnosing the level of student competence in the distance learning system, which is oriented towards functioning in the educational environment, are determined.

MATERIAL AND METHODS

The growth of distance learning is a key tool for the digitalization and development of intellectual abilities of society, the formation of a harmonious personality and the reduction of social gaps in education. From a methodological point of view, this format of training helps to eliminate territorial restrictions, making higher education accessible regardless of the place of residence. Significant informational opportunities, which are opened thanks to the latest technologies in the field of distance education, stimulate innovative progress both in the field of education and for society in general. In our study, the methodological base is responsible for the humanitarian sphere of higher education, taking into account its organizational complexity and species dispersion.

An important feature of using DL is the set of applied pedagogical methods and techniques that form the methodological basis of this research.

1. The consciousness and learning activeness method implies the interrelation of pedagogical guidance with students' conscious, active, and creative activity. The consciousness is manifested in comprehending the aims and goals of learning, in full knowledge of the facts, deep understanding of the material, understanding of the essence of the material, and the ability to apply it consciously in practice. The essence of conscious learning is the mental activity of students.
2. The method of systematic and sequential approach. A person has scientific knowledge only when it clearly reflects the picture of the outside world and represents a system of interrelated concepts. The general means, and the main way of forming scientific knowledge is organized learning. The system of scientific knowledge is created in a sequence determined by the internal logic of the educational material and students' cognitive abilities.
3. The method of learning accessibility is the correspondence of the organization and implementation of the didactic process to the level of progress and proficiency of students, their personal abilities, and their age. A high level of progress is achieved at the limit of possibilities. Therefore, the learning process can be complex but manageable for students.
4. The method of advanced training involves:
    a. the revealing of the conditions for restructuring the learning content following the shift from linear forms of educational content presentation;
    b. the implementation of open forms and methods of teaching based on using disseminated educational information resources that provide the possibility of continuous self-improvement of students;
    c. the inclusion of modern achievements of science and technology and relevant promising areas in the content of the learning material.

5. The method of expediency involves providing independent practice-oriented actions for the implementation of information activities with a clear understanding of the specific goals and objectives of educational activities while independently choosing the method of information learning activities, as well as the variability of actions in the case of making an independent decision.

RESULTS

At the end of the XX century, the traditional form of education could not meet the increased demands for education among the population. It has led to the emergence of a new education technology called distance education. The concept of the systemic approach implies that any system arises and is organized according to its necessary bases. One of the foundations of distance learning is the social demand - the existing need among specific population segments to fulfill their educational aspirations through distance education platforms (Oleshko, Rovniahin, Hodz, 2021).

Socio-economic principles of using digital remote platforms in educational and scientific activities

The closure of educational institutions due to COVID-19 has caused great difficulties in the field of education around the world. According to information from several high-income countries in the region, the pandemic is causing a decline in the quality of education and deepening social gaps. To reduce and counteract the long-term consequences, Ukraine and other states had to develop measures to restore educational activities, guarantee funding in the field of education and prepare for similar challenges in the future, striving to improve the education system. COVID-19 has become a catalyst for academic and educational institutions to implement innovative learning methods in a short period of time, including online formats using a variety of platforms and tools.

At the beginning of the XXI century, technical tools changed. In particular, people began to use mobile information technologies widely. If in the late 1990s the term "mobile technology" was only starting to be used due to the beginning of the use of portable personal computers, today most digital devices have been minimized, became "smarter," and have become an everyday part of many people's lives (laptops, smartphones, etc.). These devices allow for working with both local programs and the Internet (Makedon, Mykhailenko, & Vazov, 2021).

According to Tang & Hew (2022), all of this is the basis for the emergence of a new term - "m-learning" (mobile learning). It defines the essence of mobile technologies concerning education:

- the formation of initial data of educational materials using mobile devices;
- data processing per educational goals;
- prompt connection to Internet resources;
- the implementation of academic and research tasks in the conditions of choice of space and time with quick data exchange.

This raises questions about the classification of technological means that underlie distance learning. Semih, Sibel, and Deniz (2017), when considering distance learning technologies, classify them into seven main types (Mala, 2022; Rachel, Henk, Sharon & Ale, 2023):

1) face-to-face - the use of traditional methods based on direct, in-person communication between the teacher and the student;
2) the use of audio, video learning materials, and educational television;
3) printed resources - the use of various types of printed materials;
4) CD – offline use of materials, especially interactive ones;
5) E-mail (electronic mail);
6) WWW – the use of online materials presented through the world wide web (the world wide web as one of the Internet resources);
7) LMS - the use of online learning management systems.

One of the directions of the next stage in the development of e-learning is standardization - normative and legal regulation in the field of education. It has been primarily manifested in the standardization of ICT (Information and Communication Technology), particularly with the emergence of SCORM (Sharable Content Object Reference Model) - a standard developed for e-learning systems.

SCORM sets requirements for organizing educational content and the entire e-learning platform. It enables the compatibility of components and their repeated use. The educational content is presented in separate small blocks that can be incorporated into various learning courses and utilized by the e-learning system regardless of who, where, and with what resources it was created. It is based on the XML standard (eXtensible Markup Language), a markup language recommended by the World Wide Web Consortium, which is actually a set of general syntax rules.

This, in turn, has stimulated the development of Learning Management Systems (LMS) in line with this standard, such as Moodle. Moodle (Modular Object-Oriented Dynamic Learning Environment) is a modular object-oriented dynamic learning environment. It is a free Learning Management System distributed under the GNU GPL (General Public License). The system organizes the interaction between the teacher and the student. However, it is also suitable for organizing traditional distance learning courses and supporting face-to-face learning (Muhaimin, Habibi, Riady, et al., 2023).

Rapid "Web 2.0" technology development has become a new factor in developing Distance Learning (DL) systems. This term refers to a set of technologies that enable users to collaborate in the online

environment. The learners are no longer passive recipients of educational services. They become active participants in the learning process. The research at this stage aims to develop methods for using various Web 2.0 technologies in the educational process, including distance learning. Significant changes have occurred in online resources, with the emergence of social networks, open encyclopedias, blogs, and web services (Makedon, 2019). These resources serve various functions: communication, education, and entertainment. Network technologies allow the use of textual, graphical, and multimedia resources, leading to the need for data storage in the online environment. A key feature of most published materials is the ability for users to leave a comment, which is one of the characteristics of "Web 2.0" resources (Aristin, & Purnomo, & Sayono, & Aliman, 2023).

Experts in educational strategy recognize distance education as a "21st century model". The importance of distance learning reflects the shift from technological development to an emphasis on the information age.

Distance learning modelling process

Today, distance learning is very important for students of higher medical and vocational educational institutions. Because of the pandemic. COVID-19. distance learning mode was introduced, replacing traditional forms of education. Undoubtedly, the pandemic became the impetus that contributed to the transition of medical education to the "online format".

The basic pedagogical condition for DL students in the educational environment is developing a model for this system. At the same time, DL is also considered a structured set of information resources, data transmission facilities, protocols of interaction between organizational and methodological, hardware and software, and an independent didactic system with the following components:

- Aims, goals, content, forms, methods, and means of education.
- Normative, legal, financial, economic, and marketing bases.

The process of modeling student's distance learning in the educational environment is a change of stages (characterized by internal integrity and relative independence), which includes:

1) The stage of designing the pedagogical model of distance learning consists of the following steps:
    a. identification of socio-pedagogical factors for student preparation in the educational environment using the distance learning platform;
    b. studying the peculiarities of student distance learning;
    c. developing a criteria system for assessing the effectiveness of the student's distance learning platform.
2) The stage of distance learning functioning consists of the following steps (each step involves refinement and correction of results):
    a. Information and technical support stage (providing distance learning technologies in the student's educational process; organizing a catalog of distance courses by institutes, forms, and directions of education; forming components of educational activities; ensuring a unified structure of educational-methodical complexes; facilitating communication between participants in the distance learning platform; connecting students with external partners and the global scientific community) (Makedon, & Krasnikova, & Krupskyi, & Stasiuk, 2022).
    b. Filling the distance learning platform with educational content (developing educational-methodical complexes within the distance learning system, according to the established structure; creating laboratory workshops; populating the electronic library based on bibliographic catalogs; integrating communication systems for students with business partners and the global scientific community; connecting systems for organizing project, innovative, and research activities, determining the roles of participants in the distance learning platform, and distributing students among institutes, faculties, courses, and groups).
    c. Implementation and progressive development stage (implementing distance educational technologies in the student's learning process; integrating modern communication systems for interaction among participants in the educational process; implementing strategies for organizing project, innovative, and research activities in the process of forming the student's necessary competencies) (Romanovskyi, 2019).
3) The stage of evaluating the results of distance learning includes:

a. assessing the functionality of the distance learning platform;
b. estimating the consequences of developing the student's necessary competencies in the educational environment within the distance learning system;
c. refining and correcting the results during the functioning stage of distance learning.

The pedagogical model of the distance learning system in the educational environment consists of several stages. The general pedagogical design of the distance learning platform was believed to be achievable through constant and mandatory interaction among participants in the educational process, utilizing interactive teaching methods (face-to-face practical or laboratory sessions). However, the widespread adoption of global networks and information and communication technologies has raised questions about preparing students at a distance. As a result, the authors have developed a pedagogical model for students' distance learning in the educational environment, specifically in higher education institutions (Chusova, Vakolia, and Cheipesh, 2021). The foundation of this model lies in the distance communication learning environment, which includes various subsystems, such as:

- Administrative, informational, and instructional.
- Control and self-control.
- Laboratory practices.
- Communications and project activities.
- Business.
- Electronic library, etc.

Education is faced with the challenge of organizing the educational process in such a way that it will help students develop an active attitude to academic and cognitive, educational, and professional activities based on the student's perspective of life and professional self-determination. This includes a challenge about what methods and techniques or learning technologies can have the most effective impact. Distance learning technologies can address these concerns (Cook-Sather, 2020). In the contemporary stage of development, the essence of distance learning lies in organizing the educational process in a way that practically all students are engaged in acquiring new knowledge and skills. The joint activity of students in the course of studying and mastering the educational material means that everyone makes their own exceptional personal contribution, and there is an exchange of knowledge, ideas, and means of activity.

In the context of this research, it is essential to evaluate the overall pedagogical effectiveness of the functioning of the distance learning platform for students. It is necessary to develop a mechanism for assessing the effectiveness of distance learning with the organization of the learning process in the educational environment, on the example of student learning. Distance learning is attracting more attention and has a growing impact on the entire educational process at all levels. Therefore, the need to evaluate its effectiveness becomes an inevitable issue.

In pedagogical research, a "criterion" is understood as an objective feature based on which there is a comparative assessment or classification of the pedagogical processes and factors under study (Kosenchuk & Novyk, 2020).

The generalized principles of the criteria selection in pedagogical research are as follows:
objectivity (to allow evaluation of the studied feature unambiguously, to prevent controversial assessments by different people)

- adequacy (to evaluate what the experimenter wants to assess);
- neutrality towards the studied phenomena;
- comparability (to allow comparison of the studied phenomena or processes);
- the content of essentially important indicators of the studied process or phenomenon;
- stability over a specific time frame.

In modern literature, the concept of "criterion" is defined as "a characteristic based on which evaluation, determination, and classification of something are conducted." In educational literature, a criterion emerges as the fundamental attribute through which one solution is chosen from numerous options.

In pedagogy, qualitative and quantitative criteria are distinguished. The task of obtaining specific qualitative or quantitative values of the investigated pedagogical process indicators is resolved through

measurement. The measurement provides results for analysis, identification, and substantiation of functional regularities. The process of measurement includes the following components:

- The measured quantity (the object of measurement);
- Criteria and indicators (method and units of measurement);
- Measuring instruments;
- Results (Yuan, 2022).

In the context of this study, one of the mechanisms that allow for assessing the quality of Distance Learning (DL) in the educational environment is the system of criteria and assessment of the student's level of preparation in DL, which consists of the following components of competence formation.

1. Motivational (the awareness of the student's need for professional activity; persistence in forming professional knowledge, skills, and qualities; interests and inclinations toward future professional activity; emotional expression of cognitive interest, feelings, and needs of students for intellectual activity; the presence of motivation to achieve high results in professional activity) (Kapustynska, 2022).
2. Cognitive (laws of thinking, memory, attention, and methods of cognition of the world; basic principles of the culture of mental work; regularities of functioning of modern information and communication technologies; basic concepts, categories, and tools of the professional discipline; possession of knowledge of the content of competence).
3. Activity-based (the ability to acquire knowledge independently; the ability to use acquired knowledge in practical activities; the ability to transfer their skills to other tasks; independent search for information on the given task, data collection, analysis necessary for solving professional tasks; possession of modern methods of data collection, processing, and analysis; presentation of the results of analytical and research work in the form of a speech, report, article at a scientific student conference; work with information in global networks (social services "web 2.0"); application of knowledge in various standard and non-standard situations).
4. Personal (creative self-development of the individual; awareness and purposefulness of actions, ability to control oneself, one's actions, and emotional state; the ability of the person to mobilize oneself, actively use one's capabilities to achieve set goals; emotional-volitional component formed in the process of education and self-education) (Stentiford & Koutsouris, 2021).
5. Ethical-reflexive (behavioral activity, sociability, initiative; a factor that contributes to the development of the professional orientation of the individual, mobilization for organizing one's behavior and activities following the content of professional duty; a component in the process of creative self-development of the individual necessary because self-esteem and reflection are components of the individual's understanding and analysis of one's own consciousness and activity) (Dietrich et al., 2020).

Students' performance indicators within the DL can be developed to a different extent, which allows us to distinguish different levels of competence formation: low, medium, and high.

1. The first (low) level includes the absence of skills in setting goals independently, planning activities, devising means of implementation and assessment, conducting reflection, and self-control. There is no inclination towards professional activities and weakly expressed scientific and educational motives. There is no desire to participate in innovative and project activities. Also, there is little scientific and practical knowledge, thinking, attention, and memory.
2. The second (medium) level includes the ability to set goals at a basic level, plan their activities, devise means of implementation, and construct a sequence of actions, and weak motivation for innovative, project, and research activities. There is no ability to organize communication with the global scientific community, poor understanding of ethical and behavioral rules and communication in the professional environment. It includes underdeveloped skills in presenting projects to business partners. The moderate level is characterized by integrity, consistency of the search process, possession of self-control, and reflection skills.
3. The third (high) level includes the ability to set goals and tasks, devise ways of implementation and control, select strategies for cognitive activities, and individual forms of knowledge acquisition. It includes a solid commitment to professional activities and a desire to achieve high results in

innovative, project, and research activities. There is a high level of thinking, memory, and attention; leadership position in project activities; balanced psychological state and a high level of reflection.

In the conditions of distance learning, we could better understand not only modern digital, online and pedagogical techniques but also rethink the key directions of education and its reformed embodiment in pedagogical and scientific tools. Students noted significant improvements in the use of online learning platforms compared to the times of the COVID-19 pandemic when the foundation of this technology was laid.

Model of diagnosis of the formation of student competencies in the conditions of distance learning

The diagnostics of the student's competencies were based on the achieved scientific and pedagogical experience in the research, development, and application of the competency approach in pedagogical practice:

- the structure of competencies and their existing models,
- the main essential features of competence, and general recommendations on quality control.

The diagnostics of the competence formation level is a difficult task when implementing a competency-based approach. As a result, the following formula for evaluating the activity component within the DL platform by levels is proposed:

$$K = \frac{\sum_{i=1}^{N} K_i \times b}{b_{baz} \times N_k \times N_u} \quad (1)$$

where:
Ki – the number of indicators that fall into this level;
b – a score that matches the current level;
bbaz – basic level score;
Nk – number of indicators;
Nu – number of evaluated.

The maximum score for each criterion can be expressed in points from 1 to 3. For greater objectivity, let us detail each of the criteria, thereby indicating its specificity (McMurtrie, 2021). The following formula can be used for the mathematical data processing in the given assessment:

$$K = \frac{S}{M} \quad (2)$$

where:
S – average score;
M – maximum possible score.

As noted, the performance indicators of students within the DL can be improved to varying degrees, which allows for allocating different levels of competencies formation:

- $0{,}7 \leq x \leq 1$ – high level of competence development;
- $0{,}35 \leq x \leq 0{,}69$ – medium level of competence development;
- $0 \leq x \leq 0{,}34$ – low level of competence development.

The central provision of the competency-based approach is the focus on the formation of the necessary competencies to carry out the activities in a knowledge-intensive professional-oriented environment (Table 1).

Table 1. Indicators and levels of students' educational activity formation within the distance learning platform

Professional activity	Indicators	Levels	Scores
Educational and cognitive activities	Average certification grade over the learning period	high	3
		medium	2
		low	1
	Number of completed projects during the educational period	high	3
		medium	2
		low	1
	Participation in scientific and practical conferences	high	3
		medium	2
		low	1
Innovative activities	Number of published scientific papers	high	3
		medium	2
		low	1
	Participation in contests and grants	high	3
		medium	2
		low	1
	Number of prospective ideas	high	3
		medium	2
		low	1
Project activities	Number of completed projects	high	3
		medium	2
	Number of implemented projects	low	1
		high	3
		medium	2
		low	1
	Number of commercialized projects	high	3
		medium	2
		low	1
Communication activities	Level of complexity of communication organization	high	3
		medium	2
		low	1
	Number of experts involved in communication	high	3
		medium	2
		low	1
Research activities	Number of scientific articles, theses, and other publications	high	3
		medium	2
		low	1
	Participation in international conferences	high	3
		medium	2
		low	1
Partnership and business activities	Number of approved projects	high	3
		medium	2
		low	1
	Number of involved business partners	high	3
		medium	2
		low	1

The questionnaires with the following answers were used to determine the level of personal components formation (motivational, ethical and reflective, cognitive and emotional-volitional):

- "The quality is not typical for me."
- "The quality is slightly expressed."
- "The quality is strongly expressed."

These questionnaires were adapted to reflect the individual structural components of competencies. The coefficient of the formation level, in this case, is calculated as:

$$K_{co} = \frac{k_1 \times a + k_2 \times b + k_3 \times c}{P} \quad (3)$$

where:
a – «the quality is not typical for me» (2 points);
b – number of responses with a rating «the quality is slightly expressed» (1 point);
c – number of responses with a rating «the quality is not typical for me» (0 points);
k1, k2, k3 – the number of selected responses with the appropriate rating;
P – number of diagnostic features.

Various components of both educational and scientific activities were used to assess the results and effectiveness of DL in the academic environment. The following indicators were formed: educational, innovative, project, research, communication, partnership, and business activities. The reliability of the obtained results and estimates is planned to be proved by applying methods of comparing two or more elementary statistics (means, variances, etc.) belonging to different samples. Only a comprehensive application of methods for assessing the effectiveness of DL in the student's educational environment will enable an objective assessment of the student's competence level. Thus, the identified criteria and indicators for assessing the effectiveness of DL in the academic environment will allow evaluation of the adequacy of the DL model and its applicability.

Currently, the use of distance learning platforms in the education environment is supported by social and pedagogical prerequisites. The pedagogical conditions determine the reasons for transitioning from the classical education system to the distance learning approach. Social requirements can be classified as external and internal. External conditions are expressed in the development of society and educational sciences, and they include the following:

- The informatization of society, computerization of industrial enterprises, educational institutions, and research establishments.
- The expansion of students' activity profiles in modern conditions and the contemporary information environment.
- The need for creating and using a unified information space for professional information.
- Internal prerequisites are associated with the necessity of addressing issues within the education system in the learning environment, namely:
    - The growth of the volume of educational, scientific, and professional information.
    - The problems in structuring educational materials within a department or an entire educational institution.
    - The search for new effective methods and tools for the learning process.
    - The shift towards personalized learning and preparing students in the rapidly developing field of information and communication technologies.

The external prerequisites refer to society's demand for a student preparation system. Meanwhile, the internal prerequisites encompass the requirements for the education system itself in training specialists using modern communication technologies. Therefore, distance learning plays a key role in the modern educational environment. The integration of a wide range of educational and digital communication technologies makes it possible to effectively implement a high-quality distance learning process, guaranteeing the continuity of education in emergency and conflict situations.

CONCLUSION

The distinctive features of the educational process organization in the educational environment on the example of student's DL platforms include:

- the use of the project method in teaching and conducting project activities in a group;
- students, like no one other, feel an urgent need for self-development;
- a student's learning in the DL system takes place with the involvement of social partners, in the course of a joint project or during the creation of an innovative and communication product;

- during the implementation of a project or order, it is necessary to maintain information and communication links between students and students, as well as between students and the scientific world community;
- a student in the distance learning system constantly interacts with international professional and student communities, which makes the student take into account the peculiarities of international communication, professional vocabulary and ethics, information and communication technologies;
- a student's education in the DL system requires creating an "information network," communication from student to teacher, to the international scientific community, and partners. It helps to increase the level of general intellectual development in implementing innovative projects with various enterprises, organizations, and research centers and supports interest in innovative, research, creative, and independent activities in creating and implementing projects.

One of the mechanisms that allow assessing the quality of distance learning (DL) in the educational environment is the system of criteria and evaluation of the student's level of preparation in DL, consisting of the following competency formation components: motivational, cognitive, activity-based, personal, and ethical-reflective.

Students' professional competencies have their specific characteristics, and for all the identified components of student competency formation, indicators (for each component) have been identified, considering the particular educational activities in DL. The indicators of student activities in DL can be developed to varying degrees, allowing for the identification of different levels of competency development: low, moderate, and high.

Various components of both educational and scientific activities were used to evaluate the results and effectiveness of DL in the educational environment, using the example of organizing the student's learning process. In addition, the indicators for educational, innovative, project, research, communication, partnership, and business activities were formed.

Therefore, only the comprehensive application of assessment methods for DL effectiveness in the educational environment will objectively evaluate the student's level of professional competency.

REFERENCES

Akdemir, O. & Koszalka, T.A. (2008). Investigating the relationships among instructional strategies and learning styles in online environments. *Computers & Education*, 50(4), 1451-1461.

Aristin, Nevy, Purnomo, Agus, Sayono, Joko, & Aliman, Muhammad (2023). Education Quarterly Reviews Student Retention in Distance Learning During the Covid-19 Crisis in Indonesia: Are We Disappointing Them? 6, 125-132. https://doi.org/10.31014/aior.1993.06.01.692.

Banas, E., & Emory, W. (1998). History and issues of distance learning. *Public administration quarterly*, 22(3), 365–383. http://www.jstor.org/stable/40862326

Bozkurt, A., and others (2015). Trends in Distance Education Research: A Content Analysis of Journals 2009–2013. *International Review of Research in Open and Distributed Learning*, 16(1), 330–363. https://doi.org/10.19173/irrodl.v16i1.1953

Chusova, O. M. Vakolia, Z. M. & Cheipesh, I. V. (2021). Pedagogical foundations of distance learning. *Pedahohichni nauky: realii ta perspektyvy,* Vol. 80, Part 2, 167-170. Retrieved from: http://enpuir.npu.edu.ua/handle/123456789/3481.

Cook-Sather, A. (2020). Respecting voices: How the co-creation of teaching and learning can support academic staff, underrepresented students, and equitable practices. *Higher Education*, 79(5), 885–901. https://doi.org/10.1007/s10734-019-00445-w.

Daqian Shi, Ting Wang, Hao Xing, & Hao Xu (2020). A learning path recommendation model based on a multidimensional knowledge graph framework for e-learning. https://www.sciencedirect.com/science/article/abs/pii/S095070512030085X

Dietrich, N., Kentheswaran, K., and others (2020). Attempts, Successes, and Failures of Distance Learning in the Time of COVID-19. *Journal of Chemical Education, American Chemical Society, Division of Chemical Education,* 97 (9), 2448–2457. https://hal.inrae.fr/hal-02968201/document

Dystantsiina Osvita [Distance Education]. Ministerstvo osvity i nauky Ukrainy [Ministry of Education and Science of Ukraine]. Retrieved from https://mon.gov.ua/ua/osvita/doshkilna-osvita/distancijna-osvita (in Ukrainian)

Henritius, E., Löfström, E., & Hannula, M. S. (2019). University students' emotions in virtual learning: A review of empirical research in the 21st century. *British Journal of Educational Technology*, 50(1), 80-100.

Hurzhii, A.M., Hlazunova, O.H., & Voloshyna, T.V. (2020). Digital educational content for the open education system: *Modern information technologies and innovative teaching methods in training: methodology, theory, experience, problems,* 55 (in Ukrainian)

Ismail, A. O., Mahmood, A. K., & Abdelmaboud, A. (2018). Factors Influencing Academic Performance of Students in Blended and Traditional Domains. *International Journal of Emerging Technologies in Learning*, 13(2).

Kapustynska, T. (2022). Everyone is aware: how Prometheus online education works wonders for half a million Ukrainians. Retrieved from: https://platfor.ma/topics/people/vsi-v-kursi-yak-onlajnosvita-prometheus-robyt-dyvo-dlya-pivmiljonaukrayintsiv/ (in Ukrainian)

Kosenchuk, O., & Novyk, I. (2020). Orhanizatsiia diialnosti zakladiv doshkilnoi osvity v period pandemii [Organization of preschool education during the pandemic]. Doshkilne vykhovannia [Preschool education], 9, 17-21. Retrieved from https://uied. org.ua/wp-content/uploads/2020/09/dv_2020-09_kosenchuk_olga_novyk_iryna.pdf (in Ukrainian)

Kristen Reid, Diane L. Butler, Catherine Comfort & Andrew D. J. Potter (2023). Virtual internships in open and distance learning contexts: Improving access, participation, and success for underrepresented students. *Distance Education,* 44:2, 267-283, DOI: 10.1080/01587919.2023.2209029

Lytvynova, S. H., Spirin, O. M., & Anikina, L. P. (2015). *Khmarni servisy Office 365* [Office 365 cloud services]: tutorial / Kyiv: Comprint, 170 p. (in Ukrainian).

Mala, I. 2022. Distance learning as an effective tool of management education. *Science Notes of KROK University,* 2(66), 132–151. https://doi.org/10.31732/2663-2209-2022-66-132-151 (in Ukrainian)

Makedon, Vyacheslav & Krasnikova, Nataliya & Krupskyi, Oleksandr & Stasiuk, Yuliia (2022). Arrangement of Digital Leadership Strategy by Corporate Structures: A Review. *Ikonomicheski Izsledvania,* 31, 19-40.

Makedon, V., Mykhailenko, O., & Vazov, R. (2021). Dominants and Features of Growth of the World Market of Robotics. *European Journal of Management Issues*, 29(3), 133-141. https://doi.org/10.15421/192113

Makedon, V., Zaikina, H., Slusareva, L., Shumkova, O., & Zhmaylova, O. (2019). Rebranding in the Enterprise Market Policy. Proceedings of the 34th International Business Information Management Association Conference, IBIMA 2019: Vision 2025: Education Excellence and Management of Innovations. Through Sustainable Economic Competitive Advantage: 9472-9476.

McMurtrie, B. (2021). Good grades, stressed students: They struggled with online learning last fall, but not always in the ways you might expect. Chronicle of Higher Education.

Milman, N. B. 2020. Designing asynchronous online discussions for quality interaction in asynchronous online courses. *Distance Learning*, 17(4), 59-61.

Muhaimin, M., Habibi, A., Riady, Y. et al. (2023). Covid-19 distance and online learning: a systematic literature review in pharmacy education. *BMC Med Educ.*, 23, 367. https://doi.org/10.1186/s12909-023-04346-6

Nozawa, K. (2011). To Moodle or Not To Moodle: Can It Be an Ideal E-Learning Environment? *Ritsumeikan University Journal of Policy Science, Bulletin of Universities and Institutes,* 289-312.

Perraton, H. (1988). A theory for distance education. In D. Sewart, D. Keegan, & B. Holmberg (Eds.), *Distance education: International perspectives.* New York: Routledge, 34-45.

Ögeyik, M. (2022). Using Bloom's Digital Taxonomy as a framework to evaluate webcast learning experience in the context of the Covid-19 pandemic. *Education and Information Technologies*, 27, 11219–11235. https://doi.org/10.1007/s10639-022-11064-x

Oleshko, A., Rovniahin, O., & Hodz, V. (2021). Udoskonalennia dystantsiinoho navchannia u vyschyi osviti v umovah pandemichnyh obmezhen [Improving distance learning in higher education in the context of pandemic constraints]. *Derzhavne upravlinnia: udoskonalennia ta rozvytok*, No. 1. http://www.dy.nayka.com.ua/?op=1&z=1936 (in Ukrainian).

Rachel Fitzgerald, Henk Huijser, Sharon Altena & Ale Armellini (2023). Addressing the challenging elements of distance education. *Distance Education*, 44:2, 207-212, DOI: 10.1080/01587919.2023.2209527

Rice, Mary (2022). *Online Learning*: March 2022 (26) 1. Online Learning. 26. 10.24059/olj.v26i1.3288.

Romanovskyi, O. H. Kvasnyk, O. V. Moroz, V.M. Pidbutska, N. V. Reznik, S. M. Cherkashyn, A. I. & Shapovalova, V. V. (2019). Development factors and directions for improving distance education in the higher education system of Ukraine, *Informatsiini tekhnolohii ta zasoby navchannia*, part 74, No 6, 37-42.

Rumble, G. (1989). On defining distance education. *The American Journal of Distance Education*, 3(2), 8-21.

Semih Caliskan, Sibel Suzek, & Deniz Ozcan (2017). Determining student satisfaction in distance education courses. *Procedia Computer Science*, 120, 529–538.

Shtefan, L. A., & Borzenko, O. P. (2015). *Features of the organization of distance learning of student youth in Canada: a retrospective analysis:* monohrafiia. Kh.: KhNADU, 219 p. (in Ukrainian)

Shylina, H.A. (2016*). Methods of distance learning of the Ukrainian language for primary school students.* Dysertatsiia na zdobuttia naukovoho stupenia kandydata pedahohichnykh nauk. Kyiv, Rezhym dostupu: Microsoft Word - Shylina_H_A_Dysertatsiia.pdf (in Ukrainian).

Slobodianiuk, I., Myslitska, N., Zabolotnyi, V., & Kolesnykova, O. (2020). Vykorystannia hmaro-oriientovanyh tehnolohii v umovah dystantsiinoho navchannia [The use of cloud-based technologies in distance learning]. *Fizyko-matematychna osvita,* issue 1(23), vol. 2, 78–82 (in Ukrainian).

Stentiford, L., & Koutsouris, G. (2021). What are inclusive pedagogies in higher education? A systematic scoping review. *Studies in Higher Education*, 46(11), 2245–2261. https://doi.org/10.1080/03075079.2020.1716322

Swanson, R. A., & Holton, E. F. (2005). *Research in organizations: Foundations and methods in inquiry*. Berrett-Koehler Publishers.

Tang, Y., & Hew, K. F. (2022). Effects of using mobile instant messaging on student behavioral, emotional, and cognitive engagement: a quasi-experimental study. *International Journal of Educational Technology in Higher Education,* 19(1), 1-22.

Unger, S., & Meiran, W. (2020). Student attitudes towards online education during the COVID-19 viral outbreak of 2020: Distance learning in a time of social distance. *International Journal of Technology in Education and Science* (IJTES). 4(4). 256–266.

Venton, B. J., & Pompano, R. R. (2021). *Strategies for enhancing remote student engagement through active learning.* In: Springer.

Wedemeyer, C. (1981). *Learning at the Backdoor: Reflections on non-traditional learning in the lifespan*. Madison. 130 p.

Wu, J.-H., Tennyson, R. D., & Hsia, T.-L. (2010). A study of student satisfaction in a blended e-learning system environment. *Computers & Education*, 55(1), 155-164.

Yuan, Ly (2022). MOOCs and open education. White paper. Retrieved from: http://elib.umsa.edu.ua/bitstream/umsa/16038/1/Neporada_Ocinka.pdf.