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IMPLEMENTATION OF E-LEARNING IN THE CONTEXT OF DIGITAL EDUCATION

IMPLEMENTACIÓN DEL E-LEARNING EN EL CONTEXTO DE LA EDUCACIÓN DIGITAL

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ABSTRACT

The article defines the essence, structure and content of e-learning and reveals the possibility of its implementation in modern conditions. The theoretical justification of e-learning as a pedagogical system is given and it is filled with specific content. An ideal theoretical model of the pedagogical concept of e-learning in a university is developed and on its basis a pedagogical logical-semantic model, an algorithm for its formalization and implementation by means of computer technology are developed. The procedure of pedagogical examination as a system of forecasting and correction of the educational process in "E-learning" is scientifically substantiated and diagnostic tools for its implementation are developed. It has been proven that the global educational space and the educational space of the university, as a set of all possible educational situations displayed on uniform measurement scales, is a metric space on which the operations of fuzzy equality and fuzzy inclusion are performed. For the first time, the possibility of using the language of predicate logic to create a formalized pedagogical model of training, capable of displaying in real time the current and prospective levels of achievement of the set educational goal by the student using the semantic constructions of natural language.

Keywords:

Educational activities, e-learning, modern conditions, pedagogical logical-semantic model.

RESUMEN

El artículo define la esencia, la estructura y el contenido del e-learning y revela las posibilidades de su implementación en las condiciones modernas. Se presenta la justificación teórica del e-learning como sistema pedagógico, con un contenido específico. Se desarrolla un modelo teórico ideal del concepto pedagógico del e-learning en una universidad y, sobre esta base, un modelo lógico-semántico pedagógico y un algoritmo para su formalización e implementación mediante tecnología informática. Se fundamenta científicamente el procedimiento de evaluación pedagógica como sistema de previsión y corrección del proceso educativo en e-learning y se desarrollan herramientas de diagnóstico para su implementación. Se ha demostrado que el espacio educativo global y el espacio educativo universitario, como conjunto de todas las

posibles situaciones educativas representadas en escalas de medición uniformes, es un espacio métrico en el que se realizan las operaciones de igualdad e inclusión difusas. Por primera vez, se ha creado un modelo pedagógico de formación formalizado mediante la lógica de predicados, capaz de mostrar en tiempo real el nivel actual y futuro de logro del objetivo educativo por parte del estudiante, utilizando las construcciones semánticas del lenguaje natural.

Palabras clave:

Actividades educativas, aprendizaje electrónico, condiciones modernas, modelo pedagógico lógico-semántico.

INTRODUCTION

The rapid development of information technology, the transition to a digital economy, the creation and improvement of various social and professional networks, and the availability of information require the modernization of the classical education system and its filling with new content. A new direction in the development of education is the transition from the classical educational space (building, book, teacher) to a virtual educational space created by hardware and software of computing technology, as well as the creation on this basis of the electronic learning system "Electronic Learning (E-learning)", which is based on special computer technologies that provide training within the framework of an academic discipline according to individual optimal programs with management of the learning process.

In the works published in recent years by (Stevens, 2007; Batagan et al., 2011; Guash et al., 2012; Lunenburg & Ornstein, 2012; Gioffre, 2017; Krasnenko, 2020). The theoretical possibility of significantly increasing the effectiveness of e-learning compared to classical learning, as well as the implementation of the following educational opportunities on the basis of procedural and technological components, is shown: individualization of the process of obtaining education, its "innovation", mobility, accessibility, cost-effectiveness (primarily in terms of time parameters). However, in most cases, the creation of virtual educational spaces announced by educational institutions of Ukraine is limited to the use of e-mail, multimedia, and various types of databases in the educational process (Pukhno, 2024). The main attention is currently paid to the technological and procedural components of e-learning, omitting the human component and closely related scientific achievements of pedagogy as a science of upbringing and training of a person, which does not allow to implement in practice all the educational possibilities of e-learning.

Comprehensive application of scientifically based modern pedagogical approaches in the organization of e-learning to setting an educational goal, organizing the educational process in the virtual educational space, continuous pedagogical measurements and correction of the educational process depending on the results obtained, combined into a single pedagogical concept, will ensure the effectiveness of e-learning. Compliance with its modern requirements will mean an innovative approach to training. This will provide a well-designed interactive learning environment for any student, anywhere and at any time using the resources of various digital technologies along with other forms of educational materials that are suitable for an open learning environment. E-learning training makes the transition from a data management system to a knowledge management system. At the scientific and theoretical level, the relevance of the problem under consideration is determined by the importance of developing pedagogical approaches to organizing e-learning at a university. These approaches must be combined into a pedagogical concept and scientifically based practical recommendations must be developed for teaching staff on the selection and application of technological and procedural components of e-learning, and the specifics of organizing the educational process depending on the individual educational goals of students.

The scientific and methodological level of relevance of the problem under consideration is determined by the need to develop a set of pedagogical conditions for the transition to e-learning, training of faculty to work in the virtual educational space of the university, the transition to tutoring as one of the forms of interaction with students, the development and application of educational content.

The socio-pedagogical level of relevance is determined by the importance of education for the socialization of the student's personality, the need to ensure that when organizing e-learning at a university, not only the activity and competence components, but also the social and ethical components of the student's educational goal.

Thus, the development of a pedagogical concept for organizing e-learning at a university is an urgent pedagogical problem determined by the following reasons:

- the organization of e-learning at a university is essential for solving the socio-economic problems of the development of the country and an individual;

- globalization of the labor market, the emergence of new professions, the variability of professional competencies significantly affects a person's life, his demand in the labor market, require from him an active position in the context of obtaining general and vocational education, the formation and development of relevant competencies in demand both by the student himself, and by the state and society, and acceptable to them;

- the process currently implemented in the higher education system, using individual elements of e-learning, does not sufficiently take into account the individual educational needs of the student, his personal, physiological, social, age and other characteristics, has a fairly low variability and adaptive capabilities in relation to the individual capabilities of the student;

- the new technological base of e-education requires the creation of human-machine educational systems, the educational space and educational environment of which are implemented by means of artificial intelligence, the individual educational trajectory is calculated and optimized on the basis of pedagogical models, which ensures students a guaranteed achievement of the set educational goal;

- changes in the technological base of education and the use of pedagogical models require professionally competent, targeted pedagogical activity of teaching staff, changes in the role and place of the teacher in the educational process. The teacher becomes not only a source of knowledge - he is assigned functions that are not typical for traditional education: work in virtual space, development of an individual educational trajectory (tutor), construction of electronic educational resources, etc. This requires a radical change in the forms and methods of work, a fundamentally new vision of the holistic educational process, which is possible within the framework of targeted advanced training; - changes in the technological base of education and the use of pedagogical models require the selection of educational material, its appropriate adaptation to the requirements of educational platforms, that is, the creation of specialized educational content that differs significantly from the educational and methodological support available in educational institutions.

Of particular importance for our study are the works of such authors as (Bray, 2007; Tan, 2007; Holmes et al., 2019; Marondera et al., 2020), and others, which examine the organization of e-learning in educational institutions of various levels from different angles and show the high efficiency of this form of organizing the educational process.

An analysis of scientific literature revealed the presence of a number of the following problems associated with the implementation of e-learning:

- not all researchers are ready to accept global changes in the education system. They are skeptical about the possibility of creating a formalized (ideally mathematical) model of a person and the educational process in the virtual educational space, adhering to traditional empirical ways of setting an educational goal, building individual educational trajectories, assessing the level of achievement of the student's educational goal, etc.;

- organizational issues of expanding the functions of teachers, tutoring competencies have not been sufficiently considered;

- the content, forms and methods of presenting electronic educational content for organizing e-learning in the system of continuous professional education have not been sufficiently developed.

The above shortcomings ensure a high level of relevance of the research topic touched upon.

The need to develop a pedagogical concept for organizing e-learning in a university is relevant and is determined by a number of the following contradictions.

At the philosophical and categorical level:

- between the level of theoretical generalizations, methodological elaboration of the problems of e-learning in the higher education system and their application in real life;

- between the objective need for digital transformation of higher education and the insufficient development of methodological approaches, pedagogical conditions for its implementation in the form of an e-learning system.

At the content-normative level:

- between the need for individualization of the educational goal, development of an individual educational trajectory of the student and the lack of scientifically based algorithms in the "classical" approaches to organizing the educational process at the university.

At the procedural-technological level:

- between the modern technological basis of education, the basis of which is the virtual educational space, and the "classical" representation of the educational space and educational environment in educational institutions of various levels.

At the result level:

- between the individualization of the student's educational goal and the lack of algorithms for constructing and optimizing the individual educational trajectory of its achievement, according to time and other parameters affecting the effectiveness of the educational process;

- between the students' need for pedagogical support when organizing e-learning and the lack of specialists capable of fully meeting this need;

- between the need to create fundamentally new scientifically substantiated educational content for use in the virtual space and the actual use of outdated, unreliable, controversial, and often illegal information from the global Internet in the educational process.

These contradictions define the research problem, which consists in posing the question of what are the theoretical and methodological foundations, technological support and pedagogical conditions for the practical implementation of the pedagogical concept of organizing e-learning in a university.

The purpose of the article: theoretical substantiation of the implementation of the pedagogical concept of e-learning in the university "E-learning", which includes specific content, forecasting, correction of the educational process and diagnostic tools for its implementation.

The object of the article: e-learning in the education system.

Subject of the study: the essence, structure and content of e-learning, its formalization and implementation in the educational process of the university.

Research hypothesis. It was assumed that the scientific foundations for the construction and implementation of the concept of e-learning in a university will be effective if:

- consider e-learning as a special form of training and a pedagogical system based on the use of digital technologies;

- clarify the content of the structural components of e-learning in a university as a pedagogical system that includes goals, means of communication, content of educational information, subjects of the educational process (teacher, student, etc.) with a guaranteed achievement of the result as a system-forming factor;

- take into account the features of the means of communication between the subjects of the educational process: students, teachers, tutors, expert specialists, resource developers (designer of pedagogical situations) and their functions;

- build scientific, methodological and technological support for achieving the desired result of e-learning in a university, taking into account the individual needs of students, expanding the functions of the teacher and the implementation of educational information by means of digitalization;

- develop diagnostic tools for conducting predictive pedagogical examinations in order to develop, clarify and adjust the individual educational trajectory of the student, taking into account the opinions of experts; - develop the main types of electronic educational content that meet the requirements of electronic learning at the university.

MATERIALS AND METHODS

In this study, both theoretical methods including analysis and synthesis, modeling, generalization, and analogy and empirical methods such as questionnaires, observation, testing, and pedagogical experiments were employed in combination. The experimental data were analyzed using statistical techniques. The interaction and complementarity of these research methods ensured the reliability and validity of the information obtained.

In accordance with the set objectives, a set of complementary research methods was used:

- theoretical (analysis and synthesis, generalization, comparison, abstraction, specification, modeling, systems approach);

- empirical (questionnaires, testing, expert assessment, documentation analysis, study and generalization of the experience of organizing the pedagogical process of continuous professional training);

- praxis (assessment of the results of students' activities).

RESULTS AND DISCUSSION

The scientific novelty of the article lies in the fact that:

1. For the first time, a pedagogical concept of organizing e-learning in a university has been developed based on scientifically substantiated modern pedagogical approaches.

2. It has been proven that the global educational space and the educational space of a university, as a set of all possible educational situations displayed on uniform measurement scales, are a metric space on which the operations of fuzzy equality and fuzzy inclusion are performed.

3. An educational process based on e-learning in a virtual educational space is provided with the ability to organize continuous pedagogical measurements and correction depending on the results obtained.

4. For the first time, the possibility of using the language of predicate logic to create a formalized pedagogical model of training has been shown, capable of displaying in real time the current and prospective levels of achievement of the student's educational goal using the semantic constructions of natural language.

5. For the first time, the concept of metrics in the virtual educational space was introduced, and a theorem of applicability in the metric space of fuzzy equality and fuzzy inclusion operations for formalizing the individual educational goal of the student was formulated and proven.

6. For the first time, a formalized pedagogical logical-semantic model of e-learning in a university was developed, which includes lower-level models:

- a model of the educational space of the university as a set of educational situations of various levels;
- a model of the educational environment of the university as a set of management decisions that ensure the guaranteed achievement of the individual educational goal by the student;

- an individual educational trajectory of the student, which is a set of directed transition graphs in the space of educational situations under the influence of management decisions that affect the effectiveness of the educational process.

7. Models of educational space, educational environment of the university and individual educational trajectory of the student are combined into a set of graphs of transition between educational situations, allowing its implementation by means of computer technology, optimization by time and other parameters affecting the effectiveness of the educational process.

8. Specific features of conducting pedagogical expertise as a system for predicting the individual educational goal of the student and its correction for building an optimal individual educational route are identified, which ensures the innovativeness of the educational process in E-learning.

The results of the conducted research make a significant contribution to the development of theoretical views on the problem of organizing e-learning using the example of the developed pedagogical concept of organizing e-learning in a university.

Reliance on methodological approaches: axiological, systemic, environmental, cultural, technological, informational, as well as the principles of organizing e-learning in a university - reveals its pedagogical essence and systemic organization and is a conceptual, theoretical and applied basis for the pedagogical concept of e-learning in a university (Mykolaiko et al., 2022).

The content of the main concepts of the study ("e-learning", "virtual educational environment", "educational situation", "pedagogical situation", "educational situation", "current educational situation", "target educational situation", "intermediate educational situation", "individual educational goal") is clarified in relation to the development of a pedagogical concept of organizing e-learning in a university, allowing to expand the content of the conceptual apparatus of higher education pedagogy. The concept of metrics in the virtual educational space is introduced, the theorem of applicability in the metric space of fuzzy equality and fuzzy inclusion operations is formulated and proven, which allows using the mathematical apparatus of fuzzy logic to formalize the individual educational goal of the student.

The concept of the degree of fuzzy inclusion is introduced and the theorem of its applicability in the pedagogical model of organizing e-learning in a university is proven, which allows solving the problem of an avalanche-like increase in the number of educational situations when constructing a logical-semantic model.

The developed formalized logical-semantic model of e-learning in a university has been implemented, which takes into account the features of organizing the educational process in a university and is suitable for its implementation by means of computer technology.

An algorithm has been developed: conducting a pedagogical examination when organizing e-learning in a university based on the selection of experts using the "snowball" method, adapted for use in pedagogical examination; identifying and coordinating expert opinions; transformation of the obtained data and bringing them to a formalized form for further use for prognostic and evaluation purposes.

The requirements for the structure and content of electronic educational content are substantiated, optimal forms of its presentation for use in organizing e-learning at a university are proposed.

The conditions for new directions of theoretical developments in the problem of organizing e-learning at a university, obtained at different levels of abstraction, generalization and concretization of results, are created.

The analysis of scientific literature allowed us to develop an ideal theoretical model of the pedagogical concept of organizing e-learning in a university. Due to the fact that e-learning is a specific pedagogical process, it can be presented as a five-component pedagogical system, including the goal, participants in the pedagogical process (teacher, student), educational information and communication tools. The system-forming factor of the pedagogical system is the final result (the real implementation of the ideal goal). However, the essence of e-learning makes serious amendments to the content characteristics of all components, which fundamentally distinguishes the pedagogical system of e-learning from the traditional system. The theoretical model of the pedagogical concept of e-learning in a university consists of 6 blocks: target, theoretical and methodological, concept core, content, criteria and evaluation and result.

The essence of electronic learning, or E-learning, is the creation of virtual local educational spaces by means of computer hardware and software, their consistent

unification into virtual educational spaces of a higher level, and ultimately into a single virtual global educational space in order to increase the efficiency of the educational process implemented in them. The goal of the educational process in such a specially organized educational environment is an ideal prediction of the result of the activity, an advanced reflection of events, a subjective image of a non-existent but desired state, an ideal result that guarantees the achievement of the individual educational goal set by the student. The main pedagogical feature of E-learning, the definition of the educational goal by the student himself and its description in relation to a certain situation by linguistic means of natural language are determined through the pedagogical categories of «Competent» and «Competence» (Mykolaiko, 2023). To simplify the presentation of the pedagogical concept of organizing e-learning in a university, consideration of the competencies included in the educational situation is limited to cognitive, activity, motivational, ethical, social and behavioral competencies. For most cases, the individual educational goal of a student can be described as a set that includes these competencies. Depending on the attitude to the moment under consideration, the educational situation can be current, reflecting the level of formation and development of the student's competencies at the current moment, or target, reflecting the level of development of competencies desired by the student personally, the state and society, at which the student as a competent specialist will be guaranteed to be in demand in the labor market.

The process of obtaining education by a learner is the process of his/her transition from the current to the target educational situation, the components of the competence of which have a higher, and in the limit - the highest possible level of their development. The educational process is considered as a sequence of educational situations, as a unit of measurement of the level of formation and development of the necessary or specified competencies in the learner at a certain moment. The transition is carried out by immersing the learner in a virtual educational space. Due to the change in the technical basis of the educational process and its implementation by means of computer technology, there is a need to formalize the pedagogical categories «Educational goal», «Educational space», «Educational environment», «Educational trajectory», «Pedagogical situation» and «Educational situation». The pedagogical category «Virtual educational space» in the organization of e-learning is considered as a multidimensional psychological, pedagogical, social and physical space in which the learner's competencies are formed with active pedagogical support carried out in the virtual educational environment. Defining the goal of obtaining higher education by a student when organizing e-learning at a university affects all structural components of the pedagogical system, assuming their certain «readjustment»: educational information is filled with specific content, and communication links also become compliant with the requirements of the virtual environment. The main participants in the e-learning process are, as in traditional learning, a student and a teacher, but the specifics of e-learning involve the participation of the pedagogical and expert community - a teacher, a tutor, a specialist expert, a developer of resources - a designer of pedagogical situations, etc. The forms of interaction between subjects of the educational process are expanded due to the possibility of synchronous and asynchronous communications. Students are given the opportunity for broader access to educational services at a convenient time and in any place, taking into account the individual pace of completing assignments, as well as immediate feedback, adjustment and instant restructuring of an individual educational trajectory. The main problem of implementing e-learning at a university is the lack of formalized scales for measuring the level of formation and development of competencies in a student. To solve the problem, the competencies were detailed to represent them as a set of basic qualities that are displayed on quantitative and relative scales. This approach allows us to obtain a semantic description using natural language constructions – both of the individual educational goal of the student and of the system of subgoals and sets of basic qualities, ensuring an unambiguous connection: quantitative measurement scales → basic qualities → competence → competence. This makes the student's personal parameters measurable, including in dynamics, which allows us to create a pedagogical model for achieving the set individual educational goal, suitable for implementation by means of computer technology.

The core of the concept. The core of the pedagogical concept of organizing e-learning in a university is a pedagogical logical-semantic model suitable for implementation by means of computer technology, which includes lower-level models: a model of the educational space of the university; a model of the educational environment of the university. Representation of the educational space of the university, as well as the global educational space as a metric space on which the operations of fuzzy equality and fuzzy inclusion are performed, allows us to solve the problem of an avalanche-like increase in the number of educational situations under consideration in pedagogical modeling and practical implementation by means of computer technology, provides the opportunity and legitimacy of representing the student as a current educational situation similar to educational situations that form the educational space of the university.

The form of presentation of the model and the mathematical methods used are determined by the set individual educational goal of the student, described by

linguistic constructions of natural language through the pedagogical categories «Basic quality», «Competence», «Competence», «Pedagogical situation». The predicate language is a declarative language, i.e. it is quite easily translated into low-level computer languages, since the inference mechanism is completely defined for the predicate logic language and the completeness and correctness of the equivalence of the model semantics and the proof semantics of the representations derived using the corresponding inference mechanism are proven in advance. It is possible to translate Horn sentences, which are a subset of first-order predicate logic, into the programming language. The program structure corresponds to the structure of predicate logic formulas, and within the range of this correspondence, it is possible to bring the program implementation to the level of symbolic processing, where its execution is allowed by computers whose architecture is based on the Turing principles (Pukhno, 2022).

Thus, successful practical implementation of the pedagogical model is achieved with a slight loss of completeness and reliability of the results obtained. The assumption is substantiated that the student in such a pedagogical model also represents an educational situation similar to the target educational situation, where the value of the membership function is determined on the basis of «playing out» the given pedagogical situations and the pedagogical measurements carried out. Then, at the current moment in time, the student is in an educational situation from a set of educational situations that form the virtual educational space of the university, the degree of fuzzy equality with which is maximum.

In the course of the conducted research, the main problem for students in organizing e-learning at a university is setting an individual educational goal, which in most cases is built without taking into account the prospects for the development of technology, technology and the associated labor market. Giving an «innovative» character, that is, based on scientific forecasts for the development of technology and society, to individual educational goals of students is impossible without involving specialist experts in the educational process (Shapoval et al., 2021). Selection of experts from a wide range of specialists for the organization of e-education on the principles of professional selection is impossible. For e-learning, experts are asked questions not so much about the prospects and ways of development of a specific area of science and technology, but about the role and place of a person in this direction of development, the predicted results for society as a whole and personally for the student. Pedagogical expertise is a system of support for setting and achieving an individual educational goal by students when organizing e-learning at a university.

Content block. The virtual educational space of the university is represented by technical, technological components and specific pedagogical means of communication. The technical component is modern computer and server, multimedia and peripheral equipment. The technological component is application software, the so-called «platform» - for example, eLearning Server 4G, which practically implements the pedagogical model of organizing e-learning at the university. Educational content is developed by designers of pedagogical situations, taking into account the requirements imposed by the technical and technological basis of e-learning. Pedagogical means of communication become specific.

The main activities of the teacher in organizing e-learning at the university are as follows: development of an individual educational trajectory of the student; selection, processing and preparation of information, the so-called electronic educational content; development of resources - a designer of pedagogical situations necessary for the formation of in-demand competencies and the basic qualities corresponding to them in the student; organization of pedagogical expertise, its implementation in relation to each student; Correction of the educational process depending on the results achieved by the student (tutor functions).

The educational process is organized as a sequential transition of the student in the virtual educational space of the university from the educational situation of the lower level to the target educational situation of the student, optimized by time and other parameters under the control of the knowledge base of the educational environment of the university, and includes: pedagogical design (involving students in setting the learning goal); conducting a predictive pedagogical examination; development of an individual educational trajectory of the student; organization of the learning process; development of electronic educational content; assessment of the achievement of the set educational goal by the student; adjustment of all stages of the educational process depending on the results achieved.

An increase in the level of formation and development of cognitive and activity competencies in students who started their studies simultaneously directly depends on the level of motivation or motivational competence developed during the implementation of the pedagogical concept of e-learning in a university. Assessing the formation and level of development of a student's motivational competence seems to be a complex task. Motivation should be understood as a person's genetic desire for self-realization in accordance with his or her innate abilities for certain types of activity and persistence in mastering them at a creative level. This active and

persistent desire is realized in real achievements only when the necessary conditions arise (are created). Otherwise, self-realization is suppressed to a greater or lesser extent by unmotivated types of activity, the achievements in which cannot exceed the performance level. We consider the motive in relation to the organization of e-learning in a university as an internal motivating force of a person. The results of scientific research have shown that 20-30% of a person's performance depends on intelligence, and 70-80% on the motives he pursues.

The stronger the student's cognitive motivation, the more complex tasks he is able to solve. In the process of organizing e-learning at the university, we assessed the social, cognitive and personal motives of students in the control and experimental groups. Social motives are understood by us as the student's awareness of the social significance of receiving an education, understanding the meaning of personally developing learning, the level of development of his general worldview and understanding of the world, etc. Cognitive motives for learning are understood by us as the level of interest shown by the student in obtaining knowledge, his manifestation of curiosity, the desire to develop cognitive abilities, his enjoyment of intellectual activity, etc.

Personal motives for learning are understood by us as a sense of self-respect, ambition, the desire to enjoy authority among students and the faculty and are an important basis for self-education and self-improvement of the student's personality. Of particular importance here is the coordination of the internally motivated activity of the student and the external motivating pedagogical influence of the virtual educational environment of the university, consisting in the consistent mutual complementarity of the goals and objectives in organizing e-learning at the university. The indicators within this criterion are the personal motives of students, their interests, readiness for continuous professional development, etc.

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The indicators within this criterion are the personal motives of students, their interests, readiness for continuous professional development, etc. In the process of developing and practically implementing the pedagogical concept of organizing e-learning at a university, in order to determine the level of formation and development of motivational competence of students, we decomposed motivational competence into basic qualities by involving seven experts and creating one expert group. The extraction of expert knowledge was carried out by the method of questionnaires and direct ranking of basic qualities by the number of mentions by experts.

As a result of the pedagogical examination, it was found that with regard to the motivational competence of students, the most frequently mentioned motive is demand in the global labor market, then the most frequently mentioned motives were: self-affirmation, the need for self-realization, the need to earn income, the desire for a family. Upon admission to the 1st year, students of the experimental and

control groups were offered to determine their motivation for studying in one or another form of education at a particular university in the form of passing an eidos test. As we can see from the test results, first-year university students do not have a clearly expressed desire to obtain an education in either the control or experimental groups.

An increase in the level of formation and development of cognitive and activity competencies in students who started their studies simultaneously directly depends on the level of motivation or motivational competence developed during the implementation of the pedagogical concept of e-learning in a university. Assessing the formation and level of development of a student's motivational competence seems to be a complex task. Motivation should be understood as a person's genetic desire for self-realization in accordance with his or her innate abilities for certain types of activity and persistence in mastering them at a creative level. This active and persistent desire is realized in real achievements only when the necessary conditions arise (are created). Otherwise, self-realization is suppressed to a greater or lesser extent by unmotivated types of activity, the achievements in which cannot exceed the performance level. We consider the motive in relation to the organization of e-learning in a university as an internal motivating force of a person. The results of scientific research have shown that 20-30% of a person's performance depends on intelligence, and 70-80% on the motives he pursues.

The stronger the student's cognitive motivation, the more complex tasks he is able to solve. In the process of organizing e-learning at the university, we assessed the social, cognitive and personal motives of students in the control and experimental groups. Social motives are understood by us as the student's awareness of the social significance of receiving an education, understanding the meaning of personally developing learning, the level of development of his general worldview and understanding of the world, etc.

Cognitive motives for learning are understood by us as the level of interest shown by the student in obtaining knowledge, his manifestation of curiosity, the desire to develop cognitive abilities, his enjoyment of intellectual activity, etc. Personal motives for learning are understood by us as a sense of self-respect, ambition, the desire to enjoy authority among students and the faculty and are an important basis for self-education and self-improvement of the student's personality. Of particular importance here is the coordination of the internally motivated activity of the student and the external motivating pedagogical influence of the virtual educational environment of the university, consisting in the consistent mutual complementarity of the goals and objectives in organizing e-learning at the university. The indicators within this criterion are the personal motives of students, their interests, readiness for continuous professional development, etc.

In the process of developing and practically implementing the pedagogical concept of organizing e-learning at a university, in order to determine the level of formation and development of motivational competence of students, we decomposed motivational competence into basic qualities by involving seven experts and creating one expert group. The extraction of expert knowledge was carried out by the method of questionnaires and direct ranking of basic qualities by the number of mentions by experts. As a result of the pedagogical examination, it was found that with regard to the motivational competence of students, the most frequently mentioned motive is demand in the global labor market, then the most frequently mentioned motives were: self-affirmation, the need for self-realization, the need to earn income, the desire for a family.

Upon admission to the 1st year, students of the experimental and control groups were offered to determine their motivation for studying in one or another form of education at a particular university in the form of passing an eidos test. As we can see from the test results, first-year students do not have a clearly expressed desire to obtain an education in either the control or experimental groups. The motivational competence of a student is closely related to the level of development of his ethical competence, which is considered in pedagogical science as a complex personal-psychological formation, the integration of cognitive and activity-based competencies of a student and a certain set of his personal qualities, integrated on the basis of the ethical laws of social development. One of the main conditions for the development of the formation and development of ethical competence in students is the implementation of subject technology in an educational institution when organizing e-learning at a university. A student as a person is integral and free, which is manifested in his life, communication, and self-awareness (Alforova et al., 2021).

The results of the pedagogical analysis and monitoring of the level of development of the basic qualities of cognitive, activity, motivational, ethical, social and behavioral competencies in students in the experimental groups correspond to the philosophy of e-learning as obtaining education in the global educational space. Thus, e-learning is a promising form of organizing the educational process in educational institutions of various levels. One of the most important basic qualities of a student of a pedagogical university as a future competent specialist is not only his ability to work as a teacher, tutor, designer of pedagogical situations, but also the ability to organize e-learning in an educational institution.

The pedagogical concept of organizing e-learning in a university is an opportunity to ensure a real-time transition from a data management system to a knowledge management system; to display the current and prospective levels of achievement of the set educational goal by the student using semantic constructions of natural language as a metric space on which the operations of fuzzy equality and fuzzy inclusion are performed.

The structural components of e-learning in a university as a pedagogical system are prospective individual goals of obtaining education, independently formulated by the student and adjusted as a result of conducting a predictive pedagogical examination; communication tools, a specific feature of which is the immersion of participants in the educational process in the virtual space of the university; educational information in the form of structured educational content filled with specific content that meets the requirements of the virtual educational environment and social order; subjects of the educational process: students, pedagogical and expert communities (teacher, tutor, specialist expert, resource developer - designer of pedagogical situations, etc.) with a guaranteed achievement of the result as a system-forming factor.

The basic concepts that provide scientific, methodological and technological support for e-learning at a university are: “virtual educational environment” as the information content and communication capabilities of local, corporate and global computer networks formed and used for educational purposes by all participants in the educational process; “pedagogical situation” in the form of a specially prepared problem task by a teacher based on the goal set by the student; “educational situation” as a unit of measurement of the level of formation of specified competencies, determined depending on the time of the measurements (current, target, intermediate); “individual educational goal” realized in the target educational situation of the student; “educational process” - an individual educational trajectory of the student from the input educational situation of the lower level to the target educational situation.

The methodological basis of the pedagogical concept of organizing e-learning in a university is a set of scientific approaches (axiological, systemic, environmental, cultural, technological, informational), trends, contradictions, dependencies, principles, essence and content, criteria for the effectiveness of its use, allowing us to consider this process as an organized set of modern electronic educational and other information resources aimed at satisfying the needs of subjects of the educational process, its educational, methodological and pedagogical support, the use of hardware and software for storing, processing, transmitting educational materials and prompt access to them, as well as telecommunication interaction between students and teachers in the interests of achieving educational goals.

The theoretical model of the pedagogical concept of e-learning in a university is built on the basis of a logical-semantic model in the form of electronic educational content with a modular structure and is created on the principles of contextual learning technology. A module, as a logically complete independent block of information, has certain goals and objectives and consists of many typical or «standard» pedagogical situations S = {S , S , ..., Sn}, information resources, test assignments, materials from lectures, seminars, webinars, presented by web pages, catalogs, books, links to files, and other types and forms of information presentation. Pedagogical expertise of e-learning in a university includes an algorithm for selecting experts, identifying and coordinating expert opinions, transforming the obtained data and bringing them to a formalized form for the purpose of further use in prognostic and evaluative forms and acts as a system for forecasting the needs of the labor market, social order and the competencies they demand; defining, detailing and correcting the goal setting and the optimal individual educational trajectory for achieving it by subjects of the educational process.

The effectiveness of the implementation of the developed pedagogical concept of organizing e-learning in a university setting is determined by mandatory support for the activities of students based on input and output control of the level of development of basic competencies (cognitive, activity-based, motivational, ethical, social and behavioral); the possibility of universal output of the necessary information; reducing the time it takes for the teacher to create it; prompt introduction of changes and additions; continuous improvement of existing materials, which together allows for individualization of training in terms of content, teaching methods, methods of control and self-control, pace of acquisition, level of independence, making them as accessible as possible to students.

CONCLUSIONS

The transition of educational institutions from classical forms of organizing the educational process to E-learning is a natural process of education development, caused by the ongoing changes in the social, economic and technical spheres of life of the state and society. Its importance and necessity are difficult to overestimate. The development and improvement of e-learning is a movement towards a new paradigm of education that most fully meets the educational needs of the 21st century. As a result of our study, a pedagogical concept of organizing e-learning at a university was created, the criteria for its effectiveness were determined and ways to achieve educational goals were developed.

The results obtained during the study allow us to conclude that the tasks set have been solved. This gives grounds to formulate the following conclusions:

The essence of e-learning as a special form of training is defined, a significant feature of which is the immersion of participants in the educational process in a virtual educational environment that exists around the clock in real time based on modern digital technologies. E-learning in a university is a pedagogical training system aimed at guaranteed achievement of an individual, personally oriented educational goal of a student with active interaction of subjects of the educational process in the virtual space of a university, using modern electronic educational and other information resources aimed at meeting the needs of subjects of the educational process, its educational and methodological support, the use of hardware and software for storing, processing, transmitting educational materials that provide prompt access to them, as well as telecommunication interaction between students and teachers in the interests of achieving educational goals. The structure of e-learning consists of human, procedural and technological components.

The human component consists of students and teachers, as well as a separate group of technical specialists who ensure the continuous operability of technical training tools. The procedural component contains four types of processes: the learning process; the learning management process; organizational processes and the process of developing and maintaining resources. The technological component is software. The set of components forms the virtual space of the university at the local level, and the set of local educational spaces forms the global educational space of Ukraine and the world community.

The possibility of implementing e-learning in modern conditions is ensured, on the one hand, by the ideal conditions of the information society, the rapid development of digital technologies, information networks, databases, artificial intelligence, which provides access to global educational resources, and on the other hand, by rapidly changing global social and economic conditions in the world community, and Russian aggression.

An ideal theoretical model of the pedagogical concept of e-learning in a university has been developed, including a target block (social order, regulatory framework, goal); theoretical and methodological block (methodological approaches, basic principles ensuring effective implementation of the concept, components of e-learning: human, procedural, technological, which contain the specifics of communicative connections); the core of the concept (formalized pedagogical logical and semantic model of organizing e-learning in a university, the author's theorem on the metric nature of the educational space of a university); content block (virtual educational space of a university, represented by a technical component, a technological component, specific pedagogical means of communication); criteria and evaluation block for diagnosing competencies, basic qualities, evaluation scales for pedagogical examination; the result as a system-forming factor.

A pedagogical logical-semantic model of organizing e-learning in a university has been developed, which includes lower-level models: a model of the educational space of a university as a set of educational situations of various levels; a model of the educational environment of a university, which is a set of management decisions that ensure guaranteed achievement of the individual educational goal by the student; an individual educational trajectory of a student, which is a set of directed transition graphs in the space of educational situations under the influence of management decisions optimized for time and other parameters affecting the effectiveness of the educational process. The model of the educational space of a university is substantiated based on the individual educational goal of the student and the need to use mathematical methods of "fuzzy logic" for its modeling. An algorithm for the practical implementation of the pedagogical logical-semantic model of organizing e-learning in a university by means of computer technology has been developed. New relevant areas of activity for teachers, tutors, designers of pedagogical situations and expert specialists as organizers of the educational process of e-learning in a university have been identified, ensuring guaranteed achievement of the set individual educational goal by the student. The main types of electronic educational content with a modular structure, consisting of many typical or "standard" pedagogical situations, information resources and other materials have been developed, taking into account the features of information presentation when organizing the process of e-learning in a university.

The procedure of pedagogical examination as a system for predicting the achievement of an ideal result has been scientifically substantiated and the algorithm for its implementation has been described: selection of expert specialists from a wide range of specialists using the "snowball" method; determination of the optimal number of experts in the expert group; extraction of expert knowledge; processing, formalization, checking for consistency, as well as assessing the level of their consistency.

A diagnostic toolkit for predictive pedagogical assessment has been developed, including criteria for assessing the compliance of the individual educational goal of the student with the requirements of the state and society, its correction taking into account promising, in-demand competencies in the future, levels of their development, development of quantitative and relative scales of basic qualities of competencies included in the individual

educational goal of the student. Guaranteed achievement of the individual educational goal by the student is ensured by systematic correction of the educational trajectory as a result of pedagogical support in the virtual educational space

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