ПЕДАГОГИКА И ДИДАКТИКА ИНФОРМАТИЗАЦИИ
PEDAGOGY AND DIDACTICS IN INFORMATIZATION

Methodological approaches to the formation of a teacher's digital competence

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Abstract. *Problem and goal.* Digital transformation in education requires a new approach to traditional teaching methods and leads to an accelerated change in methods and forms of education. The study and selection of the possibilities of effective networked environments in the creation of digital educational content today is becoming one of the main needs for educators. This highlighted the need for highly qualified educators who have developed digital competencies and lifelong learning skills that creatively combine continuous professional growth. In this regard, it is important to determine the methodological foundations for the formation of digital competence of teachers. The purpose of the study is to concretize the features of methodological approaches to the formation of teachers' digital competence. *Methodology.* General theoretical research methods were used: study and analysis of theoretical literature data; systemic structural analysis; concretization of the role of approaches to the formation of digital competence of teachers. The analysis of the features of methodological approaches to the formation of digital competence of teachers. *Results.* The research deals with the problem of the formation of digital competence of teachers. It is shown that the need for the development of digital competence is touched upon in many scientific works, but is not sufficiently disclosed in domestic scientific and practical research. The systematic, activity-based, axiological, personality-oriented approaches to the formation of digital competence is presented. Based on the analysis of the relevant literature, the advantages of the selected approaches in the formation of digital competencies of teachers, their main characteristics were identified. *Conclusion.* The approaches used as the methodological basis of the research, not only do not contradict each other, but also complement each other, act as a basis for constructing a concept and a structural-meaningful model of the formation of the teacher's digital competence.

Keywords: digitalization, SAMR model, digital competence of a teacher, system approach, activity approach, axiological approach, personality-oriented approach

Методологические подходы к формированию цифровой компетентности учителя

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Аннотация. *Проблема и цель.* Цифровая трансформация в образовании требует нового подхода к традиционным методикам обучения и приводит к ускоренному изменению методов и форм обучения. Изучение и выбор возможностей эффективных сетевых сред при создании цифрового образовательного контента сегодня становятся одной из главных задач для работников сферы образования. Для этого необходимы высококвалифицированные педагоги, у которых сформированы цифровые компетенции и навыки обучения в течение всей жизни, творчески подходящие к постоянному профессиональному росту. В этой связи важным является определение методологических основ формирования цифровой компетентности учителей. Целью исследования стала конкретизация особенностей методологических подходов к формированию цифровой компетентности учителей. *Методология.* Использованы общетеоретические методы исследований: изучение и анализ литературных данных теоретической направленности; системно-структурный анализ; конкретизация роли подходов к формированию цифровой компетентности учителей. Проведен анализ особенностей методологических подходов к формированию цифровой компетентности учителей. *Результаты.* Рассмотрена проблема формирования цифровой компетентности учителей. Показано, что необходимость развития цифровой компетентности затрагивается во многих научных работах, однако недостаточно раскрыта в отечественных научно-практических исследованиях. Представлены системный, деятельностный, аксиологический, личностно-ориентированный подходы к формированию цифровой компетенции. На основе анализа соответствующей литературы определены преимущества выбранных подходов в формировании цифровых компетенций учителей, их основные характеристики. *Заключение.* Подходы, используемые в качестве методологической основы исследования, не только не противоречат, но и дополняют друг друга, выступают в качестве основы для построения концепции и структурно-содержательной модели формирования цифровой компетентности учителя.

Ключевые слова: цифровизация, модель SAMR, цифровая компетентность учителя, системный подход, деятельностный подход, аксиологический подход, личностно-ориентированный подход

Problem and goal. The Internet and digitalization, reflecting the nature of the fourth industrial revolution, are not the only revolutionary technologies affecting the mechanisms of economic and social development. Several turning points have taken place in the world since the 18th century: the so-called first industrial revolution gave us the locomotive that led to the mechanization of the world; the second industrial revolution brought electricity, making mass production possible; the third used information technology to automate daily activities and increase the computing power available to humans [1].

The need for professional pedagogical activity in the context of the development of digital technologies is determined by the aspiration of the teacher to the level of "an educated person who is ready to live a full life in society" through continuous professional growth and rapid adaptation of educational methods to change the potential of digital technologies. The content of education must be updated and reflect the changes in civilization, and comprehensive general education, science and humanities is a necessary, but not sufficient condition for survival in the digital economy. Consequently, as a result of this education, solid knowledge, skills and abilities in mathematics, computer science and technology are required, including digital literacy, design and algorithmic thinking. It is necessary to develop students' ability to read, collaborate, think critically, communicate, create something new.

According to T.V. Nikulina and E.B. Starichenko, digitalization in education is necessary to ensure the continuity of the learning process (lifelong learning), as well as big data in learning, virtualization, virtual and augmented reality (VR, AR), cloud computing, mobile technologies, etc. advanced teaching technologies, including the use of advanced teaching technologies.

Digital transformation has had a diverse impact on primary and secondary education, especially in logistics, educational programs and teaching methods, and has led to the emergence of assistive technologies for people with disabilities or learning disabilities that fostered inclusiveness and equal education (https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52010DC0636). Teachers are increasingly experimenting with digital-based teaching methods and using them in their curricula. Teachers often use digital tools and pedagogical software to prepare and deliver lessons and improve interaction.

It is important to divide investments in the digital transformation of the school into four directions, subordinating them to each other, from the first to the fourth.

The first is the actual predicted and measured learning outcomes. In particular, the skills and values of the 21st century.

The second is educational technologies based on a new generation of digital technologies and solutions to achieve these results: artificial intelligence, augmented and virtual reality, gamification, distributed registration systems, cloud databases, intelligent communication and interaction systems, and much more.

The third is the skills and values of teachers, their results and self-understanding of the teaching and learning process, experimenting with children and sustainable development.

Fourth, creating a sufficient digital environment for EdTex infrastructure and digital solutions, including the next generation of digital technologies. Only these areas can provide schools with new opportunities for content. Without them, we will not be able to socialize future generations, develop skills and knowledge in the field of controlling machines and algorithms [2].

Using the SAMR model, it is possible to describe how digital technology affects teaching and learning. SAMR: Substitution, Augmentation, Modification, Redefinition. The model was introduced by Dr. Ruben Puentedura (http://www.hippasus.com/).

The model consists of four stages:

1) substitution: digital technologies replace traditional technologies (for example, typing in Word);

2) augmentation: digital technologies are becoming an optimization tool for solving educational problems (for example, current or diagnostic or final assessment using mobile applications such as Google Forms, Kahoot, Plikers, etc.);

3) modification: significant functional changes in the educational process and the interaction of its participants (for example, the use of mixed learning technologies);

4) redefinition: setting and solving new pedagogical problems that have not been solved before.

The leading functions of a teacher in a digital environment are:

– development of training forms, methods, working materials, as well as diagnostic and formative assessment tools and, on this basis, the creation of a local educational environment for a specific training course, rich in development opportunities;

– development of scripts for lessons based on various, dynamic forms of organizing educational activities and the optimal sequence of using digital and non-digital technologies;

– organization of individual and team activities (including individual, project, distribution and network) activities of students in the digital educational environment;

– design and organization of important conditions for educational communication, including network conditions;

– organizing a reflective discussion of important personal experiences;

– the formation and development of critical thinking in the process of searching and selecting information in the digital environment;

– management of student learning motives, including the use of facilitation tools in group work, as well as management as a carrier of the role images of "successful adult" and "successful professional;"

– integration of various living spaces of the digital generation – virtual and real, supporting the development of the student in the real social and professional world;

– regular constructive communication with other teachers working with students (study group, project group, etc.) [3].

Digital pedagogical competence is associated with learning, skills in the use of digital technologies that allow professionals to work with modern information

and communication technologies, computers, software applications and databases, helping to implement ideas and tasks in their work [4].

In this regard, the study of the formation of digital competencies of school teachers is based on the definition of a methodological strategy for scientific research. Methodology is a sign of the scientific organization of any activity.

In pedagogy, methodology acts as a field of scientific knowledge in two aspects – a system of knowledge and a system of action. This applies to two types of activities – methodological research and methodological support. Methodological research is indirectly related to pedagogical practice. Their tasks: to identify the patterns and trends in the development of pedagogical science associated with practice, to determine the principles of increasing the efficiency and quality of pedagogical research, to analyze their conceptual composition and methods. The term "methodological action" refers to knowing how to formulate a research topic, solve a problem, make assumptions about the logic of research, and so on [5].

Methodology. General theoretical research methods were used: the study and analysis of literary data of a theoretical orientation; system-structural analysis; concretization of the role of approaches to the formation of digital competence of teachers. The analysis of the features of metological approaches to the formation of digital competence of teachers is carried out.

The term "approach" is used to refer to a set of ideas, principles, methods that form the basis of problem solving. Methodological approaches are considered as one of the methodological concepts, along with such concepts as "method", "program", "algorithm". All of them are the basis for describing scientific activities leading to scientific knowledge. Any methodological approach to learning describes the goals of learning, the content and organization of the educational process, the assessment of educational results through a set of general principles. Today it is obvious that the modern model of education is being developed and implemented on the basis of the above methodological approaches, which harmoniously interact and complement each other [6].

Results and discussion. Let us highlight the methodological approaches underlying the formation of teachers' digital competence.

Systems approach. The term "system" is used in the scientific literature in various senses. Today there are more than forty definitions of the concept of "system", considered by different authors. A lot of large monographs, a lot of articles, reviews, discussion materials, conferences are revealed, different views on the essence of the system platform are revealed, definitions of basic concepts are given.

For example, according to the definition proposed by O.V. Chukaev, a system is a set of elements that make up a functional unit and their interaction. The content of a systemic study consists of solving two main problems: 1) the problem of systemic placement of an object, the relationship of its elements, emergent properties, mechanisms of its functioning and development; 2) problems of system modeling of an object for certain properties. The solution to this problem is to create new systems or change existing systems. Systems research is conducted through the system platform, theoretical systems structures, and systems analysis.

A systematic approach is a methodological direction of research based on considering an object as a whole set of elements in a set of relations and the re-

lationship between them, that is, an object as a system. A systematic approach is a method that covers any form of organization of our activities, identifying patterns and relationships for their effective use [7].

Our research allows to study the formation of digital competence as a system, focusing on the problem, identifying the integrity of the formation of digital competence and providing its mechanisms, identifying the types of communication of its components and bringing them together into a single theoretical picture.

Therefore, a systematic approach to the formation of digital competencies of teachers allows to correctly solve the research problem and develop an effective strategy for their study. A systematic approach to the study of the formation of teachers' digital competence (the method of systems analysis) requires consideration of all phenomena and processes in the study of this problem in such categories as "relations," "communication," "interaction." The study of the relationship between the key elements in the formation of digital competencies allows to identify the factors that contribute to their formation, describe the elements, and determine the qualitative and quantitative characteristics.

Structural connections in the formation of digital competence of teachers reflect the interaction of elements of the system as a whole, and the cause-and-effect relationships of objects distinguish them from the leading object. This platform is a phenomenon of digital competence (functions of the system, relationships between them, the relationship of the system with the environment) as a process (stage of system development, quality of stages) and as an action (the result of studying an object is a model of the researcher's work with the phenomenon under study).

Working approach. According to S.L. Rubinstein, "...human action as a whole is, first of all, an impact, a change in reality; ...it is not only an effect, a change in the world and a product of certain objects, but also a social act or attitude in a certain sense of the word. Consequently, action is not an external work, but an attitude towards people, towards society, a person manifests itself in his entire being, in action.

The action platform for the formation of digital competence of teachers includes the use of forms, methods and techniques of pedagogical activity.

Axiological approach. In the modern world, the crisis of human nature has become obvious. The development of technocratic trends not only in the production sphere, but also in the context of the growth of various social aggression (extremism, nationalism, political chauvinism, neo-fascism, etc.) threatens the world with global socio-economic and political catastrophes. Humanization of all spheres of life is the only condition for productive resistance to negative trends. At the same time, the modern world inevitably gives preference to an educated person [8].

Axiology (the study of values) has a long history of formation as a deterministic theory of axiological views. "Value", being the main concept of the axiological platform, has turned into an interdisciplinary phenomenon that now unites knowledge about the development of society and requires the involvement of various scientific apparatus for its study.

According to A.G. Kalyuzhnaya, the application of the philosophical theory of values in the context of pedagogy allows to consider the content and structure of pedagogical education as a field of objective and interdisciplinary relations that unite knowledge, value attitude of teachers and students to reality. Today, in the purposeful development of the personality, the effective professional development of students, they are guided by socio-cultural values. At the individual level, the axiological approach is focused on the implementation of optimal methods of focusing pedagogical influence on modern social values.

The methodology of the platform of values E. Fromm considered "unconscious values that serve as direct motives of human behavior are values that arise from the social system of an industrial society: property, consumption, social status, entertainment, strong emotions" [9].

In general, the analysis of the value category allowed to consider the axiological approach to the education system in the context of changes in modern society [10].

In the hierarchy of educational values proposed by V. Slastenin and G. Chizhakova, dominant (knowledge, cognitive activity, cognitive activity, communication), normative (standards, moral norms), motivational (pedagogical methods, technologies, means of control), accompanying (cognitive) qualitatively oriented: reading skills, understanding of the studied objects and phenomena) values are closely related and together form the basis of pedagogical axiology.

The axiological approach to the formation of digital competence of teachers shows that the analysis of pedagogical research includes the desire to do good not only in reality, but also in the virtual world, kindness, conscience, justice, dignity, decency, responsibility, etc.

Person-centered approach. Personality-oriented platform – the direction of education, curriculum, educational institution, etc., a universal humanistic phenomenon based on respect for the rights and dignity of the child in choice. Personality-oriented approach is a program of pedagogical activity aimed at educating a personality. The personality-oriented approach is based on the creation of a certain educational system that "activates" the mechanisms of the functioning and development of the individual.

The model of person-centered education developed by V.V. Serikov, the essence of a person is reflected in his ability to take a certain position. According to the scientist, "personality-oriented education is not the formation of a personality with certain qualities, but the creation of conditions for the full expression and corresponding development of the individual functions of students" [11].

A personality-oriented approach to the formation of digital competencies of a teacher is a methodological basis based on a system of interrelated concepts, ideas and actions of a teacher that provide and support the development of self-organization processes, his individuality when introducing digital educational technologies. Means a versatile education, consisting of concepts, principles and methods of pedagogical activity; associated with the desire of the teacher to develop professional individuality, uniqueness, reflect his subjective qualities.

Conclusion. The digital transformation of education, the transition to distance learning in the context of a pandemic, impose new requirements on teachers.

They are required to be competitive and well versed in digital learning technologies, to think creatively, communicatively, and critically. The growing pedagogical potential of digital technologies in education provides students with a wide range of opportunities to provide learning content and feedback. The methodological approaches described above are based on structural and content modeling of the formation of teachers' digital competence.

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