GENERAL AND SUBJECT DIDACTICS

ЗАГАЛЬНА ТА ПРЕДМЕТНА ДИДАКТИКА

The formation of the cognitive component of students' professional thinking in the context of digital transformation of higher education

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Abstract

The article considers the ways of forming the cognitive component of students' professional thinking in the context of digital transformation of higher education. European trends that affect the quality of educational services are highlighted; attention is focused on the problems of globalisation, the use of artificial intelligence and robotics, the use of cloud technologies, which together affect the nature of human life and the peculiarities of the development of educational institutions. Among the newest ways to solve these problems, the article highlights the following: creation of a digital educational environment for professional training of specialists competitive in the employment market. It is proved that digital transformation is of great importance in the globalised world, and the modernisation of education is aimed at solving the latest global problems. The article identifies the following modern trends in information development that influence the process of digitalisation of education: development of artificial intelligence, "machine learning", neural networks; further development of mobile-oriented tools; widespread introduction of blockchain and cryptocurrency technologies; the development of cloud computing and virtualisation technologies, cloud computing technologies; the development of augmented reality and virtual reality; widespread introduction of chatbots and virtual assistants, etc. The article considers the trends of digitalisation of the educational environment in higher education institutions in Germany and Austria, including digital ecosystems, which in the form of open learning systems offer the latest design structure for using the possibilities of modern digitalisation in the network economy. It is proved that SMART-education provides new opportunities related to the use of e-learning technologies; ensures mobility and accessibility of educational information; allows the format of autonomy of the teacher and students using mobile devices in the educational process; makes it possible to provide flexible educational services in terms of individual capabilities of the master's student; provides support for individual programmes for the personal development of each student.

Keywords: professional thinking, the structure of professional thinking, the cognitive component of professional thinking, digital transformation of higher education, ways of developing digital transformation in higher education

Формування когнітивної складової професійного мислення студентів в умовах цифрової трансформації вищої освіти

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Анотація

У статті розглянуті шляхи формування когнітивної складової професійного мислення студентів в умовах цифрової трансформації вищої освіти. Виокремлено європейські тенденції, що мають вплив на якість надання освітніх послуг; закцентовано увагу на проблемах глобалізації, застосування штучного інтелекту та робототехніки, використання хмарних технологій, що в єдності впливають на характер життєдіяльності людини та особливості розвитку освітніх інститутів. Серед новітніх шляхів вирішення визначених завдань у статті виокремлено: створення цифрового освітнього середовища для професійної підготовки фахівців, конкурентоспроможних на ринку працевлаштування. Доведено, що цифрова трансформація має велике значення у глобалізованому світі, а модернізація освіти спрямована на вирішення новітніх проблем світового масштабу. До сучасних напрямів інформаційного розвитку, котрі впливають на процес цифровізації освіти у статті віднесено такі: розвиток штучного інтелекту, «машинне навчання», нейромережі; подальший розвиток мобільно орієнтованих засобів; широке запровадження технологій блокчейн та криптовалют; розвиток технології хмарних обчислень та віртуалізації, технології туманних обчислень; розроблення доповненої реальності і віртуальної реальності; широке запровадження чат-ботів та віртуальних помічників тощо. Розглянуто тенденції цифровізації освітнього середовища у закладах вищої освіти Німеччини та Австрії, до яких віднесено цифрові екосистеми, котрі у формі відкритих систем навчання пропонують новітню структуру дизайну для використання можливостей сучасної цифровізації в мережевій економіці. Доведено, що SMART-освіта забезпечує нові можливості, що пов'язані із використанням технологій електронного навчання; забезпечує мобільність і доступність навчальної інформації; дозволяє формат автономності викладача й студентів з використанням мобільних пристроїв в навчальному процесі; уможливлює гнучкість надання освітніх послуг точки зору індивідуальних можливостей магістранта; забезпечує підтримку індивідуальних програм щодо індивідуального розвитку кожного здобувача освіти.

Ключові слова: професійне мислення, структура професійного мислення, когнітивна складова професійного мислення, цифрова трансформація вищої освіти, шляхи розвитку цифрової трансформації у вищій освіті

Statement of the problem. An urgent problem of creating a modern educational environment of a higher education institution is its digital transformation, as Ukraine has moved into a new era of digitalisation of all spheres of public life. The main factors that led to this transformation were the processes of integration and globalization, new requirements related to the development of society, which in their unity determined the current requirements for the exchange of information, its transformation and storage, as well as the peculiarities of the educational process in difficult conditions of war. An important factor determining the development of modern higher education is European integration, which requires the coordination of Ukrainian and European higher education standards, and above all, the digitalization of the educational environment in educational institutions. European integration processes in the national higher education suggest the implementation of the advanced nature of education development, a high level of professional training and competitiveness of future specialists in the European labor market, which requires the creation of an innovative model of the information and educa-

tional environment. In this context, the study of the problem of developing the cognitive component of professional thinking of students in the digitalized society is relevant and appropriate.

Analysis of recent research and publications. The problem of the formation of the cognitive component of students' professional thinking in the context of the digital transformation of higher education has been studied by the following Ukrainian scientists: O. Akimova, M. Sapohov, Ya. Hapchuk (digital transformation of the educational environment of higher education institutions in German-speaking countries); M. Sapohov (formation of professional competence of masters by means of smart technologies); O. Akimova, L. Dudikova, A. Kolomiets, Yu. Ostraus (formation of the cognitive component of professional and communicative culture); Ya. Hapchuk (digital transformation of the educational environment of higher education institutions in German-speaking countries); D. Matiiuk (the development of lifelong learning in German-speaking countries); S. Nahorniak (debates as a method of formation of professional thinking).

The purpose of the article is analysis of different ways of forming the cognitive component of students' professional thinking in the context of digital transformation of higher education.

Summary of the main material. Rapid changes typical of innovative development of social and educational institutions actively influence the professional training of future teachers. The challenges of the twenty-first century transform the goals and objectives of the entire education sector and each individual higher education facility as an important social institution, and the modernization of the education sector involves the use of the latest ways to solve these problems. Among the European-level tendencies that influence the formation of the quality of educational services, scientists identify globalization, the use of artificial intelligence, robotics, and cloud technologies, which together affect the nature of human life and the peculiarities of the educational institutions development. Among the newest ways to solve these problems, scientists and educators point to the creation of a digital educational environment for the professional training of specialists who are competitive in the labor market. Thus, digital transformation is of great importance in the globalized world, and the modernization of education is aimed at solving the latest global problems. These processes are gaining great influence on the devel-

opment and updating of theoretical approaches to the functioning and constant development of national education systems. The organization and implementation of digitalization in the educational process is based on the environmental approach aimed at the personal and professional development of teachers, especially by means of information support and the use of cloud technologies, which together change the nature of the cognitive activity of the individual and determine the peculiarities of the functioning of educational institutions. Scientists identify the continuing development and improvement of the digital educational environment of a higher education institution for the purpose of training the specialists as one of the innovative ways to solve the tasks (Sapohov, 2021).

Scientists O. Akimova, L. Dudikova, A. Kolomiets, Yu. Ostraus, who studied the problem of forming the cognitive component of the professional and communicative culture of future family doctors by means of the information and educational blog, argue that the cognitive component of the professional and communicative culture of future family doctors covers several elements, namely: linguistic competence - knowledge of the state and foreign language at the phonetic, lexical, grammatical, syntactic and stylistic levels; communicative knowledge – generalized experience in communicative activity, reflection in the consciousness of communicative situations in their cause-and-effect relations and relationships, which is the basis for any communication; ethical and etiquette knowledge - knowledge of professional ethical norms, rules of language etiquette. Improving the professional and communicative culture of future family doctors is an urgent task of higher medical education, due to the social demand of modern Ukrainian society for a family doctor who not only has a wide range of professional knowledge, skills and abilities, but also certain personality traits, communicative knowledge, skills, and a culture of communication that ensure success (Akimova, 2013). Let's briefly outline the goals and content of each section of the blog defined by the authors. The main page of the blog was used to draw students' attention to the problem of professional communication of doctors, to increase their interest and motivation to learn English, and to encourage them to use English for self-education and self-development. In order to achieve this aim, the page is being constantly updated with new posts, which can be divided into several types according to their purpose. The first type is motivational posts that highlight the

significant role of communication in the professional activities of doctors, emphasize the need to develop their professional and communicative culture, and focus on the need for medical students to learn English. The second type includes articles that aim to increase students' curiosity about their future profession with interesting facts about people, medicine, communication, languages, and the English language. The third type is professional posts, which provide text and video material on topics studied in the disciplines of Foreign Language and Foreign Language for Professional Purposes. These posts, in addition to attracting students' attention and motivation, can also improve the teaching of these disciplines, as the videos presented in them provide visualization of educational information and can be used in the classroom. The fourth type includes the posts that provide information on the organization of students' individual work in the discipline, encouraging them to self-education and self-development. For example, such articles recommend online explanatory dictionaries, textbooks for self-study of English grammar, or online resources containing English-language medical educational texts or medical scientific articles for students (Akimova, et al., 2020).

The "Pedagogical insight" was used to form the cognitive component of the development of professional thinking by the researchers O. Akimova, O. Slushnyi, A. Kolomiets, E. Hromov, N. Khamska (Slushny, et al., 2020).

The problems of digital transformation of the educational environment have been studied by V. Bykov, who, in his article "Digital Transformation of Society and Development of the Computer Technology Platform of Education and Science of Ukraine" analyzed the development of the national education and science system, taking into account the possibilities of its digitization in the context of globalization problems. Digitalization of education, as stated in the "Concept for the development of the digital economy and society of Ukraine for 2018-2020", is one of the stages of its informatization and implies filling the educational environment with electronic and digital means and devices, providing the necessary electronic communication exchange, which enables the integrated interaction of the physical and virtual, thus creating a cyber-physical educational space. V. Bykov lists the following trends in information development that influence the process of digitalization of education: the development of artificial intelligence, machine learning, neural networks; further development of mobile-oriented tools; widespread application of blockchain and cryptocurrency technologies; development of cloud computing and virtualization technologies, fog computing technologies; the development of augmented reality and virtual reality; widespread application of chatbots and virtual assistants, etc (Hurevych, 2005). New tendencies in the digitalization of the educational environment in higher education institutions in Germany and Austria include digital ecosystems, which, in the form of open learning systems, offer the most recent design structure for using the opportunities of modern digitalization in the net-work economy. The educational processes in the ecosystem provide individualized learning design, personalized learning based on intelligent systems, and a stronger link between scientific research and learning (Akimova, et al., 2022a). The consequences, risks, and potential of digitization and its interdependence on human actions, cause-and-effect processes, the nature of digital processes, and algorithmic control are often understood only by experts, so the problem of continuing digitization is excluded from the broader social debate, but it affects all the areas of the educational activity. Existing infrastructures for the digital society and their design are currently highly widespread, but their capabilities for acquiring knowledge and skills are being developed individually or within specific groups. This also applies to expert organizations, such as universities, although during the so-called "Corona-Semester" they quickly moved learning, teaching, and scientific activities into the digital space. In the German scientific discourse, several approaches to understanding the category of digital education are considered, so we believe it is appropriate to briefly highlight their main models (Akimova, et al., 2022b).

1. Teaching and learning model – digital education is included in both the educational process and its results, which requires appropriate learning conditions and the availability of related digital tools, resources and data; organization of activities and communication; consideration of social and cultural conditions, tools and resources and their importance in the educational process, which distinguishes this model from purely analog forms of education. Digital academic learning organized in this way includes digital media (content), it is based on algorithmic and methodological principles, and is evaluated in terms of

added value compared to traditional analog approaches.

2. The Research and Information Transfer Model – involves the application and analysis of the potential of digitalization for cognitive activity, the ability to use big and small data, and facilitates the use of artificial intelligence in education, its mechanisms and potential. The model serves to create knowledge and innovations in disciplines, fields of study and interdisciplinary research areas, in teaching, information transfer, management and internationalization of knowledge in general, as well as in digital innovations, which have to be fully developed. This process is carried out on the basis of scientific theories and an understanding of responsibility for overcoming major educational challenges. Thus, digital education takes place at the professional and interdisciplinary as well as cross-curricular levels in research, learning and teaching (Akimova, Sapohov, & Romashchuk, 2023).

3. The model of professional growth is based on the value of high qualification, constant improvement of its level, expansion of rights and opportunities for digitization of educational activities, it provides for the implementation of all components in full. The leaders of the educational process take responsibility for the high-quality preparation of students for their future professional and personal life, for expanding opportunities in the process of studying disciplines and participating in all areas of the university's activities, and for ensuring digital sovereignty. Digital education provides continuous, dynamic and change-responsive, technical, scientific and professional training for effective individual development, critically reflective use of digital tools, resources and data.

4. Digital competence model. Digital education facilitates the development of competencies based on knowledge embedded in time and culture. The social and individual development of the individual becomes possible, among other things, through the acquisition of the necessary skills of reflection and work in the digital environment and the world. Thus, in this model, digitalization is viewed as a process and a result that promotes individual development in a socially determined context.

5. Individuality and diversity model. In this model, digital education takes into account the starting points of different types of learning, professional requirements, and previous experience particular to each generation. The perspective of learning is fo-cused on the result in the form of developed competencies based on the use of digital technologies, taking into account the subjective background that affects the acquisition of skills (Profesiine stanovlennia osobystosti maibutnoho vchytelia: monohrafiia. 2018).

6. A model for creating a modern educational environment at the university. Digital education in this model is based on an integrated digital infrastructure that combines resources, tools and information into a powerful digital ecosystem (Akimova, et al., 2022a; Akimova, et al., 2023).

The main tasks of the information and educational environment in accordance with the principles of the environmental approach include the following: organization of educational activities of students using e-learning tools, development of skills in the use of information technologies in professional activities, and the main functions include educational, developmental, nurturing, reflective and informational. The educational function involves the implementation and monitoring of the educational process; its value depends on the integrity and awareness of the acquired special knowledge and skills, as well as the experience of creative activity. The expanding function of the information and educational environment involves the development of the motivational, intellectual and emotional areas of the student's personality during the period of preparation for professional activity (Profesiine stanovlennia osobystosti maibutnoho vchytelia: monohrafiia. 2018). The effectiveness of this function depends on the qualitative selection of didactic, technological and information resources and the ability to engage students in interactive activities as subjects of the educational process. The nurturing function is focused on the formation of the outlook, life and professional values and ideals of students, their interests and motives, moral and aesthetic views. The informational function is related to the quality of educational and scientific information, its storage and use to meet the needs of all subjects of the educational process, and its result should be the formation of the ability to effectively interact with information using ICT. The reflexive function is aimed at promoting the processes of self-development and self-improvement of the subjects of the information environment (Akimova, et al., 2023). The scientific literature also presents the main criteria for the effective functioning of the educational environment, which include the

following: 1) conceptual and content assurance (teaching and methodological complexes, innovative work programs); application of the experience of domestic and foreign educational innovations; theoretical justification of the goals and objectives of specialists training; cognitive activity, understood as the ability and willingness of students to apply theoretical, methodological and organizational skills to complete the tasks of the curriculum; 2) information and communication assurance, which provides for the available methodological literature, periodicals, access to global educational networks, implementation of distance learning and available electronic manuals; professional skills, i.e. the ability to implement the latest approaches to educational activities; professional reflection and self-control of own experience (Akimova, et al., 2022b).

The cognitive component of professional thinking includes critical thinking, which is viewed as a complex process that begins with familiarization with information and ends with making a specific decision, and consists of several sequential steps: analyzing different points of view, choosing one's own point of view; comparing with other points of view; selecting arguments to support the chosen position; making decisions based on evidence. Creative thinking is independent, analytical, logical, and social thinking is aimed at optimal problem solving and development of one's own solutions. It has its own structure (problem statement, information search, clear reasoning, decision making) and implies the use of intellectual and communication skills. The work of a teacher should be aimed at teaching students to express and prove their opinions and build constructive relationships with others. The development of critical and creative thinking helps to prepare a new generation of specialists who are able to argue, communicate, collaborate and generate new ideas (Akimova, & Shamanska, 2022).

D. Matiiuk has studied the tendencies of lifelong learning development in German-speaking countries of Europe. The author underlines its importance for the personal and professional development of the personality and singles out perspective directions of extrapolation in the education system of Ukraine, which can have a positive impact on the development of professional thinking of the student in the context of digital transformation of higher education (Matiiuk, 2017; Matiiuk, 2020).

The scientists O. Akimova, M. Sapogov, Y. Hapchuk considered modern approaches to the study and use of SMART technology in the preparation of masters. Special importance is now being attached to intelligent technologies in the field of master's training, which are aimed at enhancing the efficiency of the educational process and improving the quality of the educational services provided. SMART-education provides new opportunities related to the use of e-learning technologies designed for remote learning; enables the transition from one platform to another; ensures mobility and accessibility of educational information; allows the format of autonomy of the teacher and students using mobile devices in the educational process; makes it possible to provide educational services in terms of individual capabilities of the master's student; provides support for individual programs for the individual development of each student; use of the latest motivational learning models; constant consideration of the requirements of stakeholders and employers regarding the content of educational programs (Sapohov, 2021). The authors also consider new approaches to the study of SMART technologies in the professional training of master students, which include, in particular: the interpretation of informatization of education as an important feature of its development, which provides a new worldview and reassessment of the values in the labor market; knowledge, which is considered a commodity in the information society, becomes more important with the development of Smart education. Higher pedagogical education at the master's level responds to global trends in social development and is ready to apply the concept of Smart education, the conceptual basis of which includes the ideas of: mobile access to digital educational services; acquisition of new knowledge as the main way to modernize the social sphere; creation of SMART methodological support and IT environment identical to natural intelligence, which serves as the main concept of smart education (Akimova, et al., 2023; Akimova, et al., 2022b).

It is worth noting that not only formal but also non-formal education is important for the formation of students' professional thinking in the context of digital transformation of higher education. Therefore, it is important to study the experience of the leading countries of Europe in this direction. For example, the innovative experience of Germany in the development of non-formal education, in particular the projects "Learn to teach German" (German

"Deutsch Lehren Lernen"), "Children's Digital University" (German "Digitale Kinderuni"), "German Teens' Digital University", (German "Deutsche Digitale Junioruni"), "Content and Language Integrated Learning", studied by D. Matiiuk, can be valuable for the extrapolation into the educational and scientific space of Ukraine. The participation of students in the projects mentioned above can have a positive effect on the professional thinking of the students and can motivate them to continuing professional development (Matiiuk, 2020).

As a result of critical analysis of the scientific literature, we can conclude that professional thinking is a type of thinking that allows problem solving, conceptual analysis, use of reasoning paths, recognition of abstract structures, distinguishing between two situations, and making logical decisions through various comparisons and conclusions. Professional thinking also demonstrates similarities and differences with other types of thinking. The most commonly used types of thinking associated with professional thinking are critical, creative, systematic, reflective, and analytical thinking. Blended learning is called the "third generation" of distance education systems (Akimova, & Nahorniak, 2023). In general, blended learning refers to any combination of learning methods, mostly including face-to-face learning through asynchronous and/or synchronous computer technologies. Hybrid learning is another term that was used as a synonym for blended learning. The educational technologies used in blended learning can be in the form of learning management systems (LMS), such as Edmodo, Moodle, Schoology, and others. LMS is an online learning platform that utilizes access to the Internet. LMS is widely used to make online learning easier in blended learning for all subjects. According to the research, blended learning has become a good way for students to develop logical thinking skills. Blended learning is a suitable teaching method to overcome the challenges of face-to-face learning that are time constrained. In addition, blended learning allows students to learn with different resources at their own pace. The learning environment in blended learning contributes to the development of professional thinking through such parameters as: support for independent learning, support for collaborative learning, discussion, practice and performance, support for feedback, and knowledge construction (Kartolapov, et al., 2021). Among the motivational factors for the successful development of students' professional thinking in the process of blended learning, it can be noted that the learning environment promotes the development of professional thinking not only during online sessions, but also in the process of asynchronous work. In addition, blended learning can support students in discussion without being limited by time. This method provided an opportunity for all students to actively participate in the discussion, do self-reflection, and collaborate with other students to expand their understanding of the learning material, evaluate the topic with other students, and build their understanding on the learning materials, exploring questions and explaining ideas (Akimova, Sapohov, & Koval, 2023).

Conclusions. Thus, the formation of the cognitive component of students' professional thinking in the context of the digital transformation of higher education has its own peculiarities and implementation ways. Among the newest ways to solve these tasks is the creation of a digital educational environment for the professional training of specialists who are competitive in the employment market. Digital transformation is of great significance in the globalized world, and the modernization of education is aimed at solving the latest global problems.

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