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Дементьєва Тетяна Іванівна, кандидат педагогічних наук, доцент кафедри педагогіки, іноземної філології та перекладу Харківського національного університету економіки імені Семена Кузнеця, м. Харків, тел.: +38(050) 702-18-3, <https://orcid.org/0000-0001-8855-7556>

ЦИФРОВА КОМПЕТЕНТНІСТЬ ВИКЛАДАЧА ВИЩОЇ ШКОЛИ: СТРУКТУРА ТА ШЛЯХИ РОЗВИТКУ

Анотація. У статті здійснено теоретичний аналіз проблеми цифрової компетентності викладача вищої школи в умовах цифрової трансформації сучасної освіти. Обґрунтовано актуальність розвитку цифрової компетентності як однієї з ключових складових професійної компетентності викладача в умовах поширення цифрових технологій, дистанційного та змішаного навчання, а також активного впровадження технологій штучного інтелекту у сферу вищої освіти. Проаналізовано сучасні наукові підходи до трактування поняття «цифрова компетентність викладача вищої школи» та визначено основні тенденції його розвитку. Встановлено, що більшість дослідників розглядають цифрову компетентність як складне інтегративне утворення, яке поєднує технологічні, педагогічні, комунікативні, етичні, когнітивні та рефлексивні компоненти професійної діяльності викладача.

У статті здійснено порівняльний аналіз понять «ІКТ-компетентність» та «цифрова компетентність», визначено їх спільні та відмінні характеристики. Доведено, що цифрова компетентність є значно ширшим поняттям, оскільки охоплює не лише технічні навички використання цифрових технологій, а й здатність до критичного мислення, цифрової комунікації, створення цифрового контенту, безпечного та етичного використання цифрових ресурсів, адаптації до технологічних змін та безперервного професійного розвитку.

На основі аналізу сучасних досліджень охарактеризовано структурні компоненти цифрової компетентності викладача вищої школи та визначено основні шляхи її розвитку. Зазначається, що розвиток цифрової компетентності викладачів вищої освіти слід розуміти як стратегічний напрямок модернізації вищої освіти, що сприяє підвищенню якості освіти, сприянню педагогічним інноваціям та підготовці як викладачів, так і студентів до успішної участі в цифровому суспільстві. Також встановлено, що ефективний розвиток цифрової компетентності потребує безперервного професійного навчання, інституційної підтримки, участі у професійних спільнотах, співпраці та активного впровадження цифрових технологій і штучного інтелекту в освітній процес.

Ключові слова: цифрова компетентність, викладач закладу вищої освіти, цифрові технології, цифрова трансформація освіти, ІКТ-компетентність, професійний розвиток, цифрова педагогіка, штучний інтелект.

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Dementieva Tetiana Ivanivna, PhD in Pedagogy, Associate Professor, Associate Professor of the Department of Pedagogy, Foreign Philology and Translation, Simon Kuznets Kharkiv National University of Economics, Kharkiv, tel.: +38(050) 702-18-3, <https://orcid.org/0000-0001-8855-7556>

DIGITAL COMPETENCE OF HIGHER EDUCATION TEACHERS: STRUCTURE AND DEVELOPMENT PATHWAYS

Abstract. The article presents a theoretical analysis of the problem of digital competence of higher education teachers in the context of the digital transformation of contemporary education. The relevance of developing digital competence is substantiated as one of the key components of a teacher's professional competence under the conditions of widespread digital technologies, distance and blended learning, as well as the active implementation of artificial intelligence technologies in higher education.

Contemporary scientific approaches to interpreting the concept of "digital competence of a higher education teacher" are analyzed, and the main trends in its development are identified. It is established that most researchers consider digital competence as a complex integrative construct that combines technological, pedagogical, communicative, ethical, cognitive, and reflective components of a teacher's professional activity.

A comparative analysis of the concepts "ICT competence" and "digital competence" is carried out, and their similarities and differences are defined. It is demonstrated that digital competence is a significantly broader concept, as it encompasses not only technical skills in using digital technologies, but also the ability for critical thinking, digital communication, digital content creation, safe and ethical use of digital resources, adaptation to technological change, and continuous professional development.

Based on the analysis of contemporary international studies, the structural components of digital competence of higher education teachers are characterized, and the main pathways for its development are identified. It is noted that the development of digital competence of higher education teachers should be understood as a strategic direction of modernization of higher education, which contributes to improving the quality of education, promoting pedagogical innovations and preparing both teachers and students for successful participation in the digital society. It is also established that the effective development of digital competence requires continuous professional training, institutional support, participation in professional communities, cooperation and active implementation of digital technologies and artificial intelligence in the educational process.

Keywords: digital competence, higher education teacher, digital technologies, digital transformation of education, ICT competence, professional development, digital pedagogy, artificial intelligence.

Problem statement. The rapid digital transformation of higher education has significantly changed the requirements for teaching and learning processes. The integration of digital technologies, including artificial intelligence, has expanded the professional roles of university teachers, making digital competence a fundamental component of their professional activity.

However, despite the increasing expectations placed on educators, numerous studies indicate a gap between the required level of digital competence and the actual readiness of teachers to effectively integrate digital technologies into pedagogical practice. In many cases, the use of digital tools remains superficial and is not supported by appropriate pedagogical strategies.

Furthermore, the lack of a unified approach to defining the structure of digital competence and insufficient attention to effective pathways for its development create additional challenges for higher education institutions.

Thus, a contradiction arises between the growing demands for the digital competence of higher education teachers and the insufficient theoretical and methodological elaboration of its structure and development mechanisms. This determines the need to study the structure of digital competence of higher education teachers and to identify effective ways of its development.

Analysis of the latest studies and publications. Allan Martin is considered one of the pioneering scholars in the field of digital literacy and digital competence in education. His research significantly contributed to the theoretical understanding of how digital technologies influence learning, teaching, communication, and professional development in modern society.

Allan Martin focused on the concept of digital literacy as a complex and multidimensional phenomenon that goes beyond the ability to use computers or digital devices. He argued that digital literacy includes cognitive, social, critical, and ethical dimensions of technology use. According to Martin, a digitally competent individual should not only possess technical skills but also be able to critically evaluate information, communicate effectively in digital environments, create digital content, and participate actively in the knowledge society.

One of his most influential contributions was the development of a conceptual framework of digital literacy, presented in his work «DigEuLit: Concepts and Tools for Digital Literacy Development». In this research, Martin examined digital literacy as an essential competence for lifelong learning and professional activity in the information society. He emphasized that digital competence should support personal development, social inclusion, employability, and active citizenship.

A particularly important aspect of Martin's work was his attention to educational contexts. He explored how educators and students develop digital competence through meaningful interaction with digital technologies rather than through isolated technical training. His research laid the theoretical foundation for later studies on teachers' digital competence and digital pedagogy [7].

Jan van Dijk is considered one of the earliest scholars to systematically conceptualize digital skills within the broader framework of digital inequality. In his work «The Deepening Divide: Inequality in the Information Society», he moved

beyond the simplistic understanding of the “digital divide” as mere access to technologies and proposed a more complex, multi-level model of inequality in the digital society. According to his approach, digital inequality consists of four interrelated dimensions: motivational access (the willingness to use digital technologies), material access (physical availability of devices and internet), skills access (digital skills), and usage access (differences in how technologies are used). Particularly significant for the development of later research on digital competence is van Dijk’s identification of “skills access” as a separate and crucial dimension. He argued that even when individuals have access to digital technologies, effective participation in the information society depends on their ability to operate, understand, and strategically use these technologies. This shift in focus from access to competencies laid the conceptual foundation for later interpretations of digital competence as a structured and measurable construct.

Although van Dijk did not specifically focus on higher education teachers, his theoretical contribution became fundamental for subsequent pedagogical research. His model influenced later studies that moved from general digital skills to more specialized frameworks of professional digital competence, including those applied to educators [14].

Matthew J. Koehler is one of the most influential scholars in the field of educational technology and digital pedagogy. Together with Punya Mishra, he developed the TPACK model (Technological Pedagogical Content Knowledge), which became a fundamental theoretical framework for understanding how digital technologies can be effectively integrated into teaching and learning processes, particularly in higher education.

In their seminal work published in 2006, Koehler and Mishra argued that effective technology integration in education requires more than basic technical skills. Koehler and Mishra particularly focused on the idea that educators should not simply add technologies to traditional teaching methods. Instead, they should redesign learning environments by considering how technologies influence pedagogical strategies and subject content simultaneously. The researchers also examined how teachers develop digital competence through practical experience, collaborative design, experimentation, and reflective teaching practices.

Their work significantly influenced later studies on teachers’ digital competence, digital pedagogy, online learning, and professional development in higher education. The TPACK framework is now widely used in teacher education programs, digital competence assessment, and research on innovative teaching methods worldwide [9].

Jo Tondeur is a prominent researcher in the field of educational technology, teacher education, and digital competence. His scholarly work primarily focuses on the integration of digital technologies into teaching and learning processes, as well as on the development of teachers’ digital competencies in higher education and teacher training systems.

Jo Tondeur’s research emphasizes that effective integration of digital technologies in education depends not only on access to technological tools but also

on educators' pedagogical readiness, beliefs, professional development, and institutional support. He explored how teachers develop digital competence and how educational institutions can create conditions that foster meaningful and sustainable technology integration. A significant part of his work is devoted to the preparation of future teachers and university educators for teaching in digital learning environments. Tondeur argued that digital competence should be understood as a combination of technological, pedagogical, communicative, and reflective skills that enable educators to use digital technologies critically, creatively, and effectively in professional practice.

One of his important contributions is the development of the Higher Education Digital Competence framework, created in collaboration with other researchers. This framework specifically addresses the digital competencies required for higher education teachers.

The framework also highlights the importance of reflective practice, collaboration, innovation, and adaptability in digital higher education. Tondeur and his colleagues emphasized that university teachers need not only technical proficiency but also the ability to redesign pedagogy according to the demands of digital transformation in higher education [13].

The aim of the article is to theoretically substantiate the structure of digital competence of higher education teachers, identify its main components, and characterize effective pathways for its development in the context of the digital transformation of modern education.

Presentation of the main material. In contemporary research, the digital competence of higher education teachers is regarded as a multidimensional and dynamic construct that encompasses knowledge, skills, attitudes, and the ability to effectively use digital technologies in the educational process. At the same time, there is no single universally accepted definition of this concept in the scientific literature, however, a number of stable theoretical and empirical approaches have emerged that define its content and structure.

One of the most widely cited approaches to understanding digital competence is presented in the works of Anusca Ferrari. Digital competence is defined as a combination of knowledge, skills, attitudes, abilities, and strategies required for the confident, critical, creative, and safe use of digital technologies in learning, work, communication, and social participation. Ferrari emphasizes that digital competence is not limited to technical abilities alone, but also includes information management, communication and collaboration, content creation, problem solving, ethical awareness, and reflective use of digital media. Although this framework was not initially developed specifically for higher education teachers, it became a theoretical foundation for subsequent pedagogical research [4].

Jo Tondeur and Sarah Howard in the study «The HeDiCom Framework: Higher Education Teachers' Digital Competencies for the Future» define digital competence of higher education teachers as a complex and context-dependent set of professional competencies that enable educators to effectively design, implement, manage, and evaluate digital learning environments. The authors emphasize that

digital competence is not limited to technological proficiency but also includes pedagogical decision-making, adaptability, collaboration, digital ethics, and the ability to respond to rapidly changing educational technologies [13].

Another important contribution belongs to Andreia Inamorato dos Santos and colleagues. The researchers describe digital competence as the ability of university academics to critically, creatively, and responsibly use digital technologies for teaching, assessment, communication, professional collaboration, and continuous professional development. The study highlights that digital competence integrates technological, pedagogical, and organizational dimensions and should be considered a core professional competence of academics in modern higher education [5].

In the meta-analysis by Marta Liesa-Orus et al., digital competence of university lecturers is interpreted as a multidimensional construct combining digital literacy, pedagogical integration of technologies, communication skills, information management, and reflective teaching practices. The authors stress that effective digital competence requires not only technical skills but also the ability to create student-centered digital learning environments and adapt teaching strategies to digital educational contexts [6].

Recent studies also increasingly associate digital competence with the use of artificial intelligence in higher education. In the work by Jenniffer Sobeida Moreira-Choez et al. digital competence of higher education faculty is defined as the integrated ability to use digital and AI-based tools for teaching, assessment, academic communication, research activities, and the management of digital educational environments. The authors particularly emphasize analytical, ethical, and adaptive dimensions of competence in the context of artificial intelligence technologies [10].

A more recent interpretation of digital competence is proposed by researchers studying the integration of artificial intelligence and sustainable digital education in higher education. In the study digital competence of university teachers is understood as an integrated ability to effectively use digital technologies for teaching, communication, assessment, content creation, information management, and professional development within digital educational ecosystems. The authors additionally include data literacy, ethical use of technologies, critical thinking, and adaptive use of digital resources as essential elements of digital competence. Their research also emphasizes that digital competence should be continuously developed in response to technological innovation and the growing implementation of artificial intelligence in higher education [12].

Thus, the analysis of studies demonstrates that there is no single universally accepted definition of the digital competence of higher education teachers, however, most researchers interpret it as a multidimensional and integrative professional construct that combines technological, pedagogical, communicative, ethical, and reflective components.

A common feature of all the analyzed approaches is the understanding that digital competence is not limited to technical proficiency in using digital tools. Researchers increasingly emphasize the pedagogical and professional dimensions of

competence, particularly the ability to effectively integrate digital technologies into teaching and learning processes, design digital educational environments, organize communication and collaboration, assess learning outcomes, and ensure continuous professional development.

The analysis of contemporary approaches to understanding digital competence makes it necessary to distinguish this concept from ICT competence, since these terms are often used interchangeably in scientific literature despite significant differences in their content and scope. The distinction between ICT competence and digital competence has been examined in the works of many researchers.

In the work of Ferrari, ICT competence is described as a narrower concept primarily associated with technical skills in using information and communication technologies, including the ability to work with computers, software, digital devices, and network services. Within this approach, ICT competence is mainly viewed as the operational and technological preparedness of an individual to use digital tools [4].

In contrast, digital competence is interpreted much more broadly. According to Ferrari, digital competence includes not only technical skills but also the ability to use digital technologies critically, creatively, safely, and responsibly for learning, professional activities, communication, content creation, problem solving, and participation in social life. Thus, digital competence incorporates cognitive, communicative, ethical, informational, and reflective components.

A similar approach is presented in the studies of Kirsti Ala-Mutka, who emphasizes that digital competence represents an evolution of ICT competence. The author argues that traditional ICT competence mainly focused on technological proficiency, whereas digital competence is oriented toward the effective and meaningful use of digital technologies in various spheres of activity [1].

One important contribution belongs to Allan Martin, who analyzed the evolution from ICT skills toward broader digital literacy and digital competence concepts. In his works, Martin argued that ICT competence mainly refers to technical and operational abilities related to the use of digital devices and software, whereas digital competence includes critical thinking, information evaluation, communication, ethical awareness, and participation in digital society. He emphasized that digital competence should be understood as a holistic and socially oriented concept rather than merely technological proficiency [8].

Another significant perspective is presented in the studies of Antonio Cartelli. Cartelli distinguished ICT competence as the ability to use information and communication technologies effectively, while digital competence was interpreted as a broader integrative construct combining technological, cognitive, social, and ethical dimensions. According to the author, digital competence reflects an individual's capacity to function effectively in the digital environment and adapt to the continuously changing technological landscape [3].

A similar distinction can also be found in the works of David Bawden, who noted that ICT competence focuses primarily on technological operation and

functional use of digital tools, whereas digital competence encompasses information literacy, critical evaluation of digital information, communication practices, and reflective interaction with digital media [2].

Thus, the analysis of works demonstrates that researchers clearly distinguish between ICT competence and digital competence, considering the latter to be a significantly broader and more complex concept. While ICT competence is primarily associated with technical and operational skills in using information and communication technologies, digital competence encompasses not only technological proficiency but also cognitive, communicative, ethical, informational, and reflective dimensions.

Contemporary researchers emphasize that digital competence involves the ability to critically, creatively, safely, and responsibly use digital technologies in various spheres of professional and social activity. In contrast to ICT competence, which mainly focuses on the functional use of digital tools, digital competence is oriented toward meaningful participation in the digital society, effective communication and collaboration, information evaluation, problem solving, and continuous professional development.

Therefore, digital competence of higher education teachers should be understood not merely as the ability to operate digital technologies, but as an integrative professional quality that enables educators to effectively implement digital technologies in teaching, organize student-centered digital learning environments, adapt to technological changes, and continuously develop their pedagogical and professional practices in the context of digital transformation of higher education. The structure of digital competence of higher education teachers has been examined in the works of numerous researchers.

One of the most significant contributions belongs to Christine Redecker in the «European Framework for the Digital Competence of Educators». Redecker identified six interconnected areas of educators' digital competence: professional engagement, digital resources, teaching and learning, assessment, empowering learners, facilitating learners' digital competence [11].

In this model, digital competence is viewed not only as technological proficiency but also as the pedagogical ability to effectively integrate digital technologies into teaching, assessment, communication, and student support.

Another important approach was proposed by Jo Tondeur and Sarah Howard in the HeDiCom framework. The authors emphasized that the structure of digital competence of higher education teachers includes technological, pedagogical, ethical, communicative, and reflective dimensions. They particularly highlighted adaptability, collaboration, digital ethics, innovation, and continuous professional learning as essential components of competence in rapidly changing digital educational environments [13].

In the studies of Anusca Ferrari, digital competence was structured around five major areas: information and data literacy, communication and collaboration, digital content creation, safety, and problem solving. Although Ferrari's concept was

not developed for teachers, it later had a significant influence on later pedagogical models of digital competence for teachers [4].

A multidimensional structure of teachers' digital competence was also proposed by Andreia Inamorato dos Santos and colleagues. The authors identified technological, pedagogical, organizational, communicative, and professional-development dimensions of digital competence. According to their research, university teachers should possess not only digital operational skills but also the ability to critically evaluate technologies, organize digital communication, manage online learning environments, and continuously improve their professional practice [5].

In addition, Marta Liesa-Orus and colleagues considered digital competence as a multidimensional construct combining digital literacy, pedagogical integration of technologies, information management, communication skills, reflective teaching, and student-centered instructional design. The authors stressed that the pedagogical component is central to the effective implementation of digital technologies in higher education [6].

Recent studies devoted to artificial intelligence in education also extend the structure of digital competence. Jenniffer Sobeida Moreira-Choez and colleagues additionally included AI literacy, ethical use of AI technologies, data management, analytical thinking, and adaptive use of digital tools as important components of higher education teachers' digital competence [10].

Thus, the analysis of contemporary studies demonstrates that researchers interpret the structure of digital competence of higher education teachers as a complex integrative system that combines technological, pedagogical, communicative, ethical, cognitive, reflective, and adaptive components necessary for effective professional activity in digital educational environments.

The analysis of contemporary scientific approaches demonstrates that digital competence of higher education teachers is interpreted as a multidimensional and integrative construct. This necessitates a more detailed consideration of its structural components, since understanding the internal structure of digital competence makes it possible to determine the key areas of professional development of higher education teachers in the context of digital transformation of education.

The pathways for developing the digital competence of higher education teachers have been examined in the works of numerous researchers, particularly within the context of digital transformation, professional development, online learning, and lifelong education.

One of the most influential approaches was proposed by Christine Redecker in the framework European Framework for the Digital Competence of Educators. In this model, the development of digital competence is associated with continuous professional learning, reflective teaching practice, collaboration among educators, experimentation with digital technologies, and systematic integration of digital tools into educational activities. Redecker emphasizes that digital competence develops progressively through different proficiency levels, from newcomer to pioneer, which

allows educators to continuously improve their pedagogical use of digital technologies [11].

An important contribution also belongs to Jo Tondeur and Sarah Howard in the HeDiCom framework. The authors identify several key pathways for developing digital competence of higher education teachers, including institutional support, collaborative learning, participation in professional development programs, reflective practice, peer-learning, and engagement with authentic digital teaching experiences. They particularly stress that digital competence develops most effectively when teachers actively integrate technologies into real pedagogical contexts rather than simply acquiring technical skills in isolation [13].

In the studies of Andreia Inamorato dos Santos and colleagues, the development of digital competence is closely connected with lifelong learning, academic collaboration, institutional digital strategies, and educators' motivation for continuous self-improvement. The authors emphasize the importance of professional training programs, digital mentoring, and access to digital educational resources as essential conditions for competence development [5].

Another significant perspective is presented in the meta-analysis by Marta Liesa-Orus and colleagues. The researchers conclude that the most effective pathways for developing digital competence include continuous professional development courses, practical workshops, digital communities of practice, self-directed learning, and institutional support systems. Their findings also show that teachers' digital competence is strongly influenced by self-efficacy, openness to innovation, and opportunities for practical application of digital technologies in teaching [6].

Recent studies increasingly associate the development of digital competence with artificial intelligence literacy and adaptive learning skills. Jenniffer Sobeida Moreira-Choez and colleagues emphasize that modern professional development should include training in AI-based educational technologies, ethical use of artificial intelligence, data literacy, and adaptive use of digital tools in higher education environments [10].

Thus, the development of digital competence of higher education teachers should be understood as a strategic direction of higher education modernization that contributes to improving educational quality, strengthening professional adaptability, fostering pedagogical innovation, and preparing both teachers and students for successful participation in the digital society.

Conclusions. Rapid digital transformation, the expansion of online and blended learning environments, and the integration of artificial intelligence into higher education significantly change the professional role of university teachers and increase the requirements for their pedagogical, technological, communicative, and reflective readiness.

The analysis of contemporary studies has shown that researchers interpret the digital competence of higher education teachers as a complex integrative construct that combines several interconnected dimensions. These dimensions include technological knowledge and digital skills, pedagogical ability to integrate

technologies into the educational process, communication and collaboration in digital environments. Modern frameworks of digital competence also increasingly emphasize the importance of data literacy, cybersecurity awareness, digital well-being, and the competent use of artificial intelligence tools in teaching, research, and professional communication.

The conducted analysis also confirms that the development of digital competence cannot be effective without appropriate institutional and organizational support. Higher education institutions play a crucial role in creating favorable conditions for professional digital development through continuous professional learning opportunities, methodological support, access to digital infrastructure, participation in professional communities, mentoring, collaborative projects, and the encouragement of innovative pedagogical practices. At the same time, the effectiveness of digital competence development largely depends on teachers' motivation for lifelong learning, openness to innovation, readiness for self-improvement, and ability to critically evaluate and adapt digital technologies according to educational goals and students' needs.

Particular attention in contemporary studies is devoted to the growing influence of artificial intelligence on higher education. The integration of AI technologies into teaching and learning processes requires teachers not only to master new digital tools, but also to develop ethical awareness, critical understanding of AI capabilities and limitations, and the ability to use AI responsibly in educational practice. Therefore, digital competence in modern higher education should be considered as a flexible and evolving professional quality that enables teachers to respond effectively to technological changes, support students' digital literacy, and ensure innovative and student-centered learning environments.

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