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DEVELOPMENT OF DIGITAL COMPETENCES OF SCIENTIFIC AND PEDAGOGICAL WORKERS AND STUDENTS OF MEDICAL EDUCATION IN CONDITIONS OF DIGITAL TRANSFORMATION

ABSTRACT. *The purpose of the research is to substantiate the structure of digital competencies of scientific and pedagogical workers and medical education students and to develop a conceptual model of their development in the conditions of digital transformation. **Methods.** Bibliometric analysis of scientific publications, analysis and generalization of international normative documents and frameworks of digital competences, comparative and systemic analysis, methods of systematization, modelling and generalization were used. **The results.** The main directions of the development of digital competences in the modern educational and scientific environment are determined, international approaches to their formation are summarized, the structure of digital competences is proposed, which includes educational, research-analytical, educational-methodical, management-communication, clinical-digital and end-to-end components, and a conceptual model of their development is developed taking into account the use of digital technologies, open science and generative artificial intelligence. **Conclusions.** The proposed model can be used as a methodological basis for assessing the level of digital competences, improving educational programs, planning the professional development of scientific and pedagogical workers, and digital training of students of medical education.*

KEYWORDS: digital competences; digital transformation; medical education; artificial intelligence; digital educational environment.

INTRODUCTION. Digital transformation is one of the key areas of development of the modern system of higher education and science, which significantly changes approaches to the organization of the educational process, conducting scientific research and professional activity. The rapid development of information and communication technologies, digital platforms, cloud services, big data, open science and artificial intelligence technologies forms a new digital educational and scientific environment, in which digital competence is considered as one of the basic competences of a specialist of the XXI century (European Commission, 2020; European Commission, 2024; JISC, n.d.).

In international documents, digital competences are defined as a necessary condition for ensuring quality education, development of innovative activities and continuous professional improvement of pedagogical and scientific personnel (European Commission, 2020; Redecker & Punie, 2017).

The European Digital Competence Framework DigComp 2.2 and the European Digital Competence Framework for Teachers DigCompEdu define digital competence as a set of knowledge, skills and attitudes necessary for the effective, safe, critical and ethical use of digital technologies in education, professional activity, scientific research and social life (Redecker & Punie, 2017; Vuorikari et al., 2022). At the same time, the UNESCO recommendations on the digital transformation of education emphasize the need for the formation of a digital culture, the development of skills for working with digital data, open educational resources, artificial intelligence technologies and modern information services as important components of ensuring the quality of education and academic integrity (Johri et al., 2023; UNESCO, 2023; Pinchuk & Malytska, 2024).

The development of digital competences is especially relevant in the field of medical education, which is characterized by high dynamics of knowledge updating, wide use of digital medical technologies, electronic

health care systems, telemedicine, clinical information systems, simulation training and digital platforms for professional training of future doctors (Johri et al., 2023).

A modern teacher of a medical institution of higher education must possess not only digital learning methods, but also skills in using scientometric databases, electronic libraries, bibliographic information management systems, open science platforms, and artificial intelligence tools to support educational and research activities (JISC, n.d.; Kuzminska et al., 2023; Pinchuk & Malyska, 2024).

Equally important is the formation of appropriate competencies in medical students who must be ready to use digital technologies in future clinical practice, scientific work and continuous professional development (Computer Science Curricula, 2024; Johri et al., 2023). An additional factor that significantly accelerated the digital transformation of higher education in Ukraine was the COVID-19 pandemic and the introduction of martial law. The need to ensure the continuity of the educational process in the conditions of distance and blended learning has contributed to the widespread implementation of digital educational platforms, electronic communications, learning management systems and cloud technologies (European Commission, 2020).

At the same time, the active development of generative artificial intelligence has opened up new opportunities for personalization of learning, automation of information analysis, creation of educational materials and support of scientific research, while actualizing issues of academic integrity, critical evaluation of information, cyber security and ethical use of digital technologies (Johri et al., 2023; Pinchuk & Malyska, 2024).

It should be noted that digital competence is not a permanent characteristic, but constantly evolves according to the pace of development of digital technologies. Therefore, even a high level of digital literacy, formed a few years ago, needs systematic updating. This makes it necessary to regularly assess the level of digital competencies of scientific and pedagogical workers and students of medical education, determine their educational needs and implement effective models of continuous professional development (Aydin & Yildirim, 2022; Caena & Redecker, 2019). Thus, the development of digital competences of scientific-pedagogical workers and students of medical education is a strategic prerequisite for ensuring the high quality of the educational process, effective scientific activity, integration into the international educational and scientific space, and the training of competitive specialists of the health care system in the conditions of digital transformation (European Commission, 2024; Horizon Europe Office in Ukraine, 2025).

METHODS. The research uses bibliometric analysis of modern scientific publications, content analysis of international strategic documents and frameworks of digital competences (DigComp 2.2, DigCompEdu, documents of the European Commission and UNESCO), systematic and comparative analysis, methods of systematization and generalization. The method of structural-functional modeling was used to structure the components of digital competence, their functional distribution according to the main types of professional activity, and to substantiate the relationships between them.

RESULTS AND DISCUSSION. In order to determine the current trends in the development of digital competences of scientific and pedagogical workers and students of medical education, as well as to substantiate the structure of the author's model, a bibliometric analysis of scientific publications devoted to the development of digital competences of researchers was carried out. The analysis methodology was based on the approaches proposed by R. Liashenko and S. Semerikov (Liashenko & Semerikov, 2024). A search in the international scientometric databases Scopus and Web of Science proved that the issue of the development of digital competences of scientists is a relatively new, but dynamically growing direction of scientific research. According to the relevant search queries, 27 relevant publications were found in the Scopus database, while only three were found in the Web of Science, which indicates the initial stage of the formation of this direction of research and at the same time confirms its high relevance.

The results of the bibliometric analysis made it possible to single out several leading directions of modern research. Scientists have paid the most attention to the definition of the structure of digital competence of researchers and teachers, which includes information literacy, digital communication, management of research data, use of digital platforms, collaborative services and means of supporting scientific activity (Kuzminska et al., 2023; Pires et al., 2018). A significant number of publications are also devoted to the analysis of the relationship between the level of formation of digital competences and the effectiveness of scientific activity. The authors note that the possession of modern digital tools contributes to increasing publishing activity, expanding international scientific cooperation, more effective use of open scientific resources, and increasing the visibility of research results in the international scientific space (Corvello et al., 2020; Halaweh, 2020).

A separate direction of modern research concerns digital scientific communication and inter-institutional cooperation. The results show that digital technologies today perform not only an auxiliary function, but act as a full-fledged environment for the implementation of international research projects, professional interaction and the dissemination of scientific results (Iatsyshyn et al., 2020; Biermann et al., 2023). At the same time, researchers focus on a number of challenges related to the need for constant updating of digital skills, risks of information overload, ensuring cyber security, protection of personal data and ethical use of digital technologies, in particular generative artificial intelligence (Pinchuk & Malytska, 2024; UNESCO, 2023).

The obtained results are consistent with the conclusions of European researchers, according to which digital competence is considered an integral component of the professional competence of a modern teacher and scientist, which requires continuous development in accordance with the pace of digital transformation of education and science (Caena & Redecker, 2019; Vuorikari et al., 2022). At the same time, the analysis showed that most of the existing models are mainly focused on either pedagogical activity (Redecker & Punie, 2017) or on the research component of professional activity (JISC, n.d.). This approach is insufficient for the medical education system, where educational, scientific, clinical, organizational and communication activities are interconnected.

That is why the results of the bibliometric analysis, the generalization of international frameworks of digital competences and the analysis of modern trends of digital transformation became the basis for the development of the author's structure of digital competences of scientific and pedagogical workers and students of medical education. During its formation, the provisions of the DigComp 2.2, DigCompEdu frameworks, the recommendations of the European Commission on digital education, the principles of open science and modern requirements for the digital transformation of medical education were taken into account (European Commission, 2020; Redecker & Punie, 2017; Vuorikari et al., 2022).

The proposed structure reflects the interconnected components of digital competence, which ensure the effective use of digital technologies in educational, scientific, organizational and professional activities. Unlike most existing models, it integrates not only pedagogical and information and communication competencies, but also digital skills for working with open scientific resources, international scientometric databases, digital research platforms, academic communication services and artificial intelligence tools. This approach corresponds to the current trends in the development of digital science and the requirements for training competitive specialists in the field of medical education (Johri et al., 2023; Zhang et al., 2024).

A feature of the proposed model is its focus on the continuous development of digital competencies in accordance with the modern challenges of digital transformation. It involves not only the mastering of digital technologies, but also the formation of skills in critical evaluation of information, compliance with the principles of academic integrity, ensuring cyber security, effective interaction in the digital environment, and responsible use of artificial intelligence technologies in educational and scientific activities (Pinchuk & Malytska, 2024; UNESCO, 2023).

Thus, the results of the conducted analysis confirm that the development of digital competences should be considered as a continuous process of professional improvement of scientific and pedagogical workers and students of medical education. The proposed author's structure provides a comprehensive approach to the formation of digital competences, combining educational, research, organizational and communication components, which corresponds to modern international trends in the development of digital education and open science.

The generalized structure of digital competences of scientific and pedagogical workers and students of medical education is presented in Table 1.

Table 1. Structural components of digital competences of scientific and pedagogical workers and students of medical education

Direction of professional activity	A component of digital competence	Competency	Expected Outcome (Capacity)	Digital Tools and Resources
Educational activity	Digital educational competence	Organization of the educational process	Planning and organization of the educational process in the digital environment	LMS (Moodle, Google Classroom), Microsoft Teams, Google Workspace, calendars, cloud services
		Conducting training classes	Use of digital technologies during lectures, practical and simulation classes	Zoom, MS Teams, Google Meet, e-textbooks, virtual laboratories, digital simulators
		Management of independent work	Organization of independent work and support of education seekers	LMS, MOOCs, digital libraries, electronic educational resources
		Assessment of learning outcomes	Conducting current and final assessment	Moodle Quiz, Google Forms, Kahoot!, Quizizz, Classtime, AI-services
		Monitoring of educational activities	Analysis of learning analytics and learning results	Learning Analytics, LMS statistical modules, Power BI, Excel, AI
		Personalization of education	Using digital technologies and AI to adapt the educational process to the individual needs of applicants	ChatGPT, Copilot, Gemini, adaptive learning systems
Scientific activity	Digital research and analytical competence	Search for scientific information	Search, critical evaluation and systematization of scientific sources	Scopus, Web of Science, PubMed, Google Scholar, ORCID
		Preparation of scientific publications	Writing, editing, design and submission of manuscripts	Microsoft Word, Overleaf, Mendeley, Zotero, EndNote
		Data collection and analysis	Research planning, statistical processing and interpretation of results	SPSS, R, Python, Excel, Jamovi
		Research data management	Organization, storage and distribution of research data in accordance with the principles of open science	Zenodo, Figshare, OSF, Dryad
		Use of generative AI	Use of AI to support research activities in accordance with the principles of academic integrity	ChatGPT, Claude, Gemini, Elicit, Consensus, SciSpace
		Scientific modeling and visualization	Model building, process analysis and visualization of results	VOSviewer, CiteSpace, Tableau, Power BI, Gephi

End of Table 1

Direction of professional activity	A component of digital competence	Competency	Expected Outcome (Capacity)	Digital Tools and Resources
Educational and methodological activities	Digital educational and methodological competence	Creation of educational and methodological materials	Development of modern digital educational content	Microsoft Office, Canva, Adobe Express, Google Workspace
		Development of digital educational resources	Creation and adaptation of electronic educational resources	Moodle, H5P, Genially, Articulate
		Joint creation of documents	Organization of teamwork	Google Docs, Microsoft 365, Overleaf
		Development of educational documentation	Creation of EPP, ETP, syllabus, work programs	Office 365, Google Workspace
		Professional development	Continuous professional development	Coursera, Prometheus, EdEra, MOOCs
		Public presentation of results	Presentation of educational and scientific materials	Canva, PowerPoint, Prezi, YouTube
Organizational and communication activities	Digital management and communication competence	Online communication	Organization of professional interaction	Zoom, MS Teams, Google Meet
		Academic partnership	Development of international and inter-institutional cooperation	ResearchGate, LinkedIn, ORCID, Academia.edu
		Project management	Planning and coordination of educational and scientific projects	Trello, Asana, Microsoft Project, Notion
		Scientific communication	Dissemination of research results	ORCID, Google Scholar, Scopus Author ID, ResearchGate
		Publishing activity	Self-archiving and distribution of research results	DSpace, Zenodo, Open Journal Systems
Clinical-professional activity	Clinical-digital competence	Use of digital medical technologies	Application of digital services in professional training and clinical practice	eHealth, electronic medical record, telemedicine, Medscape, UpToDate, ClinicalKey, simulation platforms
		Use of clinical information systems	Work with electronic clinical decision support systems	Clinical Decision Support Systems, electronic registers, PACS
End-to-end digital competence	Universal digital competences	Digital literacy	Effective use of digital technologies	Common software, cloud services
		Cyber security and data protection	Safe use of the digital environment	Anti-virus software, two-factor authentication, VPN
		Academic integrity and digital ethics	Ethical use of digital technologies and AI	Turnitin, StrikePlagiarism, AI services
		Use of generative AI	Critical and responsible use of generative artificial intelligence	ChatGPT, Claude, Gemini, Copilot
		Continuous professional development	Self-learning and updating of digital competences	MOOCs, open educational resources, professional communities
		Solving professional problems	Using digital technologies for decision-making	Analytical platforms, AI, decision support systems
		Digital well-being	Rational, safe and balanced use of digital technologies	Digital environment management tools, digital activity monitoring services

The presented structure of digital competences demonstrates their complex nature and reflects digital competence as an integrated system of interconnected components that ensure effective professional activity in the conditions of digital transformation of medical education. Each of the components performs an independent function, but only their systemic interaction ensures the readiness of scientific and pedagogical workers and students of medical education to use modern digital technologies in educational, scientific and professional activities. This approach corresponds to the modern understanding of digital competence as a multidimensional characteristic that combines knowledge, practical skills, values and readiness for continuous professional development (Vuorikari et al., 2022; Caena & Redecker, 2019).

The identified components cover information and digital literacy, digital communication, creation and use of digital content, digital resource management, digital security, the use of digital technologies in scientific activities, digital pedagogy, digital interaction and the ability for continuous professional development. An important feature of the proposed structure is the integration of competencies related to the use of open science, international scientometric databases, modern digital research platforms and artificial intelligence technologies, which today determine the development of educational and scientific activities of higher education institutions (Kuzminska et al., 2023; Johri et al., 2023). Unlike most of the existing models, which focus mainly on the digital competence of the teacher or researcher separately (Redecker & Punie, 2017; JISC, n.d.), the proposed framework integrates educational, research, organizational and professional activities into a single system of digital competences. This approach is especially relevant for medical education, where professional activity involves the simultaneous use of digital educational technologies, evidence-based information resources, medical information systems, and digital means of scientific communication.

Thus, the developed structure can be used as a methodological basis for assessing the level of formation of digital competences, planning programs for improving the qualifications of scientific and pedagogical workers, improving educational programs for training medical students, as well as forming institutional strategies for the digital transformation of institutions of higher medical education.

The generalization of the results of the bibliometric analysis, the analysis of the international framework of digital competences and the systematization of modern approaches to the digital transformation of education became the basis for the development of the author's conceptual model of the development of digital competences of scientific and pedagogical workers and students of medical education. The proposed model reflects the relationship between the key components of digital competence, the factors of their formation and the expected results of professional development in the conditions of digitization of higher medical education. Unlike existing concepts, which mainly focus on individual aspects of digital competence (Redecker & Punie, 2017; Vuorikari et al., 2022), the proposed model combines educational, scientific, organizational and professional components of activities into a single system adapted to the specifics of medical education. Special attention is paid to the use of digital educational platforms, open scientific resources, artificial intelligence technologies, digital academic communication and the principles of open science, which today determine the directions of modernization of university education (European Commission, 2020; UNESCO, 2023).

A conceptual model of the development of digital competences of scientific and pedagogical workers and medical education students is presented in Fig. 1.

The proposed model is based on a competency-based approach and considers the development of digital competencies as a continuous process that encompasses the professional activity of scientific and pedagogical workers and the educational activity of medical education students. Its structure includes motivational, cognitive, activity, and reflective-evaluative components, the interaction of which ensures the formation of digital readiness for effective work in a modern digital educational and scientific environment. A similar approach to the combination of cognitive, activity and reflective components of digital competence is

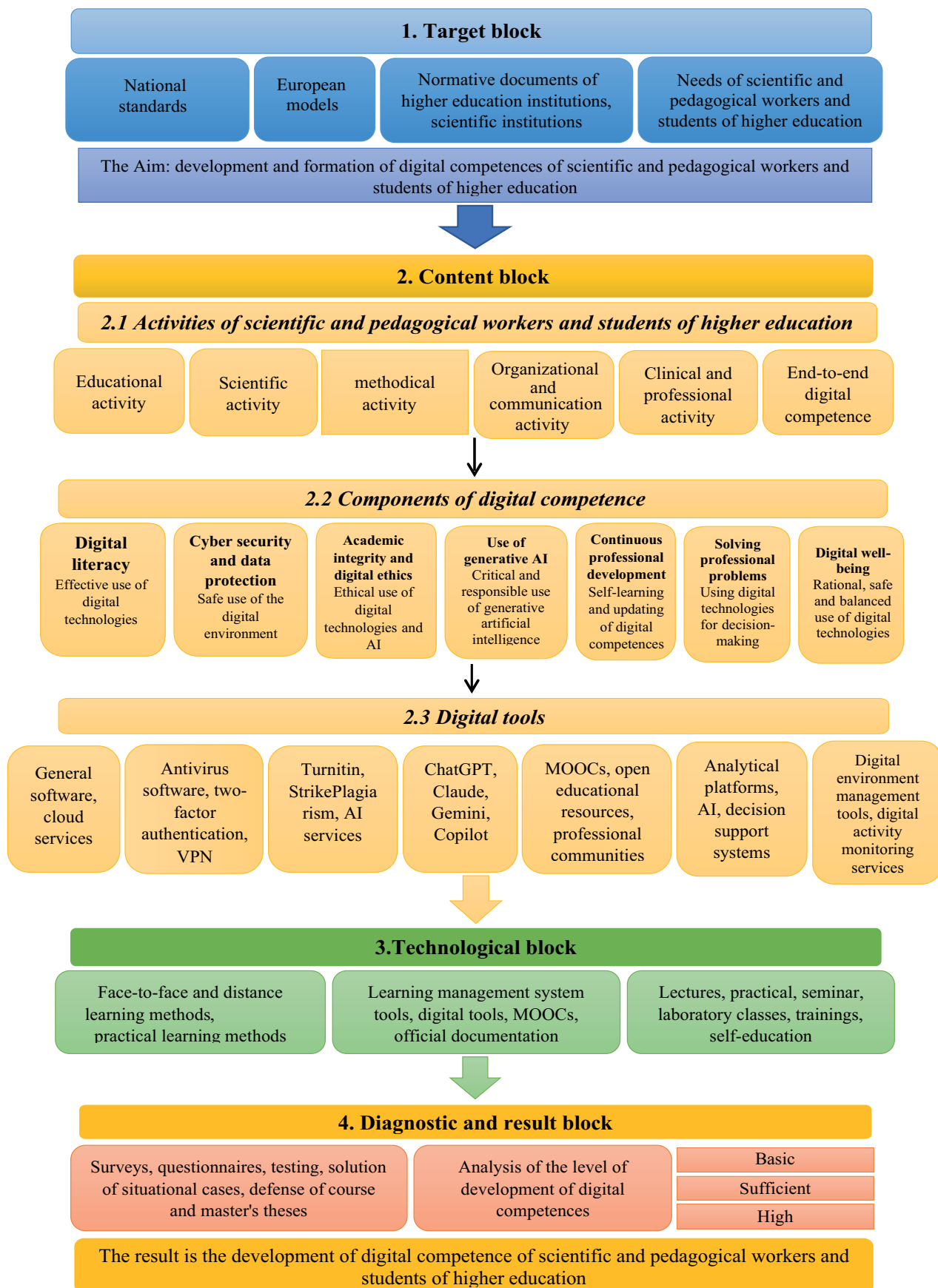


Fig. 1. Conceptual model of the development of digital competencies of scientific and pedagogical workers and medical students in the context of digital transformation

presented in the European framework of digital competences, however, in the proposed model, they are adapted to the specifics of professional training in the field of medical education (Caena & Redecker, 2019; Redecker & Punie, 2017).

The functioning of the model involves the integrated use of digital educational platforms, open scientific information systems, international scientometric databases, academic communication services, cloud technologies and artificial intelligence tools. Their integrated application creates conditions for increasing the efficiency of the educational process, optimizing research activities, expanding international academic cooperation and developing a culture of open science, which is confirmed by the results of modern international research (Corvello et al., 2020; Kuzminska et al., 2023; Johri et al., 2023).

An important feature of the model is the integration of digital competence in all areas of professional activity. For scientific and pedagogical workers, this is manifested in the ability to design a digital educational environment, use modern learning technologies, organize scientific research using digital tools and ensure compliance with the principles of academic integrity. For students of medical education, the model is focused on the formation of digital literacy, the ability to work with evidence-based information resources, critically evaluate digital content, use specialized medical information systems and digital technologies in future professional activities. This approach is consistent with modern requirements for training medical personnel in the conditions of digital transformation of the health care system and the development of digital medicine (European Commission, 2020; Zhang et al., 2024).

A separate structural element of the model is continuous professional development, which ensures timely adaptation to rapid changes in the digital environment and constant updating of digital technologies. The rapid introduction of generative artificial intelligence, digital research platforms and automated data analysis technologies necessitates the systematic improvement of digital competences as an integral component of the professional competence of a modern teacher and scientist (Johri et al., 2023; UNESCO, 2023; Pinchuk & Malytska, 2024). Thus, the proposed conceptual model has a universal character and can be used as a scientific and methodological basis for assessing the level of formation of digital competences, developing programs for improving the qualifications of scientific and pedagogical workers, modernizing educational programs for training medical students, and planning the institutional policy of digital transformation of institutions of higher medical education. Unlike existing approaches, it comprehensively integrates educational, research, organizational and professional aspects of digital activity, which expands the possibilities of its practical use in the field of medical education.

CONCLUSIONS. The conducted research confirmed that in the conditions of digital transformation, the development of digital competencies of scientific and pedagogical workers and medical education students is a necessary condition for improving the quality of educational, scientific and professional activities. Analysis of modern international approaches proved the need for comprehensive development of digital competences, covering the use of digital technologies, open science, digital research resources and generative artificial intelligence.

According to the results of the study, the author's structure of digital competences was developed, which includes six interrelated components: digital educational, research-analytical, educational-methodical, management-communication, clinical-digital and end-to-end digital competence. On its basis, a conceptual model of the development of digital competences, adapted to the needs of modern medical education, is proposed.

The practical significance of the obtained results lies in the possibility of using the proposed structure and model for the improvement of educational programs, professional development of scientific and pedagogical workers, formation of digital competences of students of medical education and implementation of digital transformation strategies of higher education institutions.

REFERENCES

- Arano-Poggi, S., & Bel, N. (2014). Datos enlazados de publicaciones, proyectos y herramientas para investigadores en humanidades digitales: Catálogo piloto del centro CLARIN IULA-UPF. *El Profesional de la Información*, 23(6), 633–642. <https://doi.org/10.3145/epi.2014.nov.11>
- Association for Computing Machinery. (2024). *Computer Science Curricula 2023*. ACM. <https://doi.org/10.1145/3664191>
- Aydin, M. K., & Yildirim, T. (2022). Teachers' digital competence: Bibliometric analysis of the publications in the Web of Science scientometric database. *Information Technologies and Learning Tools*, 91(5), 205–220. <https://doi.org/10.33407/itlt.v91i5.5048>
- Biermann, K., Peters, N., & Taddicken, M. (2023). “You can do better than that!”: Tweeting scientists addressing politics on climate change and COVID-19. *Media and Communication*, 11(1). <https://doi.org/10.17645/mac.v11i1.5961>
- Caena, F., & Redecker, C. (2019). Aligning teacher competence frameworks to 21st century challenges: The case for the European Digital Competence Framework for Educators (DigCompEdu). *European Journal of Education*, 54(3), 356–369. <https://doi.org/10.1111/ejed.12345>
- Chien, C.-W. (2024). Influences of digital checklists on emergent researchers' method designs and writing. *International Journal of Innovation and Learning*, 35(1), 99–121. <https://doi.org/10.1504/IJIL.2024.135168>
- Corvello, V., Chimenti, C., Giglio, C., & Verteramo, S. (2020). An investigation on the use by academic researchers of knowledge from scientific social networking sites. *Sustainability*, 12(22), Article 9732. <https://doi.org/10.3390/su12229732>
- European Commission. (2020). *Digital Education Action Plan (2021–2027)*. <https://education.ec.europa.eu/focus-topics/digital-education/action-plan>
- European Commission. (2020). *European Skills Agenda*. <https://ec.europa.eu/social/main.jsp?catId=1223&langId=en>
- European Commission. (2024). *Europe's Digital Decade: Digital targets for 2030*. https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/europe-fit-digital-age/europes-digital-decade-digital-targets-2030_en
- European Commission. (n.d.). *European Education Area*. <https://education.ec.europa.eu/about-eea/the-eea-explained>
- Feola, R., Crudele, C., & Celenta, R. (2024). Developing cross-cultural competence in entrepreneurship education: What is the role of the university? *The International Journal of Management Education*, 22(3), Article 101055. <https://doi.org/10.1016/j.ijme.2024.101055>
- Halaweh, M. (2020). Actual researcher contribution (ARC) versus the perceived contribution to the scientific body of knowledge. In *Digital Libraries: The Era of Big Data and Data Science* (pp. 93–102). Springer. https://doi.org/10.1007/978-3-030-39905-4_10
- Horizon Europe Office in Ukraine. (2025). *Horizon Europe strategic plan 2025–2027*. <https://horizoneurope.org.ua/uk/about-he/strategic-plan-2025-2027>
- Iatsyshyn, A. V., Hubeladze, I. H., Kovach, V. O., Kovalenko, V. V., Artemchuk, V. O., Dvornyk, M. S., Popov, O. O., Iatsyshyn, A. V., & Kiv, A. E. (2020). Applying digital technologies for work management of young scientists' councils. *CEUR Workshop Proceedings*, 2879, 124–154. <https://ceur-ws.org/Vol-2879/paper04.pdf>
- Iatsyshyn, A. V., Kovach, V. O., Romanenko, Y. O., Popov, O. O., Artemchuk, V. O., Iatsyshyn, A. V., & Kutsan, Y. H. (2021). Formation of the scientist image in modern conditions of digital society transformation. *Journal of Physics: Conference Series*, 1840(1), Article 012039. <https://doi.org/10.1088/1742-6596/1840/1/012039>

- JISC. (n.d.). Researcher role profile. <https://repository.jisc.ac.uk/8862>
- Johri, A., Katz, A. S., Qadir, J., & Hingle, A. (2023). Generative artificial intelligence and engineering education. *Journal of Engineering Education*, 112(3), 572–577. <https://doi.org/10.1002/jee.20537>
- Kuzminska, O., Mazorchuk, M., Morze, N., Prokopchuk, M., & Danylchuk, H. (2023). Integrating digital competencies of researchers into PhD curricula: A case study on open science education. In *Proceedings of the 11th Workshop on Cloud Technologies in Education (CTE 2023)*. <https://ceur-ws.org/Vol-3679/paper36.pdf>
- Liashenko, R., & Semerikov, S. (2024). Bibliometric analysis of chatbot training research: Key concepts and trends. *Information Technologies and Learning Tools*, 101(3), 181–199. <https://doi.org/10.33407/itlt.v101i3.5622> [in Ukrainian]
- Ministry of Digital Transformation of Ukraine. (2023). Conceptual and reference framework of digital competence for teachers and academic staff (Project). https://osvita.diia.gov.ua/uploads/0/2900-2629_frame_pedagogical.pdf [in Ukrainian]
- Mintii, M. M., Sharmanova, N. M., Mankuta, A. O., Palchevska, O. S., & Semerikov, S. O. (2023). Selection of pedagogical conditions for training STEM teachers to use augmented reality technologies in their work. *Journal of Physics: Conference Series*, 2611(1), Article 012022. <https://doi.org/10.1088/1742-6596/2611/1/012022>
- Pinchuk, O., & Malytska, I. (2024). Responsible and ethical use of artificial intelligence in research and publication activities. *Information Technologies and Learning Tools*, 100(2), 180–198. <https://doi.org/10.33407/itlt.v100i2.5676> [in Ukrainian]
- Pires, F., Barbosa, J., & Leitão, P. (2018). Data scientist under the Da.Re perspective: Analysis of training offers, skills and challenges. In *2018 IEEE 16th International Conference on Industrial Informatics (INDIN)* (pp. 1049–1054). IEEE. <https://doi.org/10.1109/INDIN.2018.8472108>
- UNESCO. (2023). Guidance for generative AI in education and research. UNESCO. <https://unesdoc.unesco.org/ark:/48223/pf0000386693>
- Vuorikari, R., Kluzer, S., & Punie, Y. (2022). DigComp 2.2: The Digital Competence Framework for Citizens - With new examples of knowledge, skills and attitudes. Publications Office of the European Union. <https://doi.org/10.2760/115376>
- Zhang, G., Wang, L., Shang, F., & Wang, X. (2024). What are the digital skills sought by scientific employers in potential candidates? *Journal of Higher Education Policy and Management*, 47, 20-37. <https://doi.org/10.1080/1360080X.2024.2374392>

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РОЗВИТОК ЦИФРОВИХ КОМПЕТЕНТНОСТЕЙ НАУКОВО-ПЕДАГОГІЧНИХ ПРАЦІВНИКІВ ТА ЗДОБУВАЧІВ МЕДИЧНОЇ ОСВІТИ В УМОВАХ ЦИФРОВОЇ ТРАНСФОРМАЦІЇ

АНОТАЦІЯ. *Мета дослідження* — обґрунтувати структуру цифрових компетентностей науково-педагогічних працівників та здобувачів медичної освіти й розробити концептуальну модель їх розвитку в умовах цифрової трансформації. *Методи.* Використано бібліометричний аналіз наукових публікацій, аналіз і узагальнення міжнародних нормативних документів та рамок цифрових компетентностей, порівняльний і системний аналіз, методи систематизації, моделювання та узагальнення. *Результати.* Визначено основні напрями розвитку цифрових компетентностей у сучасному освітньо-науковому середовищі,

узагальнено міжнародні підходи до їх формування, запропоновано структуру цифрових компетентностей, що охоплює освітню, дослідницько-аналітичну, освітньо-методичну, управлінсько-комунікаційну, клініко-цифрову та наскрізну складові, а також розроблено концептуальну модель їх розвитку з урахуванням використання цифрових технологій, відкритої науки та генеративного штучного інтелекту. **Висновки.** Запропонована модель може бути використана як методологічна основа для оцінювання рівня цифрових компетентностей, удосконалення освітніх програм, планування професійного розвитку науково-педагогічних працівників і цифрової підготовки здобувачів медичної освіти.

КЛЮЧОВІ СЛОВА: цифрові компетентності; цифрова трансформація; медична освіта; штучний інтелект; цифрове освітнє середовище.