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THE EUROPEAN STRUCTURE OF DIGITAL COMPETENCES IN UKRAINIAN SOCIETY: CHALLENGES AND INNOVATIONS

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Abstract

Digital competences in education not only improve the learning process, but also stimulate changes in the pedagogical process on the path of informatization of Ukrainian education and society as a whole and directly affect the reduction of the «digital divide». In recent years, the position of information and communication technologies (ICT) in Ukrainian society and education has strengthened. In addition to ICT infrastructure, digital content creation and teacher training initiatives, recent curriculum reforms support the use of digital technologies in many subjects. In order for citizens to improve their digital competence, the European Commission has proposed a tool known as The European Digital Competence Framework (DigComp). In this article, we analyze a number of concepts and approaches related to the European structure of digital competences in Ukrainian society and related with it the projects and initiatives of the Ministry of Education and Science of Ukraine on several educational, cultural and disciplinary grounds.

Keywords: digital literacy; digital competence; Ukrainian society; digital communication; digital technology.

Relevance of the research

Over the last few decades, global society has seen a trend towards large-scale technological development, which has allowed information and communication technologies (ICT) to penetrate all spheres of human activity, and led to the rapid acceleration of digital technologies, which in the last 10 years have changed markets and societies around the world [1]. New the demanding competences for the development of future professionals in society in various fields have led to new strategies. This wave of digital technologies, such as the Internet, social media, mobile devices, business analytics, big data, cloud, cyber solutions, artificial intelligence and others, have penetrated into every private and public organization, and a person's private home [2, 3, 4, 5]. The increasingly accelerated digitalization process has led to increased attention and demand for digital competences [6, 7], and [8]. New digital skills, knowledge and attitudes have highlighted the impact of the digital divide on education and the importance of digital competence at different educational levels, which shape learning and teaching paradigms, the nature of learning, and how it is implemented [9, 10, 11, 12]. This necessity led to the introduction of new tools into the training process, and future specialists began to be demanded knowledge and desire to acquire new competences. Therefore, the basic skills of the 21st century appeared [13].

Given the pervasive use of the Internet, smartphones, computers, tablets, gaming systems, and multimedia devices, it has become critical for students to accurately evaluate and interpret technology and use it effectively. In the field of digital competences in Ukrainian society, the role of the educational community should be to support technologies, to teach and use technologies for everyday life. Society's understanding, use, and appreciation of 21st century multimodal texts that incorporate media and Internet technologies can only be achieved through the integration of technology into learning and teaching processes. A society that has information, media and technological skills can bridge the gap between real life experience and school experience [14, 15].

In addition to the new pedagogical challenges faced by teachers in Ukrainian society, students' digital competence plays an important role in the new learning paradigm. Since today's students are future specialists in various fields, they must be ready to use digital competences in their activities in academic life and in their careers. The development of digital competence should be perceived as part of lifelong learning [16]. Integrating digital technology skills into the learning environment is believed to improve academic education and student achievement. For this reason, it is important to promote the use of knowledge in the educational environment, and not to ignore or inhibit new technologies [17]. Information,

media and technology empower students to improve their thinking, learning, communication, and collaboration and production skills. However, to harness this power, students must first learn the competences necessary to understand and use this information, media, and technology.

Analysis of previous research

The concept of digital competence of the European society is a concept related to the development of technologies, as well as political aspirations and expectations of citizenship in the information society. It consists of various skills and competences and covers various fields such as media and communication, technology and literacy and others. The concept of digital competence is constantly evolving, teaching society the skills needed to use digital technologies, the ability to use digital technologies to work effectively in a variety of activities and for learning, education and everyday life in general; ability to critically evaluate digital technologies, motivate society to actively participate in digital culture.

When considering the concept of «literacy», it should be noted that this term, since the end of the nineteenth century, has been considered as a term that refers to the ability to read and write a text using traditional (print) literacy [18, 19, 20]. The word «literate» means «familiar with literature» or «well-educated, learned» [19]. The concept has now been expanded to include practices mediated by new technologies, particularly computer and communication technologies [18]. Unfortunately, in the new educational environment, many students enter further and higher education without the skills needed to use digital technologies in education (European Commission, 2013) [21].

UNESCO provided recommendations for teachers, built taking into account three approaches to school informatization in the educational environment, which are related to the respective stages of professional development of teachers who master work in ICT:

1) *ICT application* is requires from teacher to be able to help students use ICT for increasing the effectiveness of educational work.

2) *Learning of knowledge* is requires the ability of teachers to help students in the deep learning of the content of educational subjects, to apply the acquired knowledge to solve complex problems that occur in the real world.

3) *Production of knowledge* is requires the ability of teachers to help students, future citizens and workers, to produce (generate) new knowledge, which is necessary for the harmonious development and prosperity of society.

Each of the three approaches contains 6 aspects of work that determine the structure of ICT competence of teachers:

1) Understanding the role of ICT in education;

2) Curriculum and assessment;

3) Pedagogical practices;

4) Technical and software tools ICT;

5) Organization and management of the educational process;

6) Professional development.

Thus, the recommendations for teachers provided by UNESCO include 18 modules.

As 90% of new jobs will require excellent digital skills, those without sufficient ICT skills will be disadvantaged in the labor market and have less access to information [21]. Expanding and improving digital competencies is an important component in the employability of graduates.

Therefore, new information and communication technologies require the introduction of a new concept – «**digital competence**» [22].

Digital competence has become a key concept in discussions about what skills and understanding students need in the Ukrainian knowledge society.

However, the concept of «digital competence», in academic literature and in teaching, learning and certification practices, in policy documents, is still interpreted in different ways (e.g. digital literacy, digital competence, e-literacy, e-skills, e-competence, computer literacy and media literacy) [23, 24, 25]. All these terms emphasize the need to work with technology in the digital age [26, 27].

Presenting main material

The concept of digital competence is a multifaceted, dynamic concept that covers many areas and is rapidly evolving with the emergence of new technologies. Be competent in the digital space means understanding media, accessing information, being critical of the information accessed, and communicating with others using a variety of digital tools and programs.

Digital competence is also understood as a cognitive, educational and technological skill that helps alleviate many problems and challenges in today's knowledge society, and it is dynamic and transversal. Digital competence involves not only digital skills, but also the social and emotional aspects of using and understanding digital devices and related technologies. Competence is more than just knowledge and skills. It involves the ability to meet complex demands by engaging and mobilizing psychosocial resources (including skills and attitudes) in a specific context [28].

Digital competence is conceived as a multifaceted moving target that encompasses different spheres and includes several spheres. Furthermore, A. Calvani generalized that digital competence consists of both specific and quantitative skills [9]. In this context, the coexistence of dimensions at the technical, cognitive, and ethical levels and the integration of relevant skills in these dimensions are highlighted [29].

In 2013, the European Commission's Joint Research Center launched the Digital Competence Framework project to create descriptors of digital competences for all levels of learners. The project took place on the basis of consultations and active cooperation with a wide range of interested parties. In 2016, the Joint Research Center released the DigComp 2.0: The Digital Competence Framework for Citizens (hereinafter the Framework) [30]. In the context of the DigComp system since 2013, the term «digital competence» refers to the use of ICT to achieve goals related to citizens' work, employment, learning, leisure, civic participation, skills and attitudes [31]. Digital competence is defined in this document as the confident and thorough use of information and communication technologies (ICT) in areas such as work, employability, education, leisure, engagement and participation in society, which are vital for participation in everyday social and economic life [30]. DigComp offers a common language for defining key areas of digital competence and a common reference at the European level [32].

DigComp is widely used in the context of employment, education and lifelong learning [30]. One of the key goals of DigComp is the planning of educational and training initiatives to increase the digital competence of specific target groups. It is a framework that is expected to serve as a guide for accessing, evaluating and using information, communicating through different channels, creating and sharing digital content, and using digital technologies in a reliable and critical way in every aspect of life [33].

This document provides examples of the application of Framework at the European, national and regional levels. Framework is the product of joint activities of international organizations and various authors - experts, scientists, teachers, and representatives of civil society. The basis for the creation of this document was the consultation and educational experience of many countries, which collected educational practices on the formation of digital skills and competence of a modern person in view of how they can be applied in the world of digital technologies.

The authors of Framework note that after the first publication of the DigComp system in 2013, radical changes took place in the evolution of digital technologies, new needs and requirements arose, which were reflected in the dictionary of the DigComp 2.0 system,

relating to the concepts of the application of digital competence, which is dynamic in nature. The glossary describes the following terms: content, data, digital communication, digital content, digital environment, digital services, digital technology, digital tools, privacy rules, problem solving, well-being, social inclusion, structured environment, technological response/solution [9].

This framework consists of five digital competency areas and 21 competences, namely: information and data literacy, communication and collaboration, digital content creation, safety and problem solving.

In 2016 Framework was updated and presented in 2017 (DigComp 2.1: The Digital Competence Framework for Citizens) with eight proficiency levels and examples of use) [34]. The digital competence system of citizens is built in four dimensions. Dimensions 1 and 2 were released in 2016 and represent the DigComp conceptual reference model:

Dimension 1 – competence areas defined as parts of digital competence;

Dimension 2 – competence descriptors and titles corresponding to the areas;

Dimension 3 includes 8 levels of learning outcomes (levels skills for each competency);

Dimension 4 – examples of knowledge, skills and attitudes;

Dimension 5 – examples of use, application of competence for different purposes.

The 3rd, 4th and 5th dimensions were updated and presented in 2017. Also by the developers the framework provided a number of examples of the application of the competence for various purposes in the field of education and employment. The areas of digital competence include the following: 1) information and the ability to work with data; 2) communication and cooperation; 3) creation of digital content; 4) security; 5) solving problems. Framework contains 21 descriptors for each industry [34].

The developed document of DigComp 2.1 provides a description of eight levels of mastery of each branch of digital competence according to four generalized levels: basic (simple tasks – 2 sublevels), medium (1– well-defined, routine tasks; 2 – straightforward problems, tasks and well-defined and non-routine problems), higher (1 – various tasks and problems; 2 – the most relevant tasks), expert (1 – solving complex problems with limited solutions; 2 - solving complex problems with many interacting factors) [34].

In 2017, the EU's European Research Center published the Digital Competence Framework for Educators (DigCompEdu), aimed at educators at all levels of education, which provides tools to develop a person's digital competence, from early childhood to higher education and adult education, including vocational education, education of people with

special needs, informal forms of education [35]. This framework covers teacher digital competence and outlines six domains and 22 components. Among the sectors outlined by the framework are the following: sector 1 is aimed at the professional environment and the use of digital technologies by educators in professional interaction with colleagues, students, parents and other stakeholders for professional development and creation of collective achievements of the educational institution; sector 2 includes the competences and qualities necessary for effective and responsible use, creation and sharing of digital resources for learning; sector 3 dedicates to managing the use of digital technologies in education; sector 4 is use of digital strategies for assessment; sector 5 focuses on the possibilities of digital technologies to improve teaching and learning strategies; sector 6 provides a detailed description of the specific competences of the teacher, which must be possessed in order to form the digital competence of students. The Ministry of Education of Ukraine also took this project as a basis for improving the skills of teachers of schools and higher educational institutions regarding ICT [36].

Digital competence is defined in different ways, and there is currently no single concept that is widely accepted and agreed upon. However, from the above understanding and perceptions of experts and scholars, it is clear that digital competence should be seen as an important skill for survival and knowledge in the digital age, meaning the ability to learn, work, relax, play and use ICT confidently and creatively.

The framework details all the qualifications needed to be competent in a digital environment and explains these competencies in terms of knowledge, skills and attitudes. Although the framework was developed for quite different purposes, it aims to describe what and how students acquire, use, adapt and learn with technology [37]. The framework emphasizes students' ability to receive and understand information; produce information; transmit digital information; and to search, create and communicate in a safe and responsible way. The field of competence «Information literacy» includes identification, search and analysis of digital information. The field of competence «Communication» involves students' awareness, knowledge and understanding of communication with others. The field of competence «Creation of content» refers to the use by students of digital tools for production and publication. The fourth area «Security» covers personal protection, data protection, and digital identity and security issues. Problem solving is related to the ability to identify and solve various problems [37].

Digital competence is often researched and discussed by academic scholars and in policy documents, and is receiving increasing attention in higher education. Now, when the

environment of teaching and learning in Ukrainian society has really changed, the use of ICT penetrates into the educational process of teaching educational disciplines and is closely related to the success of both the teacher and the student.

The Ukrainian experience of ensuring the ICT competences of teachers is based primarily on the initiative projects of the Ministry of Education and Science of Ukraine, namely on the National Strategy for the Development of Education in Ukraine for the period until 2021, approved by the Decree of the President of Ukraine dated June 25, 2013 No. 344/2013, aimed at to ensure the fulfillment of the tasks of Ukraine's transition to an innovative path of development by accelerating the introduction of ICT in education and science, the development of educational and scientific electronic information resources based on an analysis of the state and needs of educational institutions and relevant trends in global development [38].

The prepared changes to the National Strategy for the Development of Education in Ukraine for the period until 2021, approved by the Decree of the President of Ukraine dated June 25, 2013 No. 344/2013, are aimed at ensuring the implementation of the tasks of Ukraine's transition to an innovative path of development by accelerating the introduction of ICT in education and science, development educational and scientific electronic information resources based on an analysis of the state and needs of educational institutions and relevant trends in global development, develop a plan of measures to achieve the defined goals and indicators. Acceleration of the creation of a unified national educational space; access of educational institutions and participants in the educational process to electronic educational resources and systems. Formation of an expert council at the Ministry of Education and Science of Ukraine on the problems of e-education, consisting of representatives of leading educational and scientific institutions, business entities in the ICT sector, public organizations and international experts.

Creation of the Education Reform Strategy Project/strategies for the reform of specific fields of education (for higher education - provided for in № 1, Part 1 of Article 13 of the Law of Ukraine «On Higher Education») and the draft strategy for reforming the national system of science and innovation.

Ukraine's implementation of the Incheon Declaration «Education 2030: Towards inclusive and equity quality education and lifelong learning for all» adopted at the UNESCO World Forum on Education (2015), aimed at creating opportunities quality education throughout life for everyone, in all structures and at all levels of education and development of the Education 2030 («Education 2030: Towards inclusive and equity quality education and

lifelong learning for all»). Implementation of the provisions of MONU order of 21.06.2016 № 696 «On the creation of a working group with implementation of the program of development and implementation of information and communication technologies and electronic governance in the field of education and science of Ukraine (Education programs)». Implementation of the draft list of national educational indicators of the effectiveness and quality of general secondary education and the methodology of their calculation, according to the order of the Ministry of Education and Culture № 147 dated 23.02.16.

The Ministry of Education and Science of Ukraine launched a strategy for the development of the project of the concept of basic principles for the development of the national education system in the conditions of the information society, in particular, the preparation of appropriate changes to the strategies for the development of education for the activation of the introduction of ICT in the field of education.

The consideration at the meeting of the Committee on Science and Innovation the issue of introducing in Ukraine international standards and regulations on the use of ICT and ensuring information security in education, in particular – the series of standards ISO/IEC JTC 1/SC 36 had were very important and necessary. «Information technology for learning, education and training» technologies for learning, education and training questions were also important.

Equally important is the consideration at the meeting of the Science and Innovation Committee of the Public Council of the state and prospects of creating a unified national educational space of Ukraine, ensuring access of educational institutions and participants of the educational process to electronic educational resources and systems.

The first step to equip students with digital skills can start with the curriculum development process.

In Ukraine, the development of training programs according to a standardized program primarily belongs to the Ministry of Education and Science of Ukraine.

Curriculum reforms promote the use of many digital technologies in many areas. ICT classes can be offered to middle school (grades 5-8) and high school (grades 9-11) students. In grades 5-6, two hours of ICT per week are mandatory, in grades 7-8 – optional. At primary and secondary level, ICT can be taught as separate courses and is expected to be used as a common tool in other courses. It is noted that teachers and students use ICT for additional activities in all lessons except drawing at primary and secondary levels.

In higher education institutions of Ukraine, digital competence is considered as part of the basic skills of the 21st century, which develops problem-solving skills and analytical thinking, attracts students to the ICT industry and strengthens employment in ICT.

This knowledge is important for a better understanding of the current technological environment of society and raising awareness of the risks of improper use of ICT. Internet copyright infringement will also be addressed in the context of curriculum updates.

Competences acquired during learning are important for an individual to be able to engage in cognitive processing to understand and solve problem situations. In order for students to acquire such competences, more attention should be paid to developing students' understanding of how digitalization affects the development of both individuals and society. In connection with the implementation of educational reforms related to ICT, a number of changes in education are expected in Ukraine, namely more elective courses are expected. Students are expected to acquire specific competences at school, a new ICT curriculum should be compulsory from primary school and ICT should be integrated into their studies or across different subject areas.

Schools and universities should be encouraged to participate in projects that demonstrate innovative ways of using ICT in education to promote students' digital competence.

According to the new curriculum reform of Ukraine for primary, secondary and higher education from 2017, digital competence will be a part of the new national curriculum.

Adoption of the Ministry of Education and Science of Ukraine decisions and projects in education are important to facilitate other activities, including supporting the implementation of the project by providing hardware and broadband Internet for all classes, providing electronic content for topics, creating platforms for teachers to integrate IT technologies and product development. The proposed projects aim to equip all students with 21st century skills. These skills: think critically and solve problems, find effective solutions to problems, work collaboratively, acquire a sense of responsibility, acquire information literacy, reach an effective level, acquire media literacy, acquire information and communication technology literacy, use digital technologies and communication tools for research , organization and evaluation of information.

The action plan adopted by the Ministry of Education and Science of Ukraine includes various measures related to digital education policy. In this development plan, “providing people with the basic skills necessary for the information society” is defined as the main goal of the education system. For this purpose, by 2018, it is planned to improve the ICT

infrastructure of schools, support the production of digital content, and teach teachers to effectively use this infrastructure and content.

Conclusions

Based on this review, the future of the European structure of digital competences in Ukrainian society can be considered a multifaceted concept that arises from several sources. Ukrainian society has witnessed many social, economic and cultural changes and witnessed the rapid acceleration of solving the issues of digital competence and the integration of technologies in the field of education, which has led to changes in educational practices, and as a consequence to changes in approaches to teaching and learning. New digital skills, knowledge and attitudes have defined the current shape of education and revealed weaknesses in education systems around the world.

Educational practices of Ukrainian schools and institutions of higher education are in constant search due to innovations in information and communication technologies, globalization of education and social changes. Inadequate coordination of actions between the state and educational institutions, the lack of ready-made joint online platforms for learning, the lack of systematicity in the criteria for evaluating the scientific-methodical and digital competence of teachers creates a significant lag behind Ukraine in the rapid development of ICT in the world. The goals of Ukrainian society, like the goals of the Ukrainian State, should be to encourage citizens to develop skills, knowledge, ethical foundations, and self-confidence that will serve them well in the future. Considering these challenges, public institutions and politicians should define the reform of the current education as a priority to effectively respond to the changing needs of students of the 21st century. The proper acquisition of digital competence or digital literacy is the key to the active and functional participation of Ukrainian citizens both in modern Ukrainian society and in the society of the European space.

References:

1. S. Nambisan, K. Lyytinen, A. Majchrzak, M. Song. Digital innovation manage ment: reinventing innovation management research in a digital world. *MIS Q*. 2017, 41(1): 223–228.

2. E. Fischer, A. R. Reuber. Social interaction via new social media: (how) can interactions on Twitter affect effectual thinking and behavior*? J. Bus. Ventur*. 2011, 26(1): 1–18.

3. M. Fitzgerald, N. Kruschwitz, D. Bonnet, M. Welch. Embracing digital technology: a new strategic imperative. *MIT Sloan Manag.* 2014, 55(2): 1.

4. S. Greenstein, J. Lerner, S. Stern. Digitization, innovation, and copyright: what is the agenda? *Strateg. Organ*. 2013, 11(1): 110–121.

5. O. A. Zhernovnykova. Zactocyvannia hmarnux technologii pri pidgotovsi maibytnix vchuteliv matematiki do navchal`nogo proektyvannia [Application of cloud technologies in the preparation of future mathematics teachers for educational design]. *Tavriyskyi herald of education*. 2015, 3(51): 98–104. (in Ukrainian).

6. B. Cohen, J. E. Amorós, L. Lundyd. The generative potential of emerging technology to support startups and new ecosystems. *Bus. Horiz*. 2017, 60 (6): 741–745.

7. Y. Yoo, O. Henfridsson, K. Lyytinen, The new organizing logic of digital innovation: an agenda for information systems research. *Inf. Syst. Res. 21*. 2010, (4): 724–735.

8. Y. Yoo, Jr. R. J. Boland, K. Lyytinen, A. Majchrzak. Organizing for innovation in the digitized world. *Organ*. 2012, 23(5): 1398–1408.

9. A. Calvani, A. Cartelli, A. Fini, M. Ranieri. Models and instruments for assessing digital competence at school. *J. E-Learn. Knowl. Soc. Version*. 2009, 4: 183–193.

10. R. J. Krumsvik. Skulen og den digitale læringsrevolusjonen. [The school and the digital learning revolution]. Oslo: Universitetsforlaget, 2007.

11. M. Prensky. How to teach with technology: Keeping both teachers and students comfortable in an era of exponential change. *Emerg. Technol. Learn*. 2007, 2: 40–46.

12. R. Bisquerra. Metodología de la Investigación Educativa, 2nd ed.; La Muralla: Madrid, Spain, 2016.

13. C. Kivunja. Do you want your students to be job-ready with 21st century skills? Change pedagogies: A pedagogical paradigm shift from Vygotskyian social constructivism to critical thinking, problem solving and Siemens' digital connectivism, International Journal of Higher Education. 2014: 3(3), 81.

14. L. Kolb. Toys to tools. Eugene: International Society for Technology in Education. [Electronic Resource] — Mode of access: http://payflowtest.iste.org/images/excerpts/TOYTUL-excerpt.pdf

15. O. A. Zhernovnykova. Peculiarities of preparing students-mathematicians for working in new types of educational establishments. *Nauka i studia*. Przemysl. 2014, 15(125):103–110.

16. Gomez S. Carretero, R. Vuorikari, Y. Punie. DigComp 2.1: The Digital Competence Framework for Citizens with Eight Proficiency Levels and Examples of Use, EUR 28558 EN; Publications Office of the European Union: Luxembourg, 2017.

17. C. S. Bruce. Seven faces of ınformation literacy, AULSIB Press, Adelaide, 1997.

18. Belshaw, D. A. J. *What is 'digital literacy'? A pragmatic investigation* (Doctoral dissertation). Durham University. 2011.

19. United Nations Educational Scientific and Cultural Organization (UNESCO). *Education for All: Literacy for life* (Global Monitoring Report). Paris, France: UNESCO. 2006.

20. M. Area, A. Gutiérrez, F. Vidal. Alfabetización digital y competencias informacionales. (p. 225). Madrid/Barcelona: Editorial Ariel, S.A., Fundación Telefónica y Fundación Encuentro. 2012.

21. European Commission. *Digital Agenda for Europe: A Europe 2020 Initiative*. 2013. [Electronic Resource] — Mode of access: http://ec.europa.eu/digital-agenda/en

22. D. J. Leu, L. Zawilinski, J. Castek, M. Banerjee, B. C. Housand, Y. Liu, M. O'Neil. 2007. What is new about the new literacies of online reading comprehension? In L. Rush, A. J. Eakle, & A. Berger (Eds.), *Secondary school literacy: What research reveals for classroom practice* (pp. 37–68). Urbana, IL: National Council of Teachers of English (NCTE).

23. V. Yu. Bikov, O. M. Spirin, O. P. Pinchuk. Problems and tasks of the modern stage of informatization of education: Institute of Information Technologies and Teaching Aids of the National Academy of Pedagogical Sciences of Ukraine. 2017.

24. O. Ju. Burov. Educational Networking: Human View to Cyber Defense. *Information technologies and teaching aids*. 2016, 52(2): 144–156.

25. O. P. Pinchuk, S. G. Litvinova, O. Y. Burov. Synthetic learning environment is a step towards a new education. *Information technologies and teaching aids*. 2017, 60(4): 28–45.

26. A. Ferrari. *Digital competence in practice: An analysis of frameworks* (92 p.). Luxembourg: Publications Office of the European Union, 2012.

27. Gallardo-Echenique, E. 2012. Competencia digital en el siglo XXI. Paper presented at *II Congreso Internacional de Educación Superior: La formación por competencias*. Chiapas, México: Universidad Autónoma de Chiapas.

28. L. Ilomäki, S. Paavola, M. Lakkala, A. Kantosalo. Digital competence–an emergent boundary concept for policy and educational research. *Education and Information Technologies*. 2016, 21(3): 655–679.

29. A. Calvani, A. Fini, M. Ranieri. Digital Competence In K-12: Theoretical models, assessment tools and empirical research. *Anàlisi: quaderns de comunicació i cultura*. 2010, 40: 157–171.

30. R. Vuorikari, Y. Punie, Gomez S. Carretero, G. Van den Brande. *DigComp 2.0: The Digital Competence Framework for Citizens. Update Phase 1: The Conceptual Reference Model.* (44 p.). Luxembourg Publication Office of the European Union. EUR 27948 EN, 2016.

31. L. A. Siiman, M. Mäeots, M. Pedaste, R. J. Simons, Ä. Leijen, M. Rannikmäe, M. Timm. An ınstrument for measuring students' perceived digital competence according to the Dıgcomp framework. International Conference on Learning and Collaboration Technologies (p.233-244). Springer International Publishing, 2016.

32. A. Ferrari. *DIGCOMP: A Framework for Developing and Understanding Digital Competence in Europe*. (50 p.) Y. Punie & B. N. Breco (Ed.), JRC Scientific and Policy Reports. Seville: European Commission Joint Research Centre. Institute for Prospective Technological Studies. Luxembourg: Publications Office of the European Union, 2013.

33. S. Kluzer, G. Rissola. Guidelines on the adoption of DigComp, 2015. 28p.

34. S. Carretero, R. Vuorikari, Y. Punie. *DigComp 2.1: The Digital Competence Framework for Citizens with eight proficiency levels and examples of use.* EUR 28558 EN, Publications Office of the European Union, Luxembourg, 2017. 48 p.

35. C. Redecker, European *Framework for the Digital Competence of Educators: DigCompEdu*. Punie, Y. (ed). EUR 28775 EN. Publications Office of the European Union, Luxembourg, 2017.

36. New Ukrainian school. *Conceptual principles of secondary education reform*. Ministry of Education and Science of Ukraine. 2016, 11–12.

37. F. Siddiq. *Assessment of ICT Literacy. A comprehensive inquiry of the educational readiness for the digital era*. Doctoral Dissertation. 2016. 81 p.

38. Decree of the President of Ukraine on the National Strategy for the Development of Education in Ukraine for the period until 2021. Document 344/2013, valid, current edition. Adoption dated 06.25.2013. [Electronic Resource] — Mode of access: https://zakon.rada.gov.ua/laws/show/344/2013/paran10#n10