PECULIARITIES OF DIGITAL COMPETENCE FORMATION IN PRESCHOOL CHILDREN: UKRAINIAN AND INTERNATIONAL STUDIES

ОСОБЛИВОСТІ ФОРМУВАННЯ ЦИФРОВОЇ КОМПЕТЕНТНОСТІ ДІТЕЙ СТАРШОГО ДОШКІЛЬНОГО ВІКУ В УКРАЇНСЬКИХ ТА ЗАРУБІЖНИХ ДОСЛІДЖЕННЯХ

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The article analyzes studies on the issue of developing digital competence in preschool children. It has been clarified that, despite the ongoing debate about whether it is appropriate to intentionally introduce children to the digital world on a global scale, Ukraine's legislation framework clearly mandates the need to create a digital space in preschool institutions that supports personal growth, as well as the obligation to develop digital competence in older preschool children. The conceptual foundations of digital education in Ukraine have been examined. The views of leading scholars have been highlighted, who emphasize the positive trends in the development of the digital society and the need to prepare the younger generation for it. This preparation can only be achieved through purposeful educational action, while also considering the associated risks and prospects. The article presents the research studies of Ukrainian and foreign scholars, which demonstrate the early immersion of preschool children in the digital world and the negative consequences of uncontrolled use of digital devices and exposure to various types of content. The psychological and physiological features of the impact of digital devices on children's nervous system, vision, and posture have been characterized. It has been argued that the age-specific characteristics of preschool children should be considered, and sanitary regulations must be followed when using digital devices both at home and in preschools. The components of digital competence in preschool children, defined by Ukrainian and foreign researchers, have been analyzed. It has been established that, although the components of digital competence in preschool children are grouped differently, the content of educational tasks reflects the advancements in both European and Ukrainian science. The focus has been placed on practical issues, such as the presence of technical skills in preschool children for using digital devices for play, while lacking basic knowledge of personal safety during their use, rules for online communication, and skills for using devices for educational purposes, and other related concerns. The recommendations of scholars on organizing the educational process aimed at developing digital competence in older preschool children have been summarized.

Key words: *digital competence, preschool children, digital educational environment, digital devices (DD), psychological and physiological features.*

У статті проаналізовано дослідження з проблеми формування цифрової компетентності у дітей дошкільного віку. З'ясовано, що попри дискусійність питання доцільності цілеспрямованого введення дітей у цифровий світ у глобальному масштабі, законодавча база України чітко регламентує необхідність створення сприятливого для зростання особистості цифрового простору у закладі дошкільної освіти та обов'язковість формування цифрової компетентності у дітей старшого дошкільного віку. Вивчено концептуальні положення цифрової освіти в Україні. Виокремлено думку провідних науковців, які, аналізуючи супутні ризики та перспективи, наголошують на позитивних тенденціях розвитку цифрового суспільства та необхідності підготовки до нього молодого покоління, що можливо лише за умов цілеспрямованої виховної дії. Висвітлено дослідження українських та зарубіжних учених, що засвідчують раннє занурення дітей дошкільного віку у цифровий світ та негативні наслідки неконтрольованого використання цифрових пристроїв, перегляду різноманітного контенту. Схарактеризовано психолого-фізіологічні особливості впливу цифрових пристроїв на нервову систему дітей, зір, поставу. Аргументовано необхідність урахування вікових особливостей дітей дошкільного віку та важливість дотримання санітарного регламенту під час використання ЦП в умовах родини та ЗДО. Проаналізовано компоненти цифрової компетентності дітей дошкільного віку визначені українськими та зарубіжними вченими. З'ясовано, що попри різне групування компонентів цифрової компетентності дітей дошкільного віку, змістове наповнення освітніх завдань ураховує досягнення європейської та української науки. Акцентовано увагу на проблемах практики, як от: наявність у дітей дошкільного віку технічних навичок використання цифрових пристроїв з ігровою метою, натомість відсутність базових уявлень про власну безпеку в процесі їх використання та правил спілкування у мережі, навичок використання пристроїв з пізнавальною метою тощо. Узагальнено рекомендації науковців з організації освітнього процесу, спрямованого на формування цифрової компетентності дітей старшого дошкільного віку.

Ключові слова: *цифрова компетентність, діти дошкільного віку, інформаційно-освітнє середовище, цифрові пристрої (ЦП), психолого-фізіологічні особливості.*

Problem Statement. One of the most relevant issues of the modern education system is the creation of a safe digital space and the development of digital competence of the younger generation. In Ukraine, considerable attention has been given to this issue, starting from the preschool level. The Law of Ukraine "On Preschool Education," which came into effect in January 2025, emphasizes the creation of a healthy educational environment, which includes "a set of conditions, measures, and rules in educational institutions... regarding the formation of a culture of personal hygiene, healthy eating, safety

ecological awareness and behavior, including while being in the informational environment (especially the digital one)" [1]. Researchers view the creation of a safe digital environment as dependent on the proper equipping of preschool institutions, the development of educators' digital competence to effectively support the educational process, and effective communication with all participants involved. The formation of digital competence in preschool children involves developing the ability to stay safe in the digital environment, understanding the rules of the virtual world, and acquiring skills to use digital devices for cognitive purposes in accordance with safety guidelines. The task of developing digital competence in preschool children is outlined in the State Standard of Preschool Education (2021). However, due to its novelty, it has not been fully explored in theoretical studies and remains insufficiently developed for practical implementation in the educational process.

Review of Recent Studies and publications indicates that the issue of digitalization in the preschool education process and the development of digital literacy in educators and children is in the focus of attention for a significant number of scholars. The conceptual foundations of major works in philosophy, psychology, and pedagogy, addressing child development in modern society, highlight the main directions for creating a beneficial digital space (Andrushchenko V., Bekh I., Bykov V., Kremin V., Luhovyi V., Reipolskyi O., Sysoyeva S., Spirin O., Topuzov O., et al.). Researchers, examining the best conditions for raising children in today's society and considering the risks and opportunities, highlight the importance of joint efforts from the state, education system, and families to create a safe and supportive digital environment for personal development [3; 7]. In their scientific works, scholars emphasize the positive prospects of technological development, which can only be achieved through purposeful educational action.

Scholars who conduct fundamental research on the future of modern preschool education agree on the crucial role of education in the conditions of a digital society (Vasylieva S., Havrysh N., Zaitseva L., Kanishevska L., Kuzmenko V., Krutii K., Pirozhenko T., Reipolskyi O., Rogalska-Yablonska I., et al.). They note that the challenges of today and the overall trends in the digitalization of society impact the developmental environment of preschool institutions, creating an additional dimension of the digital educational and informational environment, which is an inseparable part of modern preschool institutions. Due to the above, the issue of pedagogical support of preschool children and the study of the phenomenon of certain aspects of the formation of preschool children's behavioral skills in the digital environment is urgent and relevant.

Unresolved Issues. The diverse nature of the issue of digital education for preschool children, as noted by scholars and practitioners, has led to the need to systematize and summarize existing research and findings in order to clarify the basis for the formation of digital competence of preschool children.

The Aim of the Article is to provide a comprehensive and organized theoretical review of recent studies on the formation and development of digital competence in children of preschool age.

Results and Discussion. The formation of digital competence in preschool children is a complex and multidirectional issue, which is reflected in Ukraine's legislative and regulatory framework. This includes the updated Law of Ukraine "On Preschool Education" (2024), under which the concept of digital hygiene of preschool children and an action plan for its implementation should be developed and approved throughout 2025. It is also addressed in the "Concept for the Implementation of Media Education in Ukraine" (revised edition, 2016) and the "The concept of raising children and youth in the digital space" (2022), both of which outline strategies for innovative development in preschool education. Furthermore, the State Standard of Preschool Education (2021) defines the content of education and the formation of competencies during early childhood development, serving as a foundation for updating educational programs over the next ten years.

The analysis of academic literature reveals certain terminological inconsistencies in legal and regulatory documents as well as scholarly publications that define the concept of "digital competence" term, as technological progress over the past decade has moved much faster than the development and adaptation of theoretical vocabulary. Among the concepts related to the research issue, the terms "media competence" and "digital literacy" are considered to be similar in essence and structure.

While the targeted formation of digital competence, as outlined in educational and partial programs, typically begins at the older preschool age, an analysis of academic studies on the impact of digital technologies on children indicates that children today are exposed to them from a much earlier age (Blyzniukova O., Minenko O., Petrunko O., Pykhtina N., et al.). Premature immersion of children in the digital world is clearly a negative trend, as confirmed by research conducted by both Ukrainian and foreign scientists (Danby S., Edwards S., Mantilla A., Magee C., Lee J., Stiglic N., Vella S., Viner R.; Straker L., Zabatiero J., et al.). It has been established that digital devices cause sleep problems, nervous tension, increase levels of anxiety and irritability, reduce attention span, and impair vision. Researchers note that a significant number of preschool children do not get enough sleep when a TV is located in the bedroom, due to the information overload and the device's light emission. All of this contributes to hyperexcitation of the nervous system and a decrease in sleep productivity

[13; 15; 16]. Insufficient sleep duration and nervous tension lead to behavioral disorders. Consuming excessive and age-inappropriate content is a factor in the development of anxiety. It is also important to note that the use of a computer, tablet, or phone has a more intense impact on a child's nervous system compared to watching television. Researchers link this phenomenon to the increased interactivity and dynamic fast-changing picture, which increase tension on the nervous system and negatively affect the child's emotional state. At the same time the use of digital devices at an early age harms children's vision due to age-related ophthalmological features, such as an enlarged pupil and increased light transmission through the lens. It has been scientifically proven that prolonged use of gadgets and viewing various types of content can negatively affect both physical and mental health from an early age. Therefore, it is important for adults to approach the use of digital devices with caution and be mindful of involving children in their use [13; 15; 16].

I. Kuzma's research on the psychophysiological features of preschool children supports the idea that it is reasonable to start purposefully developing digital competence at the older preschool age. This is due to the active development of cognitive processes at this age. Children begin to use visual and imaginative thinking more effectively, can solve tasks mentally, and form their own judgments, including inductive and deductive reasoning. Their understanding of the surrounding world becomes broader, deeper, and more accurate. They also start to think more critically by evaluating their own and others' thoughts, checking information, and testing ideas. Additionally, their development of cognitive activity and interest become more stable and active [6].

That is why using digital devices at the older preschool age, while strictly following safety rules, is scientifically justified. A balanced approach to exploring the possibilities of developing the foundations of digital competence is particularly necessary for children aged 4 to 5. This is due to the uncontrolled influence of digital technologies and the inability of adults to adequately protect children from such exposure, which includes a lack of awareness of potential health risks, neglect of safety rules, and insufficient supervision and guidance during device use. This is driven by the need to understand safe behavior in the digital environment, the formation of perceptions of digital devices as tools for exploring the world, the development of critical thinking, and the accumulation of experience in identifying reliable sources of information, all of which become particularly relevant when children begin using devices. This perspective is supported by the arguments presented in the studies of K. Zhurba, L. Kanishchevska, R. Malinoshevskyi, N. Kharchenko, S. Fedorenko, and others. The researchers emphasize that "to enhance the safety of preschool children in the digital space, it is essential to develop strategies and tactics for the psychological and pedagogical support of their engagement with the digital environment", which highlights the need for further research in this area [4, p. 24].

I. Nikolaescu and V. Shynkarova view digital literacy as the ability to acquire knowledge and develop skills for safe behavior and effective use of digital devices. They note that the role of a preschool teacher is to create conditions for the successful development of digital literacy. However, there is still a lack of materials focused on fostering digital competence in children, with attention to their age-specific characteristics and interests. [9]. Relying on the research of D. Belshaw, scholars have identified the key components of digital literacy in preschool children:

1) cognitive component – knowledge about available sources of information (both paid and free), their benefits and risks, understanding of social networks, their structure, advantages and disadvantages of use; understanding of the general principles of operation and connection of digital devices;

2) activity-based component – the ability to use various digital devices and information sources; independently navigate websites; send and receive emails; use social media; create digital content and share it with other users; the ability to analyze tasks and solve problems using appropriate digital tools;

3) motivational component – interest in using and creating digital content; awareness of the need for digital literacy and online safety; the desire to be part of the online community [9].

In European countries, the digital competence of preschool children is based on the European Digital Competence Framework for Citizens. Digital competence is characterized by a set of 21 competencies, organized into five competency areas: 1) Information and data literacy; 2) Communication and collaboration; 3) Digital content creation; 4) Safety; 5) Problem-solving [11; 14].

In particular, scholars from the Republic of Bulgaria view the digital competence of preschool children as a five-component structure, summarized as follows:

1) Information and media literacy – the ability to find, evaluate, and use information appropriately, manage the flow of information from various sources, and incorporate it into games.

2) Communication and collaboration – involve interaction between the child and peers or adults (text, voice, and video communication to ensure effective interaction).

3) Digital content – the use of technology as a tool for exploring the world and creating one's own product.

4) Safety – related to protecting the child's health and well-being, as well as ensuring security in the multimedia interactive environment through the available resources.

5) Problem-solving – focused on using technology for exploring, analyzing, discovering, learning new things, communicating and cooperation with others [11].

The Swedish National Agency for Education, following the European Commission's Digital Competence Framework for Citizens (DigComp 2.2), outlines four areas for developing digital competence in preschool children:

1) understanding the impact of digitization on society;

2) becoming familiar with and using digital tools and media;

3) having a critical and responsible approach;

4) solving problems and turning ideas into action.

These areas form the basis of the content of digital competence, which is implemented in the educational process of preschool institutions. Accordingly, Swedish researchers view the development of digital competence in preschool children as a process that goes beyond the basic use of digital devices by children and evolves in response to the changing needs of society and the specific circumstances in which the child finds themselves [14].

In the State Standard of Preschool Education of Ukraine, within the educational area "The Child in the Sensory-Cognitive Space. Computer Literacy", the educational objectives are structured according to the framework for developing digital competence. They include the formation of emotional and value-based attitudes, knowledge, and skills that are similar in content to the objectives identified by European researchers [2].

In studying the issues related to the development of children's understanding of the modern digital world and the safe use of digital devices, both Ukrainian and foreign researchers note that, in practice, children often possess the skills to use devices for entertainment purposes. However, they lack knowledge about safe usage, do not understand the potential of digital tools for learning, and lack the corresponding skills [4; 8; 13]. These skills are generally not developed in the context of home upbringing, as parents tend not to give them sufficient attention. Therefore, the purposeful and systematic development of children's digital competences within preschool institutions is of particular importance.

The possibilities of using information and communication technologies in the educational process of preschool institutions in Ukraine were substantiated by O. Reipolska. The scientist argues for the necessity of developing in preschool children of older age basic concepts about computers, their use, and the "expansion of informational horizons" in the context of the heavily technicalized modern life. To achieve this, forms of joint cognitive and communicative activities within the triad "child – parents – educator" are essential, as the family's primary role in upbringing is beyond question. During such interaction, it is necessary to create the prerequisites for the development of thinking, awareness, and strategies for acting in the world of digital technologies. It is important to foster children's ability to reflect, adapt, rely on trustworthy sources of information, and draw on previous experiences. Additionally, it is essential to develop skills for following rules of safe behavior, as this forms the foundation of digital competence in preschool-aged children [10].

Since modern researchers define the educational and informational environment as an integral part of today's preschool institutions, practical experience in developing digital competence in preschool children becomes especially important. This process should be based on the psychological and physiological features of early childhood development and perception. Studies by Ukrainian and international scholars highlight various aspects of digital competence development; however, they primarily focus on the enhancement of cognitive skills and the expansion of children's knowledge about the surrounding world. For example, the study by Zhao X., Roberts S., and Magnusson L. explores the potential of using digital tools in developing mathematical concepts; Ewin C., Reupert A., McLean L., and QiuMing L. investigated language development through the use of digital services and devices. The formation of children's understanding of natural objects is addressed in the works of T. Ponomarenko, L. Kozak, N. Ivanenko, O. Kuzina, and others [5; 12; 17].

It is worth noting that both Ukrainian and international researchers mainly regard digital tools as a means of demonstration for shaping children's understanding of the surrounding world, primarily by using virtual tours, educational video content, and games. The referenced studies highlight various opportunities for using digital devices and tools to develop fundamental personal competencies; however, such research remains limited in scope. Scholars consistently emphasize the need for systematic and comprehensive investigations into the development of digital competence in preschool-aged children, taking into account their age-specific developmental characteristics.

Conclusions. In summary, the generalized and systematized theoretical analysis of current research on the formation of digital competence in preschool children shows that researchers have differing views on terminology. This is due to the rapid and dynamic pace of digital technology development, which complicates the proper theoretical elaboration of the thesaurus. As a result, a large number of different terms can be observed in legislative and regulatory frameworks, as well as in scientific sources. Consensus in the research is expressed regarding the limitation of the impact of digital technologies on preschool-aged children and

the necessity of considering age-related features during the development of digital competencies. Based on research dedicated to the educational environment of preschool institutions and scientific studies discussing the role of digital technologies in the modern educational process, we note that the digital educational and informational environment of a preschool institution includes: qualified specialists, technical means (devices, digital services, the Internet), and interaction among all subjects of the educational process (parents, children, educators, administration, etc.) in accordance with educational tasks. Without any of these essential components, the comprehensive development of digital competence in preschool children will not be achievable.

Analyzing the psychological and physiological features of preschool children highlights the need for a balanced approach to the use of digital devices and services in both within family at home and in preschool settings. The scientific basis supports the identification of older preschool age as a favorable period for developing digital competence.

The review of scientific contributions from Ukrainian and international scholars indicates that a priority for the formation of digital competence in preschool children is instilling models of safe behavior online and with digital devices, as well as developing skills for using them for educational purposes. The achievement of this goal can only be realized through the collaborative efforts and mutual support of the state, educators, and families.

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