
THE USE OF DIGITAL TOOLS IN THE PRESCHOOL EDUCATION PRACTICE

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INTRODUCTION

Modern global trends in the development of digital technologies have contributed to the "digital society" formation and the emergence of a distinct "digital culture". Scholars identify digital competence as one of the key competencies of the 21st-century individual and emphasize that society functions in two dimensions, physical and virtual. The transition to a digital society calls for updated educational approaches aimed at developing communication culture and interaction skills in the younger generation. Researchers actively discuss the impact of the digital environment on children from an early age, emphasizing the emergence of "digital childhood". Since modern children are born in the digital world and do not know the world outside of technology, it is important for modern society to educate children in the conditions of the new digital world, to form a culture of safe behavior, cognition, and critical thinking. Scholars note that digital competence includes digital literacy, awareness of digital technologies, and involves the formation of digital culture, skills of safe and socially appropriate behavior in the virtual world. In light of this, the preparation of professionals capable of forming children's life competencies within the context of a digital society becomes particularly relevant.

Formation of digital competence is one of the preschool education tasks in Ukraine. To implement this task, specialists are needed who are familiar with the peculiarities of child development and the life skills formation. The issue of using digital devices and services practices in the education of preschool children is particularly interesting and debatable for many educators.

1. Literature review

In the context of European research, digital competence in preschool children is interpreted as a combination of knowledge, skills and attitudes,

and comprises three components: operational, cultural, and critical ¹. The operational component involves the development of skills in using digital devices and services, the ability to achieve desired outcomes, avoid harm, and solve problems through their use. Cultural component involves the formation of views, values, and ideas about the specific values of the children's community in the virtual world, traditions, their own language, and the ability to interact in the digital environment in accordance with the rules and norms of behavior. The critical component involves the development of cognitive skills and lays the foundation for forming a model of safe behavior in the digital world.

The vision of digital competence in preschool children aligns with the content of the educational areas outlined in the State Standard of Preschool Education of Ukraine (2021), which is structurally and conceptually similar to European programs and regulatory documents. It is worth noting that within the terminological framework of Ukrainian scholarship, the concept of “digital culture of preschool children” is not treated as an independent term. Instead, it is considered a component of “digital competence” term and is used by researchers to describe children’s emotional and value-based attitudes toward digital devices, services, and the digital environment.

The issue of developing digital competence in children is highly relevant for both scholars and practitioners. As a result, Ukrainian academic discourse is marked by an active search for ways to integrate digital devices and tools into the education of children within preschool education institutions. The culture of using digital devices is an important stage in the development of digital competence in preschool children. Therefore, studying the experience of using such technologies for cognitive and developmental purposes serves as a pathway to fostering digital competence in early and preschool-aged children.

The research of modern scientific works allowed us to note a significant number of studies that highlight the issue of digital devices and tools usage in preschool education. The potential impact of digital and analog approaches on multidimensional preschool scientific education was reviewed by Otterborn, A., Sundberg, B. Schonborn, K.². The authors analyzed how preschool educators integrate digital and analog tools when introducing children to natural sciences. Educators used tablets for video

¹ Scott F., Marsh J. Digital Literacies in Early Childhood. *Oxford Research Encyclopedia of Education*. Retrieved 5 Jun. 2025, from URL: <https://oxfordre.com/education/view/10.1093/acrefore/9780190264093.001.0001/acrefore-9780190264093-e-97> (Last accessed: 04.06.2025).

² Otterborn, A., Sundberg, B., Schönborn, K. The Impact of Digital and Analog Approaches on a Multidimensional Preschool Science Education. *Res Sci Educ*. 2024. Vol. 54. P. 185–203. DOI:10.1007/s11165-023-10133-6

recording, photography, fact finding, and using various programs, for example, for drawing. And the tablet was also connected to other digital tools such as action cameras, microscopes and projectors, allowing more children to participate and re-experience the activity through movies, photos and enlarged images. The findings showed that educators mainly use digital tools to enhance social learning and engage children in exploratory activities. The authors Zhao, X., Roberts, S.³ identified effective pedagogical practices of early childhood educators regarding the implementation of digital educational materials in the teaching of geometric shapes. Teachers used iPads, educational programs, television, and interactive whiteboards to engage children in exploratory geometric learning. Behnamnia, N., Kamsin, A., Ismail, M.A.B., Hayati, A.⁴ studies suggest that the use of DGBL (tablets and smartphones) during the use of educational digital games by children aged 3-6 years can potentially affect the ability of children to develop creative and critical thinking skills, transfer knowledge, acquire digital skills and positive attitudes towards learning, and provide deep learning.

The article by Magnusson, L. O. focuses on the connections between digital technologies, artistic activities, mathematics, literacy and children in Swedish preschool art rooms – "preschool atelier"⁵. The results show that children's activities with digital technologies (such as projectors, tablets, computers, web cameras, digital microscopes and digital voice recorders) and non-digital materials (such as shells, pens, paper, wood, bubble wrap and light) stimulate the development of creativity and aesthetic self-expression, as well as supports children's literacy and mathematical thinking.

Foreign and Ukrainian authors also investigate various aspects of the application of AR technology in education, in particular: the development of mobile AR applications for elementary schools in order to support experimental learning; the use of augmented reality tools on the example of Lego robotechnic projects (such applications as Just a line, Merge Cube Viewer, LabCamera, ARRuler, FaceRig) for the development of cognitive activity of preschool children during group work⁶; the use of augmented

³ Zhao X., Roberts S. Australian early childhood educators' perspectives on digital teaching of geometry: The pedagogical enablers and barriers. *Australasian Journal of Early Childhood*. 2024. DOI: 10.1177/18369391241234735

⁴ Behnamnia N., Kamsin A., Ismail M. A. B., Hayati A. The effective components of creativity in digital game-based learning among young children: A case study Children and Youth Services Review, 2020. vol. 116. DOI: 10.1016/j.childyouth.2020.105227

⁵ Magnusson L. O. Digital technology and the subjects of literacy and mathematics in the preschool atelier. *Contemporary Issues in Early Childhood*, 24 (3), 2023. P. 333–345. 2023. DOI: 10.1177/1463949120983485

⁶ Salvador-Herranz G., Pérez-López D., Ortega, M., Soto E., Alcañiz M., Contero M. Manipulating virtual objects with your hands: A case study on applying desktop

reality in the literary field of primary and preschool education. As the researchers note, visualization of an artistic image by means of augmented reality deepens the emotional resonance of reading an art work; becomes a powerful motivation for reading; promotes the development of creative imagination; demonstrates to children the benefits of gadgets for learning and personal development⁷; facilitates the organization of game activities, the organization of theatrical performances with the help of interactive bracelets and stickers with AR applications⁸; activates interest in research activities, develops emotional intelligence and creative thinking, promotes qualitative changes in the educational process of preschool education institutions⁹.

The mobile resources study for language education of preschool children based on wireless network technology in the context of artificial intelligence is presented in the article by QiuMing Li¹⁰. Campus network technologies, Internet of Things, artificial intelligence, and multimedia are viewed under the influence of intelligent learning environments to provide theoretical support for the scientific design of intelligent language learning environments in preschool education.

Modern foreign authors investigate various aspects of educators' readiness to implement digital tools in preschool education. Thus, in Sweden, educational technology is an integrated and widely accepted component of the preschool curriculum, and both the National Agency for Education and the The Digital Education Action Plan (2021-2027) emphasize the importance of digitally competent and confident educators¹¹.

augmented reality at the primary school, in: 2013 46th Hawaii International Conference on System Sciences, 2013. P. 31–39. DOI: 10.1109/HICSS.2013.390.

⁷ Nezhyva L. L., Palamar S. P., Lytvyn O. S. Perspectives on the use of augmented reality within the linguistic and literary field of primary education. *Proceedings of the 3rd International Workshop on Augmented Reality in Education* (2731). 2020. P. 297–311.

⁸ Nezhyva L. L., Palamar S. P., Vaskivska H. O., Kotenko O. V., Nazarenko, L. A., Naumenko M. S., Voznyak A. V. Augmented Reality in the Literary Education of Primary School Children: Specifics, Creation, Application Proceedings of the Symposium on Advances in Educational Technology (AET 2020) Kyiv, Ukraine, 2021. November 12–13, P. 1275–1288

⁹ Козак Л. В., Іваненко Н. В. Використання доповненої реальності як засобу пізнавального розвитку дітей дошкільного віку. *Інноватика у виховання*. 2021. Випуск 13. Том. 2. С. 43–52. DOI: 10.35619/iiu.v2i13.377

¹⁰ QiuMing Li. A Study on Mobile Resources for Language Education of Preschool Children Based on Wireless Network Technology in Artificial Intelligence Context. *Hindawi Computational and Mathematical Methods in Medicine* Volume 2022. DOI: 10.1155/2022/6206394

¹¹ Yngvesson T., Siraj-Blatchford J. A Way Forward for Preschool Teacher Education and Technology. In: Garvis S., Keane T. *Technological Innovations in Education*. Springer, Singapore. 2023. DOI:10.1007/978-981-99-2785-2_5

The publications of Ukrainian scientists consider various digital tools in the professional training process of preschool teachers, in particular: Easel.ly, Piktochart.com, Padlet, Symbaloo, Coggle.it, ThingLink, WordArt, LearningApps.org, PowToon, Prezi, etc. during the creation of thematic projects in the process of teaching the course "Project activity in an educational institution"¹². digital visualization tools, cooperative interaction, game services, augmented reality in learning practical disciplines in a distance format, such as: Genially, Jamboard, Conceptboard, Kahoot, H5P, Craiyon, Deepdreamgenerator, Dreamstudio, Canva, Fotor, LightShot, Fanny Photo, Blippbuilder¹³; AR technologies¹⁴; Wiki-technologies¹⁵; technologies of artificial intelligence¹⁶; creating open resources for practice¹⁷ etc.

As a result, the majority of publications on the specified problem indicate the necessity of the introduction of digital technologies in preschool education and professional training of future preschool teachers in order to achieve the development of the child's abilities, since their implementation contributes to the improvement of the professional level of educators, prompts them to search for new non-traditional forms and methods of education, reveal creative abilities, as well as increases children's

¹² Kozlitin D., Kochmar D., Krystopchuk T., Kozak L. Future Educators' Training for Project Activities Using Digital Technologies. Proceedings of the PhD Symposium at ICT in Education, Research, and Industrial Applications co-located with 16th International Conference "ICT in Education, Research, and Industrial Applications 2020" 2020. P. 31–41. URL: <http://www.scopus.com/inward/record.url?partnerID=HzOxMe3b&scp=85098740352&origin=inward> (Last accessed: 04.06.2025).

¹³ Harashchenko L., Kovalenko, O., Kozak L., Litichenko O., Sopova D. The Use of Digital Tools for Mastering Practical Disciplines in the Distance Format of Training Bachelors of Preschool Education. Information and Communication Technologies in Education, Research, and Industrial Applications. ICTERI 2023. *Communications in Computer and Information Science*, vol. 1980. 2023. P. 173–188. DOI: 10.1007/978-3-031-48325-7_13

¹⁴ Palamar S. P., Bielienska G. V., Ponomarenko T. O., Kozak L.V., Nezhyva L. L., Voznyak A. *Formation of readiness of future teachers to use augmented reality in the educational process of preschool and primary education* AREdu 2021 Augmented Reality in Education 2021 Proceedings of the 4th International Workshop on Augmented Reality in Education (AREdu 2021).2021. P. 334–350.

¹⁵ Kozak L., Popovych O., Ivanova, V., Harashchenko L., Teslenko S. Teaching professional competence in preschool education. *Amazonia Investiga*, 2024 13(73). P. 114–127. DOI: 10.34069/AI/2024.73.01.9

¹⁶ Peven, K., Khmil, N., Makohonchuk, N. The influence of artificial intelligence on the change of traditional models of learning and teaching: analysis of technologies for ensuring effective individual education. 2023. P. 306-316. URL: <http://perspectives.pp.ua/index.php/pis/article/view/5496> (Last accessed: 04.06.2025).

¹⁷ Velychko, V. Y., Fedorenko, E. G., Soloviev, V. N. Dolins'ka, L. V., Creation of open educational resources during educational practice by means of cloud technologies. CTE Workshop Proceedings [Online].2022. 9. P.278–289.

learning interest, activates cognitive activity, improves the children's grasping quality of curriculum material¹⁸.

2. The aim of the research

The purpose of this article is to highlight the experience of using digital devices and tools in teaching preschool children in kindergarten. To achieve the purpose, the following tasks must be solved:

- to investigate the level of mastery of digital devices and tools by practicing educators, to find out what digital tools they use in preparation for working with children, what content they create for children and parents;
- to include in the curriculum of students' pedagogical practical training tasks on the formation of digital literacy and cognitive development of preschool children using digital tools;
- check the effectiveness of the digital tools implemented by students in the educational process of the kindergarten through observations and conversations with children, as well as evaluate the formation of students' skills in using gadgets and digital tools (artificial intelligence and augmented reality) in educational interaction with children.

To achieve the purpose and objectives of the research, we used the following theoretical and empirical methods: 1) study, analysis, summarization of regulatory documents, scientific research on the formation of digital competence of educators and digital education of preschool children; 2) surveying of education attendees to find out whether they integrate digital tools in the education of preschool children, interaction with parents, which tools they use and which tools are relevant for them to work with children and parents; 3) monitoring and analysis of the quality of the students' performance of tasks (developed on the basis of the educational and professional curriculum (program) and in accordance with the educational tasks of industrial pedagogical practical training for the specialty 012 Preschool Education) and the acquisition of practical skills in the use of gadgets and digital tools (artificial intelligence and augmented reality) in the educational interaction with children during practical training in kindergarten.

¹⁸ Pukas I., Kozak, L., Tsukanova N., Shulyhina R., Harashchenko L. Professional training of future teachers of preschool education institutions to implement the development of child's abilities. *Amazonia Investiga*, 2023. 12(62), P. 56–65. DOI: 10.34069/AI/2023.62.02.4

3. Study of the use of digital tools by educators of preschool education institutions

The study of numerous scientific works indicates the effectiveness of using digital tools in the educational process. However, we were interested in the use of digital tools in the practice of preschool children education.

The issue of educators' digital literacy in Ukraine is regulated by the professional standard "Educator of a preschool institution"¹⁹. It defines that educators should have the following skills according to their professional category:

- 1) the ability to navigate in the modern information space;
- 2) ability to effectively use ICT and digital resources for professional activity;
- 3) the ability to create educational content with the help of digital tools, taking into account the age characteristics of early and preschool children.

In accordance with these competencies, disciplines aimed at the formation of ICT competencies are established in the educational and professional training curricula (programs) of preschool education specialists.

In addition, during the study of various professional disciplines (Art needlework, Play workshop, Health-preserving technologies in preschool education, Fundamentals of natural and mathematical sciences with methods, etc.), students acquire not only professional knowledge and practical skills, but also have the opportunity to deepen ICT competence, as educators use various digital tools in classes and offer them to be used in performing the discipline tasks^{20, 21}.

Students develop their own digital skills and the ability to use digital tools for teaching preschool children during the learning process. The issue of the use of digital tools in the preschool children education is not widely

¹⁹ Професійний стандарт «Вихователь закладу дошкільної освіти», затверджений Наказом Міністерства економіки України № 755-21 від 19 жовт. 2021 р. URL: <https://mon.gov.ua/ua/npa/pro-zatverdzhennya-profesijnogo-standartu-vihovatel-zakladu-doshkilnoyi-osviti> (дата звернення: 04.06.2025).

²⁰ Bieliienka, A., Polovina, O., Kondratets, I., Shynkar, T., Brovko, K. The Use of ICT for Training Future Teachers: An Example of the Course on «Art Education of Preschool Children». The Use of ICT for Training Future Teachers: An Example of the Course on «Art Education of Preschool Children» ICTERI 2021 ICT in Education, Research and Industrial Applications. Integration, Harmonization and Knowledge Transfer. 2021. Vol. XX. P. 361–370.

²¹ Ponomarenko T., Kovalenko O., Shynkar, T., Harashchenko L., Holovatenko T. Development of the Professional Competence of Bachelors in Preschool Education Through Online. Information and Communication Technologies in Education, Research, and Industrial Applications. ICTERI 2023. *Communications in Computer and Information Science*, vol. 1980. 2023. P. 114–128.

covered in researches and publications. This issue is actively studied and raises a significant number of questions from theorists and practitioners.

In Ukraine, the issue of digital education of preschool children is regulated by the Law of Ukraine "On Preschool Education", the State Standard of Preschool Education (2021), educational curricula for children of early and preschool age and partial ones. The State Standard of Preschool Education highlights the digital competence of preschool children. The digital competence of preschool children is defined as "the ability to use information, communication and digital technologies to meet their own individual needs and solve educational and game tasks based on acquired elementary knowledge, skills, and a positive attitude towards IT and digital technology."²² It includes: the development of interest in the children's digital environment, involves the formation of a cognitive need for consideration, knowledge about digital tools (computer, tablet, phone), interest in their use, formation of the ability to independently acquire information, consciously consume digital content, actively transfer what is known to the plane of one's own experience; formation of children's own digital culture; mastering the skills of differentiation and selection of cognitive and game content.

The main tasks of digital education of preschool children in Ukraine according to legislative documents and scientific research:

- 1) Protection of children from an aggressive digital environment;
- 2) Formation of children's critical thinking skills, development of the ability to choose and use age-appropriate digital content.

Based on the experience of using digital tools by preschool educators²³, we were interested to find out the attitude of Ukrainian educators to the use of digital tools and services in preschool education.

We conducted a survey of 4th and 5th year part-time students of Borys Grinchenko Kyiv Metropolitan University, who work in kindergartens. 66 students took part in the survey, which was conducted according to specially developed questionnaires. All survey participants gave their consent to participate in the study.

The purpose of the questionnaire was to reveal the level of mastery of digital tools by practicing educators, to find out what digital tools they use in preparation for working with children, what content they create for

²² Базовий компонент дошкільної освіти (Державний стандарт дошкільної освіти). Затверджено наказом МОН № 33 від 12.01.2021. URL: <https://mon.gov.ua/storage/app/media/rizne/2021/12.01/nakaz-33-bazovyykomponent-doshk-osv.pdf> (дата звернення: 04.06.2025).

²³ Lindeman S., Svensson M., Enochsson, AB. Digitalisation in early childhood education: a domestication theoretical perspective on teachers' experiences. *Educ Inf Technol*. 2021. 26. P. 4879–4903. DOI: 10.1007/s10639-021-10501-7

children and parents, which knowledge, skills and abilities they lack in using digital tools and services.

Qualitative analysis of the answers made it possible to note that 89.4% of respondents work in city kindergartens, 6.1% – in settlements, 4.5% – in villages. 69.7% of respondents have pedagogical experience working with preschool children aged 0-5 years, which means that they are young people who have recently changed their profession or are receiving higher education, combining it with studies. 15.2% have been working for 6–10 years, 12.1% – for 11-20 years, 3% have more than 20 years of experience.

60.6% of respondents have permanent access to a computer and the Internet, which they use for work, 10% have limited access, 22.7% use a tablet or phone for work, 6.1% do not have a computer or other gadget that can be used for work.

When working with preschool children (3-6 years old): 67.7% of educators use a smartphone, 16.9% – use a tablet, 67.7% – a computer, 27.7% – an interactive whiteboard, 7.6% – use a TV-set with Internet access, 1.5% – a projector, 1.5% – a TV with a flash drive, 1.5% – do not use any gadgets.

To the question "How often do you refer to the Internet to search the necessary information for professional purposes?" 66.7% of respondents answered that they refer often, i.e. 3-4 times a week, 31.8% – fairly often, 1–2 times a week, 1.5% – rarely, 1–2 times a month.

To the question "Do you use content from the Internet for educational interaction with children in kindergarten (videos, cartoons, animations, games, etc.)?" 22.7% use it constantly, almost every day, 47% use it often, i.e. 1–2 times a week, 28.8% use it sometimes, once every 1–2 months, 1.5% do not use it at all.

We also learned "Do educators create their own content for children?". 34.8% of educators constantly create electronic content for children, 53% – sometimes, 12.1% – do not create content, they use ready-made content from the Internet. Therefore, educators mostly use ready-made Internet resources and programs. In conversations with educators, we learned that ready-made material from the Internet does not always meet their expectations in solving educational tasks. For this reason, they often additionally supplement downloaded materials or adapt them in accordance with their own needs.

Answering the question "What kind of content do you create for children?", the respondents answered that they create: presentations – 62.1% (visualization of tasks, visualization of cognitive information, video content – 48.5% (slide shows, fragments of filmed video), animated – 16.7% (simple cartoons based on universal graphical editors such as Canva, Piktochart, PowerPoint), games – 54.5% (PowerPoint, Learningapps),

quests – 21.2% (video puzzles, visual illustrations), does not create content 16.6%. We asked a similar question to find out whether educators create content for parents. Video content (photo shows, clips of holidays, educational process, etc.) are created by 57.6%, Infographics (announcements, reminders, information letters, invitations) – 40.9%, Collages (photos) – 72.7%, 16.6% noted that they do not create their own content, they take ready-made content from the Internet. Therefore, the use of digital tools to create content for children and parents is relevant in practice for most educators. The interviewed respondents noted that modern parents prefer communication in social networks. That is why educators need to create content for effective communication and interaction with parents. It is worth noting that educators do not fully understand the possibilities of creating their own content for children, because educational digital media, like educational contents, must meet the individual needs of young learners.

We also found out what services educators use in their work: photo editors (Inshot, Snapseed, Google Photos, Pixlr Phonto) – 62,1 %, photo banks (Adobe Stock, Pnggg) – 4,5%, sound banks (Spotify) – 7,6%, banks of ideas (Pinterest, Google services, Deviantart), services for creating games (Learning apps, Purpose games, Nearpod) – 18,2%, graphic design services (Canva, Mind-maps) – 50%, virtual tour services – 4,5%, artificial intelligence (ChatGPT) – 24,2%, augmented reality (LiveColoring) – 1,5%. Therefore, educators mainly use the simplest and most popular services for creating content, which they mastered during their studies at the university.

To the question "Would you like to learn how to use any of the services mentioned?" (the list was added) 28.8% of respondents answered that they want to improve their ability to use photo editors, 18.2% photo banks, 24.2% – idea banks, 45.5% would like to be able to use sound banks, because for creating content for preschool age children it is very important. The respondents noted that it takes a lot of time to search for the necessary images and sounds of good quality, so services that offer a compilation of resources make the work much easier. Since one of the tasks of preschool education is the development of children's sensory skills, the issue of selecting audio and visual content is very important for educators. All images and videos shown to children must meet a number of requirements (image quality, graphic accuracy, appropriateness of the content of the image to the children's age). 16.7% of respondents would like to improve their skills in using video editors, 21.2% – graphic design services, 10.6% – text documents (Microsoft Office). The most interesting for educators are services for creating games – 39.4% of respondents, augmented reality – 47%, artificial intelligence – 34.8%. And so, preschool teachers are intensely curious about new digital tools that can be useful in working with preschool children. A large portion of materials for teaching

children are obtained through the Internet. Readymade developments are shared on the "Vseosvita" and "Na Urok" platforms. Educators showed specific interest in the use of AR and AI technologies in the educational process of kindergarten.

In Ukraine, in addition to the use of digital tools in the education of preschool children, the development of mental processes and abilities, considerable attention is also paid to the issues of digital education and the development of digital literacy. Since we cannot influence the rapid digitalization of society, it is necessary to teach children to find their way through digital devices and services.

1) Enrichment of ideas knowledge and formation about digital tools, their history, functional purpose, ways of use by people, etc.

2) Formation of practical skills in the use of digital tools in the preschool children education.

The task of digital education consists of preparing preschool children for life in the informational society, forming a culture of digital communication, its use, development of personal qualities, critical thinking.

The modern vision on media and digital devices and services of education is closely intertwined and is considered by scientists in a close relationship.

Considering the importance of digital literacy formation of preschool children, it is important for educators to master new digital tools and use them in the educational process.

Educators use 2 groups of digital tools in teaching preschool children:

1) Digital tools for active use, which involve active actions of children with the gadget – performing tasks for classification, extracting the superfluous, finding the correct answer option, etc. The use of such programs involves close access of the child to a computer, smartboard or gadget. Such programs are convenient to use in individual work with children or in work with small groups, in case of providing each child with a computer or other ICT tool.

2) Digital tools for passive use by children that involve viewing images or video files by children. Such programs are convenient to use both in individual work with children and in group work, provided that the image is displayed on a sufficiently large screen.

The research carried out on the basis of the Faculty of Pedagogical Education of the Borys Grinchenko Kyiv Metropolitan University allows us to note the successful formation of skills in the use of digital tools among students in the process of studying academic disciplines. However, the professional competence formation of the educators requires the formation of skills in the use of digital tools in direct interaction with preschool children in a preschool education institution.

The objective of practical training covered 2 main types of ICT-related tasks:

1. Formation of digital literacy in preschool children using digital tools (tablet, phone, computer, smartboard, TV). It is implemented in practice by fulfilling the tasks of educational curricula (programs) for children of early and preschool age.

2. Creation of educational content for children using digital tools (augmented reality interaction with children: Assemblr, Blippbuilder, Mywebar, Zapworks, Planets AR, ARloopa); artificial intelligence in preparation for classes (Playground, Fotor, Craiyon, Deepdreamgenerator, Dreamstudio, Gencraft).

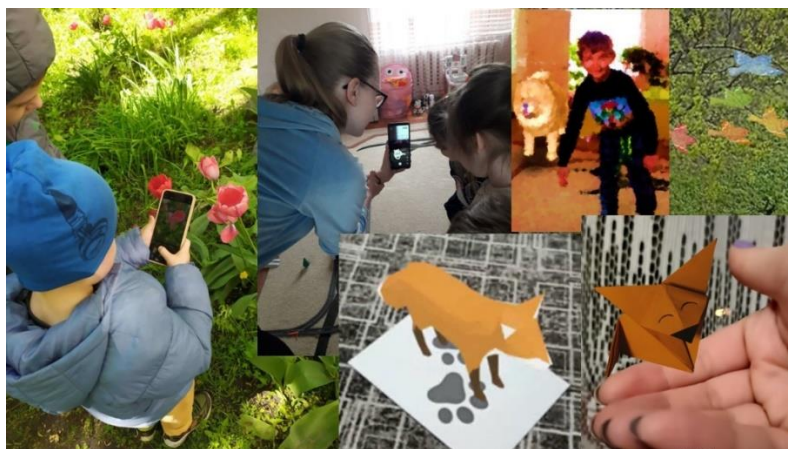


Fig. 1. Photos and images depicting the usage of digital devices and tools in teaching preschool children

In accordance with the requirements of the State Standard of Preschool Education and educational curricula (programs) for children of early and preschool age, children receive an understanding of modern devices and develop skills in their use. In particular, in their practical training at a preschool education institution, students use devices in exploratory, artistic, and playful activities. For example, during a walk with children, students used the phone's camera as one of the means of stimulating to observe the objects of nature. The children are challenged to find signs of spring and take pictures of them. Educators print out the photos or view them on a smartboard and discuss them during the lessons, analyzing spring weather changes (Fig. 1.). They also organize long-term observations of the object with photo documentation. This task was suggested to parents and children. The children and their parents searched for an interesting natural object and

then, for 5-10 days, took pictures or made video fragments every day on their way to kindergarten. Together with their parents, they created a video sequence. The children presented their video at the lesson and told about their object of observation.

Also, to prepare for lessons with children, future educators use a variety of digital tools, in particular artificial intelligence to generate images (Bing Image Creator, Craiyon, Deepdreamgenerator, Dreamstudio, Gencraft, Playground, NightCafe, Fotor). Due to the fact that preschool children have visual and imaginative thinking, educators pay a lot of attention to the selection of visual materials. When preparing materials and assignments for children, students say that they often lack pictures that illustrate the intended topic or object. Searching for the ideal image in numerous image banks, looking through various photos on the Internet is time-consuming and doesn't give the desired result. Therefore, artificial intelligence-based image generators can become a valuable tool for creating visualizations based on your request. The generated images can become the basis for a didactic guide, a game, attributes for game activities, etc (Fig. 1).

With the help of neural networks, students create:

- new unique images for the emblem or logo;
- a series of didactic pictures for creative storytelling, didactic games for the development of logical thinking "What did the painter do wrong?", "Does it happen or not?";
- a background for a model, atlas, collage, lapbook, wimmelbook, didactic game, book, album, etc;
- a plot picture for a story made up by children. For example, to bring to life a character imagined by children and create a book of his adventures;
- original pictures for the and objects on various topics;
- images for creating a proofreading chart, pictograms for a poem, etc.

For example, to develop children's imagination and fantasy, educators use various methods of developing verbal creativity. In particular, composing a creative story based on a didactic picture, a series of plot pictures or reference words. Word imaginative games are created, the educator stimulates children to compose storytelling for the development of monologic and dialogic speech in the process of acting out the plot of the picture. Children compose their own stories, make up characters and their adventures. Based on children's stories, students generate illustrations and invite children to compile their own adventure book, encouraging children to create stories about the character's further adventures. Such images are used for creative activities with children of the sixth year of life or for the development of critical thinking, i.e. finding inconsistencies or inaccuracies in images, funny or fake.

The use of AI image generators in the education of preschool children demands in-depth knowledge of child psychology and the requirements for visual and illustrative material for children. Therefore, when teaching preschool children, the generated images are used with caution and only for creative activities (verbal, artistic, game, etc.).

4. Using augmented reality to design quests for preschool children

An appealing trend in preschool education is the use of augmented reality (AR) to create a variety of educational content for children. During the practical training, students used the following digital tools of augmented reality: Assemblr, Blippbuilder, Mywebar, Zapworks, Planets AR, ARloopa.

Among the practical training tasks, students were asked to develop a quest with the elements of AR. A quest is a game for developing ingenuity. It was developed according to the traditional structure and included one or two tasks involving augmented reality.

To create a quest, students were offered 2 main approaches to organization with the usage of gadgets and augmented reality:

- 1) Performing the quest in a stations-based way. Meaning that each task will be placed at separate locations. The educator prepares all the necessary materials in advance. At one or more stations, the quest task will involve the use of gadgets;

- 2) Gadgets are used in accordance with the logic of progression of the event. Depending on the task, they can be used by the educator or children.

The quests were developed for children of older preschool age (5–6 years old). Examples of objectives: "Whose footprints are these?" Children are invited to look at the footprints on the floor and guess which animals may have run here. To check their guesses, children scan the QR codes and point at the marks (animal footprints) and see who they belong to.

"Birds' Spring song". Children look around, find birds hiding in different corners of the room. They click on them and listen to their singing. One bird does not sing, it gives a hint to the next task.

"Do as I do!" Children perform tasks from their fairy friend. He invites them to play, dance, and solve a riddle.

Algorithm for creating an AR project:

1. Pictures or 3D images are selected from the bank or generated using AI services.

2. The background of the image in Photoshop is cleared, and only the desired object or character remains.

3. An AR project is created, and the character is fixed in space. If necessary, a mark is created, sound or video is added.

To create such tasks, students used the following services: Assemblr, Blippbuilder, Mywebbar, Zapworks, ARloopa. Mobile apps: Planets AR, Solar System, Animals 4D allow the use of ready-made AR projects in cooperative activities with children, including quests.

Table 1

**Evaluation criteria of the quest for children of older preschool age
(5–6 years) using AR**

1.	Logical use of AR tasks in the quest structure	
2.	Role assignment in a game task with AR	1–4
3.	Involvement of the players (all children actively use the gadget; children use one gadget for 2–3 kids; passive observers, educator demonstrates)	
4.	Consideration of the digital tool's place of use (by the educator/children) in the process of completing the quest	1–2
5.	Using time of tasks with AR	
6.	The level of children's interest in the AR task (high, sufficient, moderate, insufficient)	1–4

To examine the quality of the game quests developed and implemented by students with elements of augmented reality, the criteria for evaluating the pedagogical content and the result of the quest were used. Table 1 shows the evaluation criteria for the use of digital devices and AR tools in games with children.

The practical training supervisor checked the students' developments, gave methodological recommendations for implementation, and monitored the quality of work in the process of working directly with children.

Also, after the quest, the children were asked, "What did you like the most?", "Which task was the most difficult?", etc. Children positively evaluated the quest, they liked all the tasks with AR elements. The most interesting for children were the tasks of high mobility (throwing balls at the target, relay races) and riddle solving games, which is quite natural for preschool children.

The results of the quest were discussed with the students, and they evaluated their achievements, difficulties, and successes. The use of gadgets in the quest did not cause any difficulties for the children, they skillfully performed all the actions. Also, students noted that during the game, children reacted positively to the tasks with augmented reality, they successfully followed the instructions given. For this reason, it is advisable to use this type of activity in the organization of children's preschool education. It is important to have a prior preparation and a good game plot that matches the age and interests of children. Children are happy to respond to all activity

suggestions using gadgets or digital tools. Success in completing tasks depends largely on the educator. As the use of gadgets or augmented reality tools, photo editors, etc. depends on the skillful organization of children's activities. This requires knowledge of child psychology and pedagogy, special methods of child development, as well as ICT competence and knowledge of scientific studies on the use of digital tools in the educational activities of preschool children.

Problems and prospects

There are high prospects for a comprehensive study of the possibilities regarding the use of gadgets and digital tools of augmented reality and artificial intelligence in teaching preschool children. For the studies we have reviewed mostly cover the experience of small research groups and organizations that have studied certain aspects of the described problem. The positive research results we have collected highlight only certain issues of using digital tools in teaching preschool children. These are very important for the vocational training of preschool education specialists. However, for a complete understanding of the possibilities, prospects, and consequences of using digital technologies in early childhood education, large-scale research is needed that will involve a significant number of specialists, including doctors, psychologists, and educationalists to conduct a comprehensive analysis of the problem.

CONCLUSIONS

The analysis of the results of using digital devices and tools in teaching preschool children in a kindergarten allows us to mark the prospects of this area of research.

The results of the survey conducted at the first stage of the study demonstrate the educators' interest in digital tools. Around 70% of respondents often use digital devices in teaching children. Over 90% of educators use Internet resources to prepare for classes, 70% of respondents use content in educational activities with children and consider it effective. A significant number of more than 80% of preschool teachers attempt to produce their own content for children and parents, as well as wish to expand their knowledge and enhance their skills in using digital technologies successfully. In the process of preparing for classes, educators create the simplest content with the help of digital tools mastered at the university. Therefore, the skills of creating content for children and parents are relevant in preschool education practice. In addition, respondents indicated that they are interested in artificial intelligence DTs, augmented reality, and the possibilities of their use.

Considering the relevance of the use of digital tools in preschool education practice, it is expedient to develop future educators ICT

competencies, in particular, the ability of using ICT in teaching preschool children. The results of the students' accomplishment of the practical training tasks, particularly the use of digital AR devices in the cognitive activity of preschool children, led us to the conclusion that digital tools are effective in teaching preschool children, if used competently and appropriately in accordance with the age-specific characteristics of children. Observations, quests, games, and classes organized by students using AI were interesting for children and made it possible to achieve the developmental goal. It is also interesting to use artificial intelligence to generate images in order to create handbooks and games for children.

The use of gadgets in teaching children adds variety to everyday activities, arouses children's interest, teaches them to use gadgets for exploration and development, and forms emotional and value-based attitude. The level of interest in cognitive activities with the use of digital devices depends on the educator's ability to organize cooperative activities, establish communication, and develop children's culture of safe usage of gadgets. That is why it is an important component in the vocational training of preschool teachers.

SUMMARY

The article substantiates the possibility of using digital tools (DT) in preschool education practice. Different directions of research into the problem of introducing DT into preschool education have been determined, namely: digital devices (smartphone, tablet, projector, interactive whiteboard) for teaching by using mobile AR apps and artificial intelligence. The professional competence of educators in the context of readiness to use DT in educational interaction with children of preschool age was investigated. The interest and need of educators in the use of augmented reality technology in the educational process of kindergarten was revealed. The authors considered the possibilities of creating educational content for children with the help of digital AR tools (Assemblr, Mywebbar, Zapworks, ARloopa) and artificial intelligence (Playground, Dreamstudio, Gencraft). An algorithm for the creation of AR projects is proposed. The main stages of AR-technology application during the organization of the game-quest are described. The results of a survey of teachers, observation of children, evaluation of student works proved the effectiveness of introducing game quests with elements of AR into the educational process of kindergarten, their advantages for activating children's cognitive activities, forming digital competence. It was concluded that the use of DT in the practice of preschool education is a powerful tool for the teacher's personal development, which will contribute to the improvement of the quality of the educational process of preschool education institutions, the involvement of children in intense

cognitive activities, and will increase both the motivation of children to study and the level of their assimilation of educational material.

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