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Developing digital competence in preschool education: training future early childhood educators

Desarrollo de la competencia digital en la educación preescolar: Formación de futuros educadores de primera infancia

Liudmyla Kozak
Doctor of Pedagogical Sciences, Professor, Professor of the Department of Preschool Education, Borys Grinchenko Kyiv Metropolitan University, Ukraine.
https://orcid.org/0000-0002-4528-1905
l.kozak@kubg.edu.ua
ResearcherID: AAM-8500-2021

Olena Mamchych
PhD in Pedagogical Sciences, Associate Professor of the Languages and their Teaching Methodology Department, T. H. Shevchenko National University "Chernihiv Colehium", Ukraine.
https://orcid.org/0000-0003-1770-3311
constantaelena@ukr.net
ResearcherID: HZL-6255-2023

Tatyana Ponomarenko
Doctor of Pedagogical Sciences, Professor, Professor of the Department of Preschool Education, Borys Grinchenko Kyiv Metropolitan University, Ukraine.
https://orcid.org/0000-0002-6801-0403
t.ponomarenko@kubg.edu.ua
ResearcherID: AAC-6254-2021

Valentyna Vertuhina
Candidate of Pedagogical Sciences, Senior Lecturer of Preschool Education Department, Faculty of Pedagogical Education, Borys Grinchenko Kyiv Metropolitan University, Ukraine.
https://orcid.org/0000-0002-8294-9193
v.vertuhina@kubg.edu.ua
ResearcherID: AAP-2481-2021

Sofia Dovbnia
Candidate of Pedagogical Sciences, Associate Professor, Associate Professor of the Department of Preschool Education, Mykhailo Dragomanov Ukrainian State University, Ukraine.
https://orcid.org/0000-0002-2882-4680
s.o.dovbnya@npu.edu.ua
ResearcherID: GMO-9932-2022

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Abstract

The article discusses the origins of digital competence, explains its content and components for early childhood educators. We define a preschooler's digital competence as a child's awareness of using information and communication technologies, as well as digital tools, to solve educational, cognitive, and everyday tasks. It also describes the tasks, functions, and principles for designing the digital educational

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environment of a modern school. The components and resources of the digital environment are outlined. The study results highlight the importance of targeted and systematic efforts to enhance and prepare for fostering digital competence in children by future educators. The goal of the formative stage was to justify and test the effectiveness of the developed teaching conditions. The final stage aims to assess the levels of readiness of future educators to promote digital competence in preschool children. The diagnostic results show positive changes in all criteria among students in the experimental group, confirming the effectiveness of the teaching conditions that were developed and put into practice.

Keywords: training of future educators, formation of digital competence, preschool children, digital environment of a modern educational institution, digital technologies.

Resumen

El artículo analiza los orígenes de la competencia digital y explica su contenido y componentes para educadores de primera infancia. Definimos la competencia digital de un niño en edad preescolar como la conciencia del niño sobre el uso de las tecnologías de la información y la comunicación, así como de las herramientas digitales, para resolver tareas educativas, cognitivas y cotidianas. También describe las tareas, funciones y principios para diseñar el entorno educativo digital de una escuela moderna. Se describen los componentes y recursos del entorno digital. Los resultados del estudio destacan la importancia de los esfuerzos específicos y sistemáticos para mejorar y preparar a los futuros educadores para fomentar la competencia digital en los niños. El objetivo de la etapa formativa fue justificar y comprobar la eficacia de las condiciones de enseñanza desarrolladas. La etapa final pretende evaluar los niveles de preparación de los futuros educadores para promover la competencia digital en niños en edad preescolar. Los resultados del diagnóstico muestran cambios positivos en todos los criterios entre los estudiantes del grupo experimental, lo que confirma la eficacia de las condiciones de enseñanza desarrolladas y puestas en práctica.

Palabras clave: formación de futuros educadores, formación de la competencia digital, niños preescolares, entorno digital de una institución educativa moderna, tecnologías digitales.

Introduction

Due to the introduction of digital technologies into education and all areas of human life, the daily life of the individual in the modern world is dynamically developing, and through constant progress, the digitalization of education is taking place. Modern processes of modernization and reform of higher education in the world cover the ideological, social, and political spheres, and require the search for innovative approaches to ensure competitive, high-quality training of future specialists in preschool education institutions.

The development of digital competence is a key problem in the training of modern early childhood educators. Intensive use of digital technologies in the field of education increases the efficiency of the educational process and contributes to the formation of professional competencies of specialists within preschool education.

An important direction of reforming preschool educational institutions is the informatization of education, which is today the main need of society and allows us to take into account various aspects of personality development and individualization. The ability to use digital technologies in the educational process characterizes a person as a modern specialist. Therefore, the problem of forming digital competence is very relevant in today's realities.

Today, we consider digital competence as one of the fundamental competencies for a modern person, for a professional educator, because it is precisely this that is necessary to ensure lifelong learning opportunities.

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Literature Review

Many scientists from different countries have studied the problem of training future specialists to form digital competence in the process of professional activity, and the effective use of digital technologies and information technologies in education and training.

In particular, the structure of digital competence and digital culture, their essence, is revealed in the studies of the following scientists.

Palau et al. (2023) define digital competence of an early childhood educator as mastery in professional activities in the use of information technologies.

Under digital competence, the researchers Hijón-Niera et al. (2023) see the ability to use digital technologies and resources, effective communication, and the ability to critically evaluate information. The scientist characterizes the components of digital competence: literacy in the media and information environment, consumer and technical components, and online communication skills.

Digital competence is defined by García-Vandewalle García et al. (2023) as the set of skills and knowledge required to use digital information sources and information technologies and to perform various tasks: problem solving, collaborative work, meeting needs, communication, information management, content distribution, and creation.

Researchers Bygstad et al. (2022) emphasize that thanks to the large digital infrastructure, a digital educational space has been created, thanks to interconnected university networks and systems and other Internet resources, which makes it possible to maintain learning suitability in different contexts, to introduce constantly new and changing opportunities.

Vuorikari et al. (2016) reveal the historical perspective of the system of professional training of future specialists for the formation of digital competence, starting from 2006, when the European Union identified key areas of competence for lifelong learning and digital competence was the main one from this list; continuing with the development of the European Digital Competence System of Citizens DigComp (Digital Competence), which was updated to version DigComp 2.0.

Interesting and important are the studies conducted by scientists from Germany, who have proven that in a world that is becoming more digital, future early childhood educators must adapt to new realities, in particular, they must have digital competence. Runge et al. (2023) raise the issue of rethinking the role and tasks of an early childhood educator, their traditional representation. During professional training, an early childhood educator must realize that now the main thing in modern education is the formation of digital competence of each individual, without which a new generation cannot exist, because it is simply impossible to isolate oneself from social changes in the world.

Bonifacio & Zuta (2021) prove that the problems of teaching children of the Alpha generation are just beginning to be studied today, and the strategic task is to form a new view in our students. Scientists are actively exploring the possibilities of using email and other services for tutor communication on the Internet. Xu et al. (2025) reveal the content of website creation and prove the effective use of online resources, multimedia creation, and multimedia in the educational process. The preparation of future early childhood educators for the formation of digital competence is aimed at teaching Generation Z, which is called digital. Future preschool early childhood educators will teach Google babies – the Alpha generation, therefore the researcher's research is aimed at methodological training aimed at developing digital competences of individuals, people of the future, taking into account their mental capabilities, ways of satisfying them, cognitive sphere, information needs, to replace the traditional system of the educational process with a new one, designed for students of the future but for modern students.

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Purpose of the article: to develop and investigate the feasibility of introducing specific pedagogical conditions into the process of training future educators to form digital competence in preschool children.

Methodology

In order to solve the purpose of the study, a set of **research methods** was used: **theoretical** – analysis of professional literature on the topic of the study in order to reveal the main provisions of the formation of digital competence in children, training future educators of preschool education institutions for the formation of digital competence; interpretation of theories that made it possible to determine the essence of the key concepts of the study, to develop pedagogical conditions for the preparation of future educators for the formation of digital competence in children; **empirical** – pedagogical observations, interviews, questionnaires, testing of respondents – to determine the levels of formation of digital competence in future educators of preschool education institutions; pedagogical experiment (confirmatory, formative and final stages), in order to verify the degree of effectiveness of pedagogical conditions for the preparation of future educators for the formation of digital competence in children; **statistical** – qualitative and quantitative processing of the results of the experiment (Kolmogorov-Smirnov λ-criterion) to determine the level of reliability of the data.

Future educators (n = 78) of higher education institutions became respondents who were involved in the experimental work.

The purpose of the ascertaining stage was to determine the actual state of readiness of future educators to form digital competence in children in preschool education institutions. To conduct the ascertaining stage of the experiment, students were divided into a control group and an experimental group, thanks to which it was possible to ascertain the state of preparation of future educators to form digital competence in children (EG: n = 40; CG: n = 38). A semi-closed questionnaire was used to clarify the attitude to the formation of digital competence in preschool children of students who participated in the experiment. The questionnaire consisted of questions that had a multivariate format in terms of the construction of the answers.

Further research was aimed at diagnosing the level of readiness of students (through testing) for the formation of digital competence in preschool children. Having analyzed the questionnaires to clarify the attitude of students participating in the experiment towards the formation of digital competence in preschool children, we came to the conclusion that future specialists note the need and importance of the formation of digital competence in children, but not all future educators have enough knowledge of digital competence. Therefore, it is not enough to have the skills to use digital competencies and technologies; conditions must be created for the formation of digital competence in children.

In order to study the state of readiness of students for the formation of digital competence in preschool children, we identified components (motivational, cognitive, and performance), criteria, and indicators. The levels of readiness were characterized as: low, satisfactory, and sufficient.

To verify the reliability of the data obtained at the ascertaining stage of the experiment, the Kolmogorov-Smirnov λ-criterion was used.

The results of the study indicate the need for targeted and systematic work to improve the preparation of future educators for the development of digital competence in their children. Thus, it is necessary to formulate and implement pedagogical conditions for the preparation of future educators for the formation of digital competence in children.

The purpose of the formative stage of the study was to substantiate and verify the effectiveness of the developed pedagogical conditions.

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The purpose of the final stage of the study is to determine the levels of readiness of future educators for the development of digital competence in preschool children, particularly in response to significant changes.

To compare the empirical data obtained in the experimental group and the control group at the formative stage, a diagnostic toolkit was used, similar to that used at the ascertaining stage.

Analysis of the results at the final stage of the experiment according to all readiness criteria showed that significant positive changes occurred in the experimental group and in the control group; these changes were insignificant.

The diagnostic results confirm positive changes in all criteria among students in the experimental group, which indicates the effectiveness of the developed and implemented pedagogical conditions. In the control group, the changes were insignificant.

The Kolmogorov-Smirnov λ-criterion was used to assess the statistical significance of the results obtained. It was assumed within the framework of the H1 statistical hypothesis that the difference between the distributions of the experimental group and the control group is significant, that is, the empirical distributions of the levels of preparedness are significantly different. The calculation of the λ-criterion at the formative stage of the experiment for the indicators of students' readiness for the formation of digital competence in preschool children was carried out using the same algorithm as at the ascertaining stage. $d_{cr} = 0.14$ (at $p \leq 0.05$) according to the table of critical values, and at $p \leq 0.01$, $d_{cr} = 0.18$.

$\lambda_{emp} = 1.29$ was obtained at the final stage of the experiment. $\lambda_{emp} = 1.15$ for the level of statistical significance with $p = 0.99$. $\lambda_{emp} > \lambda_{cr}$, and this confirms the hypothesis H1.

The data obtained lead to conclusions about the effectiveness of the developed pedagogical conditions for training future specialists of preschool institutions for the formation of digital competence in children, which indicates their high efficiency and effectiveness.

Results and Discussion

Historical origin of digital competence, content, and components of digital competence of an early childhood educator. Digital competence of a preschooler.

In 2006, digital competence was first mentioned in Europe when the European Union identified eight key areas of competence for lifelong learning. One of these is digital competence. The European system of digital competence of citizens was developed in 2013, known as DigComp (Digital Competence), which became a reference point for the development of digital competence for strategic planning initiatives at the EU level and in individual member states. In connection with the development of computer technologies and changes in the economy and society, the digitalization of the educational space is being updated and constantly improved (Vuorikari et al., 2016).

Digital competence of an early childhood educator is understood as:

- Mastery of the application of information technologies in professional activities (Cisneros-Barahona et al., 2024).
- Skills of effective communication, use of digital technologies and digital resources; ability to critically evaluate digitalization (Scott, 2015).
- A set of skills and knowledge necessary to use digital information sources and information technologies to perform various tasks, meet needs, work together, collaborate, solve problems, distribute and create content, communicate, and manage information (Silva-Quiroz et al., 2023).

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The educational digital space is created thanks to interconnected systems, a large digital infrastructure, university networks, and modern Internet resources, which allow for maintaining suitability in different contexts for learning, and to constantly introduce new innovative and changing opportunities (Saavedra et al., 2022). According to the educational digital space, the components of digital competence are distinguished: literacy in the media and information environment, online communication skills, consumer and technical components.

In today's realities, a preschool early childhood educator is a professional, not just a specialist, who is actively oriented toward innovations and scientific achievements. The child's awareness of solving educational, cognitive, and everyday tasks using information and communication technologies and digital technologies is understood as the digital competence of a preschooler (Urbina et al., 2022).

The most favorable age for the formation of digital competence is the senior preschool age. This can be traced in the development of the child, both psychological and physical. The child is capable of high-quality and rapid acquisition of knowledge at this age, and therefore, one of the important tasks of pedagogical activity is the formation of digital competence in senior preschoolers (Chávez-Melo et al., 2022).

The training of an early childhood educator who is modern, innovative, and meets the requirements of a new type is possible only if the training in higher education institutions is closely linked to the real conditions of professional activity.

Future preschool early childhood educators in the conditions of a modern information society must have competence in the professional application of digital technologies, not only when using information and communication technologies, but also must have basic work skills. In particular, the ability to use digital technologies for the development of children, to effectively integrate these technologies into the educational process, which is critically important in our time, is essential for the successful professional activity of an early childhood educator. Therefore, the training of future early childhood educators to form digital competence in preschool children is an educational dynamic process in higher education aimed at the effective development of skills and abilities, the use of information and communication, and digital technologies in education to form digital competence in preschool children (Chiecher et al., 2024).

It is advisable to distinguish the following functions of the educational, digital environment of a modern educational institution: informational, communicational, creative, developmental, control, analytical, and coordination.

The principles of designing the educational, digital environment of a modern educational institution include:

- Mobility of subjects of educational interaction, accessibility anywhere and anytime, openness of educational and educational services, availability of information exchanges, and virtualization of learning objects.
- Compliance with the requirements of integrity, pedagogical expediency, synergy, individualization, cognitive independence, and activity.
- Creation, systematic construction of new organizational structures (administrators, tutors, etc.) that ensure the functioning of environmental technologies and components (Figueira & Dorotea, 2022).
- Variability of the organizational structure of education in accordance with the state policy in the field of education, educational requests of the administration, methodological service, educational tasks of the educational institution, pedagogical students, employees, and parents.
- Based on self-educational activity and a high level of efficiency of the educational process by means of digital technologies, the creation of a personal development trajectory for all subjects of pedagogical interaction is possible.
- Representation of modern psychological and pedagogical science and modern trends in the development of education (Isoda et al., 2021).

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When designing the basic components of the digital environment (educational) of an educational institution, it is worth distinguishing its components: organizational, content, and technological.

Fundamentally important information, methodological and educational resources of the digital environment of an educational institution are:

- A structured media library includes: web resources, thematic photos, audio materials, videos, and printed matter to ensure maximum visualization of the scientific, educational, methodological, and other activities of an educational institution, satisfies the interests of potential consumers and real educational services regarding the work of creative associations, circles, and the content of educational activities.
- A virtual methodological office, portal, website, and methodological network associations of pedagogical workers allow all participants in the educational process to exchange relevant information, use the best experience of colleagues, and present their own methodological developments.
- Electronic portfolios of pedagogical workers, managers, and children enable the representation of personal or professional achievements, determine the further prospects of subjects of educational interaction, and contribute to improvement and creative development.
- Virtual electronic library with catalogs of other electronic libraries and educational, methodological, and training literature (Redecker, 2017).

In the context of the development of a digital society, the main task of education is to train early childhood educators to use modern digital technologies. Therefore, there is an urgent need in the field of digital technologies for their accelerated training, equipping educational institutions with modern computer equipment and electronic textbooks, pedagogical software, etc., accessibility and efficiency of education, further improvement of the educational process, and preparation for life in the digital space of the younger generation are ensured by the introduction of modern digital technologies (Pinto Santos & Pérez Garcias, 2022).

The state of preparation of future educators for the formation of digital competence in children in preschool education institutions.

Future educators (n = 78) of higher education institutions became respondents who were involved in the experimental work.

The purpose of the ascertaining stage was to determine the actual state of readiness of future educators for the formation of digital competence in children in preschool education institutions.

To conduct the ascertaining stage of the experiment, students were divided into a control group and an experimental group, thanks to which it was possible to ascertain the state of preparation of future educators for the formation of digital competence in children (EG: n = 40; CG: n = 38).

A semi-closed questionnaire was used to clarify the attitude to the formation of digital competence in preschool children of students who participated in the experiment. The questionnaire consisted of questions that had a multivariate format in terms of the construction of answers.

Further research was aimed at diagnosing the level of readiness of students (through testing) for the formation of digital competence of preschool children.

The following results were obtained in the ascertaining section.

To the question of the questionnaire "*What is your attitude to digitalization in professional activities?*" All respondents answered very positively. So, future educators are ready to learn, change, and be aware for the sake of high-quality education of the future generation.

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To the question of the questionnaire "*Do we need to form digital competence in children?*", the following answers were received: 89% of respondents answered "**yes**"; 11% of respondents answered "**no**", because children spend a lot of time with gadgets anyway.

To the question of the questionnaire "*What level of mastery of digital devices do you have?*", the respondents answered: good 54% of the surveyed students, enough, 36%, not enough, noted 10% of respondents.

All 100% of respondents gave a positive answer "**yes**" to the questionnaire question: "*Is it worth forming digital literacy in children?*".

Having analyzed the questionnaires in order to clarify the attitude of students participating in the experiment towards the formation of digital competence in preschool children, they came to the conclusion that future specialists note the need and importance of forming digital competence in children, but not all future educators have enough knowledge of digital competence.

Therefore, it is not enough to have the skills to use digital competencies and technologies; conditions must be created for the formation of digital competence in children.

In order to study the state of readiness of students for the formation of digital competence in preschool children, we have identified components (**motivational, cognitive,** and **performance**), criteria, and indicators. The levels of readiness are characterized as: low, satisfactory, and sufficient.

The performance component is implemented through a **motivational** criterion, which has indicators:

- Positive motivation for the formation of digital competence in children.
- Interest in digital technologies; understanding of the need for digital competence for the individual.

The cognitive component is implemented through a **cognitive** criterion that has indicators:

- Awareness and systematic improvement in mastering the latest digital technologies.
- Awareness of the danger of modern digital technologies for the child.

The performance component includes a **performance** criterion that has indicators:

- When using digital technologies, the ability to design activities for children is essential.
- When using modern digital technologies, compliance with the rules is required.

Let us show the results of an ascertaining experiment on the study of the state of readiness of students for the formation of digital competence in preschool children according to each criterion.

Motivational criterion (confirmatory stage of the experiment (Figure 1).

According to the indicator – *positive motivation for the formation of children's digital competence* – the results were as follows:

- A sufficient level was demonstrated by 19% of the respondents of the experimental group and 19% of the control group.
- A satisfactory level was demonstrated by 26% of the respondents of the experimental group and 21% of the control group.
- A low level was demonstrated by 55% of the respondents of the experimental group and 60% of the control group.

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According to the indicator – *interest in digital technologies, understanding of the need for digital competence for the individual*, the results were as follows:

- A sufficient level was demonstrated by 13% of the respondents of the experimental group and 14% of the respondents of the control group;
- A satisfactory level was demonstrated by 27% of the respondents of the experimental group and 27% of the respondents of the control group.
- A low level was demonstrated by 60% of the respondents of the experimental group and 59% of the respondents of the control group.

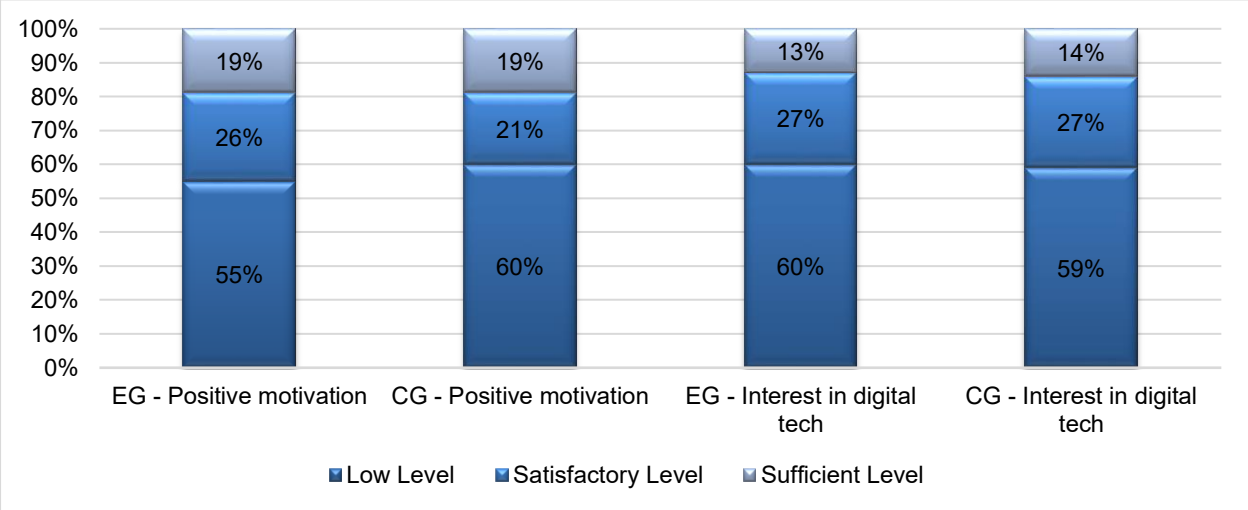

Figure 1. Motivational criterion (confirmatory stage of the experiment).

Cognitive criterion (confirmatory stage of the experiment (Figure 2).

According to the indicator – *awareness and systematic improvement in mastering the latest digital technologies* – the results were as follows:

- A sufficient level was demonstrated by 14% of the respondents in the experimental group and 14% of the respondents in the control group.
- A satisfactory level was demonstrated by 29% of the respondents in the experimental group and 27% of the respondents in the control group.
- A low level was demonstrated by 57% of the respondents in the experimental group and 59% of the respondents in the control group.

According to the indicator – *awareness of the danger of modern digital technologies for the child* – the results were as follows:

- A sufficient level was demonstrated by 12% of the respondents in the experimental group and 11% of the respondents in the control group.
- A satisfactory level was demonstrated by 18% of the respondents in the experimental group and 25% of the respondents in the control group.
- A low level was demonstrated by 70% of the respondents in the experimental group and 64% of the respondents in the control group.

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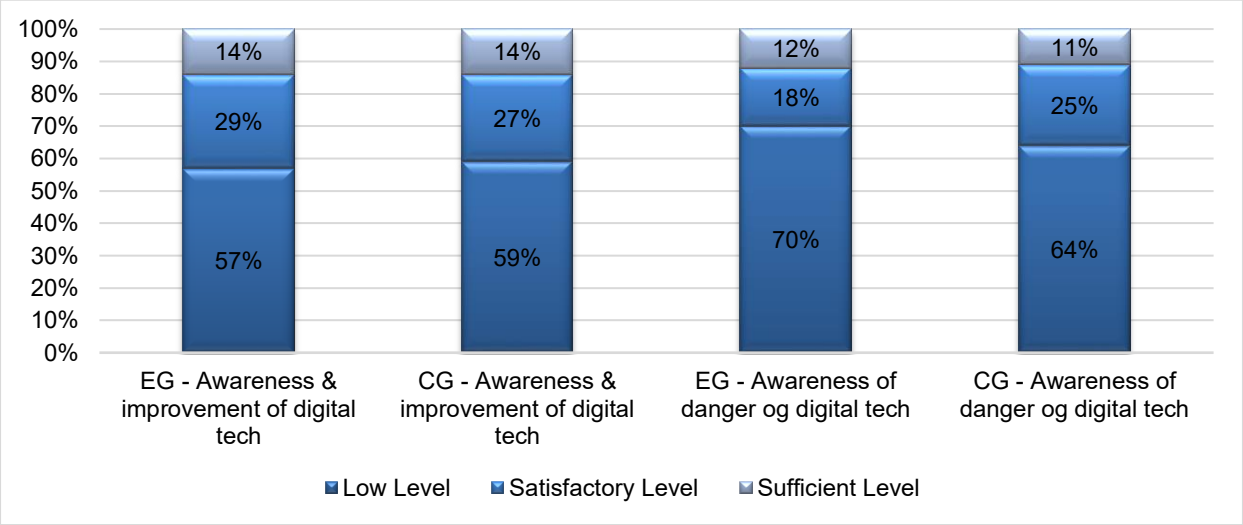

Figure 2. Cognitive criterion (confirmatory stage of the experiment).

Performance criterion (confirmatory stage of the experiment (Figure 3).

According to the indicator, *when using digital technologies, the ability to project children's activities* was as follows:

- A sufficient level was demonstrated by 13% of the respondents in the experimental group and 15% of the respondents in the control group.
- A satisfactory level was demonstrated by 25% of the respondents in the experimental group and 27% of the respondents in the control group.
- A low level was demonstrated by 62% of the respondents in the experimental group and 58% of the respondents in the control group.

According to the indicator – *when using modern digital technologies, compliance with the rules is mandatory* the results were as follows:

- A sufficient level was demonstrated by 16% of the respondents in the experimental group and 18% of the respondents in the control group.
- A satisfactory level was demonstrated by 20% of the respondents in the experimental group and 25% of the respondents in the control group.
- A low level was demonstrated by 64% of the respondents in the experimental group and 57% of the respondents in the control group.

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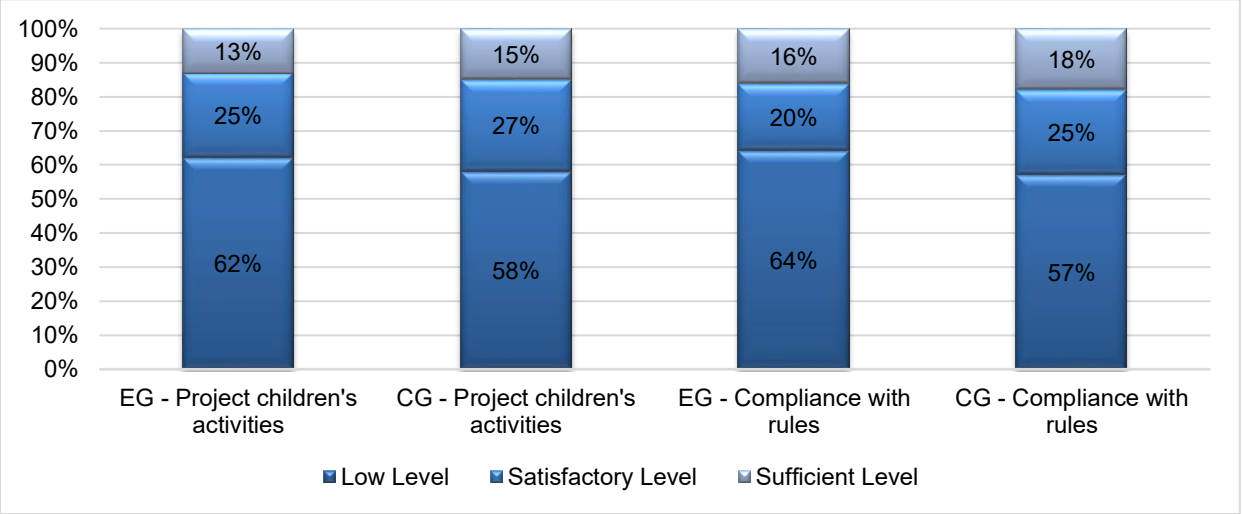

Figure 3. Performance criterion (confirmatory stage of the experiment).

Let us show the summarized results of the ascertaining experiment on the study of the level of readiness of students for the formation of digital competence in preschool children according to all criteria at the ascertaining stage of the experiment (Figure 4).

Motivational criterion – the general results were as follows:

- A sufficient level was demonstrated by 16% of the respondents of the experimental group and 17% of the respondents of the control group.
- A satisfactory level was demonstrated by 26% of the respondents of the experimental group and 23% of the respondents of the control group.
- A low level was demonstrated by 58% of the respondents of the experimental group and 60% of the respondents of the control group.

Cognitive criterion – the general results were as follows:

- A sufficient level was demonstrated by 13% of the respondents of the experimental group and 13% of the respondents of the control group.
- A satisfactory level was demonstrated by 24% of the respondents of the experimental group and 28% of the respondents of the control group.
- A low level was demonstrated by 63% of the respondents in the experimental group and 59% of the respondents in the control group.

Performance criterion − the general results were as follows:

- A sufficient level was demonstrated by 14% of the respondents in the experimental group and 17% of the respondents in the control group.
- A satisfactory level was demonstrated by 23% of the respondents in the experimental group and 25% of the respondents in the control group.
- A low level was demonstrated by 63% of the respondents in the experimental group and 58% of the respondents in the control group.

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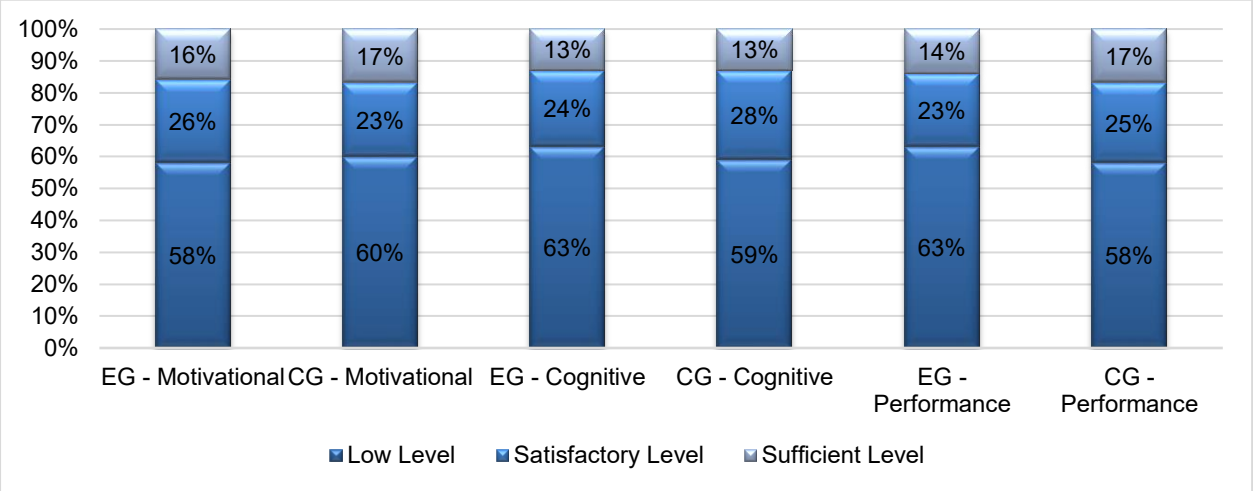

Figure 4. Summarized results of the ascertaining experiment.

To verify the reliability of the data obtained at the ascertaining stage of the experiment, the Kolmogorov-Smirnov λ-criterion was used.

The results of the study indicate the need for purposeful and systematic work to improve the preparation of future educators for the development of digital competence in their children.

Thus, it is necessary to formulate and implement pedagogical conditions for the preparation of future educators for the formation of digital competence in children.

Pedagogical conditions for training future educators to form digital competence in children.

We believe that training for the formation of digital competence in children of future educators of preschool education institutions will be effective if the developed pedagogical conditions are implemented:

- The presence of positive motivation for the need to form children's digital competence in future specialists of preschool education. It is this pedagogical condition that makes it possible to integrate and adjust educational activities, increase the degree of interest and motivation of the child to the set of information and communication technologies, which is an indicator of readiness for the formation of digital competence.
- The organization of a developing, digital, safe, and comfortable educational environment of a preschool education institution, which includes psychological and pedagogical support, material and technical base, communicative resources, and didactic tools to ensure an effective educational process. The key role in the digital environment is played by: network associations of early childhood educators, a virtual methodological office, a website or portal of the institution.
- The presence of future educators with the skills to form digital competence in preschool children. To effectively implement this pedagogical condition, a special course, “Formation of digital competence in a modern preschooler”, was introduced into the educational process of the EG.

The purpose of the formative stage of the study was to substantiate and verify the effectiveness of the developed pedagogical conditions.

Comparative analysis of the results of the ascertaining and final stages of the experiment.

The purpose of the final stage of the study is to determine the levels of readiness of future educators to form digital competence in preschool children of significant changes.

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To compare the empirical data obtained in the experimental group and the control group at the formative stage, a diagnostic toolkit was used, similar to that used at the ascertaining stage.

Analysis of the results at the final stage of the experiment for all readiness criteria showed that significant positive changes occurred in the experimental group and in the control group; these changes were insignificant.

Let us show the comparative results at the ascertaining and final stages of the experiment regarding the study of the state of readiness of students for the formation of digital competence in preschool children by each criterion (Figure 5).

Motivational criterion. We see the difference between the results obtained in the experimental and control groups at the stage of the formative and ascertaining experiment.

- A sufficient level was demonstrated by 32% (there were 16%) of the respondents in the experimental group and 20% (there were 17%) of the respondents in the control group.
- A satisfactory level was demonstrated by 36% (there were 26%) of the respondents in the experimental group and 21% (there were 23%) of the respondents in the control group.
- A low level was demonstrated by 32% (there were 58%) of the respondents in the experimental group and 59% (there were 60%) of the respondents in the control group.

Cognitive criterion. We see the difference between the results obtained in the experimental and control groups at the stage of the formative and ascertaining experiment.

- A sufficient level was demonstrated by 33% (there were 13%) of the respondents in the experimental group and 19% (there were 13%) of the respondents in the control group.
- A satisfactory level was demonstrated by 36% (there were 24%) of the respondents in the experimental group and 22% (there were 28%) of the respondents in the control group.
- A low level was demonstrated by 31% (there were 63%) of the respondents in the experimental group and 59% (there were 59%) of the respondents in the control group.

Performance criterion. We see the difference between the results obtained in the experimental and control groups at the stage of the formative and ascertaining experiment.

- A sufficient level was demonstrated by 35% (there were 14%) of the respondents in the experimental group and 18% (there were 17%) of the respondents in the control group.
- A satisfactory level was demonstrated by 48% (there were 23%) of the respondents in the experimental group and 28% (there were 25%) of the respondents in the control group.
- A low level was demonstrated by 17% (there were 63%) of the respondents in the experimental group and 54% (there were 58%) of the respondents in the control group.

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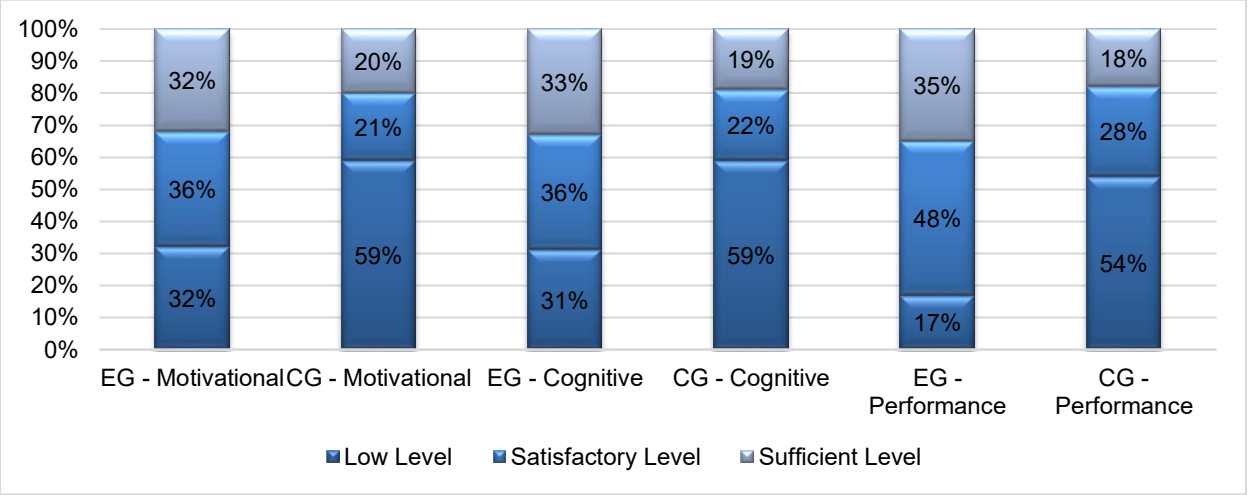

Figure 5. Summarized results of the final experiment.

Thus, the results indicate that the work carried out significantly affected the indicators of the organizational and motivational criterion in the experimental group. On the other hand, in the control group, where students studied according to the traditional program, the changes were less pronounced.

The diagnostic results confirm positive changes in all criteria in the students of the experimental group, which indicates the effectiveness of the developed and implemented pedagogical conditions. In the control group, the changes were insignificant.

The Kolmogorov-Smirnov λ-criterion was used to assess the statistical significance of the results obtained. It was assumed within the framework of the H1 statistical hypothesis that the difference between the distributions of the experimental group and the control group is significant, that is, the empirical distributions of the levels of preparedness differ significantly. The calculation of the λ-criterion at the formative stage of the experiment for indicators of students' readiness to form digital competence in preschool children was carried out using the same algorithm as at the ascertaining stage. $d_{cr} = 0.14$ (at $p \leq 0.05$) according to the table of critical values, and at $p \leq 0.01$, $d_{cr} = 0.18$.

$\lambda_{emp} = 1.29$ was obtained at the final stage of the experiment. $\lambda_{cr} = 1.15$ for the level of statistical significance with $p = 0.99$. $\lambda_{emp} > \lambda_{cr}$, and this confirms the hypothesis H1.

The data obtained lead to conclusions about the effectiveness of the developed pedagogical conditions for training future specialists of preschool institutions to form digital competence in children, which indicates their high efficiency and effectiveness.

Conclusions

The historical origin of digital competence is presented, and the content and components of the early childhood educator's digital competence are revealed. We understand the digital competence of a preschooler as the child's awareness of solving educational, cognitive, and everyday tasks using information and communication technologies and digital technologies.

The tasks, functions, and principles of designing the educational digital environment of a modern educational institution are revealed. The components and resources of the digital environment are shown. The purpose of the ascertaining stage of the experiment was to determine the actual state of readiness of future educators to form digital competence in children in preschool educational institutions. To conduct the ascertaining stage of the experiment, students were divided into a control group and an experimental group, thanks to which it was possible to ascertain the state of preparation of future educators to form

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digital competence in children (EG: n = 40; CG: n = 38). A semi-closed questionnaire was used to determine the attitude of students participating in the experiment toward the formation of digital competence in preschool children. The questionnaire consisted of questions that had a multivariate format in terms of the construction of the answers.

Further research was aimed at diagnosing the level of readiness of students (through testing) for the formation of digital competence in preschool children. After analyzing the questionnaires in order to determine the attitude to the formation of digital competence in preschool children, students participating in the experiment came to the conclusion that future specialists note the need and importance of the formation of digital competence in children, but not all future educators have enough knowledge of digital competence. Therefore, it is not enough to have the skills to use digital competencies and technologies; conditions must be created for the formation of digital competence in children.

In order to study the state of readiness of students for the formation of digital competence in preschool children, we identified components (motivational, cognitive, and performance), criteria, and indicators. The levels of readiness are characterized as: low, satisfactory, and sufficient.

To verify the reliability of the data obtained at the ascertaining stage of the experiment, the Kolmogorov-Smirnov λ-criterion was used.

The results of the study indicate the need for purposeful and systematic work to improve the preparation of future educators for the development of digital competence in their children. Thus, it is necessary to formulate and implement pedagogical conditions for the preparation of future educators for the formation of digital competence in children.

The purpose of the formative stage of the study was to substantiate and verify the effectiveness of the developed pedagogical conditions.

The purpose of the final stage of the study is to determine the levels of readiness of future educators for the formation of digital competence in preschool children.

To compare the empirical data obtained in the experimental group and the control group at the formative stage, a diagnostic toolkit was used, similar to that used at the ascertaining stage.

Analysis of the results at the final stage of the experiment according to all criteria of preparedness showed that significant positive changes occurred in the experimental group, while in the control group, these changes were insignificant.

The diagnostic results confirm positive changes according to all criteria in the students of the experimental group, which indicates the effectiveness of the developed and implemented pedagogical conditions. In the control group, the changes were insignificant.

However, the results of the study do not claim to be a comprehensive disclosure and do not exhaust the entire depth of the scientific problem of preparing future educators to form digital competence in children.

We see the prospect of further research in developing the issue of rethinking the role and tasks of the early childhood educator. During professional training, an early childhood educator must realize that the main thing in modern education is the formation of digital competence of each individual, without which a new generation cannot exist, because it is simply impossible to isolate oneself from social changes in the world.

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