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ICT COMPETENCE AND AI TOOLS AS KEY PEDAGOGICAL CONDITIONS IN THE TRAINING OF FUTURE PRESCHOOL TEACHERS

Abstract

This study explores the integration of Artificial Intelligence (AI) tools in enhancing Information and Communication Technology (ICT) competence among future preschool teachers. As modern education is undergoing rapid transformations due to evolving standards and technological progress, the importance of equipping preschool teachers with ICT and AI skills is increasingly vital. The study examines the pedagogical conditions required to foster ICT competence, particularly in preschool education, and explores how AI tools can be used to improve both the professional development and teaching methods of preschool teachers. A two-group experimental design was employed, involving 102 future preschool teachers of Abai Kazakh National Pedagogical University. The experimental group incorporated AI tools into their teacher training, while the control group followed traditional methods. Pre- and post-assessments were conducted to assess the participants' digital literacy, pedagogical use of technology, and overall ICT competence. This study highlights the critical role of AI in modernizing teacher education and offers practical recommendations for integrating AI and ICT into curriculum design and teacher training programs to better prepare future preschool teachers for the challenges of modern preschool education.

Keywords: professional training, preschool teachers, ICT competence, modern teacher, pedagogical conditions.

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АКТ ҚҰЗЫРЕТТІЛІГІ ЖӘНЕ ЖИ ҚҰРАЛДАРЫ БОЛАШАҚ МЕКТЕПКЕ ДЕЙІНГІ ҰЙЫМДАР МҰҒАЛІМДЕРІН ДАЙЫНДАУДЫҢ НЕГІЗГІ ПЕДАГОГИКАЛЫҚ ШАРТЫ РЕТІНДЕ

Аңдатпа

Бұл мақалада болашақ мектеп жасына дейінгі ұйым педагогтардың АКТ және ЖИ құралдарын пайдаланудағы АКТ құзыреттілігін дамыту мәселесінің қазіргі жағдайы қарастырылған. Бұл зерттеу болашақ мектепке дейінгі ұйым тәрбиешілер арасында ақпараттық-коммуникациялық технологиялар құзыреттілігін арттыру үшін жасанды интеллект құралдарын біріктіруді зерттейді. Қазіргі білім беру жаңа стандарттар мен технологиялық жетістіктердің әсерінен жылдам өзгерістерге ұшырап жатыр. Мектепке дейінгі ұйым тәрбиешілерін АКТ және ЖИ дағдыларымен қамту қажеттілігі барған сайын өзекті бола түсуде. Зерттеу жұмысында АКТ құзыреттілігін дамыту үшін қажет педагогикалық шарттарды, әсіресе ерте жастағы балаларды оқытуда және ЖИ құралдарын мектеп дейінгі ұйым тәрбиешілердің кәсіби дамуы мен оқыту әдістерін жақсарту үшін қалай пайдалануға болатынын зерттейді. Абай атындағы Қазақ ұлттық педагогикалық университетінде 102 болашақ мектепке дейінгі ұйым педагогтердің қатысуымен эксперименттік жоба қолданылды. Эксперименттік топ АКТ технологиялары мен ЖИ құралдарын оқытуға енгізді, ал бақылау тобы дәстүрлі әдістерді қолданды. Қатысушылардың цифрлық сауаттылығын, технологияны педагогикалық пайдалануды және жалпы АКТ құзыреттілігін бағалау үшін алдын ала және кейінгі бағалаулар жүргізілді. Бұл зерттеу ЖИ мұғалімдердің білімін жанартудағы маңызды рөлін көрсетеді және болашақ мектепке дейінгі ұйым тәрбиешілерді қазіргі заманғы мектепке дейінгі білім берудің міндеттеріне жақсырақ дайындау үшін оқу жоспарын әзірлеуге және мұғалімдерді оқыту бағдарламаларына ЖИ мен АКТ-ны біріктіру бойынша практикалық ұсыныстарды ұсынады.

Түйін сөздер: кәсіби дайындық, мектепке дейінгі тәрбиешілер, АКТ құзыреттілігі, заманауи педагог, педагогикалық шарттар.

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ИКТ-КОМПЕТЕНТНОСТЬ И ИНСТРУМЕНТЫ ИИ КАК КЛЮЧЕВЫЕ ПЕДАГОГИЧЕСКИЕ УСЛОВИЯ ПОДГОТОВКИ БУДУЩИХ ПЕДАГОГОВ ДОШКОЛЬНЫХ ОРГАНИЗАЦИЙ

Аннотация

В статье определяется современное состояние проблемы развития ИКТ-компетентности будущих педагогов дошкольных организаций в использовании инструментов ИКТ и ИИ. В этом исследовании изучается интеграция инструментов искусственного интеллекта (ИИ) для повышения компетентности в области информационных и коммуникационных технологий (ИКТ) среди будущих педагогов дошкольных организаций. Поскольку в современном образовании происходят быстрые трансформации из-за развивающихся стандартов и технологических достижений, важность оснащения педагогов дошкольного образования навыками ИКТ и ИИ становится все более важной. Исследование изучает педагогические условия, необходимые для развития компетентности в области ИКТ, особенно в дошкольном образовании, и изучает, как инструменты ИИ могут быть использованы для улучшения как профессионального развития, так и методов преподавания педагогов дошкольных организаций. Был использован экспериментальный проект с участием 102 будущих педагогов дошкольных организаций в Казахском Национальном Педагогическом университете имени Абая. Экспериментальная группа включила в свою подготовку ИКТ технологии и инструменты ИИ, в то время как

контрольная группа следовала традиционным методам. Были проведены предварительные и последующие оценки для оценки цифровой грамотности участников, педагогического использования технологий и общей компетентности в области ИКТ. В этом исследовании подчеркивается важная роль ИИ в модернизации педагогического образования и предлагаются практические рекомендации по интеграции ИИ и ИКТ в разработку учебных программ и программы повышения квалификации педагогов для лучшей подготовки будущих педагогов дошкольных организаций к вызовам современного дошкольного образования.

Ключевые слова: профессиональная подготовка, педагоги дошкольных организаций, ИКТ-компетентность, современный педагог, педагогические условия.

Introduction. Modern education is changing, new legislative acts and state educational standards of all levels of continuous education are emerging, which leads to qualitative and quantitative changes in the criteria of professional competence of teachers. The implementation of the strategy for modernizing education has significantly exacerbated the problem of insufficient professional competence of specialists, emphasizing the importance of developing pedagogical methods and conditions for improving the quality of their training, retraining and self-development in the profession.

Artificial Intelligence (AI) is increasingly being implemented into all aspects of our lives, both professionally and personally. Its global market share is expected to grow at an annual rate of 28.46% by 2030.[1] AI is transforming the way we approach early childhood education. Artificial intelligence systems are increasingly being employed to help young children learn, develop, and flourish. AI in early childhood education is defined as the use of computer systems and algorithms to analyze and respond to children's learning patterns, behaviors, and needs. This technology has the ability to completely transform the way we teach and learn, making education more individualized, interesting, and successful. Using AI capabilities, educators may design individualized learning experiences that address each child's specific requirements, resulting in a more inclusive and supportive learning environment.

O.B.Zaitseva defines the professional competence of a teacher as a set of universal and specific professional attitudes that allow him to cope with a given program and special situations that arise in the psychological and pedagogical process of a preschool institution, resolving which he contributes to the clarification, improvement, practical implementation of development tasks, its general and special abilities [2].

The priority component of professional competence is the ability to use modern technologies for teaching, educating and developing children, based on their age and individual capabilities and needs, as well as positive personal qualities, general cultural and psychological and pedagogical knowledge, skills and values.

The dynamic evolution of technology has influenced every aspect of modern life, including education. Among the most profound changes is the integration of Information and Communication Technologies (ICT), which has reshaped how educators interact with students and design learning experiences. For preschool education, this transformation is even more significant, as young children are increasingly exposed to digital tools from an early age. As such, future preschool teachers must be adequately prepared to navigate and utilize these technologies to foster learning and development.

While traditional teacher education has historically focused on pedagogical theory and child development, the importance of ICT competence has grown substantially in recent years. The proliferation of digital tools and technologies such as interactive software, educational apps, and AI-driven platforms has raised the need to prepare future educators not only in pedagogical methods but also in technological literacy.

ICT competence refers to using digital technologies effectively and responsibly in educational settings [3] (European Commission, 2018). For preschool teachers, ICT competence encompasses several key aspects: digital literacy (basic technological skills), pedagogical use of technology (using technology to support learning), and critical thinking regarding the application of technology in early childhood settings [4] (Kampylis & Punie, 2012). In preschool education, ICT competence

is essential not only for enhancing teaching practices but also for supporting young children's cognitive and social development through interactive and engaging digital tools [5].

Studies by Kirschner and van Merriënboer (2013) underscore the importance of ICT competence for educators across all levels of education, emphasizing that digital tools can serve as powerful enablers of personalized learning [6]. However, the challenge remains in providing preservice teachers with sufficient training and experience in using these technologies in ways that support early childhood development [7] (Liu & Li, 2018).

The positive effects of the ICT competence of preschool teachers, fixing the requirements for it in the professional standard of the teacher raises the issue of finding new pedagogical ways and conditions for the formation of this competence in the system of training students and retraining teachers working in preschool institutions. The information and communication competence of a modern teacher, according to A.V. Adolf [8], includes three main aspects:

1. Availability of a sufficient level of functional literacy in the field of ICT.
2. Effective and reasonable use of ICT in the professional activities of a teacher to solve professional, social, and personal problems.
3. Understanding ICT as the basis of a new paradigm in education aimed at developing students as subjects of the information society, capable of creating knowledge, and able to operate with information arrays to obtain new intellectual and activity results [8].

Artificial Intelligence in Preschool Education. AI tools in education range from intelligent tutoring systems that provide personalized learning experiences for students, to teacher assistants that can guide instructors in improving their teaching strategies [9] (Holmes et al., 2019). The potential of AI in teacher education is particularly promising, as it can facilitate interactive learning experiences that simulate classroom dynamics and allow teachers to practice handling various teaching scenarios in a controlled environment [10] (Johnson et al., 2020).

In preschool education, AI can be used to support both teachers and young learners by creating interactive and adaptive learning experiences. AI-based applications can help teachers design engaging curricula, monitor children's progress in real-time, and offer personalized feedback based on individual learning styles [11] (Alimisis, 2013). Furthermore, AI systems can model complex pedagogical situations, enabling teachers to practice their decision-making skills before entering the classroom.

Pedagogical Conditions for Forming ICT Competence in Preschool Teachers. The successful integration of AI tools into teacher training requires the creation of specific pedagogical conditions. These conditions include curriculum development, the provision of practical experience with technology, and ongoing professional development opportunities.

Curriculum Design. Curriculum design plays a crucial role in developing ICT competence in teacher education programs. According to Mishra and Koehler's [12] (2006) Technological Pedagogical Content Knowledge (TPACK) framework, effective integration of technology in teaching requires teachers to have a deep understanding of both the content they teach and the technologies they use. For preschool teachers, this means integrating ICT competencies not as separate components but as part of their pedagogical strategies.

To achieve this, teacher training programs should include both theoretical and practical components of ICT training. Theoretical knowledge about digital tools should be balanced with practical experience, where students directly interact with AI tools, educational software, and other digital technologies [13] (Ertmer & Ottenbreit-Leftwich, 2010).

Practical Training and Hands-On Experience. Practical training is essential for developing ICT competence in future preschool teachers. By allowing future preschool teachers to engage directly with AI tools, they can better understand how to integrate these technologies into real-world educational settings. This experiential learning fosters problem-solving and decision-making skills, preparing teachers to adapt digital tools to the needs of diverse student populations [14] (Voogt et al., 2015).

Moreover, simulations and interactive platforms powered by AI can offer personalized learning experiences for future preschool teachers. These tools can provide real-time feedback, allowing teachers to practice skills such as classroom management, instructional design, and student assessment in a controlled environment [15] (Schmidt et al., 2019).

Continuous Professional Development. Given the rapid pace of technological advancements, continuous professional development is necessary to ensure that teachers remain up-to-date with emerging tools and best practices. Regular training programs and workshops focused on ICT and AI technologies can help teachers stay informed and effectively integrate these tools into their classrooms. Ongoing professional development also encourages reflective practice, enabling teachers to evaluate their use of AI tools and identify areas for improvement.

Basic provisions. ICT competence is a key component of modern preschool teacher training. In the digital age, future preschool teachers must develop strong ICT skills to effectively integrate technology into early childhood education. ICT competence enhances teaching quality, improves child engagement, and aligns with global education standards.

AI tools significantly enhance the development of ICT competence among future preschool teachers. AI-powered educational platforms, adaptive learning systems, and digital assistants facilitate personalized teacher training. AI tools provide innovative solutions for lesson planning, student assessment, and interactive learning experiences.

Pedagogical conditions play a crucial role in fostering ICT competence through AI integration. A structured approach to ICT and AI training is necessary for effective knowledge acquisition and application. Practical training, workshops, and real-life classroom simulations with AI tools improve the preparedness of future teachers.

Experimental results confirm the effectiveness of AI tools in teacher training. A study involving 102 future preschool teachers at Abai Kazakh National Pedagogical University showed improved ICT competence in the experimental group that used AI tools. The experimental group demonstrated higher digital literacy, better pedagogical technology use, and increased confidence in ICT-based teaching methods.

AI and ICT integration should be incorporated into curriculum design and teacher training programs. Future preschool teacher education must adapt to technological advancements by embedding AI-driven learning methodologies. Policymakers and educators should develop guidelines for AI-enhanced pedagogical practices to prepare teachers for modern educational challenges.

Materials and methods. The experiment aimed to explore the impact of AI tools on the ICT competence of future preschool teachers, as well as to identify markers of the formation of information and communication competence of future preschool teachers.

Participants: The experiment involved 102 students of Abai Kazakh National Pedagogical University, majoring in "Preschool education", full-time education. The participants were randomly divided into two groups: the experimental group (57 students) and the control group (45 students). The experimental group used AI and ICT technologies as part of their pedagogical training, while the control group participated in traditional teaching methods without the integration of AI tools.

Materials and Tools: To identify indicators characterizing the level of formation of information and communication competence of future preschool teachers, diagnostic methods (Bocharova L. V) [16] were determined (questionnaires: "Information and communication competence of future preschool teachers in the process of professional training", "Studying the motivation for the formation of information and communication competence of future preschool teachers", test, project, observation of students during classes and pedagogical practice). AI tools included educational software platforms, AI-driven teaching assistants, and personalized learning environments. The tools were integrated into coursework focusing on child development, and digital literacy. These AI tools offered real-time feedback, simulated classroom environments, and personalized learning experiences tailored to individual needs.

Procedure: In the process of diagnostic research, we considered the multicomponent structure of the information and communication competence of future preschool teachers, represented by a set of cognitive, activity, motivational, and personal components, in accordance with which we determined the levels of formation of each component.

In scientific and pedagogical literature, the most common approach is when the main measurement criterion is the characteristics of students' progress to a higher level of mastering knowledge, skills, and abilities [17, 18, 19]. Based on this, we identified three levels of formation of each component of the information and communication competence of future preschool teachers: basic, intermediate, and advanced, which are detailed in Table 1.

Table 1. The levels of formation of the components of ICT competence of future preschool teachers

Components	Levels		
	<i>Basic</i>	<i>Intermediate</i>	<i>Advanced</i>
Cognitive	basic knowledge of working with information and a computer, does not work well with digital resources	sufficient knowledge of the use of information and communication technologies in educational and extracurricular activities, knowledge of creating various types of work and presentations, skills in using educational software and AI tools	has perfect skills in using information and communication technologies in the process of professional activity, has developed extensive knowledge in creating various types of work using ICT and AI tools, is fluent in specialized literature, and can perfectly use educational software for various educational purposes.
Personal	rarely shows his own style in information and communication activities, demonstrates low responsibility for the work performed	demonstrates his personal style of using information and communication technologies in his professional activities, is responsible for the work performed	has its own style and distinctive skills in using ICT in professional activities, and is fully responsible for the work performed
Motivational	weakly expressed value orientations and motives, not interested in success in information activities, not ready to improve information and communication competence, lack of interest in studying new advanced technologies for educational purposes	interested in success in information activities, ready to improve information and communication competence in order to advance, a value-motivational orientation to information activities has been formed, shows interest in searching for information processing, its reproduction with elements of analysis based on knowledge of the principles of working with information	pronounced value-motivational orientation, ready for continuous improvement of information and communication competence, understanding of rapid technological development and desire to use advanced technologies for professional growth, the specialist wants to manage the information and communication process, shows interest in information and communication activities and AI technologies and the need to achieve high results in information and communication activities, high motivation to use ICT
Activity-oriented	reproduces tasks based on elementary knowledge; basic skills in working with information, computer skills at the user level	have the skills to use information and communication technologies and AI tools in educational and extracurricular activities, have developed the skills to create various types of work, use educational programs, online resources, etc.	can use information and communication technologies, has developed skills in creating various types of work with complex additional features, educational programs and websites, can solve professional problems using ICT and AI tools, has a creative approach, and can predict work results when using ICT and AI.

The cognitive component is the ability to navigate modern technologies and programs, considering the needs of the educational environment, and the willingness to use knowledge of modern methods and information technologies. To determine the level of formation of the cognitive component of information and communication competence, we conducted a survey using the questionnaire "Information and communication competence of future preschool teachers " and a test for knowledge of information and communication technologies in the section "Conditions for the effective and safe use of ICT and AI tools for educational purposes". The test included open-ended questions (answers compiled by the respondent in free form) and closed questions (answers offered by the developer of the questionnaire). When diagnosing the level of formation of the cognitive component, we also observed the future preschool teachers during their pedagogical practice at Abai Kazakh National Pedagogical University and practical classes. The observation was carried out to evaluate their basic ICT competence, which measured skills such as digital literacy, the use of educational software, and the ability to apply technology in teaching contexts.

Pre-assessment: Both groups participated in a pre-assessment to evaluate their baseline level of ICT competence, measuring skills such as digital literacy, use of educational software, and ability to apply technology in teaching contexts.

1. *Intervention:* Over 10 weeks, the experimental group used ICT and AI tools during lessons and activities, while the control group participated in traditional teacher training without technology-based interventions.

2. *Post-assessment:* After the intervention, both groups took the same ICT competence test, and participants in the experimental group completed a survey to assess their experiences with the ICT and AI technologies.

Results. Quantitative Analysis. The experimental group included 2nd year students, and the control group- 3rd year students. As a result of the study of this component, the levels of formation of the cognitive component of the information and communication competence of future preschool teachers were identified. The results of the study are presented in Table 2.

Table 2. The results of the level of formation of the cognitive component of information and communication competence of future preschool teachers in the experimental and control groups

Levels	Experimental group (57)		Control group (45)	
	%	Number	%	Number
Basic	48%	27	49%	22
Intermediate	45%	25	42%	19
Advanced	7%	5	9%	4

The results obtained during the experiment indicate that the majority of students in the EG and CG have a low and medium level of development of the cognitive component of information and communication competence, that is, they have poorly developed use of ICT and AI tools in educational and extracurricular activities, insufficient knowledge of creating various types of works and presentations, they are poorly aware of the educational software acceptable for working with preschoolers.

The activity component implies a willingness to apply modern methods and information and communication technologies; the ability to apply methods of mathematical information processing by means of ICT, the ability to analyze the results of scientific research and use them in solving specific educational and research problems; readiness to use the main methods and tools of obtaining, storing, processing information, to have high computer literacy; ability to work with computer games for preschoolers and software designed for educational purposes; the ability to create educational presentations and applications using the special computer skills. Diagnostics of the level of formation of the activity component of information and communication competence was carried out during practical and seminar classes, where the ability to apply the acquired

knowledge in practice, the formation of skills in the use of information and communication technologies in preschool education, types and forms of activity using modern information technologies and educational programs for preschoolers. As a result of the study of this component, the following levels were formulated.

The basic level of development of the activity component of information and communication competence of future preschool teachers is the reproduction of information in accordance with the task based on elementary knowledge; basic skills of working with information and communication technologies, and low basic computer skills.

Intermediate level - students have enough skills to use information and communication technologies in educational and extracurricular activities, and students have skills to create various works in the digital space.

Advanced level - advanced skills in using ICT in the process of professional training; students can create various works in the digital space with additional features.

This component was assessed using the methodology developed in the dissertation research of Vorontsova E.M. [20] "Creating a project". Task example: creating a project (the topic of the project was determined by students independently from the subject: "History of preschool pedagogy", "Innovative technologies in education").

Additionally, In-depth interviews and surveys were conducted to collect feedback from the experimental and control groups regarding their experiences with the ICT and AI tools.

The obtained data provided insights that out of 57 students in the EG, a basic level of formation of information and communication competence was revealed in 34 students (59%), an intermediate level - in 21 students (36%) and advanced level - in 2 students (5%). Most students in the experimental and control groups have basic knowledge in the field of information and communication technologies and AI tools, that is, they can't work with multimedia using the simplest special features, and also use ready-made layouts offered in a wide range on the Internet, however, the creation of these works is not methodically supported.

The motivational component in the framework of our study is considered as an understanding of the importance of information and communication competence for improving the quality of pedagogical work; the need to achieve high results in information and communication activities, interest in information and communication activities, and independence in the educational process.

When studying the level of formation of the motivational component of information and communication competence, we used the method developed by L.V. Bocharova "Studying the motivation for the formation of information and communication competence of future teachers". According to this method, it was necessary to number the statements in descending order of their importance [16]:

- the successful desire for interpersonal interaction;
- desire to manage the information and communication process, using the capabilities of competence;
- interest in information and communication activities;
- the need to achieve high results in information and communication activities;
- the desire to enrich professional training through the possibilities of information and communication competence.

The results indicated that most students in the EG and CG groups lack or have a weak motivation to achieve high results in educational activities related to the use of information and communication technologies.

More specifically:

- a high level of motivation was identified in 7% of students in the control group and in 6% of students in the experimental group who lack the necessary motives in the field of information and communication activities, but have an interest in acquiring knowledge, skills and abilities in the field of information and communication technologies;

- on average, 22-23% of the students in the experimental and control groups have an average level of motivation, they show interest in information and communication activities and want to manage the information and communication process, but do not have the necessary knowledge to apply their knowledge in professional training;

- a low level of motivation was identified in 72% of students in the EG and 70% in the CG, who do not show interest in knowledge, skills, and abilities related to information and communication technologies and do not apply acquired knowledge in their professional activities.

Personal component - the ability to show initiative and independence in working with various information programs and in creating electronic educational resources; the ability to be tactful and consider the opinion of colleagues when working with information resources. With this component, students demonstrate their style in information and communication activities and are responsible for their work (questionnaire "Personal self-assessment of a student").

The results of identifying the level of formation of the personal component are presented in Table 3.

Table 3. The level of formation of the personal component of information and communication competence of future preschool teachers in the experimental and control groups

Levels	Experimental group (57)		Control group (45)	
	%	Number	%	Number
Basic	64%	45	66%	36
Intermediate	27%	10	24%	7
Advanced	9%	2	10%	2

These results show that students have a low level of formation of the personal component of the formation of ICT competence. This suggests that students have low responsibility for the work done and they do not show their style in information and communication activities. Students do not strive to achieve high results in the field of information and communication technologies, they do not have sufficient skills in developing didactic materials using ICT and educational software.

The analysis of the given data for all components shows that the majority of students in the experimental and control groups have low indicators of the formation of information and communication competence, which requires corrective work in this direction. The results of this study made it possible to identify problems that require improvements in the professional training of students, which is not sufficiently focused on the formation of information and communication competence of future preschool teachers in the process of educational and professional activities.

The quantitative results were derived from pre-and post-test assessments designed to measure the ICT and AI skills of both the experimental and control groups. The tests assessed participants' abilities in areas such as digital literacy, the use of educational software, and applying technology within pedagogical contexts.

- **Experimental Group:** The experimental group, which used AI tools during their training, showed slight improvements in their ICT competence. On average, the experimental group's post-test scores increased by 15%, indicating a marked improvement in their technological proficiency. This group showed notable improvements in using AI-driven educational software, as well as in their ability to implement technology to support preschool teaching strategies. Their ability to interact with AI tools, understand their applications, and apply them in simulated classroom environments was particularly strong. The areas of greatest improvement were in personalized learning and the use of AI-based feedback systems to tailor instruction to the needs of individual students.

- **Control Group:** The control group, which did not use ICT and AI technology in their training, showed modest improvement in their ICT competence, with an average increase of 3%. Although this group showed some improvement in general ICT skills, the lack of exposure to AI tools and

interactive technology meant that their knowledge and skills in terms of integrating technology into preschool education remained limited. The improvement was mainly in basic digital literacy, such as familiarity with educational apps and basic use of software, but their pedagogical integration of ICT remained relatively superficial.

Qualitative Analysis. In addition to the quantitative assessments, qualitative data were collected through surveys, interviews, and reflective journals. These data provided insights into participants' experiences with ICT and AI tools, revealing both positive and negative aspects.

Positive Results: The experimental group reported an increased interest in using technology-based approaches to teaching. Many participants highlighted that the use of ICT and AI allowed them to see new opportunities for integrating technology into their classrooms, that they had not previously considered.

Negative Results: Despite the positive response, participants in the experimental group raised several concerns and issues. Some participants reported feelings of being overwhelmed when first interacting with the ICT and AI tools, particularly those involving advanced simulations and personalized feedback systems. A few students had difficulties adapting to the AI-driven platforms, citing technical difficulties such as system errors or confusing user interfaces. One participant noted: “While the AI tools are great, at times, the interface was hard to navigate, and the feedback wasn’t always clear. This sometimes left me feeling frustrated.”

Additionally, a minority of students expressed concerns about over-reliance on technology. They feared that using AI tools could lead to an overemphasis on technology at the expense of human interaction and traditional teaching methods. Some also questioned the feasibility of implementing AI tools into resource-limited preschool settings. One participant shared: “AI is great, but I’m concerned about using it in a real classroom. Not all kindergartens have the resources to implement these tools, and I don’t know if it’s always the best option for young children.” While these concerns were not universal, they highlight the need for a balanced approach when integrating AI into teacher training programs.

Discussion. The generalized diagnostic results showed that for the formation of information and communication competence of future preschool teachers, it is important to develop the motivational and personal component in the process of professional training of students. According to the results of the study, a basic level of ICT competence is observed both in the experimental group (64.5%) and in the control group (65.5%). Students need to master educational materials using information and communication technologies, digital technologies, and modern educational software, they must be able to process information and create databases in applications, create educational materials using information and communication technologies, be able to use computer games designed for preschoolers, create their own digital content using various electronic and web resources, create multimedia components of web pages, supplementing with streaming sound, create gif-animations for preparing illustrations and reproducing information.

The control group, which did not use ICT and AI tools in their training, demonstrated only a modest improvement in their ICT competence, with an average increase of 3%. Although this group showed some progress in their general ICT skills, their ability to integrate digital tools into preschool education remained limited. This suggests that traditional methods of teacher training alone may not be sufficient to develop deep ICT competence, which aligns with previous research indicating that passive exposure to technology does not necessarily translate into effective use in professional practice (Liu & Li, 2018).

In contrast, the experimental group demonstrated a slight improvement in their technological skills, which is consistent with the results from previous studies that have highlighted the benefits of technology integration into teacher education (Baker et al., 2020; Holmes et al., 2019). The most notable improvements were in the areas of personalized learning and the ability to adapt teaching strategies based on real-time data. AI tools allowed participants to engage in interactive simulations, allowing them to experiment with different teaching approaches, receive immediate feedback, and improve their decision-making skills in real classroom scenarios. These results are consistent with

the findings of Hsu et al. (2020), who reported that AI-based simulations in teacher education programs can help future preschool teachers develop the necessary skills to handle complex classroom dynamics.

A comparison of the control and experimental groups highlights the added value of AI-enhanced training over traditional methods. While both groups showed improvements in basic ICT competence, the experimental group exhibited higher engagement and deeper integration of technology in pedagogical activities. This aligns with Holmes et al. (2019), who found that AI-driven learning enhances problem-solving skills and pedagogical adaptability more effectively than conventional training methods.

The positive feedback regarding the simulations suggests that ICT and AI tools, when used effectively, can provide immersive and interactive learning experiences that enhance teachers' pedagogical skills. These experiences are critical for preparing future preschool teachers to effectively use technology to meet the diverse needs of young learners. Additionally, the personalized feedback mechanisms built into AI tools enabled participants to reflect on their strengths and areas for improvement, which is an important aspect of professional growth and development.

The study also revealed several challenges that need to be addressed in future AI integration efforts. One key challenge identified was the technical complexity of some AI tools. Several participants in the experimental group expressed frustration with the interface and usability of the tools, which could be a barrier to effective learning. As noted in previous studies, the successful implementation of AI tools in education depends not only on the sophistication of the technology but also on its usability and accessibility (Luckin et al., 2016). For future preschool teachers, who may not have advanced technical skills, a user-friendly interface is essential to ensure that the technology is a useful tool rather than a barrier.

Additionally, the concerns regarding over-reliance on technology highlight the importance of finding a balance between digital tools and traditional pedagogical methods. While AI can provide valuable insights and support for preschool teachers, it is important to remember that technology should complement, not replace, teachers' human interaction and expertise. This aligns with concerns raised by Ertmer and Ottenbreit-Leftwich (2010), who argued that technology should be integrated in ways that enhance, rather than replace, the teacher-student relationship.

The concerns about resource constraints are also valid. While AI tools have the potential to revolutionize teacher education, they require significant investment in infrastructure, training, and maintenance. This could pose challenges for kindergartens with limited resources, especially in low-income or rural areas. As some participants noted, not all preschools may have the technological infrastructure to support AI tools, which could lead to differences in the quality of education offered across institutions.

Implications for Teacher Education Programs. The positive results of this study suggest that AI tools should be considered a valuable component of preschool teacher education programs. However, it is important to ensure that future preschool teachers are sufficiently prepared to use these tools effectively. Teacher training programs should include not only practical experiences with AI tools but also training on how to meaningfully integrate these technologies into their teaching practices. Furthermore, teacher education programs should offer support to address technical issues and concerns raised by some participants, such as providing clearer instructions and technical support for AI tools.

Another important implication is the need for ongoing professional development. As AI technology continues to evolve, teachers must be provided with opportunities to continue learning and adapt to new tools and techniques. This will help address the issue of resource inequalities and ensure that all preschool teachers, regardless of the resources available to them, can effectively use AI tools in their classrooms.

Conclusion. In conclusion, the current content of preschool education requires preschool teachers to use information and communication technologies in the practice of working with

children of preschool age, in the educational process, methodological work, and management activities of the educational institution. This is ensured by the appropriate professional training of preschool education specialists. The study showed that the use of information and communication technologies in the professional training of future preschool teachers at the university requires their purposeful, active, motivated participation in the activities of the university and the need to improve the professional training of future teachers of preschool organizations in the use of information and communication technologies in their future professional activities.

The integration of AI tools into teacher education programs has significant potential to improve the ICT competence of future preschool teachers. The positive results from this study showed that AI can improve teachers' technological literacy and pedagogical skills, especially in areas such as personalized learning and adaptive teaching methods. However, challenges related to technical complexity, the potential over-reliance on technology, and resource limitations need to be addressed to fully realize the benefits of AI tools in education. Future research should explore ways to optimize the design of AI tools for teacher education, ensuring they are both accessible and effective. Additionally, longitudinal studies can help assess the long-term impact of integrating AI tools on teachers' professional growth and their ability to implement technology in diverse classroom settings.

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