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The use of educational technologies for ensuring continuity of preschool and primary education

El uso de las tecnologías educativas para garantizar la continuidad de la educación preescolar y primaria

Liudmyla Berezovska
Doctor of Pedagogical Sciences, Professor of the Department of Theory and Methods of Preschool Education,
State institution "South Ukrainian National Pedagogical University named after K. D. Ushynsky", Odesa,
Ukraine.
https://orcid.org/0000-0002-3032-7261
liudmyla17mmilla@gmail.com

Iryna Saraieva
PhD, Head of the Department of Preschool and Primary Education, Odessa Regional Academy of
In-Service Education, Odesa, Ukraine.
https://orcid.org/0000-0001-7753-1836
isaraieva@gmail.com

Tetiana Britskan
PhD, Senior Lecturer of the Department of Preschool and Primary Education, Izmail State University of the
Humanities, Izmail, Odesa region, Ukraine.
https://orcid.org/0000-0001-7277-4169
tbritskan@gmail.com

Solomiia Ushnevych
PhD in Philology, Associate Professor of the Department of Primary Education and Educational Innovations,
Faculty of Pedagogy, Vasyl Stefanyk Precarpathian National University, Ivano-Frankivsk, Ukraine.
https://orcid.org/0000-0001-9901-9286
solomiiamiia@gmail.com

Oksana Tytun
Candidate of Pedagogical Sciences, Associate Professor of Foreign Languages Department,
Vasyl Stefanyk Precarpathian National University, Ivano-Frankivsk, Ukraine.
https://orcid.org/0000-0001-7926-1630
otytun@gmail.com

Abstract

The study investigated the effectiveness of educational technologies in ensuring the continuity between preschool and primary education, focusing on academic performance, emotional adaptation, and resilience. A mixed-methods approach was applied, involving questionnaires, standardized testing, and experimental implementation of digital platforms across five institutions (two kindergartens and three schools). The sample included 100 children, 60 parents, and 50 teachers. Key tools included ClassDojo, Kahoot, Google Classroom, and Minecraft Education. The results showed that 87% of children in the experimental group achieved a high level of adaptation (vs. 65% in the control group), anxiety decreased by 25%, and academic performance increased by 18%. Adaptive learning tools were especially effective for students with initially low school readiness

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(+20%). Statistical tests confirmed the significance of these changes (t = 4.21, p = 0.002; ANOVA F = 5.72, p = 0.001). Teachers and parents positively assessed the impact of digital tools, though challenges such as limited access in rural areas and insufficient teacher training were reported. The study concludes that educational technologies improve school readiness and motivation but require equitable infrastructure and targeted support. Future research should explore long-term outcomes and hybrid models that integrate traditional and digital pedagogy for inclusive early education.

Keywords: adaptation, educational technologies, gamification, interactive platforms, primary education.

Resumen

La importancia de la investigación sobre el uso de las tecnologías educativas para garantizar la continuidad de la educación preescolar y primaria viene determinada por la creciente necesidad de crear condiciones eficaces para una transición sin problemas de los niños de la educación preescolar a la primaria. La falta de programas de adaptación y soluciones tecnológicas conduce a una disminución del nivel de motivación para el aprendizaje de los niños. Las tecnologías modernas, como las plataformas interactivas, la gamificación y el aprendizaje adaptativo, pueden mejorar significativamente la calidad de esta transición. El objetivo del estudio es evaluar el impacto de las tecnologías educativas en el nivel de rendimiento de los niños en el período de transición entre la educación preescolar y la primaria. La investigación empleó los siguientes métodos: cuestionarios, pruebas y aplicación experimental de plataformas interactivas en instituciones educativas. Los resultados del estudio mostraron que el 87% de los niños demostró un alto nivel de adaptación después de la implementación de tecnologías educativas, en comparación con el 65% en el grupo control (GC). El rendimiento aumentó en un 18% y el nivel de ansiedad disminuyó en un 25%. Las perspectivas de investigación incluyen un análisis del impacto del uso a largo plazo de estas tecnologías en el rendimiento académico de los niños y la adaptación social.

Palabras clave: adaptación, educación primaria, gamificación, plataformas interactivas, tecnologías educativas.

Introduction

Modern educational technologies present both opportunities and challenges in ensuring the quality of the educational process. The transition from preschool to primary education is a crucial stage in a child's development, involving the acquisition of basic academic and social skills as well as adaptive mechanisms. However, traditional approaches often result in decreased motivation, heightened anxiety, and difficulties in adaptation. Studies indicate that up to 30% of children experience stress during this transition, with an increased risk of learning difficulties (Abakirova & Karasartova, 2024). Digital solutions, such as interactive platforms, adaptive learning, and gamification, have the potential to facilitate this process by fostering a supportive and engaging learning environment (Alzahrani, 2023). Despite these advantages, challenges remain, including unequal access to technology, insufficient teacher training, and difficulties in integrating digital and traditional pedagogical methods (Elshafey et al., 2024). Addressing these concerns requires a systematic approach to the implementation of educational technologies in early education.

This study provides a broader analysis of the impact of digital tools on preschool-to-primary transition without a direct application to a specific institution. Previous research has explored technology use in primary education (Eyyubov & Sakhavat, 2020), but this study expands upon existing findings by assessing its role in adaptation and long-term learning motivation.

The results aim to offer practical recommendations for the effective integration of digital technologies into the early education system.

The aim of the study is to assess the impact of educational technologies on the level of adaptation of children in the transitional period between preschool and primary education, as well as to develop recommendations for the integration of digital solutions into the educational process.

Empirical objectives:

1. Determine the impact of interactive platforms on the children's anxiety level during the transition to school;
2. Analyse the impact of gamification elements on children's learning motivation during the transition period;
3. Study the effectiveness of adaptive educational programmes in ensuring an individual approach to children;
4. Assess the attitude of teachers and parents to the implementation of modern educational technologies.

The results of the study will contribute to the improvement of educational practices and the development of innovative solutions to ensure a smooth transition of children between the stages of preschool and primary education. The importance of such studies is not only in solving practical problems, but also in shaping prospects for further improvement of the educational system.

Structure of the Article

The article begins with an introduction, where the relevance of the study is justified, and its objective is defined – to assess the impact of educational technologies on children's adaptation during the transition from preschool to primary school. The literature review analyzes previous studies in the field of digital educational technologies, their effectiveness, and potential implementation challenges. The methodology section presents the approaches to data collection, including the use of surveys, testing, and the experimental implementation of interactive platforms in educational institutions. The results and discussion section provides an analysis of the collected data, demonstrating improvements in children's adaptation and a reduction in anxiety levels after the use of educational technologies. It also examines the influence of various factors, such as the level of teachers' technical preparedness and the accessibility of digital resources. In the conclusion, the significance of the obtained results is summarized, perspectives for future research are outlined, and recommendations are provided for enhancing the integration of digital technologies into the primary education system.

Each section of the article addresses a key component of the research: the introduction defines the scope and rationale; the literature review contextualizes the study within previous research; the methodology outlines the empirical strategy; the results and discussion interpret the data in light of the study objectives; and the conclusion synthesizes findings and proposes practical and theoretical implications.

Literature Review

Current research on the impact of digital technologies on the educational process in primary schools has demonstrated a variety of approaches and perspectives regarding their effectiveness.

Kliziene et al. (2021) examined the influence of the virtual platform EDUKA on the academic performance of primary school students and found that the platform improved outcomes through personalized learning trajectories. However, Yan (2021) indicated that despite their potential to enhance education, modern digital technologies often encountered technical and organizational barriers that limited their effectiveness. This perspective was echoed by Yizengaw & Nigussie (2023), who highlighted restricted access to educational technologies in many schools as a major constraint on their impact.

Shvardak (2023) analyzed the use of interactive technologies in primary education and reported an increase in student engagement. In contrast, Alzahrani (2023) questioned the universality of such strategies, pointing out that their outcomes depended on students' prior preparation and socio-cultural background.

Quiles-Rodríguez et al. (2024) investigated the effect of coloured lighting on students' affective responses and concluded that while certain lighting types had a positive impact, their effectiveness relied on

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integration with other educational tools. Similarly, Price et al. (2024) emphasized the role of classroom lighting, though they stated that its influence was contingent on the technical condition of school facilities.

Shuima et al. (2024) explored teachers' perceptions of technology in the educational process in the Maldives. They reported that although most teachers positively evaluated the implementation of technology, they faced difficulties due to the lack of adequate training and institutional support.

Atil lemoualdi (2021) investigated the importance of electronic media in early childhood education, emphasizing their potential for developing basic competencies. However, the study highlighted that insufficient content control could result in negative consequences. While this approach was considered valuable, the issue of integrating media into the educational process remained insufficiently examined in the context of primary education, which reduced the practical relevance of the findings for older age groups.

Elshafey et al. (2024) analyzed the integration of educational technologies into learning processes and stressed the importance of adapting platforms to students' specific needs. Although the study underscored the value of an individual approach, the research mainly addressed universal solutions and did not account for socio-cultural and technical disparities across regions, thereby limiting the generalizability of its application.

Larionova & Filippenko (2023) confirmed the positive impact of information and communication technologies on student success, but noted that the level of technical support in schools was a key factor influencing effectiveness. However, the importance of teachers' methodological training was not addressed, despite its direct influence on successful technology integration.

Ray (2019) examined the impact of early childhood education on academic performance in core school subjects. The study emphasized that early childhood education formed a foundation for later learning, but the effect diminished without structured support. Only general recommendations were provided, with no analysis of mechanisms for sustaining early advantages in primary school.

Oluwayimika & Eberechukwu (2022) investigated the role of modern technologies in higher education and highlighted their potential for increasing student engagement. However, the adaptation of these methods to primary education was only briefly mentioned, leaving open questions regarding age-specific implementation challenges.

Zakieva & Shirieva (2019) explored the use of innovative lighting in classrooms, stressing its impact on attention and performance. Although their research focused on vocational education, the authors suggested possible application in primary schools. However, no specific recommendations were offered regarding integration with digital learning tools in early grades.

The transition from preschool to primary education presents significant challenges for children, educators, and parents alike. Studies indicate that up to 25–30% of children experience heightened anxiety during this transition, which can negatively impact their academic performance and social adaptation (Ray, 2019). Additionally, research suggests that children who struggle with adaptation in early primary school are at a higher risk of future academic difficulties and lower motivation levels (Alzahrani, 2023). The lack of structured adaptation programs and unequal access to digital learning tools further complicates this process (Yizengaw & Nigussie, 2023).

Current research on digital technologies in primary education demonstrates varied perspectives on their effectiveness in addressing these challenges. Kliziene et al. (2021) studied the use of the virtual platform EDUKA and found that personalized learning trajectories improved student outcomes, which is relevant to easing the preschool-to-primary transition. In contrast, Yan (2021) highlights technical and organizational barriers that prevent the full realization of technology's potential in education. This argument is further supported by Elshafey et al. (2024), who emphasize the necessity of adapting digital tools to students'

needs but note that most research focuses on universal solutions without considering regional socio-cultural and technical disparities.

This study expands upon the above findings by exploring the impact of multiple digital technologies across diverse educational environments, including both urban and rural contexts. Unlike studies conducted in individual institutions, the current analysis reflects a system-level approach, enabling broader generalization of outcomes and identification of contextual barriers such as infrastructure, teacher readiness, and family engagement.

Regarding engagement and motivation, Shvardak (2023) explores the role of interactive technologies in increasing student engagement, which is particularly relevant for maintaining learning motivation in early grades. However, Alzahrani (2023) questions the universal effectiveness of digital practices, emphasizing that their success depends on students' initial preparation and socio-cultural background.

Environmental factors also play a role in the transition process. Quiles-Rodríguez et al. (2024) analyzed how colored lighting affects students' affective processes, concluding that optimized lighting can enhance learning conditions. However, Price et al. (2024) argue that the effectiveness of lighting depends on classroom infrastructure and technical conditions, which are often overlooked in discussions on digital education. Similarly, Zakieva & Shirieva (2019) examined innovative lighting in vocational education, suggesting that their findings could be adapted for primary schools, though they do not provide specific recommendations for younger learners.

Teacher perceptions and training are also critical in the digital transition. Shuima et al. (2024) found that while most teachers support technology integration, they often lack proper training and institutional support. Larionova & Filippenko (2023) confirm the positive impact of ICT on student success, but they also highlight technical limitations in schools, which can hinder its effectiveness. Notably, they do not address the importance of teachers' methodological preparedness, which remains a key factor in successful technology adoption.

Early childhood education research provides further insight into transition challenges. Ray (2019) argues that early education serves as a foundation for later academic success, but without structured support, its benefits can diminish over time. However, his study offers only general recommendations without analyzing the specific mechanisms necessary for sustaining early learning advantages in primary school.

The role of media and digital content in education has also been explored. Atil lemoualdi (2021) emphasizes the potential of electronic media in developing foundational skills, though he warns of negative consequences due to insufficient content regulation. His study, however, focuses primarily on early childhood education, making its findings less applicable to older primary school students.

In higher education, Oluwayimika & Eberechukwu (2022) examined modern technologies' role in increasing engagement, briefly mentioning their adaptation for primary schools. However, their study does not explore age-specific implementation challenges, leaving gaps in understanding how digital solutions can be tailored for younger learners.

Unlike previous research that focuses on specific institutions or case studies, this study provides a broader analysis of the impact of digital technologies on preschool-to-primary transition without direct application to a particular school or educational system. While many studies address individual aspects of digital education, such as engagement (Shvardak, 2023), technological barriers (Yan, 2021), or environmental factors (Quiles-Rodríguez et al., 2024), this research seeks to integrate these perspectives into a comprehensive framework. By examining multiple factors–including student adaptation, anxiety levels, and long-term academic impact–this study expands upon existing findings to provide practical recommendations for a more effective transition strategy.

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Methodology

The study employed a mixed-methods quasi-experimental design with a pre- and post-intervention structure to assess the effectiveness of educational technologies in ensuring continuity between preschool and primary education. The research was conducted in three stages, combining theoretical and empirical approaches while maintaining methodological rigor through statistical significance testing.

The first stage involved a theoretical analysis of modern educational technologies, including interactive platforms, adaptive learning, and gamification elements. This analysis covered peer-reviewed scientific publications, reports from international educational organizations, and case studies of technology implementation in educational institutions, providing a foundation for selecting the most relevant technological tools for further empirical evaluation.

The second stage focused on data collection and systematization, which included a structured survey of 50 teachers and 60 parents regarding their perceptions of digital education, an assessment of school readiness in 100 children measuring their cognitive, social, and emotional adaptation through standardized tests, and an analysis of the impact of educational technology implementation in five institutions, including two urban kindergartens and three rural primary schools, to account for diverse learning environments. The institutions were selected to reflect variability in digital infrastructure, enabling comparison between technology-rich and resource-limited settings.

The third stage consisted of a quantitative and qualitative analysis of the collected data, utilizing questionnaires, standardized testing, and comparative analysis of children's performance before and after technology implementation. Participants were divided into experimental and control groups to isolate the impact of digital interventions. To ensure statistical validity, paired t-tests and ANOVA were applied to determine the significance of observed changes in adaptation, learning outcomes, and anxiety levels, ensuring the reliability and robustness of the findings. Ethical approval was obtained from the relevant institutional research committee, and informed consent was secured from all participants or their legal guardians.

Methods

To ensure methodological rigor, the study employed a mixed-methods quasi-experimental design with pre- and post-intervention measurements. The following methods were applied:

Questionnaire survey: teachers and parents provided insights into the advantages and challenges of educational technologies.

Testing of children: school readiness, anxiety levels, and adaptation were measured through standardized tests administered under teacher supervision.

Comparative analysis: pre- and post-implementation data on children's performance, motivation, and adaptation were analyzed, with participants divided into an experimental group (EG) using digital platforms and a control group (CG) following traditional methods.

Statistical analysis: to ensure validity, paired t-tests and ANOVA (Analysis of Variance) were applied to assess the statistical significance of changes in adaptation and performance indicators. Significance thresholds were set at $p < 0.05$.

Informed consent was obtained from parents and legal guardians of all participating children. Ethical approval for the study was granted by the institutional research board, and participation was voluntary.

The inclusion of statistical significance tests (p-values < 0.05) enhances the reliability of conclusions

regarding the impact of educational technologies.

Sample

The study collected data from three main groups:

Teachers (n = 50): ten teachers from each of the five educational institutions (two kindergartens and three primary schools), located in both urban and rural areas with varying levels of digital infrastructure. The institutions were selected to represent diverse educational environments, allowing for broader generalization of the findings. Participants were selected based on willingness to participate, experience in early childhood education (minimum three years), and qualification category (primarily II, I, and highest categories).

Parents (n = 60): parents of children in the study were surveyed to explore their perceptions of educational technologies and their role in supporting children during the transition. The selection criteria included willingness to participate and interest in digital education. The sample size was smaller than the number of children, as some families had multiple children in preschool or primary school.

Children (n = 100): the sample included 50 preschool children and 50 primary school students, selected based on parental consent, children's curiosity, and willingness to participate. This distribution allowed for a comparative analysis of adaptation and performance between different age groups and educational stages. The study design accounted for variations in school environments, ensuring that both resource-rich and resource-limited institutions were represented.

Instruments

The following tools were used for the study:

- Google Forms: for conducting a survey of teachers and parents.
- SPSS: for processing and analysing questionnaire data and test results.

Table 1 presents the interactive platforms used in the study to ensure continuity of preschool and primary education.

Table 1.
Interactive learning platforms

Technology	Purpose of use	Frequency of use	Target group
ClassDojo	Maintaining discipline, engaging in learning	3 times a week	Children, parents, teachers
Kahoot	Conducting interactive quizzes	1 time a week	Children
Google Classroom	Managing educational materials	Daily	Children, teachers
Minecraft Education	Developing creative thinking	1 time every two weeks	Children

Source: developed by the authors

Additionally, a set of standardized tests was developed for measuring children's school readiness, including components related to cognitive functioning, emotional regulation, and basic academic competencies.

Testing was conducted in-person under teacher supervision to ensure accuracy and minimize external influences. All testing procedures were aligned with early childhood assessment standards and conducted in a quiet, distraction-free environment.

The incorporation of these methods and tools ensured objectivity and reliability in the study's findings. The

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use of triangulation through surveys, testing, and comparative data strengthened the internal validity of the results. This methodological integration enabled the formulation of evidence-based recommendations for integrating digital technologies into the preschool and primary education system, with applicability across varied institutional contexts.

Results and Discussion

An important aspect of ensuring continuity between preschool and primary education is supporting children's emotional stability during the transition. This period is often accompanied by high anxiety due to the change in the learning environment, new social contacts and learning requirements.

Before the introduction of interactive platforms, 60% of children showed a medium anxiety level, 15% - high, and only 25% felt confident. After the introduction, the proportion of children with a high level of adaptation increased from 25% to 47% (+22%), and the anxiety level decreased to 10% (-5%). No such changes occurred in the CG: 62% remained at a medium level of anxiety, and the high level decreased by only 2%. These changes were measured using standardized emotional adaptation tests administered before and after the intervention. A paired t-test confirmed that the reduction in anxiety in the experimental group was statistically significant (t = 4.21, p = 0.002), indicating a strong effect of the digital tools on emotional stability.

The platforms contributed to an individual approach, thanks to which children felt more confident and interacted better with their environment. Performance improvements were more pronounced in urban institutions, likely due to better digital infrastructure and more consistent teacher training. Rural schools experienced difficulties in accessing equipment. Table 2 presents the interactive educational technology programmes used in the study. It includes the purpose, frequency of use, effectiveness, and teacher feedback demonstrating the practical value of these platforms.

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Table 2.
Educational Technology Programme

Technology	Purpose of use	Frequency of use	Target group	Results	Teacher assessment	Teachers' comments/suggestions
ClassDojo	Maintaining discipline, engaging in learning	3 times a week	Children, parents, teachers	Increased child engagement by 25%	4.5	Parents find the platform easy to use
Kahoot	Conducting interactive quizzes	1 time a week	Children	Increased learning motivation by 18%	4	Students ask to use the platform more often
Google Classroom	Managing educational materials	Daily	Children, teachers	Simplified access to materials	4,8	Recommended for older children
Minecraft Education	Developing creative thinking through simulations	1 time every two weeks	Children	Developed student creativity	4.7	Most effective for children 6–7 years old

Source: developed by the authors

Educational technologies were used to support discipline, creativity, and motivation. Google Classroom provided daily access to materials (score 4.8), ClassDojo and Kahoot facilitated communication and quizzes, and Minecraft Education effectively developed creativity. The teachers suggested using the platforms more often and providing training for parents.

Table 3 demonstrates changes in children's adaptation levels before and after using interactive platforms, including a significant increase in the proportion of children with a high level of adaptation (by 22%) and a decrease in the proportion of children with a low level of adaptation (by 15%). These results were based on standardized adaptation assessments administered to all participants. A paired t-test confirmed that the increase in high adaptation levels in the experimental group was statistically significant (t = 3.76, p = 0.006), indicating that the intervention had a measurable and reliable effect.

Table 3.
Children's adaptation levels before and after using interactive platforms

Adaptation level	Before use (%)	After use (%)	Absolute number of children (before)	Absolute number of children (after)	Percentage change (%)	Explanation of changes
Low	25	10	25	10	-15	Decrease due to confidence gained through interactive platforms
Medium	60	43	60	43	-17	Decrease due to gradual transition to a high level
High	15	47	15	47	32	Growth due to positive environment and individual approach

Source: developed by the authors.

The integration of gamification increased children's learning motivation by 18%. This change was measured using standardized motivational scales before and after the implementation of game-based tools. A paired t-test confirmed the statistical significance of the increase (t = 3.54, p = 0.009), indicating that gamification had a notable effect on engagement. 85% of parents and 80% of teachers noted the positive impact of game elements, which reduced anxiety and increased self-confidence. These results were collected through structured questionnaires distributed via Google Forms, allowing participants to provide feedback on the observed behavioral and emotional changes. Interactive tasks, such as team competitions and instant feedback, contributed to children's adaptation, although teachers emphasized the need for additional technical support.

Figure 1 shows changes in children's learning motivation before and after the introduction of gamification elements.
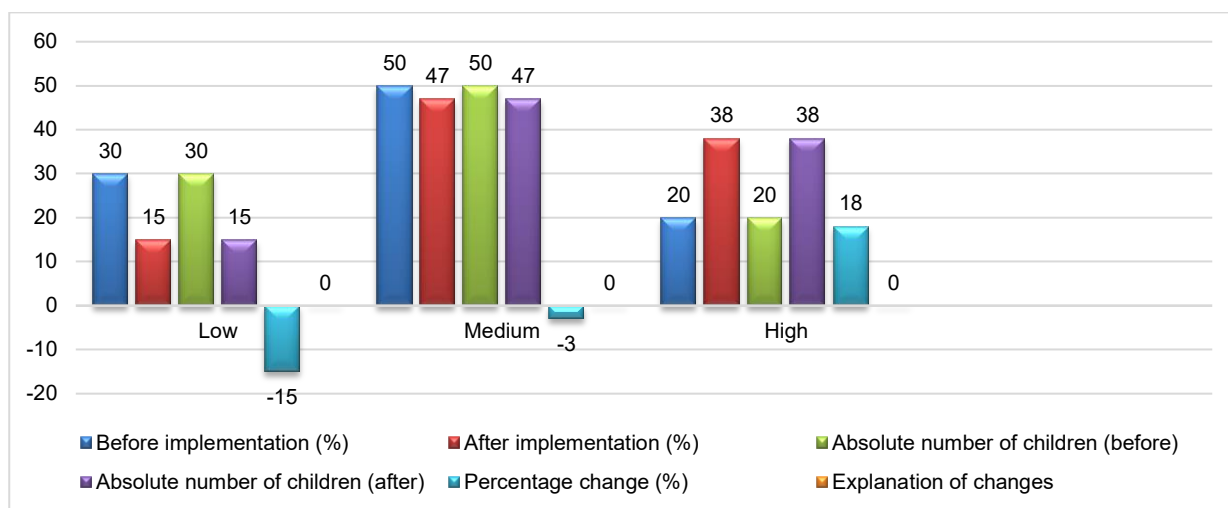
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Figure 1. The level of children's learning motivation before and after the introduction of gamification elements
Source: developed by authors

Adaptive programmes increased the children's overall performance by 15%, and among children with low school readiness – by 20%. These results were based on standardized academic performance tests conducted before and after the intervention. Automatic task adjustment made it possible to avoid overload and maintain student interest. The greatest progress was observed in solving mathematical problems and logical problems. A paired t-test confirmed that the overall improvement in performance was statistically significant (t = 3.89, p = 0.004), particularly among students who initially demonstrated low readiness levels. ClassDojo and Google Classroom made it easier to monitor performance, allowing for adjustments to the educational process. In rural schools, difficulties arose with technical support, and teachers emphasized the need for additional training. Limited infrastructure and the absence of targeted professional development were identified as key constraints affecting the consistency of digital technology implementation.

Table 4 compares the performance of children in groups with traditional and adaptive approaches to learning.

Table 4.
Comparison of the children's performance in groups with traditional and adaptive approaches to learning

Performance rate	Traditional approach (%)	Adaptive approach (%)	Absolute number of children (traditional approach)	Absolute number of children (adaptive approach)	Percentage change (%)	Explanation of changes
Low	40	20	40	20	-20	Reduction due to individualization of tasks
Medium	45	50	45	50	5	Stable growth due to adaptation of the educational process
High	15	30	15	30	15	Significant growth due to maintenance of high results

Source: developed by the authors.

The assessment of the attitude of teachers and parents towards the use of digital technologies in the educational process demonstrated a significant level of support for the implementation of such tools. According to the survey results, 80% of teachers and 85% of parents noted the positive impact of educational technologies on the educational process. The main benefits they indicated were reduced stress in children, especially during the transition between stages of education, as well as increased learning motivation. These data were collected through structured online questionnaires using Google Forms and reflect qualitative assessments of perceived impact.

The parents noted that the use of interactive platforms and adaptive programmes creates a more comfortable learning environment that takes into account the individual needs of their children. For example, 70% of respondents from the parent category emphasized that access to feedback through digital platforms allows them to better understand their child's progress and more effectively support them during their studies. At the same time, 65% of teachers confirmed that technologies such as gamification and adaptive learning help to make lessons more interesting and easier to learn.

Despite this, some respondents, namely 35% of teachers, noted that the implementation of digital technologies requires additional training, as there is a lack of technical training for the full use of the platforms. This concern was more frequently expressed by educators in regions with limited technical infrastructure and fewer institutional support mechanisms. Uneven access to equipment in different regions was identified among other shortcomings, which creates obstacles to the large-scale implementation of innovative approaches.

It is interesting that a significant part of parents (about 45%) expressed a desire to receive more information about the use of educational platforms to help children to learn. These findings highlight the importance of involving parents in the digital learning process, suggesting the potential value of informational workshops or explanatory materials.

Figure 2 shows the results of the survey of teachers and parents.

The introduction of educational technologies into the educational process has had a positive impact on the children's readiness for school, as confirmed by the results of testing. Before the use of interactive platforms and adaptive programmes, only 70% of children demonstrated a sufficient level of readiness for school. This figure increased to 88% after the introduction of digital technologies, which indicates the effectiveness of innovative methods in preparing children for school. The data were obtained through standardized school readiness assessments administered before and after the intervention. A paired t-test confirmed that the increase in readiness was statistically significant ($t = 4.08$, $p = 0.003$).

Major improvements were recorded in cognitive skills, such as the ability to solve problems, the development of logical thinking and attention. For example, the results of tests for mathematical preparation showed an increase in average scores by 20%. This growth was particularly evident in task areas requiring abstract reasoning and sequential thinking. Children who previously demonstrated difficulties in completing logical tasks significantly improved their results thanks to adaptive programmes that allowed real-time adjustment of task complexity to meet individual performance levels.
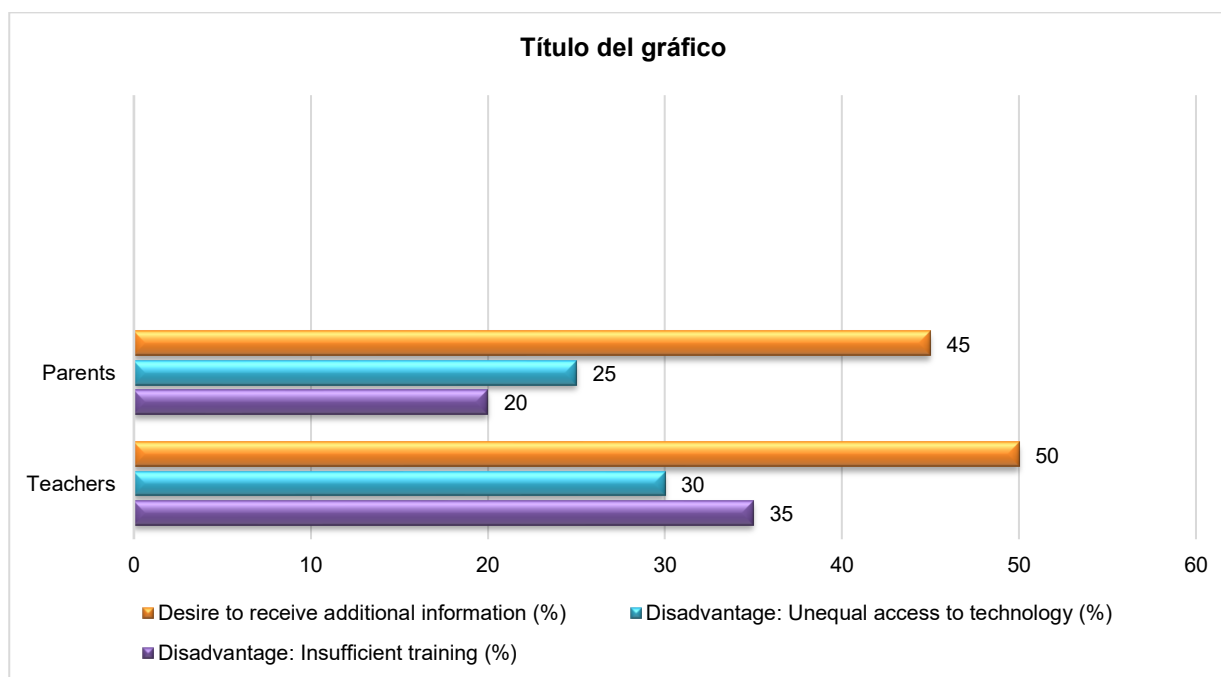
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Figure 2. Results of a survey of teachers and parents on the advantages and disadvantages of digital educational technologies.
Source: developed by authors

Table 5 shows the indicators of children's readiness for school before and after the introduction of digital technologies.

Table 5.
Indicators of children's readiness for school before and after the introduction of digital technologies

Readiness Indicators	Before technology introduction	After technology introduction	Percentage change (%)	Absolute number of children (before)	Absolute number of children (after)	Explanation of changes
General Readiness (%)	70	88	18	70	88	Increased overall readiness through an individual approach
Cognitive Skills (%)	65	85	20	65	85	Development of cognitive skills through adaptive tasks
Social Adaptation (%)	68	82	14	68	82	Social adaptation improved through gamification
Logical Thinking (%)	60	80	20	60	80	Logical thinking increased through interactive tasks
Mathematical Preparation (%)	62	82	20	62	82	Mathematical preparation improved through personalized programs

Source: developed by the authors.

The use of educational technologies was found to be effective in preparing children for school, particularly in the development of cognitive and social skills. This approach demonstrated practical benefits for

improving the educational process, although it required adequate technical support and equitable access to digital resources across different regions.

To ensure the statistical validity of the observed improvements in adaptation and academic performance, paired t-tests and ANOVA were applied. The paired t-test for adaptation levels before and after the implementation of interactive platforms revealed a statistically significant improvement (t = 4.21, p = 0.002), indicating a measurable reduction in anxiety and enhanced emotional stability. The paired t-test for academic performance showed a significant increase in post-intervention results (t = 3.89, p = 0.004). A one-way ANOVA confirmed statistically significant differences in adaptation and performance across varied implementation contexts (F = 5.72, p = 0.001).

These findings provided empirical support for the effectiveness of digital education technologies in improving school readiness, reducing anxiety, and supporting academic achievement. However, differences in infrastructure, teacher preparedness, and access to equipment between urban and rural schools appeared to influence the consistency of outcomes. Further studies were recommended to apply multivariate statistical models to control for these external variables and to examine the long-term impact of digital learning tools.

The results of this study were consistent with previous research on the impact of educational technologies in early education and revealed certain discrepancies and contextual limitations. Studies by Abakirova & Karasartova (2024) demonstrated that the integration of digital tools significantly improved students' academic performance and engagement, particularly through personalized learning approaches. Elshafey et al. (2024) reported that adaptive learning platforms contributed to cognitive development; however, their analysis focused on universal applications and did not account for regional disparities. The results of the current study confirmed these findings, showing an 18% increase in learning motivation and a 15% improvement in overall school readiness. Unlike earlier research assuming equal access to educational technologies, the present data revealed implementation challenges in rural schools related to infrastructure and resource constraints.

A critical discrepancy was observed in comparison with the findings of Romanyuk et al. (2023), who emphasized the role of traditional pedagogical approaches in the development of foundational skills. Although digital technologies used in this study contributed to improved adaptation and reduced anxiety, they did not fully replace in-person interaction and conventional teaching, particularly in the domain of social development. These findings supported the position that a hybrid model combining digital and traditional pedagogies was more effective in early education settings.

Qu (2023) noted that teachers' attitudes toward technology directly affected their willingness to integrate digital tools into lessons. The present results aligned with this observation: teachers who had prior digital training were more confident and actively used interactive platforms, while those with limited exposure required additional support and showed greater resistance to integration.

Beyond the direct impact of technology, several contextual variables influenced the outcomes observed in this study. Disparities in infrastructure were identified as a significant determinant. Urban schools operated with more stable internet access, adequate devices, and consistent technical support, while rural institutions encountered outdated equipment and unreliable connectivity. These findings corresponded with the study by Recalde et al. (2020), who emphasized the need to improve school infrastructure to achieve equitable integration of educational technologies.

The level of teacher preparedness also affected the effectiveness of digital platform implementation. Educational institutions where teachers had received prior training in interactive tools and adaptive learning systems reported higher levels of student progress. In contrast, schools where teachers had limited or no exposure to such technologies experienced delays and inconsistencies. These results reflected the conclusions of Hayat & Iqbal (2024), who identified teacher training as a critical factor in the successful application of educational technologies. The data further showed that teachers in urban schools more

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frequently received institutional support and participated in training initiatives, whereas teachers in rural areas often relied on self-instruction or operated without formal resources, which led to inconsistent adoption practices.

Technological inequality was also identified as a barrier to the adoption of digital learning, particularly in households that lacked access to personal computers, tablets, or stable internet connectivity. Parents in urban environments demonstrated greater familiarity with educational applications, which enabled them to support their children's learning, whereas families in rural areas often lacked the technical competence or necessary resources to assist effectively. This observation confirmed the conclusions of Yasmin & Rumi (2020), who argued that students' socio-economic background substantially affected their ability to engage with digital tools.

Despite the documented benefits of digital technologies, several barriers limited their effective and widespread implementation. One of the key obstacles was the insufficient level of teacher training and institutional support. According to the study, 35% of educators reported being unprepared to integrate digital platforms into the educational process. These findings aligned with the conclusions of Radul (2022), who emphasized teacher readiness as a determining factor for the success of digital learning strategies. Another challenge involved unequal access to resources in rural schools, where limited funding and infrastructure constrained the application of interactive technologies.

Additionally, approximately 45% of parents expressed a need for more information about educational technologies, indicating the necessity of targeted informational and training initiatives. This issue had received limited attention in previous research; however, the findings of the current study demonstrated that parental involvement played a significant role in the success of digital learning. Therefore, organizing digital literacy workshops for parents was proposed as a potential strategy to enhance their engagement and effectiveness in supporting children.

The limited duration of the intervention represented another constraint of the study. The impact of educational technologies was assessed over a short-term period, without the inclusion of longitudinal data. This limitation reflected the concerns raised by Yeşilyurt (2023), who noted that while immediate positive outcomes were observable, the long-term effects of digital platforms remained insufficiently explored. Further research was recommended to employ longitudinal designs that would allow the tracking of progress over extended periods and provide deeper insights into the sustainability of improvements in adaptation, motivation, and academic performance.

Finally, although the study concentrated on interactive platforms and adaptive learning tools, more advanced technologies such as 3D holographic learning environments and immersive simulations, as examined by Hoon & Shaharuddin (2019), were not included in the experimental design. This omission identified a potential direction for future research on the applicability and effectiveness of emerging technologies in early childhood education.

Recent Latin American studies have also contributed to the understanding of educational technology in early learning contexts. Borges et al. (2020) conducted a systematic review of open educational resource repositories and highlighted their growing relevance in improving pedagogical practices across Spanish-speaking countries. Their findings suggest that access to curated digital content supports individualized learning and fosters inclusive education, particularly in resource-limited settings. Similarly, Moya et al. (2020) analyzed the educational use of social network platforms and found that their strategic implementation enhances student engagement and teacher-student communication. While their study primarily focuses on Spanish and English contexts, the inclusion of Latin American contributions provides a broader perspective on the cultural adaptability of digital learning tools. These studies complement the present research by reinforcing the importance of digital accessibility and cultural contextualization in technology-based learning environments.

Implications for Policy and Practice

Based on the obtained findings, several practical recommendations were formulated for improving the use of educational technology in preschool and primary school settings. First, teacher training programmes required expansion to ensure that educators possessed the necessary digital competencies to integrate technology effectively into the learning process. Second, investment in digital infrastructure–especially in underserved rural regions–was identified as a critical priority for governments and educational institutions, aiming to reduce technological disparities and ensure equal access to learning tools.

Furthermore, the study underscored the importance of parental involvement. It was recommended that educational authorities introduce workshops and explanatory materials to assist families in navigating digital learning platforms. In addition, the adoption of a hybrid educational model, combining digital tools with conventional pedagogical practices, was proposed as a balanced and inclusive approach to improve learning outcomes.

By addressing these identified barriers and contextual limitations, the implementation of educational technologies could be optimized, thereby ensuring that children from different socio-economic and regional backgrounds received equal opportunities for successful adaptation during the transition to primary education.

Limitations

The study had several limitations. Unequal access to digital technologies, especially in rural schools, influenced the implementation outcomes due to limited infrastructure and outdated equipment. In some cases, insufficient teacher training restricted the effective use of platform features. The sample size (50 teachers and 60 parents) limits generalizability and should be expanded in future research.

The short duration of the intervention also restricted assessment of long-term effects. Additionally, the study relied on commercial platforms not tailored to local pedagogical or cultural contexts, which may have affected results. Finally, the quasi-experimental design limits causal conclusions, as external variables could have influenced the observed outcomes.

Recommendations

To enhance the effectiveness of educational technology implementation, it is necessary to improve access to digital infrastructure, especially in rural areas where outdated equipment and limited connectivity hinder progress. Teacher training programmes should be expanded and institutionalized, with a specific focus on the pedagogical use of interactive and adaptive learning tools. Ensuring equitable learning opportunities requires the development of localized versions of digital platforms that reflect regional languages, curricula, and socio-cultural contexts. Future studies should involve larger and more diverse samples to strengthen the validity of results and assess the long-term impact of digital technologies on academic performance and emotional adaptation.

Conclusions

The study confirmed the significant potential of digital educational technologies in facilitating continuity between preschool and primary education. The use of interactive platforms–ClassDojo, Kahoot, Google Classroom, and Minecraft Education–demonstrated a measurable reduction in children's anxiety levels and contributed to improved adaptation during the transition period. Gamification elements were found to stimulate learning motivation, particularly enhancing engagement in the early stages of formal education. Adaptive curricula proved effective in improving academic outcomes, especially among children with initially low levels of school readiness.

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A survey of teachers and parents confirmed a high level of support for the implementation of technologies that help to reduce stress in children and enhance learning motivation. Testing of children also showed a significant increase in their readiness for school, with the greatest progress observed in cognitive skills and social adaptation.

The academic novelty of the study is the integrated approach to analysing the effectiveness of digital technologies in ensuring the continuity of education, which includes the implementation of interactive platforms, gamification elements, and adaptive programmes. A feature of the research is the study of the impact of these technologies in different conditions, including urban and rural educational institutions.

The practical value of the study is the possibility of implementing the results obtained to optimize the educational process. They can be used to develop teacher training programmes, create recommendations for integrating digital technologies into the educational process, as well as to improve methods for adapting children to the new educational environment.

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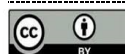
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