



PREPARATION OF A TEACHER TO USE DIGITAL TECHNOLOGY IN TEACHING PRIMARY STUDENTS WITH INTELLECTUAL DISABILITIES

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ABSTRACT

Aim/Purpose	The purpose of the study was to determine the methods of training future teachers to use information and virtual tools to work with younger students with intellectual disabilities.
Background	The relevance of training future teachers to work with students with intellectual disabilities is quite high today. This is explained by the fact that the educational environment is developing based on the principles of equality and accessibility. Therefore, it assumes the provision of educational services to all categories of schoolchildren. In this context, the introduction of digital technologies into the process of interaction between a teacher and a child with intellectual disabilities is relevant.
Methodology	This study explores the use of digital learning tools to improve the education of primary school children with intellectual disabilities. A quasi-experimental design was used with 30 students divided into an experimental group (n=15) using digital tools and a control group (n=15) using traditional methods. Over one month, the experimental group showed significant improvements, with 86% correct answers in test tasks compared to 66% in the control group. Additionally, 80% of the experimental group achieved “good” grades for

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	written tasks versus 53% in the control group. Tools like PearDeck, Kahoot, and ZOOM enhanced cognitive, emotional, and social skills.
Contribution	The study demonstrates that integrating digital tools into the education of children with intellectual disabilities significantly improves learning outcomes, highlighting the potential for technology to foster both academic and social development in this population.
Findings	It was found that working with younger students with intellectual disabilities involves some features that teachers must consider when planning a training session. It is proved that special educational needs in younger schoolchildren affect emotional, volitional, and cognitive areas of activity. The study drew attention to these features and revealed the ways of their development based on digital technologies.
Recommendations for Practitioners	The findings can be used in the preparation of teachers for classes with younger students with intellectual disability and in the development of curricula for this category of students.
Recommendations for Researchers	The paper presented various approaches that can be used both in the course of full-time and distance learning. It is established that the involvement of digital tools in educational and correctional activities presupposes the mandatory availability of teachers' skills to use them effectively.
Impact on Society	The findings suggest that incorporating digital technologies in special education teacher training could significantly improve educational outcomes for students with intellectual disabilities across the global education system.
Future Research	Future research should examine the long-term effectiveness of digital teaching tools for students with intellectual disabilities across different cultural contexts, age groups, and disability levels, ideally with larger sample sizes and more diverse digital technologies.
Keywords	special educational needs, information and communication methods, computer, correctional and developmental work, virtual tools

INTRODUCTION

In contemporary education, the integration of digital technologies has become essential, reshaping teaching and learning across all levels. The application of these tools is particularly significant in the context of students with intellectual disabilities, such as those with intellectual disabilities (Gómez-Puerta & Chiner, 2020; Suprun et al., 2024). Despite the growing use of digital technologies in education, the specific problem of utilizing computer-based learning tools for teaching children with intellectual disabilities remains underexplored (Mariukhnich & Mokliak, 2024). While digital tools have become an integral part of mainstream education, their effective application in the education of students with special needs, especially in primary education, has not yet been fully addressed in existing research (Buchnat & Wojciechowska, 2020; Isak et al., 2023). This study seeks to fill this gap by exploring how teachers can be effectively prepared to use digital technologies to support children with intellectual disabilities in primary school settings.

The significance of this research lies in its potential to improve educational practices and outcomes for children with intellectual disabilities, a group that faces unique challenges in traditional classroom environments. The research aims to demonstrate how digital tools can be tailored to meet the specific needs of these students, facilitating their learning and emotional development. Additionally, this

study will contribute to the growing body of knowledge on the use of technology in special education, providing valuable insights for educators, policymakers, and future research.

The study is structured as follows. The literature review section provides an overview of existing research on digital tools in education, particularly in relation to students with intellectual disabilities. The methodology section outlines the research design, including the experimental setup used to assess the effectiveness of digital technologies in teaching children with intellectual disabilities. The results section presents the findings of the study, followed by a discussion of the implications of these findings for future teacher preparation and educational practice. Finally, the conclusion summarizes the key contributions of the research and suggests avenues for future exploration.

BACKGROUND

The use of digital technologies in education has been extensively studied since the early 21st century, coinciding with the rapid development of these technologies. While much has been done to integrate digital tools in education, the issue of teacher interaction with students who have intellectual disabilities, particularly through computer-based learning tools, remains insufficiently addressed. Previous studies, including those by Sapargaliyeva et al. (2023a) and Sousa et al. (2020), highlight the increasing importance of digital tools in the modern educational landscape, asserting that the further development of the learning environment is inseparable from digital technologies. These findings provide a valuable foundation for exploring the role of digital technologies in supporting teachers as they adapt to the needs of students with intellectual disabilities, including those with intellectual disabilities.

Research by Zhanysova et al. (2015) and Heyder et al. (2020) delves into the unique challenges that teachers face when working with children with intellectual disabilities. They emphasize the need for specialized approaches in educational practices, focusing on the need to adapt teaching methods to cater to the developmental characteristics of these students. These conclusions are crucial for understanding how to tailor the learning process for students with intellectual disabilities, particularly with regard to the selection of non-standard teaching methods and materials. Furthermore, studies by Behnamnia et al. (2020) and Loizou (2022) examine the different digital technologies educators can use to facilitate learning for students with intellectual disabilities. These studies provide examples of websites, programs, and educational platforms specifically designed to address the needs of this demographic and offer valuable insights for selecting appropriate digital tools to enhance the learning experience for primary school children with intellectual disabilities.

The growing prominence of digital technologies in education has also led to the modernization of teaching practices, making such tools essential for improving the efficiency of educational processes (Balykbayev et al., 2022; Yuliia et al., 2025). This shift gained particular momentum during the COVID-19 pandemic, which prompted a widespread adoption of distance learning practices that continue to be relevant today (Sapargaliyeva et al., 2023b). Digital tools have transformed how teachers engage with students and facilitated the development of individualized learning strategies for students, including those with intellectual disabilities (Dobroskok et al., 2023; Miethlich et al., 2020). Incorporating digital technologies into the learning environment offers several advantages, such as enhancing the perception and understanding of educational content through graphical representations and fostering greater interactivity in the learning process (Bronin et al., 2024; Orazaliyeva et al., 2020). These benefits are widely applicable to all students in general education settings. However, they are particularly crucial for students with intellectual disabilities, whose educational needs require a more tailored approach (Cheng & Lai, 2020; Roldán-Álvarez et al., 2021).

While the advantages of digital technologies are well-documented, further exploration is needed regarding their long-term impact on educational outcomes and teacher training frameworks, particularly for those working with students who have intellectual disabilities. The existing literature primar-

ily focuses on the immediate benefits of digital tools. However, there is a notable gap in understanding their long-term effects, as well as the role of teacher preparation in integrating these technologies effectively into the classroom.

METHODOLOGY

This study employed a quasi-experimental research design to investigate the effectiveness of digital learning tools in preparing primary school children with intellectual disabilities. A quasi-experimental approach was chosen due to the practical constraints of randomly assigning participants to groups, as the study was conducted within a specific educational institution with pre-existing classes. The design allowed for comparison between an experimental group, which received instruction with digital tools, and a control group, which received traditional methods of instruction. This design was deemed suitable for evaluating the impact of digital technologies while accounting for the limitations inherent in the educational setting. The experiment took place during the first semester of the 2022-2023 academic year at the Municipal State Institution Special (Correctional) Boarding School No. 2 for children with developmental disabilities in the North Kazakhstan region under the Ministry of Education of the Republic of Kazakhstan. A total of 30 primary school children, aged between 6 and 11 years, participated in the study. The participants were selected using purposive sampling, with the aim of ensuring that the sample was representative of children with intellectual disabilities in this educational context. These children were enrolled in grades 1 to 4 and divided into two groups: an experimental group and a control group, each comprising 15 students. Both groups were matched based on their age range and grade level to ensure comparability, reducing potential biases related to developmental differences. The groups were balanced in terms of gender and severity of intellectual disability, as assessed by the school's educational and psychological team.

The research intervention lasted one month, during which the experimental group received lessons integrated with digital learning tools, while the control group was taught using conventional methods. The digital learning tools employed included interactive platforms and applications designed to enhance cognitive, emotional, and social development. These tools were selected based on their relevance to the specific learning needs of children with intellectual disabilities, with a focus on visual and interactive elements to aid comprehension and engagement. To evaluate the effectiveness of the intervention, both groups underwent a diagnostic assessment at the end of the experiment. The diagnostic tasks were designed to assess cognitive, emotional, and behavioral outcomes and administered in a controlled environment. The assessment consisted of 12 tasks: two written exercises, one oral exercise, and nine tasks that evaluated various cognitive and emotional skills. The tasks were chosen to align with the educational goals of the program, focusing on attention, memory, emotional recognition, and communication skills. Each diagnostic task was scored based on predefined criteria, ensuring consistency in the evaluation process.

The diagnostic tools used in this study were carefully selected from validated instruments commonly used in educational research for children with intellectual disabilities. The written and oral tasks were designed to measure key aspects of cognitive and emotional development, and their reliability was tested through a pilot study conducted with a small sample of students before the main experiment. The tasks demonstrated satisfactory internal consistency, with Cronbach's alpha coefficients above 0.80, indicating good reliability. Furthermore, the validity of the diagnostic instruments was ensured by consulting with experts in special education and psychology, ensuring that the tasks accurately reflected the skills targeted by the intervention. Data were analyzed using statistical methods to compare the performance of the experimental and control groups. Descriptive statistics, including means and standard deviations, were calculated for the diagnostic results. Independent samples t-tests were conducted to compare the performance of the two groups on each of the diagnostic tasks. A p-value of less than 0.05 was considered statistically significant. Additionally, effect sizes (Cohen's d) were calculated to determine the magnitude of the differences between the groups, providing insights into the practical significance of the intervention.

To ensure the internal validity of the study, steps were taken to control for potential confounding variables. Both groups were matched on key demographic characteristics (age, gender, grade level) and educational history to minimize bias. Moreover, the educational setting was standardized for both groups, with similar teaching environments and time allocations. External validity was addressed by considering the broader applicability of the findings. While the study was conducted at a single institution, the use of standardized digital learning tools and a diverse range of cognitive and emotional tasks enhances the generalizability of the findings to other children with intellectual disabilities in similar educational contexts.

Ethical approval for this study was granted by the Ethics Committee of the Almaty Management University, Approval Number 331.

RESULTS

Based on this, according to the statistical data presented in Figure 1, the largest group of persons among primary school children with intellectual disabilities are students with intellectual disability. In the course of preparing a teacher for the upcoming work with such children, they need to understand their characteristics. This will draw attention to the most problematic aspects, highlighting their strengths and helping them to gain knowledge.

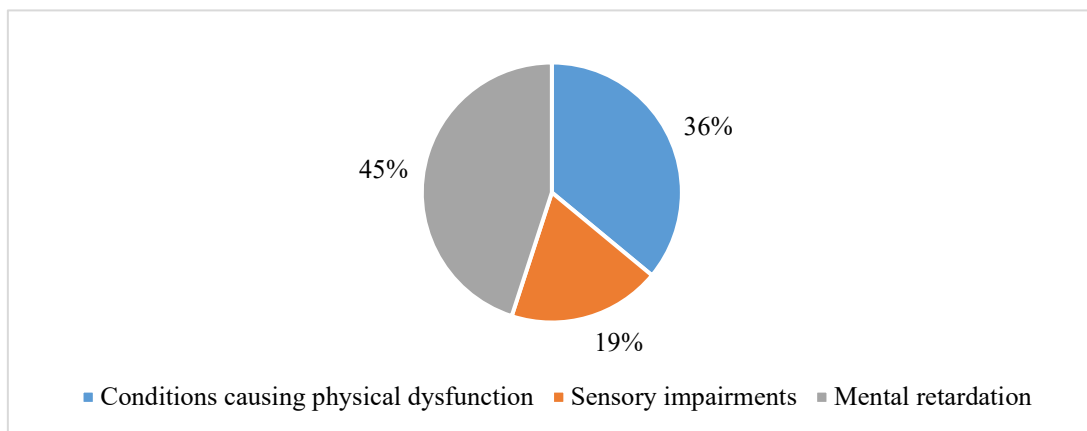


Figure 1. Comparison of the most common types of special educational needs among younger schoolchildren from Kazakhstan

Note: International News Agency “Kazinform” (2022, June 21).

In this context, intellectual disability is understood as a boundary state between the norm and a violation of ontogenesis, resulting in difficulties in the intellectual and emotional-volitional sphere, affecting a decrease in the level of educational and cognitive activity and social adaptation of the individual as a whole. Therefore, for a future teacher, during the development of curricula and programs for working with such children, it is necessary to consider their characteristic features. The latter includes the discrepancy in the development of cognitive functions, expressed in perception, attention, memory, and speech (Cobzaru, 2021).

In order to describe appropriate approaches to the use of digital tools in teaching younger students with intellectual disabilities, it is necessary to reveal the main manifestations of their features in the educational process. First of all, it is necessary to characterize the emotional sphere. In it, schoolchildren have difficulties in the process of verbalizing their own emotions, which is conditioned by an insufficient level of “emotional experience.” As a result, a problem arises, which consists of the inability of the student to recognize personal emotions and the emotional state of others. Based on this, they may show increased anxiety and even aggression towards other subjects of educational activity.

The volitional sphere is closely related to the previous one. This is conditioned by the fact that as a result of a high level of exhaustion of mental processes, rapid physical fatigue occurs. As a result, the arbitrariness of mental regulation and working capacity of the younger student decreases, which weakens their motivation to perform educational exercises. Special attention should be paid to the general awareness of students with intellectual disability, which is characterized by a low level of knowledge and ideas about the environment and social processes.

One of the main ones in the educational process is the cognitive sphere since it is responsible for acquiring new knowledge and skills for schoolchildren to expand their horizons and opportunities (Sharov et al., 2021). In this context, students with intellectual disability face difficulties with respect to sensorimotor development. In addition, such students have writing of problems with attention since their concentration is unstable, which makes it impossible for a person to concentrate on one object or topic and provokes unmotivated distraction to other subjects. In the course of describing the features of cognitive activity of students with intellectual disabilities, special attention should be paid to such a component as memory. Due to the use of involuntary memory, there is a significant decrease in the level of meaningful memorization of information activity (Imangaliyeva et al., 2018). This affects its preservation and reproduction by the child in the future. In younger students with intellectual disabilities, imaginative memory prevails to a greater extent. As for speech, the vocabulary of such subjects of educational activity is narrower than that of children of their age, which makes it impossible for them to express the desired emotions in full.

Based on the above description of the main forms of manifestation of intellectual disability in the educational activities of younger schoolchildren, it is advisable to note that all of them should be considered when preparing future teachers to work with such students. As for the nature and vectors of educational and developed work with such children, the teacher should aim at developing and consolidating their internal motivation to acquire knowledge and use it in the future. To do this, the teacher needs to ensure the proper implementation of educational conditions, including high-quality materials and tasks that will meet the educational goals of students. In this context, digital technologies should be used since they will prevent the occurrence of most difficulties and ensure the effective operation of the educational process. This should be done by slowing down the pace of learning, which is possible through its graphic display. This approach prevents the appearance of anxiety in schoolchildren and increases the level of perception of the material. Using digital technologies such as cloud environments and the PearDeck web platform is advisable. In particular, the cloud space can host educational materials and tasks, access to which will be unlimited time. Thus, students will always be able to return to it if necessary. As for the PearDeck web platform, it allows teachers to create interactive presentations for training sessions and demonstrate them to students during the educational process. This tool allows slowing down the learning topics since it assumes that the teacher independently flips through the presentation slides, thereby setting the pace of the lesson. In addition, during the demonstration of graphic images, schoolchildren can be attracted to perform additional creative interactive tasks that contribute to improving the level of assimilation of the material.

Moreover, when working with students with intellectual disability, it is important for the teacher to adhere to a specific lesson plan. This helps to discipline the student and shape their learning abilities. To do this, it is appropriate to use the Tiki-Toki web service, which is designed to develop interactive event feeds. It is possible to attach photos, audio, and video materials to such boards. In this way, students' interest in the implementation of the curriculum can be increased, and the teacher will be able to control the sequence of implementation of the learning and remedial blocks of tasks and games. To implement these functions, the teacher can use Classroom, in which the training topics can be separated from each other, and the necessary information can be added to the appropriate branches. Systematic compliance with this approach allows for the volitional and emotional activity of schoolchildren to be influenced. Also, in the future, students will be able to independently determine the type and essence of the task in the lesson.

During the training, the teacher must consider the characteristics of a particular child with intellectual disability (Berikkhanova et al., 2021; Ismailova et al., 2019). Virtual whiteboards, such as Padlet.com, can be used to allow the teacher to make a gradual transition from simple to complex tasks aimed at specific students. This will increase the dynamics of their mental activity and develop a special list of psychogymnastic exercises. Such interactive virtual whiteboards allow attaching graphic images, providing access to its management to several persons. Thus, the tasks aimed at different groups of students will be separated and will allow the teacher to assess the level of their knowledge.

In order for the learning process to be interactive, the teacher can use digital technologies such as Kahoot, Plickers, and ClassMarker. The listed web services allow developing, sharing, and playing educational games. During this process, the teacher needs to consider the characteristics of students with intellectual disabilities so that the proposed games meet the interests of students and are aimed at the development of various spheres of their activities. During this process, younger students will perform various mental actions, such as tentative research, evaluation, analysis, comparison, and modeling. As a result of using such digital technologies, it is possible to provide a game organization for the performance of educational tasks.

As mentioned above, a modern teacher should be ready to work in different conditions, both remote and full-time. That is why the teacher must also have the skills to use web services such as ZOOM or Teams. These tools are universal, so they can also be used in the course of interaction with younger students with intellectual disabilities. They are aimed at oral communication of subjects of educational activity, contribute to multiple modifications of training information, and allow repetition and consolidation of the material. In addition, the use of these digital technologies will contribute to the development of students' speech activity, which is an important component in the course of their educational and correctional activities.

To test the effectiveness of the above approaches related to the use of digital technologies in the course of teaching younger students with intellectual disabilities, an experimental study was organized. The students were divided into control and experimental groups. When teaching the first, the tools specified in the paper were not used; respectively, the educational process was organized without the involvement of digital technologies. During the preparation of the experimental group, all the training programs and resources offered in the paper were used, namely PearDeck, Kahoot, Plickers, ClassMarker, and special software suites: Classroom, ZOOM, and Teams.

The study took place within one month, so it was possible to conduct 25 training sessions using digital technologies according to the abovementioned purpose. After that, the students of both groups were asked to undergo diagnostic work aimed at evaluating the effectiveness of various forms of their activities. As a result, the following results were obtained: the number of correct answers to test tasks in the experimental group was 86%, and the control group was 66%. As for written tasks, 80% of students who used digital technologies in their studies received a "good" grade, while only 53% of control group students received such results. The evaluation of oral tasks took place according to the criteria of "high," "medium," and "low" levels. As a result, 93% of the students in the experimental group and 60% of the control group had a "high" level (Figure 2).

Based on this, it was noted that the younger schoolchildren who were part of the experimental group showed higher indicators than the students of the control group. This was expressed in the fact that the students of the first group could describe their emotions without the help of others and find the emotional state of others. In addition, it is noticeable that the students were active in all classes during the day, which indicates an increase in their productivity. It was also noted that the participants of the experimental group assimilated the training material better and could reproduce it independently during the control work. Separately, it is worth noting the improvement in the memory performance of pupils as expressed in their learning tasks, as well as in their study of memory texts. It was found that the involvement of digital technologies in the experimental group

improved the broadcasting of its participants, which became clearer and more expressive, and expanded the vocabulary of students.

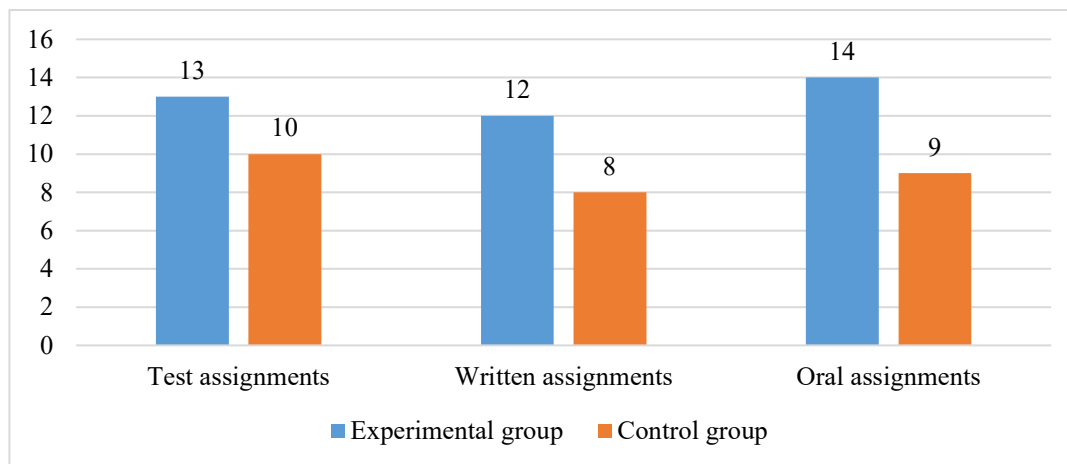


Figure 2. Ratio of the success of performing diagnostic tasks by younger schoolchildren

Based on the results obtained, it can be established that the indicators of the experimental group differ significantly from the control group. This indicates that there are advantages to the approach, which consists of the use of digital learning tools in the preparation of primary students with intellectual disabilities.

DISCUSSION

The results of this study emphasize the significant role of digital technologies in enhancing the educational outcomes of primary school children with intellectual disabilities. These findings align with the conclusions of several previous studies, which have also recognized the benefits of digital tools in special education (Haitembu & Mbongo, 2024). For example, Haleem et al. (2022) and de Oliveira et al. (2023) highlight how digital technologies, such as interactive tools and virtual environments, contribute to improving cognitive and emotional development in students with intellectual disabilities. Our study further corroborates this, as the experimental group demonstrated better engagement, improved attention, and enhanced emotional recognition, particularly when using digital tools such as PearDeck and Kahoot. The improvement in cognitive skills observed in this study, particularly in areas such as memory and attention, mirrors findings by Tapalova et al. (2022) and Kong et al. (2021). Their research emphasized the importance of interactive and game-based learning for children with intellectual disabilities. They found that role-playing games, like “Kolobok,” can help enhance socialization and engagement, and our study supports these findings by showing that the inclusion of digital learning tools led to similar improvements. The interactive nature of the tools, such as the ability to control the pace of lessons and engage in creative tasks, contributed to the students’ increased participation and motivation.

However, the current study diverges from the work of Kucheriava (2021) and Sevda (2022), who focused primarily on self-esteem and motivation in students with intellectual disabilities. While self-esteem is indeed a crucial factor in the development of these students, this study expands on their findings by showing that digital tools can simultaneously address cognitive, emotional, and academic challenges. The integration of digital technologies improved the students’ cognitive abilities, social engagement, and emotional regulation, which had not been explicitly addressed in previous studies. This suggests that the use of technology in the classroom can be a comprehensive tool for supporting the multifaceted needs of students with intellectual disabilities. Additionally, the study’s

findings support Satova and Kalinichenko's (2022) "workaround principle," which emphasizes the importance of adapting digital tools to a student's specific developmental stage and needs. The results indicate that when digital tools were selected based on the individual needs of the students, they were more effective in improving cognitive and emotional skills. This highlights the need for teachers to carefully assess the developmental level of their students and choose digital tools that align with their current abilities.

The study also aligns with the work of Behnamnia et al. (2020) and Loizou (2022), who explored the effectiveness of various educational platforms, such as interactive websites and applications, in promoting learning for children with intellectual disabilities. As demonstrated in this study, these platforms can improve students' ability to concentrate, process information, and express emotions. Using tools like PearDeck and Kahoot, students in the experimental group could interact with the content in ways that traditional methods did not allow, contributing to the higher academic and emotional performance observed.

These findings have important practical implications for teacher training and curriculum design. Teachers need to be equipped with the skills to effectively integrate digital technologies into their teaching practices (Abril, 2025; Yernar et al., 2021). Training programs should include a focus on how to select and use digital tools that cater to the specific needs of students with intellectual disabilities, as well as how to assess the developmental levels of students to ensure the appropriate tools are used (Anđić et al., 2022; Batsurovska et al., 2021). The results of this study suggest that teachers should be trained to use digital tools in a way that complements their pedagogical approach, enhancing both academic outcomes and emotional development. For curriculum design, this study suggests that digital technologies should be integrated as core elements of the educational process for children with intellectual disabilities. The use of interactive digital tools can provide individualized learning experiences, allowing students to progress at their own pace and in line with their cognitive abilities (Miethlich & Šlahor, 2018). Furthermore, curriculum developers should ensure that digital tools are accessible and suitable for students with a range of special educational needs, providing a diverse array of learning opportunities that can engage all students.

The findings from this study contribute to the growing body of evidence supporting the use of digital learning tools in the education of children with intellectual disabilities. These tools not only enhance cognitive abilities but also improve emotional regulation and socialization, addressing multiple aspects of students' development. By relating the findings to existing research, this study offers new insights into the potential of digital technologies to support students with intellectual disabilities. It provides a foundation for further exploration in this area. As such, the use of digital tools should be considered a key component of modern educational practices for children with intellectual disabilities.

PRACTICAL IMPLICATIONS

The results highlight the positive impact of digital learning tools on the education of primary school children with intellectual disabilities. The experimental group showed higher engagement, cognitive development, and emotional recognition compared to the control group, suggesting that digital technologies can enhance learning for these students. For practice, educators should incorporate digital tools to create more interactive and individualized learning experiences. Training for teachers on effective technology integration is essential. For policy, it is important to prioritize the inclusion of digital tools in special education curricula and provide the necessary resources and support for teachers. For future research, studies should examine the long-term effects of digital learning tools on academic and social outcomes and explore how different technologies can be tailored to meet specific learning needs in diverse educational contexts.

CONCLUSIONS

Based on the conducted research, it can be concluded that the integration of digital technologies in the education of younger schoolchildren with intellectual disabilities plays a crucial role in enhancing their learning experience. The study emphasized the need to adapt teaching methods to the specific cognitive, emotional, and volitional characteristics of these children. These characteristics, such as difficulties with sensorimotor development, attention, memory, and speech, require tailored approaches to ensure effective learning. The findings demonstrate that digital technologies, such as PearDeck, Kahoot, Plickers, ClassMarker, and communication platforms like Classroom, ZOOM, and Teams, can be used to slow down the pace of learning, stimulate mental actions, and support speech development. These tools help create an interactive and engaging environment that caters to the unique needs of children with intellectual disabilities. By incorporating game-based learning and structured lesson plans, these technologies also foster socialization and improve students' cognitive abilities.

The experimental study conducted as part of the research revealed that the experimental group, which used digital tools, outperformed the control group in test tasks, written assignments, and oral activities. This indicates that the use of digital resources significantly enhances the educational outcomes for children with intellectual disabilities compared to conventional methods. The study highlights the importance of preparing future teachers to work effectively with children who have intellectual disabilities, ensuring they understand the specific needs of their students and are equipped to use digital tools effectively. Future research should explore the potential of interactive methods for teaching children with intellectual disabilities.

LIMITATION

There are several limitations to this study. The sample size ($n=30$) is relatively small, which limits the generalizability of the findings. The study was conducted within a single educational institution, and the findings may not be applicable to children with intellectual disabilities in other regions or educational settings. The duration of the study (one month) is another limitation, as it prevents us from assessing the long-term effects of digital tool usage on students' academic achievement and social development. Longer-term studies are necessary to evaluate how these tools influence students' progress over time.

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