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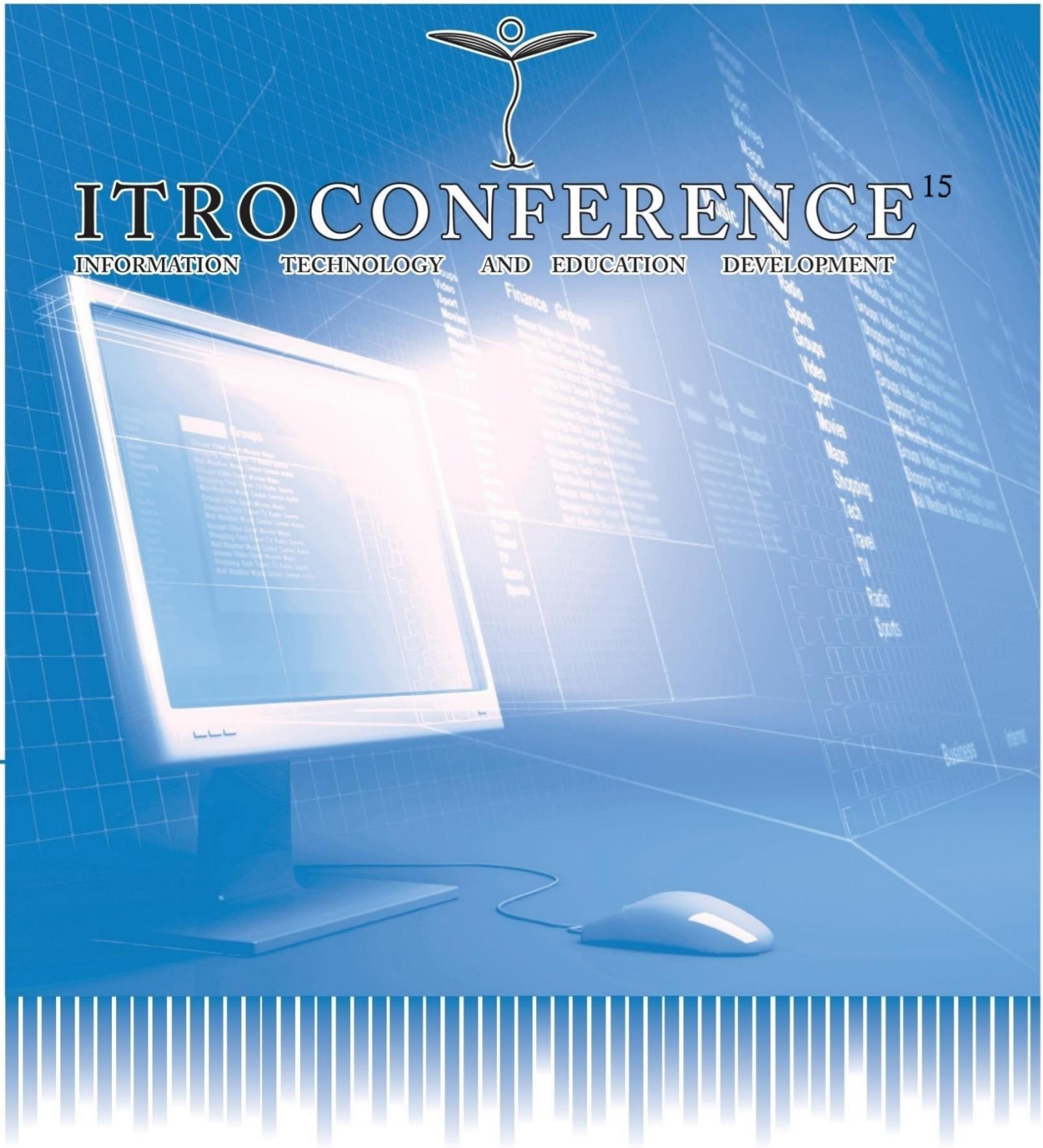
INFORMATION TECHNOLOGY AND EDUCATION DEVELOPMENT



PROCEEDINGS

ZRENJANIN, November 2024

UNIVERSITY OF NOVI SAD
TECHNICAL FACULTY "MIHAJLO PUPIN"
ZRENJANIN
REPUBLIC OF SERBIA

XV INTERNATIONAL CONFERENCE OF

INFORMATION TECHNOLOGY AND DEVELOPMENT OF EDUCATION ITRO 2024

PROCEEDINGS OF PAPERS

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INFORMACIONE TEHNOLOGIJE I RAZVOJ OBRAZOVANJA ITRO 2024

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INTRODUCTION

This Proceedings present the articles delivered at the international conference Information Technology and Education Development (ITRO 2024), held for the jubilee fifteenth time on November 29, 2024. This international event was conducted in a hybrid format, combining in-person and online participation. The conference continues its tradition of bridging science, professional practice, and educational experiences, with this year's focus on the conditions and perspectives of teachers' digital competencies.

The thematic fields of the conference reflect contemporary trends in education, addressing topics such as: the digitalization of education, education in crisis situations, educational challenges, theoretical and methodological issues in contemporary pedagogy, digital didactics and media, modern communication strategies in teaching, curriculum development for contemporary education, advancements in e-learning, education management practices, methodological approaches in teaching natural and technical sciences, and the integration of information and communication technologies in education.

The conference featured three plenary lectures that explored various aspects of the main topic, with the corresponding articles included at the beginning of this volume.

In total, this edition comprises 57 peer-reviewed articles, evaluated through a double-blind review process. These contributions represent the latest research and advancements in the field.

The conference received financial support from the Provincial Secretariat for Higher Education and Scientific Research, Novi Sad. Hosting and technical support were generously provided by the Technical Faculty "Mihajlo Pupin." We extend our sincere gratitude for this invaluable assistance.

The Organizing Committee expresses its heartfelt thanks to the authors, reviewers, and participants for their contributions, which ensure the success and continued tradition of this event.

We look forward to welcoming you to the next ITRO Conference!

On behalf of the ITRO Organizing Committee

Jelena Stojanov

CONTENTS

PLENARY PAPERS

SCIENTIFIC PAPERS

Using ICT in the Education of Children with Special Needs: a Scoping Review

Hristovska V.*[1] and Koceska N.*[2]

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Abstract. According to resent UNICEF reports, the number of children with special needs is increasing every day. These children face multiple and often compounding challenges in realizing their rights, including the right to education. One way to address the needs of children with special needs and to help them in education process is through the use of information and communication technologies (ICT). This scoping review provides insight into recent technology practices in special education contexts, reviewing studies during the period 2019-2024. Following the PRISMA methodology, we analyzed 29 articles that met the inclusion criteria, out of a total of 340 identified. The articles were selected from major databases including Scopus, IEEE, ERIC, and ScienceDirect. The research systematically classifies these studies based on four key criteria: the type of technology implemented (assistive technology, AR/VR, mobile/computer applications, or e-learning platforms), the specific disability addressed (including visual impairments, autism spectrum disorders, intellectual disabilities, dyslexia, and multiple disabilities), the target age group and the benefits from the technology used. The purpose of this review is to provide evidence of good practices and recommendations for successful implementation of ICT in an educational context for children with special needs.

Keywords and phrases: special education, assistive technology, augmented reality, virtual reality, e-learning, educational technology, children with special needs**.**

1 INTRODUCTION

Every child may sometimes experience difficulties in learning some material, but if that difficulty is not temporary, then we have a case of a child with special educational needs (SEN). The term SEN is used to describe learning difficulties or disabilities that make it harder for children to learn than most children their age. Children with special educational needs usually have difficulties that can be divided into several areas:

- Difficulties in thinking, understanding, and learning
- Difficulties in speech, communication, and language
- Problems with managing emotions and behavior
- Physical or sensory difficulties
- A combination of multiple difficulties

Education should be a guaranteed right for every child regardless of their limitations, whether physical or mental. However, children with SEN may require additional support and special attention, to reach their outcomes or learning goals. To provide this support and implement an adequate educational process for every child, ICT technology can be used.

Surrounded by technology, since birth, it is natural for children to learn through technology (Duh et.al., 2017), (Gogova et. al., 2014), (Runcev et. al., 2017), (Timoski et. al., 2020), (Koceski and Koceska, 2022). Children with SEN are no exception. Digital technology engagement to support children with SEN is becoming more common nowadays. It can provide a more learner-centered approach to education focusing on the individual children's needs. It can help create continuity between home and school learning, as well as allow greater independence. ICT has the potential to be an effective leveller for children with SEN creating the conditions for

equal opportunity to learn and access to the curriculum. However, it should be carefully used and under the supervision of trained personnel in order to maximize benefits.

Researchers have investigated various technologies that support children with SEN in their learning process. Mobile, web and desktop applications have been created to help them better understand the complex concepts being taught and provide assistance with the educational material. On the other hand, applications need to be attractive, interactive, motivating and fun to attract children to use them, while at the same time making them feel comfortable and safe. Therefore, these applications are enriched with various multimedia elements, like audio, video, 3D object etc. AR and VR are also used to promote various supports in education, and to facilitate learning activities, integrating real-life situations with the virtual ones.

Previous review studies have attempted to explore the use of ICT in education of children with SEN. However, these reviews fail to provide comprehensive knowledge on the most recent state of the literature. For instance, Sarasola Sanchez-Serrano et. al. (2020) provided a bibliographic review of studies undertaken between 2009–2019, presenting the data according to their citation and repercussion index. Chelkowski et. al. (2019) focused only on using mobile devices with students with disabilities across education settings. They examine the literature on who is using the devices, what specific mobile devices are being used, how mobile devices are used, and what the major effects are. Dogan and Delialioğlu (2020) review the technological tools utilized to exchange reading, writing and math skills in children with SEN. Baykal et al. (2020) focused only on collaborative technologies for children with special needs. Haleem et.al (2022) discussed the needs for digital technologies in education, as well as the challenges of using these technologies in education settings. Apart from these reviews, there are some other reviews that focused only on one disability within the educational domain (Zhang et.al.,2022), (Anagnostopoulou et.al.,2021), (Cibrian et. al, 2022).

The aim of this scoping review is to analyze and synthetize the scientific work published in the last 5 years (from 2019 to 2024), on the use of ICT to support children with special needs, which has been evaluated with at least one child with some form of disability.

2 METHODS

The scoping review was conducted utilizing the PRISMA methodology, through which a significant number of relevant scientific papers were identified and analyzed. The steps of this study consisted of framing research questions, defining eligibility criteria, as well as search strategy, and data acquisition and analyses process.

2.1 Scope and research questions

The purpose of this review is to identify research studies dealing with the use of technology to support and assist children with special needs, including the evaluation process and resultant outcomes. The technology in focus was intended to assist or support educational activities for children with special needs, facilitate their learning process, capture and maintain their attention, create an accessible virtual environment suitable to learning, and establish conditions where they will not feel excluded or disadvantaged compared to their peers without disabilities.

For each article included in the analysis process, we were particularly interested in examining the type of technology used, its purpose and implementation, the target group, and the specific type of disability addressed. To this end, the following research questions were formulated to extract relevant information from each article:

- RQ1: What technology was implemented?
- RQ2: What was the purpose and application of the technology?
- RQ3: Which specific group of children with special needs was the technology designed for or utilized with?
- RQ4: What was the target age group for which the technology was designed or evaluated with?

2.2 Eligibility criteria

The selection of studies for inclusion in our research was guided by the following inclusion criteria: (1) Only articles and conference papers were considered; (2) Publications written in English language; (3) Studies published within the last five years (2019-2024); (4) Articles documenting technological applications in the educational process of children with special needs; (5) Studies that included evaluation of the implemented technology with at least one child.

The exclusion criteria were defined as follows: (1) All types of review papers; (2) Articles describing technology use in educational processes but not specifically for children with special needs; (3) Studies where evaluation was not conducted with children with special needs; (4) Articles where technology was utilized solely for rehabilitation purposes.

2.3 Sources and search strategy

The literature search was conducted across multiple databases including Scopus, IEEE, ERIC, and ScienceDirect. The search was filtered to include only publications from the past five years (2019-2024), written in English, and limited to articles and conference papers. The following keyword search terms were used during the electronic scanning phase: ((Information and communication technology) OR (Computer technology) OR (ICT)) AND (education) AND ((children with special needs) OR (children with disabilities)). The initial search across all databases yielded a total of 367 publications: 4 publications from ScienceDirect, 4 publications from ERIC database, 188 publications from Scopus and 171 publications from IEEE database. After removing 27 duplicate entries, the final corpus consisted of 340 unique publications.

2.4 Selection of studies

After compiling the initial list of publications from our database searches, the next phase involved screening titles and abstracts to determine which studies warranted further consideration. This screening process resulted in the identification of 115 potentially relevant publications.

Subsequently, we attempted to access the full texts of these 115 publications. However, 54 publications were inaccessible, while we successfully obtained and thoroughly reviewed 61 full-text articles. Upon evaluation of these articles against our research objectives and inclusion criteria, only 29 publications were found to be directly relevant to our research questions and were included in the final literature review and analysis. The complete selection and elimination process is illustrated in Fig.1.

This systematic screening process followed standard academic protocols for literature review methodology, ensuring a rigorous and transparent selection of relevant studies for our analysis.

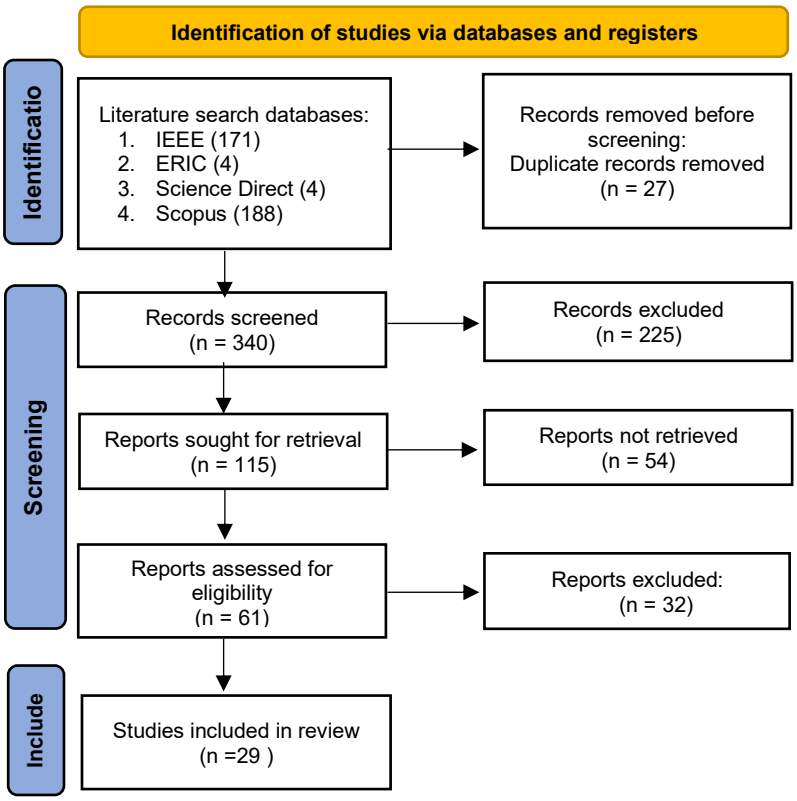

Figure 1. PRISMA Flow Diagram

3 RESULTS

The corpus of 29 studies that document and evaluate technological interventions in inclusive educational settings is presented in Table 1. These studies were further subjected to detailed analysis and systematic classification according to their contributions to our research objectives and their ability to address our primary research questions.

Title	Authors	RQ1: What technology was implemented?	RQ2: What was the purpose and application of the technology?	RQ3: Which specific group of children with special needs was the technology designed for or utilized with?	RQ4: What was the target age group for which the technology was designed or evaluated with?
Serious Exergame for Special Education Needs using 3D-Depth Camera	Kusumaningsih, A. Kurniawati A., Wahyuningru R. T., Khozaimi A., Pratama R. N.	Virtual reality	For supporting cognitive learning and therapy in developing motor skills, balance, and coordination	For children with Mild Autistic Spectrum Disorder and Low-Level Intelligence	For children from 7 to 20 years old
Class VR: Learning Class Environment for Special Educational Needs using Virtual Reality Games	Kurniawati A. Kusumaningsih A., Hasan I.	Virtual reality	For motoric training	For autism-mental disabilities and learning disabilities	6-20 average years
Augmented Reality Application for Improving Writing and Motoric Skills in Children With Disabilities	Kotevski B., Koceska N., Koceski S.	Augmented reality	For Improving Writing and Motoric Skills	For children with various forms of disabilities	For primary school children
User-Centered Virtual Reality Environments to Support the Educational Needs of Children With ADHD in the COVID-19 Pandemic	Cardona-Reyes, H., Ortiz-Aguiñaga, G., Barba-Gonzalez, M. L., & Muñoz-Arteaga, J.	Virtual reality	To improve attention	For children with ADHD	For children from elementary school
Augmented Reality Based Learning Environment for Children with Special Needs	Shaltout, E. H., Afifi, A., & Amin, K. M.	Augmented reality	For enhancing the Reading and Cognitive skills	For children with Down syndrome and Autistic Children	For children from elementary school
A Context-Aware Augmentative and Alternative Communication System for School Children with Intellectual Disabilities	Chan, R. Y. Y., Sato-Shimokawara, E., Bai, X., Yukiharu, M., Kuo, S. W., & Chung, A.	Assistive technology	For improving their communication skills	Children with Intellectual Disabilities (ID)	It can be used for elementary-middle and high school environments
Effectiveness of "Maghzineh"- Cognitive Video Game on Reading Performance of Students with Learning Disabilities in Reading	Kashani-Vahid L., Taskooh S. K., Moradi H.	Computer technology	Increasing problem solving and decision making and improving reading performance	For children with Learning Disability (Dyslexia, Dyscalculia, Math Disabilities)	Elementary School
e-Ucumari: A multimedia device based on ontologies and embedded systems for pedagogical support of children with multi-disabilities	Robles-Bykbaev V., Arévalo-Illescas C.; Carrera-Hidalgo P., Robles-Bykbaev Y., Tigre-Andrade G., Ochoa-Fajardo D., Quisi-Peralta D., Pesántez-Avilés F., Martínez-Gutiérrez J.	Assistive technology	Maintain longer periods of attention, greater knowledge of their own body and basic spatial notions	For children with Multiply Disabilities	For all ages of children.
ICT, Inclusion and Pedagogical Diferention: Exploratory Study	Filipe M., Marques N., Pedro S.S., Gil H.	Mobile technology	To stimulate fine motor skills, develop visual perception skills and eye-hand coordination, improve cognitive ability, language and improve memory, logic and concentration.	For children with multiple disabilities	For kindergarten
Design and Development of Educational Game Using ARCS Model	Koceska N, Koceski S., Tashkova E.	E-learning/ online learning	For improving motoric skills	For children with learning disabilities	For kindergarten and elementary school
Using tangible interfaces for teaching Braille	Andrés Sandoval-Bringas J., Carreño-León M. A., Durán Encinas I., Leyva Carrillo A., Estrada Cota I., Cosio Castro R.	Assistive technology	For Helping the Visual Impaired Children to learn Braile	For children with Visual Impairments	Preschool children

Title	Authors	RQ1: What technology was implemented?	RQ2: What was the purpose and application of the technology?	RQ3: Which specific group of children with special needs was the technology designed for or utilized with?	RQ4: What was the target age group for which the technology was designed or evaluated with?
Use of Learning Paths Through a Digital Ecosystem to Support Children With Learning Problems in Basic Math	Cardona-Reyes H., Ortiz-Esparza M. Á., Muñoz-Arteaga J.	E-learning/ online learning	For creating customized paths in the moodle for mastering and improving basic math skills	For children with learning disabilities	For elementary school kids
Design and Development of an Android App (HanDex) to Enhance Hand Dexterity in Children With Poor Handwriting	John S. and Renumol V. G.	Mobile technology	For improving and supporting handwriting skills	For children with writing difficulty	Primary school children
The effectiveness of a mobile application "Kalcal" on the learning of mathematics in students with dyscalculia	Dehghani H.	Mobile technology	For teaching arithmetic and computational skills	For children with Dyscalculia	For elementary school.
Digital transformation to support literacy teaching to deaf Children: From storytelling to digital interactive storytelling	Leandro Flórez-Aristizábal, Sandra Cano, César A. Collazos, Fernando Benavides, Fernando Moreira, Habib M. Fardoun	Computer technology	For Supporting Literacy Teaching	For Deaf Children	For preschool and elementary school children
Attention-driven read-aloud technology increases reading comprehension in children with reading disabilities	Schiavo G., Mana N., Mich O., Zancanaro M., Job R.	Assistive technology	For increasing the Reading	For Children with Development Dyslexia	For primary school
ICT use and competencies of school children with intellectual disabilities in low-resource settings: the case of Ghana in sub-Saharan Africa	Bayor A.A., Brereton M., Sitbon L., Ploderer B.	Mobile technology	For supporting the learning process	For children with intellectual and developmental impairments	For all ages
Feasibility of an eye-gaze technology intervention for students with severe motor and communication difficulties in Taiwan	Hsieh Y.-H., Granlund M., Hwang A.-W., Hemmingsson H.	Assistive technology	Allow students to communicate and participate in cur-riculum activities and leisure	For children with severe motor and communication difficulties	For all ages
Web Technologies in the Development of Computational Thinking of Students with Mental Disabilities	Assainova A., Abykenova D., Aubakirova Z., Mukhamediyeva K., Kozhageldinova K.	E-learning/ online learning	For teaching computational thinking	For children with mental disabilities	For primary school
Information and communication technologies-based teaching methodologies for Peruvian children with down syndrome	Villasante J., Poma S., Gutierrez-Cardenas J., Rodriguez-Rodriguez N.	Mobile phone	For improving mathematical and language skills	For children with Down Syndrome	For elementary and primary school children
Time orientation technologies in special education	Guillomía M.A., Falcó J.L., Artigas J.I., García-Camino M.	Assistive technology	For improving time orientation skills in classroom	For Children with various forms of disabilities	For all ages
The role of technology-mediated music-making in enhancing engagement and social communication in children with autism and intellectual disabilities	Kossyvaki L., Curran S.	Assistive technology	For enhancing engagement and social communication	For children with dual diagnosis of autism and intellectual disabilities	For preschool and primary school children.
Physical Programming for Blind and Low Vision Children at Scale	Morrison C., Villar N., Hadwen-Bennett A., Regan T., Cletheroe D., Thieme A., Sentance S.	Assistive technology	For teaching computational learning	For Blind and Low Vision children	For primary school
Design of an interactive system of tangible interfaces to support	Carreno-Leon M.A.; Andres Sandoval-Bringas J., Encinas I.D., Cosio Castro	Assistive technology	For teaching colors	For Children with Autism	Preschool and elementary school

Title	Authors	RQ1: What technology was implemented?	RQ2: What was the purpose and application of the technology?	RQ3: Which specific group of children with special needs was the technology designed for or utilized with?	RQ4: What was the target age group for which the technology was designed or evaluated with?
learning in children with autism	R., Cota I.E., Leyva Carrillo A.				
An emotion regulation app for school inclusion of children with ASD: Design principles and evaluation	Fage C., Consel C., Etchegoyhen K., Amestoy A., Bouvard M., Mazon C., Sauzéon H.	Assistive technology	For better emotion regulation in mainstream classrooms	For children with autism spectrum disorder and Intellectual Disabilities	For adolescents
Conceptual learning through accessible play: Project Torino and computational thinking for blind children in India	India G., Ramakrishna G., Pal J., Swaminathan M.	Assistive technology	For teaching computational thinking	For visual impaired children	For primary school children
UDL using ICT for Inclusive Learning; Learning Support for Students with Diverse Learning Styles, Including Students who Need Special Support	Shimojo M., Teruya H., Soland M.	Computer technology	For learning English	For Children with various forms of learning disabilities	Primary School
Effects of gesture-based match-to-sample instruction via virtual reality technology for Chinese students with autism spectrum disorders	Hu X., Han Z.R.	Virtual reality	For improving match-to-sample skills	For children with autism spectrum disorder	For children in elementary school
Serious game as support for the development of computational thinking for children with hearing impairment	Cano S., Naranjo J.S., Henao C., Rusu C., Albiol-pérez S.	Assistive technology	For Development of Computational Thinking	For Children with Hearing Impairments	For children in elementary school

Table 1. Overview of the studies

3.1 Assistive Technology

Assistive Technology encompasses devices, tools, and software solutions that help overcome learning and communication barriers for individuals with various types of special needs. From our research examining assistive technology applications in education for visually impaired individuals, we identified three significant papers focusing on this area. These studies predominantly emphasize the utilization of tangible interfaces. The evaluation results reported by Andrés Sandoval-Bringas et al. (2020) show that learning Braille through tangible interfaces reduces learning time by up to 40% while simultaneously reducing children's frustration from repeated failure. In terms of tangible systems, TORINO system, designed to develop computational thinking through play, was evaluated in two articles. The evaluation conducted from (India et al., 2020) demonstrated a positive effect on children, highlighting the importance of creating an environment with creative freedom and playful exploration opportunities. Morrison et al. (2021) not only documented active student participation and engagement but also received positive feedback from teachers regarding the system's ease of implementation and use.

In the domain of computational thinking development, we identified a study from (Cano et al., 2021) working with hearing-impaired children utilizing the Perdi-Dog game. Post-evaluation findings indicated high student motivation and benefits in decision-making and problem-solving skills.

Regarding assistive technology applications for children with autism and intellectual disabilities, several studies were identified. Chan, et al. (2020) published a study that presented the design, implementation, and evaluation of a Bluetooth low energy-based context-aware augmentative and alternative communication system. The system facilitates daily communication for nonverbal school children with moderate intellectual

disabilities. The Cosmo hardware, discussed in the music-making study (Kossyvaki and Curran, 2020), contributed to communication, curiosity, and motivation of children with autism and intellectual disabilities at school. The positive outcomes, regarding social communication skills, are reported, which are of significant value to educational researchers and school staff. Tangible user interface enabled natural object interaction during learning, while supporting communication and self-expression were reported by Carreno-Leon et al.(2020). The prototype was evaluated by experts, and by end users with characteristics of the autism spectrum, and the results obtained were considered favorable. Assistive technology for emotional support of adolescents with autistic spectrum disorders in a typical everyday classroom environment, is of great importance because it not only improves childrens' behavioral outcomes but also contributes for the development of their social and cognitive skills (Fage et al., 2019).

Among the articles examining assistive technology and its evaluation, the study by Guillomía et al. (2019) concentrates on temporal orientation of children with special needs in educational settings through the implementation of an audio-visual system. The reported results show a consistent improvement in performance related to time orientation, which in turn provides a basis for improving personal autonomy.

To overcome dyslexia-related challenges in reading and writing, Schiavo et al. (2021) utilize eye-tracking technology that synchronizes audio with text, based on the user's gaze direction. Similarly, assistive technology based on eye-tracking was also used by Hsieh et al. (2024), but for children with severe motor and communication impairments.

Among all identified studies focusing on assistive technology, only one study (Robles-Bykbaev, et al., 2019) addresses children with multiple disabilities (in this case a child with cerebral palsy and hearing loss concomitantly). The research shows an easily modifiable solution, based on electronic device and an ontology, that facilitates the inclusion of children with SEN in the educational process.

3.2 AR, VR

AR (Augmented Reality) and VR (Virtual Reality) technologies create immersive and interactive experiences that can be leveraged in education to enhance learning outcomes and engagement for students with special needs. Children with autism and intellectual disabilities sometimes find it more challenging to connect with teachers than with technology. The study by Kurniawati, et al. (2019) investigates a user-friendly virtual environment that motivates children to independently follow instructions through virtual games. The study reported a positive outcome, particularly in improving cognitive and motor skills. Another research shows how virtual reality enhances curiosity, promotes whole-body activity, and improves cognitive, motor, and language skills (Kusumaningsih et al., 2022). Hu and Han (2019) investigate the effectiveness of using gesture-based instruction via Leap Motion-aided virtual reality technology to teach matching skills to school-aged students with autism spectrum disorder. Virtual reality also found significant application in education during the COVID-19 pandemic. In this context, VR technology was utilized to provide a friendly, focused, and calming environment where children could engage in problem-solving activities while teachers can continue the teaching process despite pandemic restrictions (Cardona-Reyes et al., 2021).

Regarding augmented reality applications, two studies that document improvements in writing, reading, motor, and cognitive skills were identified (Kotevski, et al., 2024) (Shaltout, et al., 2020). The first study examines the application of augmented reality for children with ADHD, while the second investigates the use of AR application in children with Down syndrome and ADHD in the process of learning to read and write. These applications make the learning process interactive, entertaining, and motivating while increasing concentration and eliminating boredom.

3.3 Mobie Technology, Tablets and Computers

Mobile technology (smartphones and tablets) are ubiquitous and readily accessible technologies in our daily lives. Several studies evaluate the implementation of mobile technology in special education. John and Renumol (2022) examine mobile technology's application in improving handwriting skills. Dehghani (2019) focused on developing arithmetic and computational skills in children with dyscalculia. The study by Villasante et al. (2019) utilizes mobile technology to enhance mathematical and language skills. Filipe et. al. (2019) used mobile technology to stimulate fine motor skills, develop visual perception skills and eye-hand

coordination, improve cognitive ability, improve memory, logic and concentration, while Bayor et al. (2023) investigated the use of mobile technology in supporting and facilitating the overall educational process.

Evaluation and implementation of computer technology in the educational process for children with learning disabilities and hearing impairments can be found in several studies (Kashani-Vahid et al., 2019), (Leandro Flórez-Aristizábal et al., 2019), (Shimojo et al., 2020). The results from these implementations demonstrate improvements in problem-solving and decision-making capabilities (computational thinking), reading proficiency, and language and literature learning.

3.4 E-learning, online learning

E-learning or online learning refers to an educational process conducted through internet platforms and technology, as opposed to traditional physical environments. The implementation of these technologies in the educational process for children with learning difficulties has demonstrated several beneficial outcomes:

- Enhancement of motor and cognitive skills (Koceska et al., 2024)
- Creation of customized learning materials tailored to individual children's needs (Cardona-Reyes et al., 2022)
- Improvement of computational thinking abilities (Assainova et al., 2023)

4 CONCLUSION

The analysis of studies in this scoping review, demonstrates the diverse and evolving landscape of technological solutions that support children with special needs in educational settings. The research highlights four primary categories of technological interventions: assistive technology, AR/VR/MAR solutions, mobile/tablet/computer applications, and e-learning platforms.

Assistive technologies, particularly those incorporating tangible interfaces and eye-tracking capabilities, show promising results in reducing learning barriers and enhancing engagement for students with various disabilities. AR and VR technologies demonstrate significant potential in creating immersive, safe learning environments that improve cognitive, motor, and social skills, particularly for children with autism and intellectual disabilities. Mobile and computer-based technologies have proven effective in developing specific skills such as handwriting, arithmetic, and computational thinking. E-learning platforms offer great opportunities for personalized learning experiences even during challenging conditions such as the COVID-19 pandemic.

The review underscores the transformative potential of technology in special education while highlighting the importance of continued innovation and evaluation to ensure these tools effectively serve their intended purpose of creating more inclusive and accessible educational environments.

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