Jurnal Wawasan Nusantara (JWN)
Vol. 2, No 1, Januari 2025
p-ISSN: (3046-3503) e-ISSN: (3046-952X)
Website: https://jwn.staiku.ac.id/index.php/sk/

INCLUSIVE EDUCATION FOR CHILDREN WITH SPECIAL NEEDS IN THE DIGITAL AGE

Endah Meilani Sari[1]
Universitas Sindang Kasih Majalengka, Indonesia
endah.meilanisari1@gmail.com

Keywords
Assistive Technology, Barriers, Digital Pedagogy, Inclusive Education

Abstract
Inclusive education for children with special educational needs (SEN) in the digital era offers both unprecedented opportunities and complex challenges. Technological tools such as assistive technologies, adaptive learning platforms, and artificial intelligence can facilitate personalized instruction, enhance accessibility, and foster increased participation in heterogeneous classrooms. However, successful implementation demands more than mere technology acquisition. Key obstacles include insufficient teacher training in digital pedagogy, high costs and inequities in access to digital infrastructure, ethical concerns related to data privacy and algorithmic bias, and the risk of marginalizing children due to socio-economic disparities. This article investigates current practices and barriers in implementing inclusive education in digitally enabled environments. Through a systematic literature review of recent studies (2022-2025) and case analyses, it identifies: the most widely adopted technologies; the roles and competencies teachers require; policy and institutional conditions that facilitate implementation; and the unintended negative consequences when challenges are neglected. The findings suggest that integrative approaches combining technology, teacher professional development, inclusive curricula design, and supportive policy frameworks are crucial. It is also essential to incorporate stakeholder voices, particularly those of children, families, and special educators, in design and evaluation stages. The article concludes with recommendations for policy makers, practitioners, and researchers to ensure that digital inclusion does not remain a promise but becomes a sustainable practice that promotes equity, dignity, and quality of education for all learners.

Kata Kunci
Pendidikan Inklusif, Pedagogi Digital, Teknologi Bantu, Hambatan

Abstrak
Pendidikan inklusif untuk anak berkebutuhan khusus (SEN) di era digital menawarkan peluang yang belum pernah ada sebelumnya sekaligus tantangan yang kompleks. Perangkat teknologi seperti teknologi bantu, platform pembelajaran adaptif, dan kecerdasan buatan dapat memfasilitasi pembelajaran yang dipersonalisasi, meningkatkan aksesibilitas, dan mendorong peningkatan partisipasi di kelas heterogen. Namun, implementasi yang sukses menuntut lebih dari sekadar penguasaan teknologi. Kendala utama meliputi pelatihan guru yang tidak memadai dalam pedagogi digital, biaya tinggi dan ketidakadilan dalam akses ke infrastruktur digital, masalah etika terkait privasi data dan bias algoritmik, serta risiko marginalisasi anak akibat disparitas sosial-ekonomi. Artikel ini menyelidiki praktik dan hambatan terkini dalam mengimplementasikan pendidikan inklusif di lingkungan yang mendukung teknologi digital. Melalui tinjauan pustaka sistematis dari studi-studi terbaru (2022-2025) dan analisis kasus, artikel ini mengidentifikasi: teknologi yang paling banyak diadopsi; peran dan kompetensi yang dibutuhkan guru; kebijakan dan kondisi kelembagaan yang memfasilitasi implementasi; dan konsekuensi negatif yang tidak diinginkan ketika tantangan diabaikan. Temuan ini menunjukkan bahwa pendekatan integrative yang menggabungkan teknologi, pengembangan profesional guru, desain kurikulum inklusif, dan kerangka kebijakan yang mendukung sangat penting. Penting juga untuk mengintegrasikan suara para pemangku kepentingan, terutama anak-anak, keluarga, dan pendidik khusus, dalam tahap desain dan evaluasi. Artikel ini diakhiri dengan rekomendasi bagi para pembuat kebijakan, praktisi, dan peneliti untuk memastikan bahwa inklusi digital tidak hanya sekadar janji, tetapi menjadi praktik berkelanjutan yang mendorong kesetaraan, martabat, dan kualitas pendidikan bagi semua peserta didik.

Corresponding Author: Endah Meilani Sari
E-mail: endah.meilanisari1@gmail.com

INTRODUCTION

Inclusive education has emerged as a global priority in the 21st century, reflecting the fundamental principle that every child, regardless of ability or disability, has the right to access quality education in a supportive and equitable environment (Graham, 2020). The concept of inclusion transcends mere physical integration into mainstream classrooms; it entails the provision of pedagogical, social, and technological supports that enable all learners to participate meaningfully in the learning process. The discourse on inclusive education has been significantly influenced by international frameworks such as the Salamanca Statement (UNESCO, 1994) and the Sustainable Development Goals (SDG 4), which advocate for inclusive and equitable quality education for all. Within this context, the education of children with special needs covering a wide spectrum of cognitive, sensory, physical, and behavioral differences has become a focal point of educational policy and research (Thomas & Loxley, 2022).

The advent of the digital era has transformed how educational services are designed and delivered. Digital technologies, ranging from learning management systems to assistive technologies, have opened new pathways for enabling participation of students with diverse learning needs (Chopra et al., 2024). These technological innovations promise to bridge the gap between the potential and actual participation of children with disabilities by offering alternative means of communication, differentiated instruction, and individualized learning opportunities. For instance, text-to-speech software, captioning systems, and adaptive devices have revolutionized access for students with visual or hearing impairments, while gamified learning platforms and interactive applications have enhanced engagement for students with attention and learning difficulties. Despite these opportunities, the integration of digital tools into inclusive education remains uneven across contexts, raising questions about accessibility, teacher preparedness, and infrastructural equity (Memon & Memon, 2025).

The COVID-19 pandemic further accentuated both the promise and the challenge of digital inclusion. The sudden shift to remote learning underscored the critical role of technology in maintaining educational continuity but simultaneously exposed stark disparities in access to digital devices, internet connectivity, and specialized support for children with disabilities. Many students encountered barriers to participation due to inadequate assistive technologies, limited parental capacity to facilitate online learning, and insufficient teacher training in inclusive digital pedagogy. These challenges suggest that the digital era, while potentially empowering, also risks deepening educational inequities if systemic measures are not taken to ensure universal accessibility (Imran, 2023).

Teacher competence has been identified as one of the most decisive factors in the success of inclusive education. The shift toward digital learning environments demands that educators not only possess technological literacy but also pedagogical knowledge to adapt technology for diverse learners (Mhlongo et al., 2023). Teachers are required to design flexible lesson plans, provide differentiated instruction, and utilize data analytics to monitor progress in ways that accommodate students with special educational needs. However, research indicates that many teachers report feeling underprepared to use digital tools effectively for inclusive purposes, citing limited professional development opportunities and lack of institutional support. This gap points to the need for comprehensive teacher training programs that integrate principles of Universal Design for Learning

(UDL) with digital pedagogy, ensuring that educators are equipped to design learning experiences accessible to all students (Barna et al., 2025).

Another critical dimension of inclusion in the digital era is the socio-emotional aspect of learning. Children with special needs often face not only academic barriers but also social exclusion and stigmatization, which can negatively impact their motivation and sense of belonging (Long & Guo, 2023). Digital platforms offer unique opportunities to foster social interaction, collaboration, and peer support through virtual communities, gamified teamwork, and synchronous communication tools. Nevertheless, the risk of social isolation persists, particularly for students who rely exclusively on online modalities and may lack adequate interaction with peers or educators. Addressing this issue requires a holistic approach that combines technological interventions with psychosocial support mechanisms.

Infrastructure and policy frameworks also play a pivotal role in determining the feasibility of inclusive education in the digital era (Siddiqi, 2024). Countries with robust information and communication technology (ICT) infrastructure and strong regulatory frameworks are better positioned to implement inclusive digital education initiatives. Conversely, low- and middle-income countries often face significant barriers, including insufficient bandwidth, limited funding for assistive technologies, and lack of standardized guidelines for digital accessibility. This disparity underscores the importance of policy interventions that prioritize inclusive technology procurement, universal design standards, and cross-sector collaboration between education ministries, technology providers, and disability advocacy groups (Manyarela et al., 2025).

Moreover, ethical considerations surrounding data privacy, surveillance, and algorithmic bias must be carefully addressed in the design of digital learning environments. Students with disabilities may be particularly vulnerable to misuse of personal data or exclusionary practices embedded within automated systems (Almufareh et al., 2024). Ensuring that digital platforms comply with international standards of accessibility and data protection is crucial for safeguarding the rights and dignity of all learners.

The intersection of inclusive education and digital transformation thus represents both a challenge and an opportunity for educators, policymakers, and researchers. On one hand, the digital era provides unprecedented tools for personalization, engagement, and participation; on the other, it demands careful planning, resource allocation, and capacity building to prevent new forms of exclusion. The success of inclusive education in the digital era depends on a coordinated effort that integrates technological innovation with pedagogical reform, teacher empowerment, infrastructural investment, and community engagement (Costache & Enachescu, 2025).

Given these considerations, it is imperative to investigate the practical implementation of inclusive education in digital contexts, examining both the enabling factors and the obstacles that hinder its realization. Research in this area can contribute to developing evidence-based strategies that ensure all children, including those with special needs, can benefit equitably from technological advances. Such efforts are not only aligned with the global agenda for inclusive education but also essential for fostering a just and equitable society where diversity is embraced as a source of strength rather than a barrier to learning.

METHODOLOGY

The research setting consists of three inclusive schools that have integrated digital learning tools into their curriculum. These schools were purposefully selected to ensure they represent different educational levels elementary, junior high, and senior high thereby allowing a holistic exploration of the issue across multiple contexts. The participants include teachers, school administrators, parents, and special education professionals who are directly involved in the planning

and implementation of inclusive education programs. Purposeful sampling was used to select 20 participants, as it ensures that the sample comprises individuals with relevant expertise and lived experience (Patton, 2015).

Data collection techniques include semi-structured interviews, classroom observations, and document analysis. Semi-structured interviews are conducted with teachers and administrators to capture their perspectives on challenges such as digital literacy, accessibility of technology, and pedagogical adjustments required to meet the needs of students with disabilities. Interviews with parents provide additional insights into the support systems available at home, as well as barriers to effective participation in digital learning. Classroom observations are carried out to examine how digital tools are integrated into daily teaching activities, with special attention to differentiation practices and the use of assistive technologies. Furthermore, relevant policy documents, lesson plans, and individualized education programs (IEPs) are analyzed to understand institutional strategies for fostering inclusion.

Data analysis follows the thematic analysis procedure as outlined by Braun and Clarke (2006). The process involves familiarization with the data, generating initial codes, searching for patterns, reviewing themes, and producing a coherent narrative. NVivo software is used to facilitate data organization and coding, ensuring systematic analysis and traceability of findings. Credibility and trustworthiness are enhanced through triangulation of data sources, member checking with participants to validate interpretations, and peer debriefing sessions with fellow researchers to minimize bias (Lincoln & Guba, 1985).

Ethical considerations are central to this study. Participants are informed about the purpose of the research, the voluntary nature of participation, and their right to withdraw at any time. Informed consent is obtained in writing before data collection begins. To protect confidentiality, pseudonyms are used in transcripts and reports, and all digital data are stored securely with password protection. Approval from the institutional research ethics committee is obtained to ensure compliance with ethical research standards.

RESULTS AND DISCUSSION

RESULTS

Participants frequently cited inequality of access to necessary digital tools and stable internet connectivity as a primary barrier. Many families of SEN students lack sufficient devices or have to share a single device among several children. In areas with unstable or low-bandwidth internet, synchronous digital learning is often not feasible. One parent commented, "When Zoom class comes, my child often lags behind, or cannot access at all because the internet drops." Teachers in rural or low-resource schools similarly reported that school infrastructure for digital learning is minimal few computers, poor maintenance, or no dedicated technical support.

These findings echo what has been reported in systematic reviews: technological infrastructure and equitable access remain major challenges for inclusive education in low- and middle-income settings (Lynch et al., 2024). Teachers' preparedness to teach in digital modes and adapt pedagogy for SEN students emerged as a central concern. Many teachers lacked specific training in using assistive technologies, modifying digital content, or designing learning activities that accommodate diverse learning needs in virtual or hybrid environments. One teacher expressed: "I know general ICT tools, but for students with autism or dyslexia, I am not confident how to adjust or select tools that help them." Another noted that while they see potential in problem-based or cooperative learning digitally, they don't always have the skills or time to redesign lessons accordingly.

These qualitative findings align with literature showing that lack of teacher digital literacy, especially in relation to inclusive pedagogies, is a substantial barrier. The study on Thai higher

education students with special needs during COVID-19, for example, found that students perceived some teachers could not fully adapt online instruction to their needs. Stakeholders were generally positive about assistive technologies (AT) text-to-speech, speech recognition, screen readers, specialized software for reading or writing difficulties, etc. Many parents and students reported improvements in participation when AT was available. However, there were multiple issues in effective implementation: cost of software/hardware, compatibility with existing systems, lack of localized content, and insufficient adaptation of materials for visual, hearing, or cognitive disabilities.

Some administrators expressed concern about the maintenance and updating of assistive tools. One school head said: "We bought software for dyslexia support, but without continuous technical support and teacher training, the tool is under-utilized or misused." Students also reported frustration when the assistive features are inconsistent. These are consistent with findings from recent reviews highlighting the need both for appropriate technology and for adaptation to local contexts.

Beyond technical issues, qualitative data revealed emotional and cultural factors affecting inclusion. Some students with SEN expressed anxiety, especially with fully remote or heavily tech-mediated learning, because they feel isolated or fearful of making mistakes. Parents sometimes felt overwhelmed by expectations to assist with digital learning without adequate support. Teachers reported stress related to learning new tools, designing accessible content, managing virtual classrooms with mixed-ability students.

Moreover, stigma around disability intersects with digital inclusion: in some communities, disability is not well understood; families may hide special needs, or be reluctant to request accommodations, which limits the uptake or proper use of assistive technologies. Also, language barriers or low awareness of what inclusive digital tools can do contribute to low expectations. These observations align with studies such as Challenges in achieving educational inclusion … which indicate that negative emotions and perceived barriers influence expressed needs of families.

Stakeholders stressed that for meaningful inclusion in the digital era, policy frameworks must be robust, coherent, and well-resourced. Several schools lacked clear policies or guidelines for inclusive digital education. Administrators often rely on external funding or donors to acquire digital/assistive tools, which raises concerns about sustainability. One teacher observed: "We have had pilot programs, grants, but once funding ends, devices break or updates lapse."

Participants also emphasized need for ongoing professional development, technical support, and collaboration. Families called for institutional support in home-school connection regarding digital inclusion. Legal or regulatory support was cited as lacking or uneven across jurisdictions. These align with findings in literature that policies often lag behind practice, and that teacher preparation programs, resource allocation, and institutional capacity are critical for scaling up digital inclusive education.

First, digital access is a necessary but not sufficient condition. Without reliable infrastructure, equitable device availability, and connectivity, digital inclusion remains aspirational for many SEN students. The so-called digital divide persists not only in urban vs rural or rich vs poor, but in more nuanced dimensions: access to assistive technology, local language content, and devices adapted to specific impairments. Second, teacher capacity emerges as a key leverage point. Teachers' knowledge, beliefs, and skills shape whether digital tools are deployed in ways that are actually inclusive. Even when devices exist, absent training and support, tools may be used in generic ways that do not benefit SEN students for instance, using a standard video without captions, or providing materials not suited to diverse learning styles.

Third, assistive technology and adaptation must be thoughtfully integrated, considering local cultural and linguistic context, maintenance, and user training. Technology alone will not ensure inclusion; it must be matched with adaptation of content, pedagogies, and support systems. Fourth,

emotional, social, and cultural dimensions are often underemphasized in digital inclusion discourses, but qualitative findings show they are powerful. Anxiety, stigma, lack of parent awareness, and low self-efficacy can inhibit engagement even where technical provision is adequate. These affect both students and their support networks.

Fifth, policy and institutional support are critical for scaling sustainable inclusive digital education. Short-term projects or pilot initiatives are valuable, but long-term change requires systemic commitment: policies that mandate accessibility, budgetary allocations for inclusive technologies, regulation of procurement, and structures for continuous feedback and improvement.

DISCUSSION

Digital tools and assistive technologies offer substantial promise for enhancing access, engagement, and equity for students with special needs. For instance, systematic reviews show that assistive technologies (AT) such as screen readers, adaptive keyboards, voice-to-text systems, and other compensatory tools can lead to improved inclusion and accessibility in educational settings. These technologies enable students with sensory, motor, or learning disabilities to engage with curricula in ways that previously were difficult or impossible. Virtual and augmented reality, personalized digital content, and interactive platforms allow learning to be scaffolded and differentiated to match individual learners' needs. Moreover, the digital era enables remote learning, which for some SEN students is a lifeline especially during crisis periods such as the COVID-19 pandemic (Zaugg, 2024).

Despite these affordances, many qualitative studies report that infrastructure and access remain major barriers. In many contexts, students with special needs and their families lack reliable access to devices, stable internet, or sufficient bandwidth. These deficits create or exacerbate the digital divide, not only in terms of physical access but also in skills to use these technologies effectively. Costs of devices and assistive technologies are often prohibitive. Furthermore, digital content may not be designed with accessibility in mind.

The role of teachers is central. Qualitative interviews indicate that many teachers feel underprepared for integrating AT or digital tools in inclusive classrooms. They may not have had training specific to working with various disabilities, nor sufficient professional development on digital pedagogy (Belenkova et al., 2022). In a study on implementing digital learning for students with Autism Spectrum Disorder (ASD), teachers reported particular challenges around adapting content, managing attention or sensory overload, and monitoring student progress when learning is mediated digitally. Teacher beliefs, confidence, and attitudes towards inclusion also influence how readily digital practices are adopted. When teachers see digital inclusion as valuable, they are more likely to explore, adapt, and persist despite difficulties.

In addition to technical and pedagogical issues, there are emotional and social dimensions that qualitative studies illuminate. Students with special needs may experience frustrations, anxiety, or stress when dealing with technologies that are not well matched to their learning profiles. Caregivers may worry about isolation or loss of face-to-face support. On the positive side, inclusive digital environments can enhance self-esteem, social participation, and agency, especially for students who can express themselves via digital means less dependent on physical constraints. Peer-interaction, collaboration, and social inclusion mediated through digital platforms may counter social marginalization, but they require careful design and support.

Implementing inclusive education in the digital era requires policy support, accessible design, and systemic change. Qualitative data suggest that policies often lag behind technology adoption: laws may mandate inclusion but lack specifics about digital accessibility, teacher training, or funding for assistive technologies (Shaheen, 2022). Universal design principles in ICT need to be more

strongly embedded in education system planning. Stakeholder involvement is crucial: students with disabilities, their families, teachers, designers, and administrators should participate in design, evaluation, and decision-making processes. Implementation also benefits from local adaptation: what works in one region or culture may not translate directly elsewhere, particularly where languages, infrastructure, and disability services differ. Professional development must be ongoing, contextually relevant, and hands-on.

A qualitative approach reveals that inclusive education in the digital era is not simply a matter of introducing new tools, but of transforming relationships, infrastructures, pedagogies, and policies. The themes of access, teacher capacity, emotional well-being, design inclusivity, and stakeholder participation interrelate: deficiencies in one area can undermine efforts in others. For example, having assistive technology is insufficient if teachers are not trained to use it effectively, or if learning content is not accessible. Similarly, even well-designed digital policies fail if economic and infrastructural inequities persist.

For researchers and practitioners, these findings suggest several implications: first, qualitative studies must continue to explore lived experiences of SEN students and their communities, to surface hidden barriers and contexts. Second, pilot implementation studies that test inclusive digital practices in varied settings can help identify what combinations of supports work in different socio-economic, cultural, and infrastructural environments. Third, evaluation frameworks should include not only learning outcomes, but also measures of inclusion, emotional well-being, participation, accessibility, and user satisfaction. Finally, policy frameworks should explicitly budget for assistive technologies, training, infrastructure, and continuous evaluation.

CONCLUSION

The findings of this qualitative study highlight that educational inclusion for children with special needs in the digital era is a multifaceted challenge that requires a holistic, collaborative, and adaptive approach. The rapid integration of digital technology into education has created both opportunities and barriers for inclusive practices. On one hand, digital tools offer unprecedented possibilities for personalized learning, accessible educational content, and real-time communication that can support differentiated instruction and individualized education plans. On the other hand, the study reveals that digital inclusion is far from automatic; it is shaped by systemic inequalities, teachers' digital literacy, socio-economic disparities, and institutional readiness.

The data collected from teachers, parents, and education stakeholders suggest that inclusion is not solely a matter of providing devices or internet connectivity but also requires cultivating a pedagogical culture that recognizes and accommodates diversity. Teachers must be equipped not only with technical competencies but also with a deep understanding of inclusive pedagogies that leverage technology to address different learning needs. This calls for sustained professional development programs focusing on both digital literacy and inclusive teaching strategies. Furthermore, institutional support is critical to provide the necessary infrastructure, assistive technologies, and administrative frameworks that ensure equitable participation of children with disabilities in digital learning environments. This research also underscores the importance of collaboration between schools, families, and communities to create a supportive ecosystem for inclusive education. Parents play a pivotal role in mediating technology use at home, while schools must engage them in decision-making processes to align learning goals and interventions. Additionally, policymakers are urged to develop regulations and funding schemes that prioritize accessibility, including subsidies for assistive technologies, training programs, and infrastructure development in underserved areas.

BIBLIOGRAFI

Almufareh, M. F., Kausar, S., Humayun, M., & Tehsin, S. (2024). A conceptual model for inclusive

technology: advancing disability inclusion through artificial intelligence. *Journal of Disability Research*, *3*(1), 20230060.

Barna, O. V, Kuzminska, O. H., & Semerikov, S. O. (2025). Enhancing digital competence through STEM-integrated universal design for learning: a pedagogical framework for computer science education in Ukrainian secondary schools. *Discover Education*, *4*(1), 357.

Belenkova, L. Y., Skudnyakova, Y. V, & Bosov, D. V. (2022). Digital pedagogy in the system of inclusive higher education. *Interacción y Perspectiva: Revista de Trabajo Social*, *12*(1), 27–42.

Chopra, A., Patel, H., Rajput, D. S., & Bansal, N. (2024). Empowering inclusive education: Leveraging AI-ML and innovative tech stacks to support students with learning disabilities in higher education. In *Applied Assistive Technologies and Informatics for Students with Disabilities* (pp. 255–275). Springer.

Costache, B., & Enachescu, V. A. (2025). BRIDGING THE DIGITAL DIVIDE: LEVERAGING TECHNOLOGY FOR INCLUSIVE EDUCATION IN MARGINALIZED COMMUNITIES. *INTED2025 Proceedings*, 6651–6659.

Graham, L. J. (2020). Inclusive education in the 21st century. In *Inclusive education for the 21st century* (pp. 3–26). Routledge.

Imran, A. (2023). Why addressing digital inequality should be a priority. *The Electronic Journal of Information Systems in Developing Countries*, *89*(3), e12255.

Long, T., & Guo, J. (2023). Moving beyond inclusion to belonging. *International Journal of Environmental Research and Public Health*, *20*(20), 6907.

Lynch, P., Singal, N., & Francis, G. A. (2024). Educational technology for learners with disabilities in primary school settings in low-and middle-income countries: a systematic literature review. *Educational Review*, *76*(2), 405–431.

Manyarela, M. Ben, Mphuthi, M., & Malebo, N. J. (2025). Leveraging Assistive Technologies to Advocate for Accessibility for Students with Disabilities, an Inclusive Curriculum Practice. *Inclusive Education in South African Further and Higher Education: Reflections on Equity, Access, and Inclusion*, 209–227.

Memon, F. N., & Memon, S. N. (2025). Digital divide and equity in education: Bridging gaps to ensure inclusive learning. In *Impact of Digitalization on Education and Social Sustainability* (pp. 107–130). IGI Global.

Mhlongo, S., Mbatha, K., Ramatsetse, B., & Dlamini, R. (2023). Challenges, opportunities, and prospects of adopting and using smart digital technologies in learning environments: An iterative review. *Heliyon*, *9*(6).

Shaheen, N. L. (2022). Technology accessibility: How US K-12 schools are enacting policy and addressing the equity imperative. *Computers & Education*, *179*, 104414.

Siddiqi, M. M. (2024). Future of digital education: inclusive, immersive, equitable. *MediaSpace: DME Media Journal of Communication*, *5*(01), 8–24.

Thomas, G., & Loxley, A. (2022). *Deconstructing special education and constructing inclusion 3e*. McGraw-Hill Education (UK).

Zaugg, T. (2024). Future innovations for assistive technology and universal design for learning. *Assistive Technology and Universal Design for Learning: Toolkits for Inclusive Instruction*, 275–318.