

Inclusive Learning in Early Childhood Education Based on Digital Technology: Innovation or Challenge?

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ABSTRACT

Early Childhood Education (ECE) serves as a critical foundation for children's cognitive, social, and emotional development, including those with special needs. In today's digital era, the integration of technology into inclusive education presents vast opportunities to enhance accessibility, engagement, and the overall quality of learning processes. This article aims to explore both the opportunities and challenges in implementing digital-based inclusive learning in ECE through a literature study. Findings reveal that technology can serve as an effective tool to support diverse and individualized learning needs. However, challenges such as unequal access to digital infrastructure, low digital literacy among educators, and issues of data privacy must be addressed. Collaboration among educators, parents, technology developers, and policymakers is essential to create an inclusive, safe, and sustainable digital learning ecosystem for all children.

Introduction

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Early Childhood Education (ECE) is a crucial phase in children's growth, where cognitive, social, emotional, and physical aspects begin to form. The implementation of inclusive education in ECE aims to provide equitable learning access for all children, including those who require special attention. This concept emphasizes the importance of learning environments that are adaptable and sensitive to children's diverse abilities and backgrounds (Yustitia et al., 2024).

In the current digital age, technology plays a significant role in supporting inclusive education. The use of digital tools, interactive educational applications, and online platforms can assist educators in delivering tailored learning materials that meet the needs of each student. For example, assistive technologies such as screen readers or text-to-speech applications are highly beneficial for children with visual impairments or dyslexia in understanding lessons. This is reinforced by findings from Fauziah (2023), which show that digital-based learning media such as interactive flashcards can significantly improve receptive language skills in early childhood. However, the study also highlights limitations among teachers in fully optimizing technological tools, pointing to the need for systematic teacher capacity-building.

Despite its benefits, the application of digital technology in ECE also faces several challenges. One major challenge is the digital divide, where not all students have equal access to technological devices and stable internet connections. This can lead to learning inequalities, particularly among children living in remote areas or from low-income

families. Additionally, many ECE educators lack sufficient digital skills to effectively use technology in learning. Limited training and technical support hinder the integration of technology into daily classroom activities.

Another challenge relates to data protection and children's privacy. The use of digital platforms in learning introduces risks associated with the security of students' personal information, requiring special attention from educational institutions and technology developers (Miyazaki et al., 2024).

Inclusive education in the digital era also demands stronger collaboration among stakeholders. Parents, educators, and communities need to work together to create learning environments that support children with diverse needs. This includes sharing information, resources, and experiences to develop best practices in inclusive education. With solid collaboration, these challenges can be addressed, and the opportunities offered by technology can be optimally utilized (Taufiqurrahman, 2022).

Methods

This study adopts a descriptive qualitative approach using a literature review method. This method was chosen to gain an in-depth understanding of digital-based inclusive learning in ECE by examining various relevant sources. Data were collected from accredited national journals, online scientific articles, and government policy reports published over the last five years (2020–2025), ensuring the relevance

and currency of the information. As stated by Sugiyono (2013), a literature review enables researchers to identify and analyze theories and previous findings relevant to the topic being studied.

One reference examined in this study was research by Fitria et al. (2025), which discusses the development of early childhood creativity through eggshell media. Although it does not directly involve digital technology, the creative approach used in the study provides inspiration for designing digital learning media suited to the characteristics of ECE students. This enriches the understanding that inclusive learning in the digital era is not solely dependent on technological sophistication but also on creativity and the relevance of learning media to children's needs.

Data analysis was carried out thematically to identify patterns, trends, challenges, and solutions emerging from each literature source. Thematic analysis helps organize and interpret data from diverse sources, allowing researchers to extract relevant insights and thoroughly understand the studied phenomenon. The procedure includes familiarization with the data, initial coding, theme identification, theme review, theme definition, and final reporting.

To ensure data validity, this study employs source triangulation. Source triangulation tests data accuracy using various types of data to gain a more comprehensive understanding of the phenomenon. By analyzing data from multiple sources, researchers can detect and reduce bias or misinterpretation, thereby strengthening the credibility of the

research findings.

Result and Discussions

Below is a literature review table presenting several articles and references related to the topic “Digital-Based Inclusive Learning in Early Childhood Education: Innovation or Challenge?” This table provides an overview of authors, study titles, sources, research purposes, themes, and key findings to reinforce the theoretical and empirical foundation of this study.

Authors	Title	Source	Research Purpose	Theme	Findings	Significance
Ahmad Putro, Dwi Prasetyo, and Rahman Hidayat	<i>Revolusi Belajar di Era Digital</i>	<i>Revolusi Belajar di Era Digital (Book)</i>	Analyzing the transformation of education in the digital era and the role of	Digital learning innovation	Digital technology can improve learning effectiveness when combin	Provides practical guidance for teachers and parents in optimizing educational

			technology in improving learning quality.		ed with conventional methods.	technology.
Nur Khayati, Siti Rahmawati, and Dinda Lestari	<i>Peranan Guru dalam Pendidikan Inklusif untuk Pencapaian SDGs</i>	<i>Jurnal Pendidikan Inklusif Indonesia, 8(2)</i>	Examining the role of teachers in creating a sustainable inclusive education system.	Inclusive education	Inclusive teachers must possess pedagogical and social competence to manage student diversity.	Strengthens the importance of improving teacher competencies as agents of SDG 4.
Fathiya	<i>Literasi</i>	<i>Jp2n:</i>	Identify	Digital	ECE	Highligh

Nur Rahmi and Sri Wijayanti	<i>Media Digital Terkait Pendidikan Inklusif di Kalangan Guru PAUD Wilayah Kecamatan Cipanas</i>	<i>Jurnal Pengembangan dan Pengabdian Nusanara</i>	ing the level of digital literacy among ECE teachers and its relation to the implementation of inclusive education.	literacy and inclusion	teacher s' digital literacy remain s varied and require s contin uous improv ement.	ts the urgency of digital literacy training to support inclusive ECE practices.
Laila Azizah and Nur Hendriani	<i>Implementasi Penggunaan Teknologi Digital sebagai</i>	<i>Jurnal Teknologi Pendidikan</i> , 9(2)	Exploring the effectiveness of digital technology use in	Inclusive educational technology	Digital technology helps create adaptive and partici	Provides recommendations for best practices in applying technolo

	<i>Media Pembelajaran pada Pendidikan Inklusi di Indonesia</i>		inclusiv e learning		patory learnin g enviro nments	gy for inclusive educatio n.
Fatmawiyati and Nurul Permata	<i>Implementasi Pendidikan Inklusif di PAUD</i>	<i>Jurnal PAUD Inklusif</i> , 4(3)	Explaini ng strategi es for implem enting inclusiv e educati on in early childho od.	Inclusi ve educat ion manag ement	Childr en with special needs receive equal learnin g opport unities as their peers.	Emphasi zes the importan ce of flexible curricula and child- friendly environ ments.
Pipit	<i>Integra</i>	<i>Jurnal</i>	Analyzi	Digital	Interac	Demonst

Rika Wijaya, Ade Irma Noviyanti, and Nury Kurnia	<i>si Teknologi Digital untuk Mendukung Manajemen Perilaku dan Pembelajaran Bahasa Inggris pada Anak PAUD Inklusif</i>	<i>Inovasi PAUD Digital</i> , 3(1)	ng the use of digital technology for English learning and behavior management in inclusive ECE settings.	techno logy innovation	tive apps and digital videos increase children's engagement and positive behavior.	rates the effectiveness of digital technology in supporting inclusive children's learning.
Siti Kamilah	<i>Peran Literasi Digital dalam Mencaipai</i>	<i>Jurnal Pemberdayaan Berkelanjutan</i> , 5(2)	Examining the relationship between digital	Digital literacy & SDGs	Digital literacy promotes independence	Provides a conceptual foundation for

	SDGs 2030		literacy and sustaina ble commu nity empow erment through inclusiv e educati on.		and innova tion in educati on.	technolo gy-based sustaina ble educatio n.
Rina Fitria and Ahmad Arismu nandar	<i>Menin gkatkan Kualita s Pendid kan Inklusi di PAUD: Tantan gan dan Inovasi</i>	<i>Jurnal Pendid kan Anak Usia Dini, 6(1)</i>	Identify ing challen ges and innovati ons in inclusiv e learning in ECE.	Inclusi ve learni ng innova tion	Innova tions such as assistiv e tech and adapti ve learnin g improv e	Encoura ges teachers to innovate based on children' s needs.

					inclusion effectiveness.	
Laila Azizah, Fitri Handayani, and Iwan Setiawan	<i>Tantangan dan Peluang MPAI (Model Pembelajaran Adaptif dan Inklusif) di Sekolah Dasar</i>	<i>Jurnal Pendidikan Dasar</i> , 7(2)	Developing adaptive and inclusive learning models in the digital era.	Adaptive learning model	The MPAI model strengthens personalized learning approaches in inclusive classrooms.	Provides new directions for implementing adaptive learning in primary education.
Bambang Nugroho, Ika Rahayu,	<i>Mewujudkan Pendidikan Inklusif</i>	<i>Jurnal Pendidikan Global</i> , 9(1)	Analyzing policies and strategies	Inclusive education policy	Low digital literacy remains a	Offers participatory solutions between

and Sari Pratiwi	<i>dan Berkela njutan di Era Digital</i>		es toward sustaina ble digital-based inclusiv e educati on.		barrier, but the Digital -Aware Parents Move ment enhanc es equitab le access.	teachers and parents in digital educatio n.
Rismaya ni, Siti Mahpud zoh Siregar, Hajijah Adelina, and Hilda Zahra Lubis	<i>Games in Arabic for Early Childho od: A Literat ure Study</i>	<i>Ceria: Jurnal Progra m Studi Pendidid kan Anak Usia Dini</i> , 14(1), 43–67	Explori ng the effectiv eness of using games in early childho od Arabic languag e learning	Game-based learni ng	Games enhanc e childre n’s langua ge, social, cogniti ve, and motor skills.	Offers enjoyabl e and Islamic-based approac hes to Arabic language learning.

Mujibur rohman, Nurjann ah, Ahmad Helwani Syafi'i, Agam Sulaima n, Ilham Manses, and Ibnu Zakiyya h	<i>Permainan Tradisional Kideng sebagai Media Pembelajaran Bahasa Arab</i>	<i>Al-Af'idah : Jurnal Pendidikan Bahasa Arab</i> , 7(2)	Exploring the potential of the traditional Kideng game for teaching Arabic.	Traditional educational media	The Kideng game improves children's Arabic-speaking skills.	Combines cultural preservation with innovative language learning.
Nasrullah and Syifaullah Adhima h	<i>Pengaruh Permainan Tebak Gambar untuk Menin</i>	<i>Jambura Elementary Education Journal</i> , 5(1)	Measuring the effectiveness of picture-guessing games in	Interactive visual media	Children recognize and remember vocabulary	Proves interactive visual games as an effective method for

	<i>gkatkan Pemahaman Kosakata Bahasa Arab pada Anak Usia Dini</i>		masteri ng Arabic vocabulary.		faster through picture games.	learning Arabic.
Nurul Khoirun nisa Dalimunthe and Rahmaina	<i>Media Pembelajaran Berbasis Games Gambar Berangkai dalam Pembelajaran Maharah</i>	<i>Jurnal Educatio</i> , 9(3)	Developing game-based media to enhance listening skills (maharah istima').	Educational audio-visual media	Sequencial picture games improve memory and listening skills.	Offers a fun interactive visual-audio model for children.

	<i>Istima'</i>					
Ahmad Iqbal H. S.	<i>Pengembangan Media Pembelajaran Berbasis Permainan Roda Putar pada Pembelajaran Kosakata Bahasa Arab di Taman Kanak-kanak</i>	<i>Al-Athfaal: Jurnal Ilmiah Pendidikan Anak Usia Dini</i> , 4(2)	Developing digital spinning-wheel media for Arabic vocabulary learning	Interactive media development	The spinning-wheel media is valid and effective for improving children's Arabic vocabulary.	Integrates technological and game elements into language learning.

Following the analysis of ten relevant articles and books, it can be concluded that digital-based inclusive learning in Early Childhood Education (ECE) is a complex approach that offers substantial

innovation but also presents significant challenges. Overall, digital transformation in education has had a widespread impact, particularly in improving access and enriching learning processes. Digital technology can be an effective tool to enhance learning quality when utilized properly as a complement to traditional methods, especially those emphasizing active learning, social interaction, and real-world exploration by children (Putro et al., 2023). The book *Revolusi Belajar di Era Digital* highlights that the success of technology use depends not only on the tools but also on how they are thoughtfully integrated into contextual, human-centered, and child-centered learning processes.

In the context of inclusive education, the role of digital technology becomes increasingly important because it bridges the learning needs of children with diverse backgrounds and abilities, including those with special needs. As explained by Azizah and Hendriani (2024), the use of technology can create flexible, adaptive, and inclusive learning environments. Tools such as interactive applications, video-based learning media, and digital assistive devices have been proven to improve the learning process, including in teaching English and managing children's behavior (Wijaya et al., 2025). This indicates that digital-based approaches are not only relevant but also highly beneficial in supporting inclusive ECE practices.

However, major challenges arise regarding the readiness of human resources, especially educators. Teachers play a crucial role in inclusive education and are required to have competencies that include

knowledge of inclusive pedagogy, the ability to manage diverse learning abilities, and adequate digital literacy (Khayati et al., 2020). Research by Rahmi and Wijayanti (2024) shows that improving digital media understanding among ECE teachers is essential for the success of inclusive learning. Additionally, educators must be capable of designing flexible, adaptive curricula aligned with all children's needs. Parents' involvement is also highly influential. Nugroho et al. (2025) emphasize that low digital awareness among parents often becomes an obstacle in implementing digital-based inclusive education. Initiatives such as the *Digital-Aware Parent Movement* must be promoted to enable parents to guide children at home and school and understand the appropriate, child-friendly use of technology.

Research by Miranti et al. (2024) highlights parents' roles in fostering local cultural literacy among early childhood learners. Although the study focuses on cultural literacy, its findings underscore the importance of parental involvement in children's learning processes, including within digital-based learning contexts.

Systemically, challenges include disparities in infrastructure, limited availability of technological devices, and unequal teacher training distribution across Indonesia. Articles by Kamilah (2024) and Fitria & Arismunandar (2024) emphasize the importance of innovative strategies such as educational games, inclusive classroom design, and assistive technologies suited to children's needs. Approaches such as the Adaptive and Inclusive Learning Model (MPAI) developed by Azizah

et al. (2024) also show that educational innovation must be continually updated to align with principles of equity and sustainability.

Thus, it can be concluded that digital-based inclusive education in ECE holds high potential in creating an equitable, relevant, and accessible educational system. However, this innovation is not free from challenges. Strong collaboration among teachers, parents, policymakers, and relevant stakeholders is needed to overcome structural and technical barriers. Inclusive digital education is not solely about technology use but also involves shifting mindsets, commitment to inclusivity, and awareness of diversity in early childhood contexts. If these challenges can be addressed through appropriate policies and practices, the shift toward more inclusive and sustainable education is highly achievable.

Conclusion

Based on the literature review conducted, digital-based inclusive learning in Early Childhood Education (ECE) is a crucial and innovative approach in addressing today's educational challenges, especially for children with special needs. Digital innovation provides numerous opportunities to improve participation, accessibility, and learning quality tailored to each child's needs. Digital media such as interactive applications, assistive tools, and online learning platforms have proven effective in creating inclusive and responsive learning environments.

However, the use of such technologies faces several challenges, including unequal access to digital infrastructure, low digital literacy

among teachers and parents, and issues regarding children's data protection. The success of implementing digital-based inclusive education depends on strong collaboration among educators, parents, educational institutions, governments, and technology developers. Therefore, comprehensive strategies involving teacher training, child-friendly facility provision, supportive policies, and active parental involvement are needed. With collaboration across stakeholders, equitable, responsive, and sustainable inclusive digital education is not merely an aspiration but a necessary goal that must be realized.

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