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Strategy for Using Information and Communication Technology in PAUD to Build Digital Literacy

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Abstrak

Perkembangan teknologi informasi dan komunikasi (TIK) membawa perubahan besar dalam berbagai aspek kehidupan, termasuk pendidikan anak usia dini (PAUD). Meskipun TIK memiliki potensi mendukung perkembangan kognitif, sosial-emosional, dan motorik anak, masih banyak lembaga PAUD yang menghadapi kendala dalam pemanfaatannya. Permasalahan yang muncul antara lain keterbatasan fasilitas, kurangnya kompetensi guru dalam mengintegrasikan TIK, serta minimnya panduan tentang penggunaan teknologi yang sehat dan aman bagi anak. Kondisi ini menimbulkan kesenjangan antara kebutuhan literasi digital di era modern dengan kemampuan lembaga PAUD dalam memenuhinya. Penelitian ini bertujuan untuk mengidentifikasi strategi efektif pemanfaatan TIK dalam mendukung literasi digital anak usia dini, menganalisis tantangan implementasi di lembaga PAUD, serta memberikan rekomendasi praktis bagi guru, orang tua, dan pemangku kepentingan. Metode penelitian yang digunakan adalah studi kepustakaan dengan pendekatan sistematis, yaitu menelaah literatur yang relevan berupa jurnal, buku, dan artikel terkait TIK dan literasi digital pada anak usia dini. Hasil penelitian menunjukkan bahwa pengintegrasian TIK dalam pembelajaran PAUD dapat meningkatkan keterampilan kognitif, sosial-emosional, dan motorik anak. Penggunaan aplikasi edukasi interaktif dapat mendukung pengembangan literasi digital, meskipun tantangan seperti keterbatasan fasilitas dan kurangnya pelatihan guru masih ada. Penelitian ini menyimpulkan bahwa strategi penggunaan TIK yang efektif dapat membantu mempersiapkan anak menghadapi tantangan digital di masa depan. Kolaborasi antara pemerintah, lembaga pendidikan, dan orang tua sangat penting untuk mengoptimalkan pemanfaatan TIK di PAUD.

***Kata kunci**: Anak Usia Dini, Digital, Literasi*

Abstract

The development of information and communication technology (ICT) has brought about major changes in various aspects of life, including early childhood education (PAUD). Although ICT has the potential to support children's cognitive, social-emotional, and motor development, many PAUD institutions still face obstacles in utilizing it. The problems that arise include limited facilities, a lack of teacher competence in integrating ICT, and a lack of guidance on the healthy and safe use of technology for children. This situation has created a gap between the need for digital literacy in the modern era and the ability of ECE institutions to meet it. This study aims to identify effective strategies for utilizing ICT in supporting the digital literacy of early childhood, analyze the challenges of implementation in PAUD institutions, and provide practical recommendations for teachers, parents, and stakeholders. The research method used is a systematic literature review, which examines relevant literature in the form of journals, books, and articles related to ICT and digital literacy in early childhood. The results of the study show that integrating ICT into early childhood education can improve children's cognitive, social-emotional, and motor skills. The use of interactive educational applications can support the development of digital literacy, although challenges such as limited facilities and a lack of teacher training still exist. This study concludes that effective ICT use strategies can help prepare children for future digital challenges. Collaboration between the government, educational institutions, and parents is essential to optimize the use of ICT in early childhood education.

Keywords: *Early Childhood, Digital, Literacy*

Introduction

The development of information and communication technology (ICT) has had a significant impact on various aspects of life, including the field of education (Huraerah et al., 2024). Digital connectivity has rapidly advanced over the past decade, contributing to fundamental changes in how people interact with one another, seek information, and access services. Among all demographic groups, young people have increasingly turned to technology and the internet as their preferred tools for communication, socialization, entertainment, and, more recently, education. From the use of social media applications to online gaming and educational resources, digital technology has become an integral part of the daily routines of many young individuals across the world (Buchan, M. Claire; Bhawra, 2024).

These days in the digital world we live in, digital literacy stands out as a key skill kids need to build starting when they are young. It goes beyond just knowing how to work gadgets and tech tools. It really covers grasping digital info, judging it wisely, and creating it

in ways that show critical thinking and good responsibility (Cynthia & Sihotang, 2023). When you look at early childhood settings, this literacy means spotting basic digital signs or icons. It also involves handling easy moves around on devices like tablets or screens (Fatma, 2022), on top of that kids start picking up simple ideas about staying safe online (Budiarti, 2024), things such as keeping personal details private come into play here. They learn to steer clear of stuff that does not fit their age. Starting this kind of education early on sets kids up solid. They end up growing into people who handle tech well. At the same time, they get what it means to act as thoughtful, secure, and proper citizens in the digital space.

Digital literacy in early childhood refers to the attitudes, knowledge, and skills involved in using digital media to seek information, learn, and play (Lindriany et al., 2023), as well as to engage in healthy entertainment activities under adult supervision. Digital literacy through technology offers various benefits in supporting children's development (Khasanah & Herina, 2019), including enhancing behavioral understanding, stimulating cognitive abilities, positively influencing motor development, and fostering the importance of collaboration. Early Childhood Education (ECE) plays a strategic role in building the foundation for these essential skills.

The integration of ICT in early childhood education offers opportunities to create more engaging, interactive, and contemporary learning experiences (Saputra & Fatkhurohman, 2023). The use of devices such as tablets, educational applications, and other digital tools can help children learn through play-based activities that foster creativity, communication, and collaboration. However, the implementation of ICT in early childhood education faces several challenges, including limited resources, insufficient teacher training, and concerns about the potential negative effects of technology on children (Hendrik Dewantara, 2024). Therefore, effective strategies are needed to optimize the use of ICT in supporting the development of digital literacy among young learners.

Although the potential of ICT to support early childhood education is considerable, many educational institutions have yet to utilize it optimally. Several challenges frequently arise, including teachers' limited understanding of how to integrate ICT into learning, inadequate facilities and technological equipment in most ECE institutions (Bintang et al., 2024), and the lack of guidelines on the safe and healthy use of ICT for young children (Ulfah, 2020). These issues create a gap between the growing need for digital literacy in the modern era and the capacity of ECE institutions to meet that need.

This study aims to identify effective strategies for the use of ICT in ECE to support the development of digital literacy among young children, analyze the challenges encountered in the implementation of ICT in ECE, and provide practical recommendations for teachers, parents, and other stakeholders to utilize ICT optimally. The results of this research are expected to offer theoretical benefits by enriching knowledge about the role of ICT in early childhood education, particularly in fostering digital literacy, practical benefits by providing guidelines for teachers and ECE institutions in developing effective and safe ICT integration strategies, and social benefits by contributing to the creation of a generation prepared to face future digital challenges.

This study is grounded in several relevant theories, including Piaget's theory of child development, which examines how young children learn through direct experience and interaction with their environment (Putri & Suryana, 2022), UNESCO's framework for digital literacy, which outlines essential components such as access, analysis, and evaluation of digital information (Syarifuddin et al., 2023), and Vygotsky's social learning theory, which emphasizes the importance of social interaction and the use of tools including technology in supporting children's learning processes (Alimuddin et al., 2023). Based on these theoretical foundations, this study is expected to contribute meaningfully to the development of ICT utilization strategies that support digital literacy in early childhood education.

Methodology

This study employed a literature review method using a systematic approach to examine and analyze various relevant sources of literature (Ridwan et al., 2021). The data collection technique involved identifying, collecting, and reviewing secondary data sources such as scholarly journals, books, research reports, articles, and official guidelines related to the use of ICT and digital literacy in early childhood education.

The data sources consisted of both national and international literature obtained from online databases. The collected data included qualitative information in the form of theories, concepts, findings, and practical recommendations derived from previous studies. The data were analyzed using a qualitative descriptive approach to identify patterns, relationships, and gaps in the application of ICT to support digital literacy in early childhood education settings.

Results and Discussion

Technology Based Learning

The advancement of science and technology has had a significant impact on various aspects of human life (Muhson, 2010). Education, as a crucial element in the process of individual development, not only contributes to the growth of science and technology but must also be able to utilize these advancements to achieve learning objectives effectively and efficiently. In the context of Early Childhood Education (ECE), technological progress has brought fundamental changes to the curriculum, learning materials, and teaching methods.

In the past, children's learning processes primarily relied on concrete learning aids, printed books, and conventional methods. Today, however, the integration of digital media such as educational applications, interactive learning videos, and technology-based games has become increasingly prevalent. This shift allows learning materials to be presented in more engaging, visual, and comprehensible ways for young learners. Furthermore, pedagogical approaches have evolved from one directional teaching models toward more interactive and collaborative learning experiences supported by digital media.

The ECE curriculum in the digital era emphasizes the importance of digital literacy as a core competency. Children are not only expected to recognize letters, numbers, and shapes but are also introduced to basic navigation skills on digital devices, symbol recognition, and an early understanding of digital ethics and safety. However, this transformation also presents new challenges, including limited infrastructure, unequal teacher competencies, and the need to balance technology-based learning experiences with real-world activities to ensure optimal child development.

Research findings indicate that technology-based learning can increase young children's learning motivation and engagement (Sambella et al., 2023). The use of devices such as tablets and interactive educational applications provides enjoyable learning experiences while supporting cognitive skill development. For example, children can learn to recognize letters, numbers, and colors through digital games. Similar findings were reported by (Herodotou, 2018) who explained that digital educational applications have the potential to enrich children's learning experiences by providing visual and interactive stimuli aligned with their developmental stages. Moreover, Vygotsky's social learning theory emphasizes the importance of social interaction in the learning process, including the use of technology-based media. Children can learn through collaboration with peers or

guided interaction with adults when engaging in digital activities (Vygotsky, 1978). Thus, technology serves not only as an individual learning tool but also as a medium to develop social, communication, and collaboration skills within ECE environments (Plowman & McPake, 2013).

The use of technology in early childhood education can also be analyzed through the learning theories of Jean Piaget and Lev Vygotsky. According to Piaget, children learn through cognitive developmental stages that emphasize active exploration and environmental manipulation (Hanafi & Sumitro, 2019). Technology, such as interactive educational applications, supports the principle of discovery learning, which aligns with the needs of children in the preoperational stage. Digital media can help children understand symbolic concepts, such as numbers and letters, in engaging and developmentally appropriate ways. However, Piaget also emphasized the importance of balancing digital experiences with real-world activities to strengthen conceptual understanding through concrete experiences (Wahyudi et al., 2024).

Meanwhile, Vygotsky's theory highlights the significance of social interaction in learning, particularly through the concept of the Zone of Proximal Development (ZPD) (Masrura et al., 2024). Technology can act as a scaffolding tool that enables children to learn beyond their independent capabilities, for instance, through applications designed with gradual levels of difficulty. In addition, technological media can facilitate collaboration both directly through group activities in the classroom and virtually through applications that encourage peer interaction. In this sense, technology functions not only as a learning tool but also as a means of enriching children's social experiences.

Despite its great potential, the implementation of technology in early childhood learning faces several challenges, such as limited facilities and insufficient teacher training (Bintang et al., 2024). To optimize the use of technology, teachers need to understand children's cognitive developmental stages and provide appropriate learning support. Therefore, a technology-based approach grounded in the theories of Piaget and Vygotsky can serve as an effective solution to enhance the quality of learning, provided it is supported by adequate infrastructure and professional training.

Early Childhood Education in the Digitalization Era

In the era of digitalization, early childhood education is experiencing significant transformation. Children today grow up in environments surrounded by technology, requiring learning approaches that align with contemporary developments. The integration

of ICT into early childhood education represents a strategic step in preparing children to face digital challenges. For instance, the use of applications specifically designed for young learners can enhance critical thinking and problem-solving skills. These technological changes can be beneficial if society is able to utilize them optimally and possesses adequate digital literacy skills. Conversely, they may pose problems if technology is not used appropriately or effectively (Sri Marmoah & Suharno, 2024).

The application of cognitive development theories helps explain the relevance of technology-based learning for young children. According to Piaget, children aged 2–7 are in the preoperational stage, while those aged 7–11 are in the concrete operational stage. During the preoperational stage, children learn through symbolic representations; thus, learning applications that incorporate images, sounds, and digital animations can help them grasp simple concepts such as numbers, colors, and shapes. As children enter the concrete operational stage, the use of technology through simulations or digital games can train logical thinking skills by illustrating rules and consequences directly. Therefore, digital media can effectively support the transition from concrete learning experiences to more abstract logical understanding (Ismawati & Puspita, 2024).

Meanwhile, Vygotsky's theory through the concept of the Zone of Proximal Development (ZPD), emphasizes the importance of social support in learning. ZPD describes the gap between what children can achieve independently and what they can accomplish with the guidance of adults or peers. In the digital context, learning applications that provide step-by-step guidance and interactive feedback can function as scaffolding tools to support children's development. However, the role of teachers and parents remains crucial to ensure that children are not merely passive users but are able to develop new skills through guidance and collaboration (Djollong et al., 2023).

Despite offering numerous benefits, technology-based learning also faces several challenges. One of the main issues is screen addiction. Research by (Kabali, 2015) revealed that more than 75% of four-year-old children in the United States have independent access to mobile devices, making them vulnerable to excessive use that negatively affects physical health and socio-emotional well-being. Additionally, the digital access gap remains a major concern in Indonesia. Moreover, low levels of teachers' digital literacy also hinder the effective implementation of ICT-based learning. (Winarti et al., 2022) emphasized that the lack of training and technical guidance prevents many early childhood educators from fully integrating technology into the curriculum.

On the other hand, various studies have identified good practices that can serve as examples in integrating ICT into early childhood education. The use of game-based educational applications has been proven to increase children's learning motivation (Herodotou, 2018). Furthermore, the implementation of blended learning—combining conventional methods with digital media—can promote children's active participation while strengthening social skills (Plowman & McPake, 2013). The integration of collaborative technologies such as interactive digital whiteboards also provides opportunities for children to learn teamwork in small groups. Additionally, parental involvement through digital communication platforms enables parents to monitor their children's progress directly and support learning activities at home.

Based on the discussion above, it can be concluded that technology-based learning in the digital era holds great potential for supporting the cognitive, socio-emotional, and digital literacy development of young children. However, this potential also comes with challenges such as screen addiction, digital access inequality, and limited teacher competence. Therefore, the most effective strategy is to integrate ICT in a balanced manner with adult supervision, continuous professional training for teachers, and collaboration among governments, educational institutions, and parents to create digital learning environments that are safe, healthy, and meaningful for early childhood development.

The Urgency and Strategies of Digital Literacy in Early Childhood

Digital literacy serves as a key agent of empowerment within educational institutions. This form of literacy encompasses competencies in locating, processing, producing, and communicating information and is defined as the awareness, attitude, and ability of individuals to use digital devices effectively (Alt & Raichel, 2020). Digital literacy in early childhood represents an urgent need to prepare a generation that can adapt to the demands of the digital era. In the context of early childhood, this literacy can be translated into basic abilities such as recognizing appropriate information, using educational applications ethically, and understanding simple rules related to digital safety.

Digital literacy is no longer merely a technical skill but has become a fundamental necessity for young children growing up in a digital age. UNICEF's report *Childhood in a Digital World* (2025) emphasizes that the internet has become an essential resource for children, enabling them to learn, play, and stay connected. However, insufficient digital

access can hinder the development of digital skills and widen inequalities, particularly in areas with limited connectivity (UNICEF, 2025).

Practically, digital literacy should include basic competencies such as recognizing valid information, understanding consequences, and using educational applications appropriately according to children's developmental stages. Training programs that emphasize access, evaluation, and the critical use of information—aligned with UNESCO's digital literacy framework—can effectively establish this foundation.

Digital literacy in early childhood not only focuses on technical skills but also supports children's motor, socio-emotional, and cognitive development. Through digital games that include simple physical activities, children can enhance motor coordination. Collaborative educational applications foster socio-emotional skills such as sharing, cooperation, and empathy. Meanwhile, cognitive abilities are strengthened through interactive stimuli that help children recognize letters, numbers, colors, and basic problem-solving patterns (UNESCO, 2019).

The importance of digital literacy is further reinforced by UNESCO's digital literacy framework, which emphasizes access to, evaluation of, and the critical use of digital information. Building digital literacy from an early age enables children to grow into individuals who can face the challenges and opportunities of the digital world with confidence.

In terms of implementation strategies, several effective steps can be adopted: 1) Curriculum integration, incorporating simple digital content that aligns with children's developmental stages into the ECE curriculum. 2) Teacher training, equipping teachers with the skills to facilitate digital learning and guide safe technology use. 3) Parental collaboration, engaging parents through digital communication platforms or student portfolio applications, allowing them to monitor and support learning at home. 4) Development of healthy technology guidelines, including content verification, appropriate screen time management, and ethical ICT use.

Therefore, digital literacy in early childhood is not merely a normative expectation but a practical strategy that equips children with knowledge and confidence to navigate the future. Implementing strategies suited to children's developmental contexts will yield long-term benefits in shaping a digitally competent and character-driven generation.

The findings indicate that developing effective ICT strategies grounded in digital literacy not only supports early childhood learning but also contributes to long-term

outcomes in shaping a generation prepared for the future. Digital literacy fosters cognitive, social, and emotional development while equipping children to face the challenges of the digital age (Miyazaki et al., 2024). A digital literacy-based strategy that is designed according to developmental stages and supported by social guidance will provide sustainable benefits in building an adaptive and competent generation.

Closing

This study found that the integration of Information and Communication Technology (ICT) in early childhood education (ECE) has a significant impact on enhancing children's learning interest and foundational skills, such as letter and number recognition, as well as problem-solving abilities through interactive applications. Moreover, digital learning has been shown to strengthen socio-emotional skills, particularly when children engage with digital media collaboratively under the guidance of teachers or parents. However, the study also highlights several challenges, including limited infrastructure in ECE institutions, gaps in teachers' digital competence, and weak regulations concerning children's digital safety.

The implications of these findings emphasize the need for intensive training programs for teachers to integrate technology appropriately according to children's developmental stages, as well as the development of curricula that include digital literacy modules for early childhood. Additionally, technical guidelines for healthy ICT use should be established to minimize risks such as screen addiction or exposure to age-inappropriate content. For policymakers, these findings provide a foundation for designing early digital literacy initiatives starting from ECE levels, while for parents, the results underscore the importance of active involvement in guiding children's interactions with technology to ensure safe, balanced, and meaningful digital experiences.

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