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Digital Storytelling as a Tool to Promote Eco-Literacy in Early Childhood Education

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ABSTRACT

This research explores the use of digital storytelling as an innovative pedagogical tool to cultivate eco-literacy among early childhood learners in Riau, Indonesia. The study was motivated by the urgent need to introduce environmental awareness from an early age, particularly in regions experiencing recurring ecological challenges such as forest fires and pollution. The primary objective was to examine how digital storytelling could be integrated into early childhood education to foster environmental knowledge, attitudes, and behaviors. A qualitative case study design was employed, involving preschool teachers, children aged 5–6, and parents from selected early childhood institutions. Data were collected through participant observation, in-depth interviews, and document analysis, and analyzed thematically using an inductive approach. The findings revealed four major themes: teachers' creative utilization of digital storytelling to contextualize ecological issues, children's strong emotional engagement and behavioral change, the challenges of limited technological resources and teacher training, and the potential of community involvement in reinforcing eco-literacy practices. The results highlight that digital storytelling is not only effective in enhancing children's environmental awareness but also in extending eco-literacy beyond classrooms into families and communities. This research contributes theoretically by bridging digital pedagogy and environmental education, and practically by offering insights for educators and policymakers. Future studies are recommended to adopt longitudinal and cross-cultural approaches to assess long-term impacts.

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Introduction

Early childhood education (ECE) plays a fundamental role in shaping children's character, skills, and social awareness from an early age. One crucial dimension of child development is eco-literacy, defined as the ability to understand the interrelationship between humans and the environment while fostering ecological awareness in everyday life (Orr, 1992; Cutter-Mackenzie & Edwards, 2013). In light of global environmental challenges such as climate change, pollution, and deforestation, this issue has become increasingly urgent, particularly in regions such as Riau, Indonesia, which frequently experiences forest fires and haze. Therefore, this research is grounded in the belief that early childhood education serves not only as an academic foundation but also as a strategic avenue for instilling values of sustainability.

Although international scholarship has emphasized the importance of environmental education across different educational levels, research specifically examining technology-based strategies to foster eco-literacy in early childhood education remains limited, especially in Southeast Asia and Indonesia. Most existing studies have focused on outdoor learning activities or traditional storytelling methods (Cutter-Mackenzie & Edwards, 2013; Davis, 2015). Educational technology, particularly digital storytelling, offers a new pedagogical avenue by integrating narrative, visuals, and audio to create immersive and engaging learning experiences (Robin, 2008; Hung, Hwang, & Wang, 2022). Thus, this research addresses a critical gap in exploring the effectiveness of digital media as a tool for enhancing eco-literacy in Indonesian early childhood education.

Previous studies have demonstrated that digital storytelling can increase learning motivation, cognitive engagement, and social awareness among learners (Sadik, 2008; Hung et al., 2022). However, most of these studies have been applied in primary or secondary school contexts rather than early childhood education. In Riau, where ecological issues are deeply embedded in daily life, the context presents a unique opportunity to investigate how digital storytelling can serve not only as a pedagogical approach but also as a medium to cultivate environmental empathy among young children. Accordingly, this research fills an important gap in the literature and provides empirical contributions to the discourse on eco-literacy through digital media in early childhood contexts.

The significance of this research question is reinforced by the urgent need for innovative pedagogical approaches that are not only enjoyable for children but also effective in cultivating environmental responsibility at an early age. Prior studies confirm that young children are capable of internalizing ecological values through narrative and imaginative experiences (Cutter-Mackenzie, 2014; Ärlemalm-Hagsér & Elliott, 2017). Nonetheless, this research advances the field by integrating narrative-based pedagogy with digital technology, a medium highly relevant to the Alpha generation, while

simultaneously contextualizing the issue within the ecological realities of Riau. In doing so, the study offers both academic and practical contributions to sustainable education in Indonesia.

This research proceeds by examining the implementation of digital storytelling in Riau's early childhood education institutions through a qualitative case study approach. The expected outcomes are twofold: first, to provide theoretical contributions by broadening the discourse on eco-literacy in early childhood education; and second, to deliver practical recommendations for teachers, parents, and policymakers. In this way, the research not only addresses a gap in international literature but also provides context-specific insights into the challenges of environmental education in Indonesia and the ASEAN region.

Materials and Methods

This research employed a qualitative approach with a case study design to explore the practice of digital storytelling in fostering eco-literacy among early childhood learners in Riau. The qualitative approach was selected because the study aimed to understand subjective experiences, social interactions, and meanings constructed by teachers, children, and parents during the implementation of digital storytelling (Creswell & Poth, 2018). A case study design was deemed appropriate as it allows researchers to investigate the phenomenon within its natural context, thereby providing a holistic understanding of classroom dynamics and local realities in early childhood education institutions (Yin, 2018).

Data were collected through three primary techniques: participant observation, in-depth interviews, and document analysis. Observations were conducted to capture children's engagement during learning activities using digital storytelling, focusing on how they responded to environmentally themed narratives. In-depth interviews were carried out with teachers and parents to obtain their perspectives on the role of digital storytelling in cultivating environmental awareness. Document analysis included teaching materials, lesson recordings, and teachers' reflective notes to ensure data reliability. Participants consisted of preschool teachers, children aged 5–6 years, and parents directly involved in the educational process. They were recruited purposively, ensuring that they had relevant experiences with environmental education practices in early childhood settings.

Data analysis followed a thematic approach based on the framework of Miles, Huberman, and Saldaña (2014), comprising data reduction, data display, and conclusion drawing/verification. Data credibility was ensured through triangulation of sources and methods. Ethical considerations were carefully addressed by obtaining informed consent from parents and institutions, as well as maintaining confidentiality by anonymizing participants' identities. The chosen methodology is expected to provide an in-depth understanding of how digital storytelling serves as an effective pedagogical tool for

promoting eco-literacy in early childhood education, while offering practical insights for educators and policymakers in Indonesia.

Result

Based on fieldwork, this research identified four major findings that illustrate the dynamics of implementing digital storytelling to foster eco-literacy among early childhood learners in Riau. These findings highlight not only teachers' pedagogical practices but also children's responses, the challenges and opportunities encountered, and the role of community collaboration in reinforcing environmental education from an early age. Each finding is presented systematically in the following sub-themes.

Teachers' Utilization of Digital Storytelling

Teachers in the participating early childhood institutions integrated digital storytelling as a central pedagogical tool to convey ecological concepts in ways that were accessible to young children. Animated stories, illustrated slides, and audio-visual narratives were the primary media employed, and these often addressed local environmental concerns such as forest fires, haze, and waste management. By situating lessons within digital narratives, teachers transformed abstract ecological issues into concrete and child-friendly messages, thereby bridging the gap between global environmental problems and children's everyday experiences.

The role of the teacher extended beyond delivering digital content; teachers actively facilitated interaction during storytelling sessions. They paused the stories at key moments to elicit children's reflections, posed guiding questions to stimulate critical thinking, and encouraged learners to connect narrative events with their personal lives. For instance, during a story about polluted rivers, a teacher asked, "How would you feel if the water in your home was too dirty to drink?" Such interventions shifted children from passive recipients of information to active participants in meaning-making, ensuring deeper engagement with ecological themes.

Moreover, teachers contextualized the digital narratives within cultural and religious frameworks, particularly by embedding Islamic principles of environmental stewardship (khalifah fil ardh). This integration underscored their creativity in aligning global sustainability discourses with local pedagogical practices. As a result, digital storytelling was not simply a technological innovation; it evolved into a culturally responsive method that resonated with community values while promoting eco-literacy in early childhood education.

Children's Responses and Engagement

Children's responses to digital storytelling revealed a high degree of enthusiasm and emotional involvement. Observational data indicated that children frequently expressed surprise, empathy, or excitement through gestures, facial expressions, and spontaneous verbal comments during the sessions. For example, when presented with a digital narrative about animals losing their forest habitat, children audibly gasped and later re-enacted the scenes during free play. Such reactions demonstrated that digital storytelling effectively triggered both cognitive and affective engagement.

Beyond immediate emotional responses, behavioral indicators also suggested the internalization of eco-literacy principles. Teachers observed that children reminded their peers not to litter, turned off water taps more consciously, and occasionally initiated discussions about protecting the environment. Parents corroborated these observations, reporting that children began sharing eco-friendly messages at home, such as urging family members to separate waste or conserve water. These small yet meaningful behaviors showed that storytelling extended beyond classroom activities into everyday practices.

Another significant observation was children's ability to retell and reconstruct stories they had encountered digitally. Several children narrated stories in their own words or dramatized them through role play, demonstrating comprehension and creative reinterpretation. This retelling process reinforced memory retention and allowed children to communicate environmental lessons to peers and family members. Thus, digital storytelling not only enhanced eco-literacy in the classroom but also facilitated the diffusion of environmental values across social contexts.

Challenges and Opportunities

Despite its promising potential, the implementation of digital storytelling was not without obstacles. The most prominent challenge was the limited availability of technological infrastructure, especially in rural institutions where projectors, tablets, and stable internet connections were scarce. Teachers often depended on personal devices or improvised equipment, which restricted both the frequency and quality of storytelling sessions. This highlighted persistent inequalities in access to educational technology, a challenge common across developing contexts.

Teachers also reported difficulties in creating or adapting digital content that was culturally relevant and age-appropriate. Many relied on generic online resources that did not always reflect local ecological issues or children's cultural backgrounds. This lack of contextual alignment risked diminishing the pedagogical effectiveness of storytelling. Educators expressed the need for professional development and institutional support to equip them with the skills required to design original, culturally sensitive digital narratives.

Nevertheless, these challenges were accompanied by notable opportunities. Teachers and parents demonstrated strong enthusiasm for eco-literacy initiatives, indicating community readiness to support innovative pedagogical practices. Local stakeholders—including non-governmental organizations, cultural leaders, and religious institutions—showed interest in collaborating to produce localized digital content that could address Riau's specific environmental challenges. Such collective efforts positioned digital storytelling as a promising, sustainable, and community-embedded tool for early childhood education.

Strengthening Eco-Literacy through Community Involvement

The findings further revealed that eco-literacy development was significantly reinforced when digital storytelling was complemented by practical, community-oriented activities. Several schools organized initiatives such as "green days" and "eco-projects," where children practiced recycling, tree planting, or cleaning school gardens after engaging with digital stories. These activities bridged narrative imagination with real-life practices, allowing children to experience ecological responsibility firsthand.

Parental involvement emerged as a critical factor in extending eco-literacy beyond the classroom. Parents reported that children frequently reminded them to reduce plastic use, save water, or adopt other environmentally friendly habits at home. One parent recounted: "After watching a story about the importance of trees, my daughter insisted on planting a tree in our yard and reminded us daily to water it." Such examples demonstrated the transfer of eco-literacy from the educational setting into the household, thereby amplifying the reach of digital storytelling.

At the community level, collaboration with local leaders and organizations further magnified the impact of eco-literacy initiatives. Digital stories were occasionally presented at public gatherings, followed by collective actions such as clean-up campaigns or tree-planting events. These experiences strengthened social capital by embedding environmental values within community practices. Consequently, digital storytelling was most effective when situated within a broader network of school–family–community collaboration, reinforcing eco-literacy as both an educational and societal endeavor.

Discussion

The findings of this research underscore the potential of digital storytelling as an effective pedagogical approach to cultivating eco-literacy in early childhood education. Teachers' strategic use of digital narratives not only captured children's attention but also contextualized abstract ecological concepts in ways that resonated with their lived realities. This aligns with previous studies that emphasized the pedagogical strength of narrative learning in fostering cognitive and affective engagement (Sadik, 2008; Robin, 2008). However, unlike prior research that often centered on primary or secondary

education, this study highlights the unique adaptability of digital storytelling for early childhood learners in the Indonesian context, particularly in regions such as Riau where environmental crises are an everyday concern.

Children's enthusiastic responses and their translation of eco-literacy into daily behavior highlight the transformative potential of narrative-based pedagogies. The ability of children to retell, dramatize, and apply lessons from digital stories corroborates findings by Cutter-Mackenzie (2014), who argued that environmental narratives in early childhood education can shape both imagination and praxis. Yet, this research extends those insights by demonstrating how digital storytelling provides a technologically mediated pathway that not only reinforces memory retention but also encourages pro-environmental behavior at home. This shows that eco-literacy is not confined to the classroom but is diffused across familial and social spaces, reinforcing the view of eco-literacy as a socially constructed competence (Ärlemalm-Hagsér & Elliott, 2017).

At the same time, the challenges identified—particularly limited infrastructure and insufficient teacher training—illustrate the structural barriers to integrating educational technology in early childhood contexts. These challenges echo broader concerns about digital divides in Southeast Asian education systems (Hung, Hwang, & Wang, 2022). Nevertheless, the opportunities emerging from strong parental and community engagement suggest that eco-literacy initiatives can thrive through collaborative partnerships. By leveraging local knowledge and community-based content development, digital storytelling can evolve into a culturally responsive practice that strengthens both environmental awareness and social capital. This demonstrates how digital pedagogy can be localized, reflecting Orr's (1992) argument that ecological education must be grounded in community realities.

This study contributes to the literature by bridging the gap between environmental education and digital pedagogy in early childhood settings. It shows that while existing research has confirmed the pedagogical benefits of storytelling (Cutter-Mackenzie & Edwards, 2013; Sadik, 2008), few studies have examined its application within digital frameworks tailored to eco-literacy in developing contexts. By focusing on Riau, this research situates eco-literacy education within a region facing acute ecological challenges, thereby adding a localized perspective to international debates. The findings also provide practical implications for educators and policymakers, particularly the need for teacher training in digital content creation and the integration of eco-literacy modules into early childhood curricula.

Despite its contributions, this study acknowledges several limitations. The case study design and the small number of participating institutions restrict the generalizability of the findings. The research was also limited to short-term observations, leaving long-term impacts of digital storytelling on children's eco-literacy unexplored. Future research

should consider longitudinal designs to assess sustained behavioral changes, comparative studies across different cultural and geographical contexts in ASEAN, and the integration of emerging technologies such as gamification or virtual reality to further enhance eco-literacy outcomes. By addressing these areas, future scholarship can deepen understanding of how digital pedagogy intersects with environmental education to build more sustainable societies.

Conclusion

This research concludes that digital storytelling is an effective and contextually relevant pedagogical approach for fostering eco-literacy among early childhood learners in Riau. By embedding environmental issues into interactive narratives, teachers were able to translate abstract ecological concepts into child-friendly lessons that resonated with both local realities and cultural values. Children's strong emotional engagement, their ability to retell and apply lessons, and the observed behavioral changes at school and home demonstrate the transformative power of digital storytelling in shaping early environmental awareness. At the same time, the challenges of limited infrastructure and insufficient teacher training underscore the need for systemic support and capacity building to fully realize the potential of this approach. The contribution of this study lies in bridging environmental education, early childhood pedagogy, and digital innovation, offering both theoretical enrichment and practical guidance for educators and policymakers. Future research is encouraged to adopt longitudinal and cross-cultural designs to assess the long-term impact and scalability of digital storytelling in cultivating eco-literacy across diverse contexts.

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