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Fostering Environmental Awareness through Nature-Based Learning in Indonesian Early Childhood Education: Implications for Sustainable Development Goals

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ABSTRACT
Despite the growing body of international research highlighting the benefits of nature-based learning for early childhood development, empirical evidence from developing countries, particularly Indonesia, remains limited. Most existing studies focus on cognitive or motor outcomes, leaving a gap in understanding how nature-based learning contributes to environmental awareness as part of Sustainable Development Goals (SDGs), especially SDG 4 (Quality Education) and SDG 13 (Climate Action). This study aims to examine the role of nature-based learning in fostering environmental awareness among early childhood learners in Indonesia. Employing a qualitative descriptive approach, data were collected through classroom observations, in-depth interviews with teachers, and documentation of learning activities in early childhood education settings. The findings reveal that nature-based learning significantly enhances children's engagement, ecological empathy, and responsible environmental behaviors through direct interaction with natural elements. Children demonstrated increased awareness by caring for plants, maintaining cleanliness, and reminding peers to protect the environment. This study contributes theoretically by reinforcing constructivist learning perspectives and empirically by providing context-specific evidence from Indonesia. Practically, the findings offer guidance for educators and policymakers to integrate nature-based learning as an effective strategy to support sustainable education and environmental stewardship from early childhood.

ABSTRAK
Meskipun semakin banyak penelitian internasional yang menyoroti manfaat pembelajaran berbasis alam untuk perkembangan anak usia dini, bukti empiris dari negara berkembang, khususnya Indonesia, masih terbatas. Sebagian besar studi yang ada berfokus pada hasil kognitif atau motorik, sehingga menyisakan kesenjangan dalam memahami bagaimana pembelajaran berbasis alam berkontribusi pada kesadaran lingkungan sebagai bagian dari Tujuan Pembangunan Berkelanjutan (SDGs), terutama SDG 4 (Pendidikan Berkualitas) dan SDG 13 (Aksi Iklim). Studi ini bertujuan untuk meneliti peran pembelajaran berbasis alam dalam menumbuhkan kesadaran lingkungan di kalangan anak usia dini di Indonesia. Dengan menggunakan pendekatan deskriptif kualitatif, data dikumpulkan melalui observasi kelas, wawancara mendalam dengan guru, dan dokumentasi kegiatan pembelajaran di lingkungan pendidikan anak usia dini. Temuan menunjukkan bahwa pembelajaran berbasis alam secara signifikan meningkatkan keterlibatan anak, empati ekologis, dan perilaku lingkungan yang bertanggung jawab melalui interaksi langsung dengan unsur-unsur alam. Anak-anak menunjukkan peningkatan kesadaran dengan merawat tanaman, menjaga kebersihan, dan mengingatkan teman sebaya untuk melindungi lingkungan. Studi ini berkontribusi secara teoritis dengan memperkuat perspektif pembelajaran konstruktivis dan secara empiris dengan memberikan bukti spesifik konteks dari Indonesia. Secara praktis, temuan ini memberikan panduan bagi pendidik dan pembuat kebijakan untuk mengintegrasikan pembelajaran berbasis alam sebagai strategi efektif untuk mendukung pendidikan berkelanjutan dan pelestarian lingkungan sejak usia dini.

INTRODUCTION

Global environmental degradation, manifested through climate change, deforestation, pollution, and waste accumulation, has positioned environmental education as a critical global priority (Hayik, 2021; Sun, et al., 2025; Frigerio, et al., 2023). Education is increasingly recognized as a key instrument in promoting sustainable development, particularly through early interventions that shape attitudes and behaviors from a young age (Khoirurrijal, et al., 2025; Muñoz-Losa, et al., 2025). Early childhood education (ECE) represents a strategic phase for embedding environmental awareness (Ekwesaranna, et al., 2025; Aravani & Daskolia, 2025; Mu'min, et al., 2025), aligned with the Sustainable Development Goals (SDGs), notably SDG 4 (Quality Education) and SDG 13 (Climate Action).

Children in early childhood experience a sensitive developmental period in which learning occurs primarily through direct, concrete experiences and active engagement with their surroundings (Matsumoto & Tsuneda, 2019; Chu & Joseph, 2024). However, contemporary lifestyles marked by urbanization and excessive indoor activities have reduced children's interaction with nature, limiting opportunities to develop ecological sensitivity (Gaywood, et al., 2025; Fyssa, et al., 2023). This condition has raised concerns regarding children's disconnection from the natural environment.

International studies have demonstrated that nature-based and outdoor learning positively influence children's cognitive, social-emotional, and ecological development (Song, et al., 2014; Davidson & Fouts, 2024; Thieme, et al., 2025). Such approaches strengthen children's emotional connection with nature (biophilia) and encourage pro-environmental behavior. Nevertheless, much of this research is concentrated in Western contexts, while empirical studies from Southeast Asia, particularly Indonesia, remain scarce.

In Indonesia, early childhood education practices tend to emphasize classroom-based academic activities, often marginalizing experiential and outdoor learning. This pedagogical orientation creates a gap between educational ideals promoting sustainability and the realities of early childhood instruction.

Grounded in constructivist learning theories proposed by Piaget and Vygotsky, nature-based learning emphasizes knowledge construction through direct experience and social interaction (Jung, et al., 2025). Additionally, Louv's concept of *nature-deficit disorder* underscores the developmental risks associated with limited exposure to natural environments (Yildirim, et al., 2025). Despite its theoretical and practical relevance, systematic research examining how nature-based learning fosters environmental awareness among Indonesian early childhood learners is still limited. This study addresses this gap by exploring the role of nature-based learning in cultivating environmental awareness in early childhood education within the Indonesian context.

METHOD

This study employed a qualitative descriptive research design to explore the implementation of nature-based learning and its influence on environmental awareness among early childhood learners. A qualitative approach was chosen to capture rich, contextual insights into children's behaviors, learning processes, and interactions with their natural environment.

Data were collected through three main techniques: (1) non-participant classroom observations of nature-based learning activities, (2) semi-structured interviews with early childhood teachers, and (3) documentation analysis, including lesson plans and photographic records of learning activities (Creswell & Creswell, 2018). These methods enabled data triangulation to enhance the credibility of the findings.

The research setting consisted of early childhood education institutions that implemented outdoor and nature-based learning activities, such as gardening, plant observation, and environmental cleanliness practices. Data analysis followed thematic analysis procedures, involving data reduction, coding, categorization, and interpretation to identify recurring

patterns related to environmental awareness development. Ethical considerations were addressed by obtaining consent from teachers and ensuring anonymity of participants.

FINDINGS AND DISCUSSION

Finding

Table 1. Observed Outcomes of Nature-Based Learning on Children's Environmental Awareness

Dimension of Development	Nature-Based Learning Activities	Observed Behavioral Indicators
Environmental Awareness	Planting and caring for plants	Children voluntarily watered plants and avoided damaging vegetation
Ecological Empathy	Observing insects and animals	Children showed concern and curiosity toward living organisms
Responsibility	Waste sorting and cleaning areas	Children reminded peers not to litter and disposed of waste properly
Active Engagement	Outdoor exploration activities	Increased participation, enthusiasm, and focus during learning
Social Interaction	Group-based outdoor tasks	Improved cooperation and peer communication

Table 1 summarizes the observed outcomes of nature-based learning activities on early childhood environmental awareness. The findings indicate that direct engagement with natural elements fosters not only cognitive understanding but also observable pro-environmental behaviors. Children demonstrated increased responsibility by independently caring for plants and maintaining cleanliness without direct instruction. Activities involving observation of living organisms enhanced ecological empathy, while group-based outdoor tasks strengthened social interaction and cooperation. Overall, the table illustrates that nature-based learning contributes holistically to environmental awareness by integrating behavioral, emotional, and social dimensions, reinforcing its relevance for early childhood education aligned with sustainable development goals.

The Effectiveness of Nature-Based Learning in Increasing Children's Active Involvement

Research results show that nature-based learning significantly engages children's attention. This is evidenced by the high level of participation of children in activities such as observing plants, planting, watering, and cleaning the school environment (Lee & Ensel Bailie, 2019; Aisyah & Novita, 2025). Compared to classroom learning, outdoor activities create a more interactive, varied, and engaging learning environment.

Early childhood is in Piaget's preoperational stage, where they understand concepts through concrete actions and direct experience. When children touch soil, observe the shape of a leaf, or find an insect, they are building new cognitive schemas through the processes of assimilation and accommodation (Jordan, et al., 2023; King, et al., 2024). Therefore, nature-based learning not only provides an understanding of simple concepts about nature but also enhances exploration, observation, language skills, and even socio-emotional development.

Furthermore, this study shows that nature-based activities stimulate children's gross and fine motor skills. Digging in the soil, filling pots, watering plants, and picking up trash are physical activities that support children's coordination development. Thus, the effectiveness of nature-based learning goes beyond cognitive development; it also strengthens motor, social, and emotional skills in a balanced way.

Nature-Based Learning Builds Environmental Awareness in Children

One of the most significant findings was a change in children's behavior toward the environment after consistent implementation of nature-based learning activities (Küpeli & Bayındır, 2025). Children began to show empathy for living things, such as not stepping on plants, touching leaves carefully, and reminding their friends if they litter.

Planting plays a crucial role in fostering a sense of responsibility. When children are given a personal plant to care for, they feel that it is "theirs," fostering a sense of ownership and responsibility. Teachers also report that many children water their plants without being asked. This demonstrates the development of an internal awareness, not simply adhering to teacher instructions.

This finding aligns with Eraktaş, et al. (2025) research, which revealed that nature-based activities enhance a sense of place, a feeling of connection to the environment in which they find themselves. Children who have an emotional connection to nature tend to exhibit pro-environmental behaviors in their daily lives.

Furthermore, research by Buckingham (2025) shows that nature-based educational activities can increase ecological empathy in children. This is evident in the study when children demonstrate concern for the condition of plants, encourage their friends to maintain cleanliness, and explain why trash should be disposed of properly. Thus, nature-based learning not only builds environmental knowledge but also fosters a tangible and measurable sense of environmental stewardship.

Relevance to Piaget and Vygotsky's Constructivism Theory in Natural Learning

The findings of this study also support Piaget and Vygotsky's constructivist theories. According to Piaget, early childhood constructs knowledge through concrete experiences. All nature-based learning activities in this study involved direct experience, which enriched children's cognitive schemas.

Meanwhile, Vygotsky emphasized the importance of social interaction in learning. In this study, the interaction between teacher and child when planting plants or cleaning the environment reflects the process of scaffolding, which is the teacher providing temporary assistance to help children achieve new skills. Children learn not only from their own activities but also from the examples of teachers and peers (Ugwuozor, 2020). This social interaction reinforces a more meaningful understanding of environmental concepts.

Thus, nature-based learning in this study is in line with the principles of constructivism: children are not only recipients of information, but creators of meaning through exploration and interaction.

Nature Learning and the Reduction of Nature-Deficit Disorder

Wünsche, et al. (2025) theory of nature-deficit disorder explains that modern children are increasingly disconnected from the natural environment due to technological developments, urbanization, and a more indoor lifestyle. This condition makes children more prone to stress, boredom, emotional outbursts, and reduced sensitivity to their surroundings.

The results of this study indicate that nature-based learning can mitigate these impacts. Children appear calmer, happier, and more enthusiastic when engaging in outdoor activities. Many teachers report that children become more focused after outdoor activities before returning to class. This reinforces Louv's view that children's connection to nature is a developmental need that must be met.

Challenges of Implementing Nature-Based Learning in Early Childhood Education

Despite its positive impact, implementing nature-based learning presents several challenges. Unpredictable weather is a major obstacle, as some activities must be conducted outdoors. Furthermore, young children are easily distracted when exposed to the many stimuli in nature, requiring teachers to provide clear direction and close supervision (Herman, et al., 2025).

Limited resources, such as limited green space, a lack of planting equipment, and a lack of dedicated time for nature-based activities, also pose challenges. However, these obstacles can be overcome through creativity, such as utilizing pots, used bottles, small wooden boxes, or creating a mini garden in a corner of the classroom.

Discussion

The findings confirm that nature-based learning effectively enhances environmental awareness among early childhood learners, supporting previous international studies (Kiviranta, et al., 2024; Geletu, 2025). Consistent with constructivist theory, children constructed environmental knowledge through direct interaction with natural elements.

This study extends prior research by demonstrating that environmental awareness is not merely cognitive but behavioral and affective, as evidenced by children's spontaneous actions in caring for plants and maintaining cleanliness. Such findings resonate with Vygotsky's notion of socially mediated learning through scaffolding (Zhang, et al., 2024).

Importantly, this research contributes context-specific evidence from Indonesia, addressing a gap in the predominantly Western literature. The results also reinforce Zhai et al. (2025) argument that regular exposure to nature mitigates the negative effects of nature-deficit disorder.

From a sustainability perspective, the study highlights the relevance of nature-based learning as an early intervention strategy to support SDG-oriented education. Unlike previous studies focusing on short-term developmental outcomes, this research emphasizes long-term character formation and environmental stewardship.

CONCLUSION

This study concludes that nature-based learning is an effective pedagogical approach for fostering environmental awareness in early childhood education in Indonesia. Through direct interaction with nature, children develop ecological empathy, responsibility, and pro-environmental behaviors that extend beyond cognitive understanding. Despite its contributions, this study is limited by its qualitative scope and contextual focus. Future research is encouraged to employ mixed-methods or longitudinal designs to measure long-term behavioral impacts across diverse educational settings. Practically, this study recommends that policymakers and educators integrate nature-based learning into early childhood curricula as a strategic pathway to achieving Sustainable Development Goals, particularly SDG 4 and SDG 13.

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