
Eco-Literacy in ECE: A Case Study of Climate Change Awareness in Indonesia

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Abstract

Objective: This study analyzes the implementation of ecoliteracy-based climate change education in Early Childhood Education (PAUD) as a strategy to build environmental awareness and environmentally friendly behavior from an early age. **Novelty:** This study explores an approach that has not been widely explored that integrates the concept of sustainability into early childhood learning. **Method:** The study was conducted using a case study method in qualitative research. Data were collected through observation, teacher interviews, and document analysis. The ecoliteracy-based program involved activities such as gardening, recycling, and ecological storytelling. **Results:** The findings revealed that the majority of participants (85%) experienced developments in understanding the interconnectedness of ecosystems and awareness of nature protection. Through observation, positive behavioral changes were identified in children, such as increased discipline in sorting waste and active involvement in caring for plants. These changes indicate that the ecoliteracy approach has the potential to foster environmental awareness from an early age. **Conclusion:** This study offers new insights by positioning ecoliteracy as an alternative pedagogy for climate change education in PAUD. The findings show strong potential for integrating climate literacy into the PAUD curriculum and provide policy recommendations to support sustainable development through early childhood education.

Keywords: Climate Change Education, Eco-Literacy, ECE, Sustainability, Environmental Awareness.

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INTRODUCTION

Climate change has been one of the most pressing global challenges of the modern era (Hallinger, 2020). The impacts of climate change, such as the rising global temperature, extreme weather, and damaged ecosystems, threaten the sustainability of living on earth. In Indonesia, the impact of climate change can be seen from the increasing risk of natural disasters, floods, droughts, and rising sea levels sea level, all of which potentially lower the quality of community life (Anggraeni & Zaman, 2019; Suhadi et al., 2023). One example is the tornado that hit Jatinangor, Sumedang, in February 2024. In addition, high rainfall in Padang Pariaman, West Sumatra, in March 2024 caused land landslides and tidal floods that hit the area of Tanjung Emas Port industry in Semarang in 2022 due to the broken embankment.

A changing environment is also seen in the thinning of the ice sheet in Papua, which is melting at a speed of up to 2.5 meters per year. Season drought impacts agriculture terribly, causing part of the harvest in Banda Aceh to fail in April 2023. The crisis of the availability of clean water is more serious, as seen in the case of water shortage in 30 villages in Probolinggo in November 2023.

In addition to water disasters and crises, extreme conditions such as increased rainfall and rains increase the risk of flooding and landslides in various regions. This situation needs awareness and collective effort from various parties, including education, to deal with it (Anggraeni, 2024a; Ariska et al., 2022). As a country vulnerable to a climate crisis, Indonesian society must protect itself from various impacts that threaten prosperity and continuity of life. Besides that, Indonesia is also one of the domestic gas producers of glass (GHG) in terms of amount. Hence, an effort must be made to reduce GHG emissions, at least through daily activity at the levels of individuals, families, communities, and nations. Response to the climate crisis is often called climate action, which includes adaptation action and climate change mitigation.

Education plays a significant role in facing a climate crisis. Through system-integrated education, society can be equipped with the knowledge and skills to apply climate action effectively. Early environmental education, for example, at the early childhood education (PAUD or ECE) level, can instill awareness and environmentally friendly behavior in children so that they grow into individuals who care and are responsible for the environment. At the level of education, elementary and secondary, the curriculum can expand. It covers topics related to climate change, energy, renewable energy, and sustainability, which helps students understand complex climate issues and the importance of mitigation and adaptation.

ECE becomes a crucial phase for forming values and behaviors that will influence how individuals look and interact with the environment in the future (Anggraeni, 2024a; Fitriana, 2022). At this age, kids are very responsive and open cognitively to character formation (Anggraeni, 2023; Liu, 2022). Thus, integrating climate change education through learning in ECE can start to build the next generation's care for the environment. Through a customized learning process with the development age, children can learn concepts based on climate change and its importance in guarding sustainability naturally (Bizikova, 2020).

In facing the issue of climate education, according to Bizikova (2020) and Anggraeni (2024c), there are three important roles. First, education empowers individuals with increased awareness and ability to make an effort to mitigate climate change. This includes preventing the climate crisis from getting worse. Second, education helps build resilience and the capability to adapt to the impact of the climate so that the public can adapt and survive in a

changing environment. Third, education pushes sustainable learning that allows the public to keep going and access the latest and most accurate information and facts about the climate. With constantly updated knowledge, society can respond to a climate crisis more precisely and effectively.

However, implementing climate change education in ECE still faces various challenges, especially in the methods and materials appropriate for children at an early age (Anggraeni, 2024c). Young children are not ready to understand the complex climate of change design. Children at an early age are at the concrete-operational cognitive stage, where the ability to think is more about real things that can be observed and experienced directly. The concept of climate change covers abstract issues like carbon emission, global warming, and its impacts on complex global ecosystems, which are explained correctly with age.

In addition, the complexity of climate change involves understanding causal relationships that are not direct, such as how human activities affect the atmosphere or how global warming affects weather patterns and habitats for living things. This knowledge requires logical and abstract thinking skills that are not yet fully developed in early childhood.

Learning in ECE generally focuses on developing skills such as reading, writing, and arithmetic. A dense curriculum with activity literacy and numeracy leaves limited space for more complex and abstract material like climate change. The main focus on reading, writing, and arithmetic often ignored the importance of developing an awareness environment, which is also essential at this early age. This makes climate change integration education more challenging as educators must balance the goal of achieving an academic base with introducing environmentally relevant concepts.

Although several studies have highlighted the importance of eco-literacy and activities based on the environment in children's early education, a significant gap exists in implementing climate change education in ECE. Previous studies, such as those conducted by Syarifuddin et al. (2019) and Rahman and Nurdin (2020), have focused more on aspects of environmental literacy in general, such as understanding sustainability, waste management, and nature conservation, but have not deeply discussed how climate change education can specifically be integrated into learning in ECE.

Most of the studies focus on implementation-related activities related to environmental issues without touching the core concepts of climate change, such as global warming, the impact of climate change on the ecosystem, or the importance of mitigation and climate change adaptation. For example, Putri and Santosa (2021) and Andini (2023) focus on the introduction draft environment through activity practical. However, no discussion in a specific way about how children can prepare to face the challenge of climate change. Research emphasizes aspects of the preservation of the environment, while knowledge and awareness related to changing climate a deep global issue, not yet emphasized enough.

This research aims to find out how the implementation of climate change education in ECE learning and how climate change education can be done in an effective and relevant way for early childhood. By understanding how climate change education can be integrated into the curriculum and learning methods in ECE, it is expected that future generations will be aware of their role and responsibility in preserving the earth.

METHODS

This research uses a qualitative approach with a case study design to explore the application of eco-literacy as a basis for climate change education in early childhood education. The case study involved three teachers, learners, students, and parents at RA Al-Urwatul Wustqa Ciamis who implemented eco-literacy-based learning. The site selection was done by considering the existence of an environment-based learning program and school support to integrate sustainability values into the curriculum.

Data collection techniques included in-depth interviews with teachers, observation of teaching and learning activities, and documentation of teaching materials such as posters and works related to eco-literacy. Interviews were used to gain understanding and experience on the topic of eco-literacy. At the same time, observations were made to directly observe the learning process in the classroom, especially activities involving the cycle of nature recognition and environmental conservation (Creswell, 2007).

Data analysis used thematic analysis techniques, including data reduction, theme classification, and interpretation results. This study used triangulation of sources and methods to maintain data validity, namely comparing information from interviews, observations, and documentation to obtain accurate and consistent results (Bradt, 2013). The results of the study are expected to provide an understanding of the effective implementation of eco-literacy in building ecological awareness in preschool children.

RESULTS AND DISCUSSION

Overview of the Learning Program Based on Eco-literacy in ECE

The results showed that the climate change education program based on eco-literacy in ECE successfully increased environmental awareness in children. Teachers reported that 85% of children showed a better understanding of the importance of protecting the environment through activities such as planting trees, sorting waste, and saving energy. One of the teachers stated, "Children now understand why we have to sort waste and how the actions they do every day can help the environment" (ECE Teacher A).

Children also show improvement in their emotional connection with nature. For example, when doing gardening activities, a child said, "I like to plant flowers because I can see how they grow and help keep the air clean." This aligns with Louv's (2008) findings, which state that direct engagement with nature can improve children's relationship with the environment.

Around 78% of children showed positive behavioral changes after participating in the eco-literacy-based education program. Children are more likely to dispose of waste in its proper place and are more aware of the use of power in nature. A mother of one of the child participants said, "My child now more often reminds us to turn off the lights when leaving the room. There should be no littering." Such behavioral changes support Barrable's (2004) findings that education in the practical environment increases knowledge and encourages concrete actions to preserve the environment. In addition, this study aligns with the Behavior Change Communication theory (Fishbein & Ajzen, 2010), which emphasizes the importance of educational interventions in changing behavior through increasing knowledge and awareness.

Parental involvement proved to be an important factor in the success of this program. Children whose parents participated in activities in the home environment showed higher

awareness and caring behavior levels than those not involved. One parent said, "We often do recycling at home, and our children are very enthusiastic about helping. This makes them understand the importance of protecting the environment."

This finding aligns with Epstein's (2001) research that emphasizes the importance of parental involvement in children's education to strengthen learning at school. In addition, a study by Santosa et al. (2021) showed that support from the home environment can strengthen the influence of formal education on children's behavior.

Ecology of Literacy Integration with the Basic Curriculum

Teachers reported that integrating ecological activities with the reading, writing, and arithmetic curriculum helps children understand environmental concepts more comprehensively without disrupting the learning base. For example, when reading stories about animals adapting to weather changes, children learn to read and understand the importance of adaptation to climate change. This integrative approach supports the theory proposed by Orr (1992), which states that environmental education should be integrated into all subjects to maximize effectiveness. In addition, Harris et al. (2008) found that integrating topic environments into the academic curriculum can increase students' motivation to learn and understand concepts. Although the program has shown positive results, research has also identified some challenges that must be overcome. One of the main ones is limited resources, both in terms of teaching materials and training for educators. One teacher said, "We need more demonstration tools and training, especially to teach ecological concepts more effectively."

This challenge is in line with the findings of Tilbury (2011), who emphasizes that the success of education in the environment is highly dependent on the availability of resources and competent educators. In addition, Monr (2008) states that continuous training and professional development are key to implementing practical environmental education programs.

Integration of Climate Change Action in the Early Childhood Education (ECE) Learning Program

Integrating ecological literacy with curriculum-based learning, such as reading, writing, and arithmetic, helps children understand environmental design more comprehensively without disrupting the learning base. Teachers reported that using illustrations and interactive discussions enabled children to understand environmental design correctly according to the developmental stage of cognitive skills. This approach supports the theory proposed by Orr (1992), which states that the educational environment should be integrated into all subjects to maximize effectiveness. Harris et al. (2008) also found that integrating topic environments into the academic curriculum can increase students' motivation to learn and understand concepts.

Although the program has shown positive results, research has also identified some challenges that must be overcome to enhance effective implementation. One of the main ones is limited resources, both in terms of teaching materials and training for educators. Teachers need more demonstration tools and training, especially in teaching concepts effectively. This

is in line with the findings of Tilbury (2011) and Jorritsma, (2022), who emphasize that the success of education in the environment depends on the availability of resources and competent educators. Monroe (2008) also states that continuous training and professional development are key to implementing practical environmental education programs.

It is recommended that the government and educational institutions collaborate to provide the required resources and continuous stage training for educators. In addition, community involvement in the program can provide the materials needed and create an environment that supports learning. For example, working with local environmental organizations can provide teaching aids and recycled materials needed for learning activities. This collaborative approach aligns with the community-based education model proposed by Bronfenbrenner (1979), which emphasizes the importance of interaction between school, family, and community in supporting children's learning.

The Impact of Eco-Literacy-Based Learning Strategies on Children's Understanding of Climate Change

The results show that the eco-literacy-based learning strategy impacts children's conceptual understanding of the environment and sustainability. Preschool children who participated in this program began to recognize plants' life cycle and the environment's role in daily life. This is in line with the findings of Chawla (1998), who emphasizes the importance of the early education environment in developing environmental care attitudes in children. Through activities such as planting trees and caring for plants in the school garden, children gain theoretical and practical knowledge that strengthens their understanding of the importance of preserving the environment.

In addition to increased understanding, the study also found that the children showed behavioral changes, such as putting garbage in its place and saving energy. These changes support Barrable's (2004) findings, which show that education in practical environments increases knowledge and encourages concrete actions to preserve the environment (Geriguis, 2021). Teachers reported that children became more responsive to activities involving nature, reflecting increased emotional engagement and concern for animals and plants. This aligns with Piaget's theory of cognitive development, which emphasizes the importance of hands-on experience in teaching young children (Piaget, 1952).

Parental involvement in the program has also contributed positively to learning outcomes. Children whose parents are actively involved in activities in the home environment show higher levels of awareness and concern for the environment than those who are not involved. This is in line with Epstein's (2001) research that emphasizes the importance of parental involvement in children's education to strengthen learning at school. In addition, research by Santosa et al. (2021) shows that support from the home environment can strengthen and influence formal education on children's behavior, thus creating consistency in shaping a friendly environment.

In addition to cognitive and behavioral, this study also identified improvements in children's socio-emotional aspects, particularly empathy and responsibility. Children not only know the concept of climate change but also begin to understand the consequences of human

actions on nature. For example, children who previously did not understand the importance of keeping the environment clean are now more aware of the impact of waste on the environment. This shows that climate change education through an eco-literacy approach can positively shape attitudes and behaviors that support sustainability. This aligns with research by Harris et al. (2008), who found that integrating environmental topics into the academic curriculum can increase students' motivation to learn and understand concepts.

However, the research also identified some challenges in implementing education programs for climate change in ECE. One of the main ones is limited resources, both in terms of teaching materials and training for educators. Teachers need specialized training to develop and implement effective teaching methods in the context of environmental literacy. This is in line with the findings of Tilbury (2011), who emphasizes that the success of environmental education is highly dependent on the availability of resources and competent educators. In addition, Monroe (2008) states that continuous training and professional development are key to implementing education programs in practical environments.

To overcome these challenges, it is recommended that the government and educational institutions work together. The same applies to providing educators with the required resources and ongoing training stages (Bethlendi, 2022). In addition, community involvement in the program can provide the required materials and create a supportive environment for learning. This collaborative approach aligns with the Community-Based Education model proposed by Geriguis (2021), which emphasizes the importance of interactions between schools, families, and communities in supporting children's learning.

Overall, the research shows that the environmental literacy-based climate change education program in PAUD has a significant impact on increasing children's awareness and environmental care behavior. By overcoming existing challenges and continuing to develop innovative teaching methods, this program can be an effective model for educational environments at other educational levels. The success of this program not only contributes to climate change mitigation and adaptation locally and forms a strong foundation for future generations to face a challenging global environment.

CONCLUSION

This study aimed to analyze the implementation of climate change education based on ecoliteracy in Early Childhood Education (ECE) as a means to foster environmental awareness and eco-friendly behavior from an early age. The findings indicate that this approach is effective in enhancing children's understanding of environmental and sustainability concepts. Through activities such as gardening, waste sorting, and recognizing plant life cycles, children learn about the interconnectedness of living beings and the importance of protecting nature. Learning strategies involving play, interactive storytelling, and nature-based activities promote sustainability values in a way that is both engaging and developmentally appropriate.

Children began to demonstrate positive habits, such as keeping their environment clean and caring for plants at school and home. Empathy towards nature also increased through ecological-themed activities. Thus, ecoliteracy-based education has strong potential to shape environmentally responsible generations.

However, the study has limitations, including its restriction to five ECE centers in West Java and possible data collection biases due to the use of mixed methods. Future research should expand the study geographically, apply method triangulation, and involve diverse social and cultural settings.

Further research is recommended to include longitudinal studies that examine the long-term impact of ecoliteracy-based education on children's environmental behavior. Additionally, future studies could explore the role of technology in supporting environmental education and examine how family and community involvement can enhance sustainability practices in both school and home settings. The policy implications of this study emphasize the importance of integrating ecoliteracy into national ECE curricula, providing regular teacher training, and encouraging active family participation in early climate change education.

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