8% Overall Similarity

The combined total of all matches, including overlapping sources, for each database.

Filtered from the Report

- Bibliography

Match Groups

18 Not Cited or Quoted 7%
Matches with neither in-text citation nor quotation marks

4 Missing Quotations 1%
Matches that are still very similar to source material

0 Missing Citation 0%
Matches that have quotation marks, but no in-text citation

1 Cited and Quoted 0%
Matches with in-text citation present, but no quotation marks

Top Sources

6% Internet sources
5% Publications
2% Submitted works (Student Papers)

Match Groups

- **18** Not Cited or Quoted 7%
  Matches with neither in-text citation nor quotation marks
- **4** Missing Quotations 1%
  Matches that are still very similar to source material
- **0** Missing Citation 0%
  Matches that have quotation marks, but no in-text citation
- **1** Cited and Quoted 0%
  Matches with in-text citation present, but no quotation marks

Top Sources

6% Internet sources
5% Publications
2% Submitted works (Student Papers)

Top Sources

The sources with the highest number of matches within the submission. Overlapping sources will not be displayed.

1	Internet	repository.unibabwi.ac.id 1%
2	Internet	www.journal.gmpionline.com <1%
3	Publication	Binar Winantaka, Rozanah Katrina Herda, Nina Sulistyowati, Margana Margana e... <1%
4	Student papers	UIN Sultan Maulana Hasanudin <1%
5	Publication	Cansu Yildiz, Tulin Guler Yildiz. "Exploring the relationship between creative think... <1%
6	Internet	ejournal.iainkendari.ac.id <1%
7	Internet	ejournal.imperiuminstitute.org <1%
8	Internet	pssh.umsida.ac.id <1%
9	Internet	americanjournal.us <1%
10	Internet	radjapublika.com <1%

11	Publication	
Zuri Pamuji, Titik Rahmawati. "Strategy for Strengthening Teacher Capacity at M...		<1%
12	Internet	
acopen.umsida.ac.id		<1%
13	Internet	
dspace.jaist.ac.jp		<1%
14	Publication	
Najmeh Behnamnia, Amirrudin Kamsin, Maizatul Akmar Binti Ismail, Siavash A. H...		<1%
15	Publication	
U Umroni, R Romelah. "Implementation of Al-Quran Learning With the Iqra' Meth...		<1%
16	Internet	
ecohumanism.co.uk		<1%
17	Internet	
international.aripi.or.id		<1%
18	Internet	
risetpress.com		<1%

Journal of General Education and Humanities
Vol. 5, No. 1, February 2026, pp. 1543 – 1550, https://doi.org/10.58421/gehu.v5i1.1042
ISSN 2963-7147

Implementation of Nature-Based Deep Learning to Develop Ecoliteracy Skills in Early Childhood

Wildan Alim Nurhidayah[1], Abda Billah Faza Muhammadkan Bastian[2]
[1]Universitas Islam Negeri Profesor Kiai Haji Saifuddin Zuhri, Jawa Tengah, Indonesia
[2]Universitas Islam Negeri Sultan Maulana Hasanuddin, Banten, Indonesia

Article Info

Article history:

Received 2026-01-19
Revised 2026-01-30
Accepted 2026-02-10

Keywords:

Deep Learning
Early Childhood
Nature-Based Deep Learning
Ecoliteracy Skills

ABSTRACT

This study aims to implement and evaluate the Nature-Based Deep Learning model in developing ecoliteracy skills in early childhood. Using a qualitative descriptive approach and field research design, the study was conducted at BA Aisyiyah Kalilandak involving 18 children aged 5–6 years. Data collection techniques included observation, interviews, and documentation. The model was implemented through three sequential phases: authentic exploration, guided reflection, and conceptual application. The results showed significant improvements in children's cognitive abilities, including observation, classification, and understanding of ecological relationships, as well as the development of empathy, environmental responsibility, and pro-environmental behavior. The structured integration of direct experiences in nature with reflective processes proved effective in fostering deep ecological understanding and agency in children. Pedagogically, this study emphasizes the role of teachers as facilitators of reflection and the importance of a systematic, nature-based learning design to achieve meaningful and sustainable educational outcomes.

Corresponding Author:

Wildan Alim Nurhidayah
Universitas Islam Negeri Profesor Kiai Haji Saifuddin Zuhri, Jawa Tengah, Indonesia
Email: wildanalim46@gmail.com

1. INTRODUCTION

The world today faces a variety of complex environmental challenges, from the climate crisis to biodiversity loss. This situation demands the formation of a generation that not only cares but also possesses sufficient ecological literacy (ecoliteracy) to play an active role in environmental restoration and preservation. UNESCO (2021) emphasizes that education, including at the earliest levels, bears a crucial responsibility in equipping individuals with sustainability competencies. Early childhood, the golden age of development, fosters ecological values and understanding, laying the foundation for

lifelong character [1]. Therefore, strengthening ecoliteracy from an early age is no longer just an option, but a necessity.

However, there is a gap between this urgency and the learning practices in many Early Childhood Education (PAUD) institutions. Learning is often confined to classrooms dominated by worksheets, thus providing minimal direct and exploratory experiences with nature [2]. In fact, Bronfenbrenner's bioecological theory [3] and ecological learning emphasize that the immediate physical and social environment (microsystem) is the primary context that shapes children's development. Direct engagement with nature is a crucial foundation for developing awareness, empathy, and pro-environmental behavior [4]. Without this authentic interaction, children's ecological understanding risks being verbalistic and not being based on real action.

Various previous studies have demonstrated the benefits of nature-based learning. Activities such as gardening, outdoor exploration, and environmental projects have been shown to increase children's environmental knowledge, creativity, independence, and positive attitudes [5], [6]. However, most of these studies focus on outdoor activities in general or on improving specific developmental aspects in isolation. Few studies explicitly and systematically integrate these natural experiences with the principles of deep learning, an approach that emphasizes in-depth understanding, critical reflection, meaning-making, and connecting concepts through meaningful experiences [7]. This integration is essential to bridge concrete experiences in nature with the formation of a complex and enduring ecological framework.

Based on the identification of these gaps, this study proposes and implements an integrative model called "Nature-Based Deep Learning." This model is designed to overcome the limitations of conventional approaches by not only providing direct experiences in nature but also deliberately designing stages of reflection, discussion, and contextualization after the experience. Through this model, activities such as observing insects do not stop at observation, but continue to build an understanding of the role of insects in the ecosystem, reflect on human impacts, and design simple actions to conserve them. Thus, this study aims to analyze how applying this model holistically develops ecoliteracy skills in early childhood, encompassing ecological knowledge, attitudes, and skills, and to identify effective pedagogical strategies in this process.

The theoretical basis of this research is eclectic, synergizing Bronfenbrenner's bioecological theory, Kolb's experiential learning theory, and the concept of deep learning. This synergy forms a framework that places authentic experiences in nature as a starting point, which is then processed through a cycle of reflection and conceptualization to achieve a deep understanding of the principles of ecology and interdependence in nature, as is the core of ecoliteracy [8].

Theoretically, this research is expected to enrich the literature at the intersection of early childhood education, environmental education, and reflective pedagogy by presenting an integrative model. In practice, the results of this study are expected to serve as an operational guide for early childhood educators in designing contextual, meaningful, and effective learning experiences that build a strong foundation of environmental stewardship

in children from an early age, thereby contributing to the realization of a sustainable generation.

2. METHOD

The method used in this study is a qualitative, descriptive approach to in-depthly describe the process of implementing nature-based deep learning to develop children's ecoliteracy. This type of research is field research because it focuses on a single educational institution, the location of the study. This research was conducted at BA Aisyiyah Kalilandak, with the research subjects being teachers and early-age children involved in nature-based learning activities. The research aims to implement a deep learning model and examine its impact on children's ecoliteracy skills. Data collection was carried out through observation, interviews, and documentation to obtain comprehensive information. After all data were collected, the researcher conducted an interactive analysis process through the stages of data reduction, data presentation, and conclusion drawing to obtain valid and meaningful findings.

3. RESULTS AND DISCUSSION

3.1. Results

3.1.1. Location and Participants

This research was conducted at BA Aisyiyah Kalilandak, Purwareja Klampok District, Banjarnegara Regency, Central Java, over 3 months, involving 18 children from Class B (aged 5-6 years) as the focus group. The activities were carried out through integrated thematic learning, with 2-3 sessions per week, each lasting 60-90 minutes. As a comparison, the activities also involved Class A to observe different group dynamics, but the in-depth analysis focused on Class B.

3.1.2. Implementation of the Nature-Based Deep Learning Model

The model was implemented in three sequential phases, following the deep learning cycle (Fullan et al., 2017): Authentic Exploration, Guided Reflection, and Conceptual Application.

a. Phase 1: Authentic Exploration in the School Environment

The first activity was focused on direct observation of the diversity and condition of plants around the school. Children are invited to go around to identify different types of plants (roses, jasmine, ornamental flowers) and observe their condition (fresh, withered, dry, dead). Observational data indicated that of 18 children, 15 (83%) actively approached and touched plants, and 16 (89%) asked at least one spontaneous question. The questions that arise are causal and classifying, such as: *"Why is this one with brown leaves and all the fall?"* and *"What is the name of the flower? How is it different from the previous one?"* The teacher does not answer directly but encourages the child to formulate a simple hypothesis: *"In your opinion, why is it so?"* This triggered an initial discussion in the field.

b. Phase 2: Simple Experiments with Natural Elements (Soil and Water)

In this phase, children are divided into 4 small groups. Each group was given a medium: dry soil, water, containers, and simple tools. Teacher instruction is open: *"What happens when water meets soil?"* The children experimented with pouring water, stirring, squeezing, and shaping the soil. The results of the documentation showed that: 1) 100% of the children were involved motorically (pouring, squeezing), 2) 14 children (78%) were able to mention at least two differences in texture (*"Dry coarse, soft wet/sticky"*), 3) 12 children (67%) asked follow-up questions about the absorption process: *"Where did the water disappear?"* and *"Why is the soil so heavy?"*, and 4) Some children (5 children/28%) began to make connections with previous experiences: *"Oh, that is what it looks like when we make a cake dough!"*.

c. Phase 3: Integrated Ecosystem Exploration (Goat Pen Visit)

This activity is designed to expand understanding of mutualism relationships in ecosystems. The children observe the goat, its food (cassava leaves, grass), and its droppings. When the teacher shows the pile of dirt, a critical question arises: *"It stinks, why don't you just throw it away?"* The teacher then guides the discussion with simple visual aids (cycle images) and explains the concept of compost and its relationship to previously observed plants. The key points recorded are:1) Children understand simple cause-and-effect flows: *Plants → eaten by goats → goat dung → become fertilizer → fertilize the plants*, 2) 10 children (56%) were able to reinterpret the relationship in their own language when asked again a week later, and 3) Observations of ants and other decomposers added to our understanding of the webs of life.

3.1.3 Observed Development of Ecoliteracy Skills

Based on the analysis of field notes, children's portfolios (pictures, works), and mini-interviews with teachers, the development of ecoliteracy skills can be detailed as follows:

a. Observation Abilities and Early Science Skills: Children not only see, but also begin to classify and compare. For example, they can group leaves by color and size and predict what will happen if the soil is not watered. This ability aligns with the development of scientific *process skills* in early childhood [9].
b. Conceptual Understanding of Ecological Relationships: An evolving understanding of isolated facts (*"This is a flower"*) towards relational understanding (*"Plants need water, goat manure makes plants healthy"*). Simple concepts of cycles and dependencies began to take shape, which were the foundations of systems thinking [10].
c. Attitude of Empathy and Environmental Responsibility: There is a shift from viewing nature as an object to treating it as a subject that deserves care. Children voluntarily remind friends not to step on plants and show sad expressions when they see plants withering. This *caring* attitude is a key affective component of ecoliteracy [11].
d. Communication and Reflection Skills: Post-exploratory discussions demonstrate improved language skills for expressing experiences. Children use new vocabulary

such as *"fertile," "wilt," and "fertilizer."* They also begin to reflect on their feelings, for example: *"I love to see flowers bloom"*.

e. Pro-Environmental Agencies and Initiatives: Some children (6 children/33%) demonstrated initiatives through tangible actions outside of activity hours, such as watering plants at home or collecting dry leaves to "make fertilizer." This shows the internalization of values and the willingness to act (*ecological agency*).

3.2. Discussion

3.2.1. Implementation of Nature-Based Deep Learning in Early Childhood Learning

The results of the study show that the application of *the Nature-Based Deep Learning* model at BA Aisyiyah Kalilandak occurs through three main stages: authentic exploration, guided reflection, and conceptual application. This stage allows children to gain direct experience of the natural environment while reflecting on these experiences. This pattern aligns with Kolb's (1984) theory of experiential learning, which asserts that meaningful learning occurs when concrete experiences are processed through reflection and conceptualization in a continuous cycle.

In contrast to nature-based learning that is purely recreative or observational, this approach is consciously designed to encourage children to build meaning from their ecological experiences. The teacher acts as a facilitator, guiding children to ask questions, formulate simple hypotheses, and reflect on their observations. This process makes outdoor activities not only a means of exploration but also a vehicle for developing a deeper conceptual understanding.

This practice reflects the principles of deep learning as stated by Alabi (2024): learning that emphasizes active involvement, the meaning of experiences, and the connection between concrete experiences and concepts. Thus, nature-based learning does not stop at physical activity alone, but develops into a structured, meaningful, and sustainable cognitive and affective process for early childhood development.

3.2.2. Development of Children's Cognitive Aspects and Science Process Skills

The implementation of *Nature-Based Deep Learning* has been proven to improve children's ability to observe, classify, predict, and ask critical questions. Children not only recognize natural objects descriptively but also begin to compare, classify, and relate new experiences to previous ones. For example, children can explain the difference between dry and wet soil texture and predict the impact if plants are not watered. These findings are consistent with Lind's view [13] that exploratory experience is an important foundation for the development of early childhood science process skills.

Children's understanding develops from factual knowledge to relational understanding. Children not only identify plant and animal types but also begin to understand cause-and-effect relationships in simple ecosystems, such as those among plants, animals, and soil. This shows the formation of an early systemic mindset, at the core of ecoliteracy, as stated by Armstrong [14]. These findings also reinforce Armstrong's [14], Saputra & Afriyadi's [15], and Mariah et al.'s [16] research, which show that environment-based learning is effective in improving children's ecological understanding,

but this study adds a dimension: this understanding becomes more profound when combined with structured reflection.

3.2.3. Formation of Attitudes of Caring and Empathy towards the Environment

In addition to the cognitive aspect, the study's results show significant development in children's affective realm, especially in empathy and concern for the environment. Children begin to show concern for plant condition, feel concerned about withered plants, and remind friends not to damage the surrounding environment. This behavior reflects a shift in the child's perspective, from seeing nature as a passive object to seeing it as a subject that needs to be cared for and protected. As Hiola (2025) affirms, the affective dimension is the main component in the development of ecoliteration.

These findings reinforce the findings of Villarosa [18] and Ismawati et al. [19], which indicate that nature-based learning is effective in fostering an attitude of environmental care in early childhood. However, this study shows that the formation of such attitudes is influenced not only by direct experience but also by the reflective process that accompanies it. Children are not only interacting with nature but are also directed to understand the meaning of the ecological experiences they are having.

Through discussions and reflective dialogues, children begin to interpret their relationship with the environment more consciously, so that the caring attitude formed is more stable and potentially sustainable. Thus, nature-based learning, integrated with guided reflection, not only develops emotional awareness but also strengthens the internalization of ecological values in the daily lives of early childhood.

3.2.4. Strengthening Children's Agency and Pro-Environmental Behavior

The results showed that some children began taking pro-environmental action outside formal learning contexts, such as watering plants at home or collecting dry leaves for fertilizer. This shows that learning not only improves knowledge and attitudes but also encourages the emergence of real behaviors that reflect the internalization of ecological values. This phenomenon aligns with the concept of ecological agency, which emphasizes the ability of individuals, including those in early childhood, to act as agents of change in the context of the environment [20], [21].

These findings expand on the results of previous research, which generally ended at increasing awareness or positive attitudes towards the environment [22], [23]. In this study, *Nature-Based Deep Learning* was shown to bridge the gap between ecological awareness and real action through hands-on experience, followed by reflection and conceptual application. Thus, this approach has the potential to lay the foundation for sustainable behavior from an early age.

3.2.5. Pedagogical Implications for Environment-Based Early Childhood Education Learning

Pedagogically, the findings of this study confirm the importance of teachers as facilitators of reflection and dialogue, rather than just conveyors of information. Teachers encourage children to express opinions, formulate hypotheses, and reflect on their

experiences, so that children are actively involved in the process of knowledge construction. This practice aligns with the principles *of deep learning, which emphasize* meaningful learning through problem-solving, collaboration, and critical reflection [24], [25], [26].

The Nature-Based Deep Learning *model* applied in this study shows that nature-based learning needs to be systematically designed to avoid becoming a purely exploratory activity. Children's direct experience in the natural environment must be followed by guided reflection and reinforcement of concepts to ensure learning is truly meaningful. With this approach, outdoor activities serve not only as a means of play but also as a medium for developing a deep ecological understanding.

The integration of experience, reflection, and conceptual application enables children to develop a holistic, long-lasting ecological understanding. Therefore, this model can be used as a pedagogical alternative in the development of an early childhood education curriculum that is oriented towards continuous education and the strengthening of character traits of caring for the environment from an early age.

4. CONCLUSION

This study successfully implemented a Nature-Based Deep Learning model structured into three phases: authentic exploration, guided reflection, and conceptual application, to develop early childhood ecoliteracy skills holistically. The results showed that this approach not only improved cognitive abilities and early science processes, such as observation, classification, and understanding of ecological relationships, but also fostered empathy, concern, and responsibility for the environment. Furthermore, this model fostered the emergence of ecological agency, as children began to take pro-environmental action in their daily lives. Pedagogically, these findings emphasize the importance of the teacher's role as a facilitator of reflection and dialogue, as well as the need for a systematic, integrated nature-based learning design that enables direct experiences to be deeply meaningful and sustainable.

REFERENCES

[1] R. Utari, "Systematic Literature Review on Eco-literacy Learning in the Lower Grades of Elementary School," *J. Prima Edukasia*, vol. 13, no. 1, pp. 1–14, 2025.
[2] A. R. Safira and I. Wati, “Pentingnya pendidikan lingkungan sejak usia dini,” *JIEEC (Journal Islam. Educ. Early Childhood)*, vol. 1, no. 1, p. 21, 2020.
[3] U. Bronfenbrenner, "Ecological models of human development," *Int. Encycl. Educ.*, vol. 3, no. 2, pp. 37–43, 1994.
[4] H. M. Alakrash and N. Abdul Razak, "Technology-based language learning: Investigation of digital technology and digital literacy," *Sustainability*, vol. 13, no. 21, p. 12304, 2021.
[5] N. Najmina, K. Sukmawati, and Y. N. Afifah, "Nature Based Learning Strategies for Building Environmental Awareness in Early Childhood," *AlBanna J. Pendidik. Islam Anak Usia Dini*, vol. 5, no. 2, pp. 60–68, 2025.
[6] R. R. Saputri and E. Waluyo, "The Effectiveness of Food Garden School on Eco-Literacy in Early Childhood Sustainability Concept," *J. Pendidik. Anak Usia Dini Undiksha*, vol. 12, no. 3, pp. 542–551, 2024.
[7] M. P. Ferawati and S. M. Mustafa, *Deep Learning sebagai Inovasi Pembelajaran Era Digital: Konsep, Model, dan Aplikasi*. PT. Revormasi Jangkar Philosophia, 2025.
[8] R. W. Kimmerer, "Searching for synergy: Integrating traditional and scientific ecological knowledge in environmental science education," *J. Environ. Stud. Sci.*, vol. 2, no. 4, pp. 317–323, 2012.
[9] J. Jirout and C. Zimmerman, "Development of science process skills in the early childhood years," in

research in early childhood science education, Springer, 2015, pp. 143–165.

[10] G. Paprotna, "On the understanding of ecological concepts by children of pre-school age," *Int. J. Early Years Educ.*, vol. 6, no. 2, pp. 155–164, 1998.

[11] A. Knafo, C. Zahn-Waxler, M. Davidov, C. Van Hulle, J. L. Robinson, and S. H. Rhee, "Empathy in early childhood: Genetic, environmental, and affective contributions," *Ann. N. Y. Acad. Sci.*, vol. 1167, no. 1, pp. 103–114, 2009.

[12] M. Alabi, "Experiential learning: Fostering deep learning through active engagement." December, 2024.

[13] K. K. Lind, "Science in Early Childhood: Developing and Acquiring Fundamental Concepts and Skills.," 1998.

[14] S. Armstrong, "Transformative Ecoliteracy Development in Postsecondary Education: Cultivating Intentional Relationships Through Garden-Based Learning." Portland State University, 2022.

[15] T. A. Saputra and M. M. Afriyadi, "Menumbuhkan Kesadaran Ekologis Siswa Sejak Dini: Menjadikan Lingkungan Sebagai Sekolah Kehidupan," *Muallimun J. Kaji. Pendidik. dan Kegur.*, vol. 5, no. 1, pp. 1–21, 2025.

[16] S. Mariah, F. Puspita, and M. Ma'arif, "Integrasi Nilai-Nilai Ekologis Dalam Kurikulum Paud Berbasis Alam: Studi Observasi Pada Kegiatan Pembelajaran Anak Usia Dini," *J. Intelek Dan Cendikiawan Nusant.*, vol. 2, no. 3, pp. 2146–2154, 2025.

[17] Z. W. Hiola, "Dimensions of Ecoliteracy Attitudes in Islamic Elementary Teacher Education: The Construction of Islamic Theo-Ecology, Socio-Ecology, Bio-Ecology, and Cosmo-Ecology," *Galore Int. J. Appl. Sci. Humanit.*, vol. 9, no. 4, pp. 61–68, 2025.

[18] M. A. Villarosa, "Eco-Literacy Awareness of Pre-Service Science Teachers: Assessment of Knowledge, Awareness, Ethics, Emotion, and Behaviour," *J. Interdiscip. Perspect.*, vol. 3, no. 7, pp. 537–547, 2025.

[19] D. Ismawati, P. Y. Fauziah, D. S. Fuadi, and S. Suhardiman, "Developing of Eco-Literacy Learning Model to Enhance Environmental Caring Character," *J. Ecohumanism*, vol. 3, no. 5, pp. 1017–1027, 2024.

[20] S. Hanifah and E. Kurniati, "Eksplorasi peran lingkungan dalam masa transisi pendidikan anak usia dini ke sekolah dasar," *Kiddo J. Pendidik. Islam Anak Usia Dini*, vol. 5, no. 1, pp. 130–142, 2024.

[21] R. A. Fauzi, E. Elan, and G. Gandana, "Analisis Kebutuhan Media Pendidikan untuk Pengembangan Kecerdasan Lingkungan pada Anak Usia Dini," *J. Paud Agapedia*, vol. 8, no. 1, pp. 57–64, 2024.

[22] R. Pamitasari and I. D. Sartika, "PENERAPAN METODE PEMBIASAAN DALAM MENANAMKAN KARAKTER PEDULI LINGKUNGAN PADA ANAK USIA DINI," *Sindoro Cendikia Pendidik.*, vol. 17, no. 7, pp. 71–80, 2025.

[23] I. Anggraeni, "Pengelolaan Komposter untuk Anak Usia Dini: Mengubah Kesadaran Lingkungan dan Pengurangan Sampah," *WISDOM J. Pendidik. Anak Usia Dini*, vol. 5, no. 1, pp. 15–27, 2024.

[24] R. Guo, N. Jantharajit, and P. Thongpanit, "Construct an Instructional Approach Based on Collaborative Learning and Reflective Learning for Enhance Students' Analytical Thinking and Critical Thinking Skills.," *Asian J. Contemp. Educ.*, vol. 8, no. 2, pp. 115–125, 2024.

[25] S. Utami, J. Nur, and Y. Liyong, "The Role of Deep Learning in Promoting Collaborative Learning and Critical Thinking in Future Educational Systems," *J. Am. Inst.*, vol. 2, no. 3, pp. 449–461, 2025.

[26] L. M. Andayanie, M. S. Adhantoro, E. Purnomo, and G. T. Kurniaji, "Implementation of Deep Learning in Education: Towards Mindful, Meaningful, and Joyful Learning Experiences," *J. Deep Learn.*, pp. 47–56, 2025.