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ECO-PEDAGOGY FOR SUSTAINABLE CHARACTER EDUCATION IN ELEMENTARY SCHOOLS: A CRITICAL REVIEW IN THE CONTEXT OF PHILOSOPHY OF SCIENCE

Heni Yuliani[1*], Yusuf Tri Herlambang[2] , Dede Margo Irianto[3]
[1,2,3]Universitas Pendidikan Indonesia
[1]heniaulia16@upi.edu

Abstract

Global environmental crises such as climate change, pollution, and biodiversity loss demand a paradigm shift in education that focuses not only on cognitive aspects but also on character building and ecological awareness. Primary education plays a strategic role in instilling sustainability values from an early age through an integrative approach. This study aims to analyze the role of philosophy of science in the development of eco-pedagogy as a foundation for strengthening sustainable character education in elementary schools. The research uses a literature review method with the following stages: (1) searching for scientific articles through relevant national and international databases; (2) selecting sources based on the suitability of the themes of philosophy of science, ecopedagogy, and character education; and (3) conceptual analysis and thematic synthesis. The results of the study show that ontologically, ecopedagogy views humans as an integral part of the ecosystem; epistemologically, environmental knowledge is constructed through reflective, contextual, and critical learning; and axiologically, education is directed at forming moral responsibility and concern for the environment. The integration of philosophy of science in ecopedagogy strengthens the integration between knowledge, values, and ecological actions of students. In practical terms, elementary school teachers can design environment-based thematic learning, use reflective methods and contextual projects, and instill environmental ethics values in daily learning activities. Thus, eco-pedagogy based on the philosophy of science contributes significantly to shaping the character of students to be sustainable and ecologically aware.

Keywords: *philosophy of science; eco-pedagogy; character education; sustainability; elementary school*

Abstrak

Krisis lingkungan global seperti perubahan iklim, pencemaran, dan penurunan keanekaragaman hayati menuntut transformasi paradigma pendidikan yang tidak hanya berorientasi pada aspek kognitif, tetapi juga pada pembentukan karakter dan kesadaran ekologis. Pendidikan dasar memiliki peran strategis dalam menanamkan nilai keberlanjutan sejak dini melalui pendekatan yang integratif. Penelitian ini bertujuan menganalisis peran filsafat ilmu dalam pengembangan ekopedagogik sebagai landasan penguatan pendidikan karakter berkelanjutan di sekolah dasar. Penelitian menggunakan metode *literature review* dengan tahapan: (1) penelusuran artikel ilmiah melalui basis data nasional dan internasional yang relevan; (2) seleksi sumber berdasarkan kesesuaian tema filsafat ilmu, ekopedagogik, dan pendidikan karakter; serta (3) analisis konseptual dan sintesis tematik. Hasil kajian menunjukkan bahwa secara ontologis, ekopedagogik memandang manusia sebagai bagian integral dari ekosistem; secara epistemologis, pengetahuan lingkungan dibangun melalui pembelajaran reflektif, kontekstual, dan kritis; serta secara aksiologis, pendidikan diarahkan pada pembentukan nilai tanggung jawab moral dan kepedulian terhadap lingkungan. Integrasi filsafat ilmu dalam ekopedagogik memperkuat keterpaduan antara pengetahuan, nilai, dan tindakan ekologis peserta didik. Implikasi praktisnya, guru sekolah dasar dapat merancang pembelajaran tematik berbasis lingkungan, menggunakan metode reflektif dan proyek kontekstual, serta menanamkan nilai etika lingkungan dalam aktivitas belajar sehari-hari. Dengan demikian, ekopedagogik berlandaskan filsafat ilmu berkontribusi signifikan dalam membentuk karakter peserta didik yang berkelanjutan dan berwawasan ekologis.

Kata kunci: filsafat ilmu; ekopedagogik; pendidikan karakter; keberlanjutan; sekolah dasar

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Introduction

Advances in science and technology in the modern era have significantly shaped human lifestyles, including how humans perceive and interact with the natural environment. In philosophical discourse, technology is no longer understood merely as a neutral instrument, but as a social and cultural phenomenon that influences patterns of interaction, communication, and the construction of reality (Oktavia et al., 2023). Alongside these developments, a dominant human-centered worldview has emerged, positioning humans as the primary beneficiaries of nature. This paradigm has legitimized the large-scale exploitation of natural resources without adequate consideration of ecological limits. The urgency of this study is rooted in the escalating global environmental crisis, which manifests in extreme climate change, accelerating biodiversity loss, and widespread pollution. Scientific reports indicate rising global temperatures, prolonged droughts, and increasingly frequent hydrometeorological disasters (IPCC, 2023). Alongside species extinction occurring far beyond natural rates (IPBES, 2019). Large-Scale Pollution: Plastic pollution in the ocean, air pollution in large cities, and contamination of water resources (UNEP, 2023).

These phenomena are closely linked to a dominant human supremacy paradigm that prioritizes economic growth and technological advancement over ecological balance (Kopnina et al., 2024). Responding to this crisis requires a fundamental paradigm shift from anthropocentrism toward ecocentrism, which recognizes nature as a community of life with intrinsic value rather than merely an object of exploitation. Such a shift must be cultivated through education from an early age. In this context, the philosophy of science plays a strategic role, not only in supporting technological literacy, but also in critically examining the ontological relationship between humans and nature, the epistemological foundations of environmental knowledge, and the axiological dimensions of ecological ethics and responsibility(Amanda et al., 2024). In basic education, schools hold a crucial position in fostering environmental awareness. However, learning practices in elementary schools remain predominantly focused on cognitive achievement, with limited emphasis on the formation of ecological consciousness and moral responsibility (Hijriyanah & Sutarna, 2023). This condition indicates the need for an educational approach that integrates ecological knowledge, values, and concrete actions within meaningful learning experiences. Eco-pedagogy emerges as a relevant approach to address this challenge. Rooted in philosophical inquiry, eco-pedagogy emphasizes the interconnectedness between humans and nature, ecological literacy, and ethical responsibility for environmental sustainability (Yunansah & Herlambang, 2017; Durrotun Nafisah et al., 2019). The philosophical basis of eco-pedagogy includes ontological aspects that discuss the nature of the relationship between humans and nature, epistemological aspects that study how environmental knowledge is acquired, and axiological aspects that emphasize moral values and responsibility for ecological sustainability. (Dewi, 2021). Eco-pedagogy aims to develop culture-based ecological literacy that enables the emergence of multicultural knowledge about how different cultural groups interact and interpret their relationship with nature. (Kahn, 2008).

Based on this foundation, education does not solely focus on developing knowledge, but is also directed towards building ethical character and caring for the environment (Zeng et al., 2024). Previous studies have shown that eco-pedagogical practices can positively influence students' environmental character through contextual learning, routine school activities, and curriculum integration, including within the framework of the Merdeka Curriculum (Fitriyani et al., 2025; Wahyuni et al., 2023). In addition, fields of knowledge such as biotechnology can be used as a means to instill eco-pedagogical values that help develop critical thinking skills and increase awareness of climate change issues (Ichsan et al., 2021). Globally, this approach is also

consistent with the view that direct experience in primary education has a stronger impact on teaching the principles of conservation and sustainability (Gadotti, 2007). This shows that ecopedagogy is not only a pedagogical approach, but also a philosophical framework that builds ecological awareness and moral responsibility among students. Therefore, this article examines Ecopedagogy for Sustainable Character Education in Elementary Schools: A Critical Review in the Philosophy of Science through a literature review method to fill the gap in studies that explicitly link these three aspects. This gap indicates a lack of comprehensive analysis that positions eco-pedagogy simultaneously as a pedagogical strategy and a philosophical framework for sustainable character education, particularly in the context of elementary schools. Therefore, this article offers a critical literature review that explicitly connects eco-pedagogy, sustainable character education, and the philosophy of science. The novelty of this study lies in its integrative philosophical perspective, which systematically maps ontological, epistemological, and axiological dimensions to strengthen eco-pedagogy as a foundation for sustainable character education in basic education. Based on this background, the research problems addressed in this study are: how the philosophical foundations of eco-pedagogy can serve as a basis for sustainable character education in elementary schools; how eco-pedagogical practices integrate ecological knowledge, values, and actions in meaningful learning; and how philosophical literature contributes to enriching the conceptual direction of eco-pedagogy. Accordingly, this study aims to analyze the philosophical basis of eco-pedagogy, examine its application in elementary school learning, and explore the contribution of the philosophy of science in developing eco-pedagogy as a framework for sustainable character education.

Research Methods

This study uses a literature review approach conducted in accordance with standard methodological guidelines, starting from the process of systematic literature search, screening, critical review, interpretation, synthesis, to reporting the results of studies from various publications relevant to the research topic. This approach aims to collect as much literature as possible related to the field being studied. After assessing the quality of each study, SLR allows researchers to exclude studies that are considered to fall short of quality standards so that only valid and credible studies are analyzed further(Pati et al., 2018). A review of previous research is a crucial element in scientific work. A well-structured review can serve as a solid foundation for further scientific contributions. Through such reviews, researchers can strengthen theoretical development, identify interrelationships between fields of research, and map out potential future research directions (Priharsari et al., 2022). This approach is used to ensure that the review process is focused, systematic, and organized, thereby producing a valid synthesis of knowledge that is scientifically accountable (Candra et al., 2025). This approach was chosen because the objective of the study was to map the concepts, philosophical foundations, implementation models, and empirical evidence from previous studies on ecopedagogy and sustainable character education, as well as to compile, assess, and synthesize various scientific findings in a structured manner to produce a more in-depth and accountable understanding. Similar methods were used by the reviewed ecopedagogical studies, including systematic reviews and interpretive content reviews. SLR is relevant in the context of this study, given that studies on ecopedagogy, philosophy of science, and character education are scattered across various academic publications and require a systematic search process to obtain clear research patterns and trends. To maintain transparency and accuracy in the literature selection process, this study refers to the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines. The PRISMA approach is a set of evidence-based guidelines designed to assist

authors in compiling reports of various systematic reviews and meta-analyses that provide the effectiveness of an intervention or specific benefits (Costanius et al., 2024). To maintain transparency and accuracy in the literature selection process, this study followed the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines. During the identification stage, a total of 100 articles were retrieved from scientific databases relevant to the study focus. At this stage, 54 articles were excluded due to duplication, inaccessible full texts, or clear irrelevance to the research topic.

After the identification stage, 46 articles remained and proceeded to the screening stage. Titles and abstracts were screened to assess their relevance to ecopedagogy, philosophy of science, character education, and the elementary school context. As a result, 12 articles were excluded because they did not address the core themes of the study or focused on non-educational or non-basic education settings. The remaining 34 articles entered the eligibility stage and were reviewed in full text. At this stage, 4 articles were excluded because they did not meet the inclusion criteria, such as lacking explicit philosophical analysis, insufficient discussion of sustainable character education, or misalignment with the elementary school context. Consequently, 30 articles met all inclusion and quality criteria and were included in the qualitative synthesis and analysis. These articles formed the primary data sources for examining how perspectives from the philosophy of science contribute to the development of ecopedagogy as a framework for strengthening sustainable character education in elementary schools. The quality of the selected articles was assessed using an internal appraisal checklist, focusing on clarity of objectives, conceptual and philosophical depth, methodological transparency, relevance to the research questions, and coherence of findings. All included articles met the minimum quality standards and were assigned equal analytical weight, as the review emphasized conceptual synthesis rather than comparative measurement of intervention effectiveness.

Thus, the articles selected and analyzed in this study represent scientific works that provide a comprehensive understanding of how philosophical foundations guide the development of eco-pedagogy in elementary schools. To ensure analytical rigor, the study employed a thematic content analysis instrument in the form of a structured literature analysis matrix. This instrument was used to systematically extract and organize key information from each article, including author and year, research context, methodological approach, dominant philosophical dimension (ontological, epistemological, or axiological), main findings, and implications for sustainable character education in elementary schools. Data synthesis was conducted using a narrative–thematic synthesis technique, in which extracted data were grouped into recurring themes and patterns related to philosophical foundations, eco-pedagogical practices, and character education outcomes. This approach enabled the integration of conceptual and empirical findings without reducing the philosophical depth of the reviewed studies.

The quality of the selected articles was assessed using explicit internal quality criteria, focusing on clarity of research objectives, relevance to the research questions, consistency of philosophical arguments, methodological transparency, and coherence between findings and conclusions. Only articles that met these minimum quality standards were included in the final synthesis, and all selected studies were assigned equal analytical weight, as the review aimed at conceptual and philosophical integration rather than comparative evaluation of empirical effectiveness. The literature search was conducted through Scopus, Web of Science, Google Scholar, ERIC, and ScienceDirect. Search keywords included combinations such as

"ecopedagogy" OR "eco-pedagogy" AND "philosophy of science", "character education" AND "environmental ethics", and "elementary school" OR "primary education". Data extraction followed a predefined scheme encompassing bibliographic information, philosophical orientation, educational focus, and key contributions, ensuring that the entire review process was transparent, replicable, and logically structured in synthesizing the 30 core articles forming the basis of the discussion.

Results and Discussion

The article selection process followed the PRISMA flow, which consists of four main phases: identification, screening, eligibility, and inclusion. In the identification phase, a total of 100 records were retrieved from Scopus, Web of Science, Google Scholar, ERIC, and ScienceDirect. After merging search results from all databases, 54 records were removed as duplicates, leaving 46 unique records for further screening. In the screening phase, the titles and abstracts of the 46 records were reviewed to assess their relevance to ecopedagogy, philosophy of science, sustainable character education, and the elementary school context. As a result, 12 records were excluded because they were irrelevant to the research focus or addressed different educational levels or disciplines. The remaining 34 articles proceeded to the eligibility phase, in which full texts were carefully assessed. At this stage, 4 articles were excluded due to not meeting the inclusion criteria, such as the absence of explicit philosophical discussion, insufficient focus on character education, or lack of relevance to elementary education. Finally, 30 articles met all inclusion and quality criteria and were included and analyzed as the primary sources in the systematic literature review. These articles formed the empirical and conceptual basis for examining how perspectives from the philosophy of science contribute to the development of eco-pedagogy as a foundation for sustainable character education in elementary schools.

Table 1. PRISMA Flow of Study Selection

PRISMA Stage	Description	Number (n)
Identification	Records identified through database searching	100
Identification	Duplicate records removed	54
Screening	Records screened (titles and abstracts)	46
Screening	Records excluded (irrelevant topic/context)	12
Eligibility	Full-text articles assessed for eligibility	34
Eligibility	Full-text articles excluded with reasons	4
Included	Studies included and analyzed in the SLR	30

Based on the article selection process described in the PRISMA table, 30 articles met all inclusion criteria and were deemed eligible for further analysis. These articles were the main sources used to compile the results of this study. Through a process of identification, screening, feasibility assessment, and inclusion, each article was carefully selected to ensure its suitability with the focus of the study, namely eco-pedagogical analysis, character education, and its relevance to sustainable development goals (SDGs). Furthermore, the twenty selected articles were analyzed in depth using an analysis table compiled based on key aspects, such as research

objectives, methods, main findings, and relevance to the study topic. This analysis aimed to obtain patterns, trends, and theoretical and practical contributions from each study so as to provide a comprehensive picture of the development of the concept of eco-pedagogy in the context of education. The synthesized results of the twenty articles are then presented in the results and discussion section. Through this presentation, the study seeks to show how the findings from various studies can reinforce each other, complement each other, or even present new perspectives relevant to the study theme.

Table 2. Findings from Various Literature Studies

FINDINGS	KEY FINDINGS	EVIDENCE FROM STUDY / SOURCE STATEMENT
Eco-pedagogy	Students' ecological awareness is influenced by curriculum policy, availability of facilities/media, learning methods, teacher role models, and students' psychological concerns.	Students' ecological awareness is influenced by curriculum support, availability of facilities and infrastructure, and students' attitudes towards environmental education. Budi Hendrawan et al. (2020)
	The application of eco-pedagogy in social studies learning in elementary schools results in changes in student behavior (green behavior).	Environmental character education needs to be integrated into learning through eco-pedagogy, so that students become accustomed to understanding, thinking critically, and taking responsibility for the environment. Indah Wardatussa'idah, et al. (2024)
	The teaching materials are designed with content that emphasizes eco-pedagogical values: instilling environmental awareness, appreciating local wisdom and the surrounding environment, and shaping students' ecological literacy rather than merely transferring academic knowledge.	Digital design facilitates the updating of materials in line with local wisdom and the latest environmental issues, ensuring that learning remains relevant to the context and needs of students. Dede Margo Irianto, et al. (2022)

FINDINGS	KEY FINDINGS	EVIDENCE FROM STUDY / SOURCE STATEMENT
	Education cannot be separated from the context of the environment, and Indonesia's biodiversity is important for students to learn about flora/fauna, ecosystems, conservation, and the relationship between humans and nature from an early age.	21st century education oriented towards ecology, ecological development, understanding, empathy, environmental awareness, and conservation. Waode Hamsia, et al (2022)
	Most prospective teachers demonstrated good pedagogical and ESD competencies when they integrated the SDGs into their science teaching design and practice.	Elementary school teachers need to undergo training to improve their ESD competencies so that they can design learning activities that support the SDGs, rather than just teaching in a traditional manner. Chen Guo, Ying Huang, and Xiangdong Chen (2024)
	Environmental education helps build collective awareness and understanding of good thinking among students, educators, and the wider community.	Environmental education requires a balance between ecological, social, and economic aspects, that is, protecting the environment while supporting welfare, social justice, and quality of life in accordance with SDG principles. Kgosietsile Velempini (2025)
	Research shows that the most emphasized PEB domains are energy conservation/resource use, recycling/waste, and simple everyday actions; while domains such as biodiversity protection (flora/fauna), environmental advocacy, or long-term actions are less explored	Schools need to hold environmental activities on an ongoing basis so that environmentally conscious behavior is truly formed and ingrained in students. Jianjiao Liu & Raymond James Green (2024)
	Explicitly incorporating sustainability issues/goals into the curriculum (SDGs) can support increased awareness and pro-environmental behavior, especially concrete	Elementary schools need to incorporate environmental awareness and concern directly into the subject

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FINDINGS	KEY FINDINGS	EVIDENCE FROM STUDY / SOURCE STATEMENT
	behavior, among students, although the effect on awareness (knowledge/attitudes) is more moderate.	matter as part of the curriculum, not just as an addition. Walaa Al Husban (2025)
Philosophy of Science	The global ecological crisis calls for holistic solutions that integrate science, religion, and environmental philosophy.	The integration of science, religion, and environmental philosophy is very important (Ahmada et al., 2023).
	Educational models consist of humanistic models, religious models, and democratic models.	The development of education at Sekolah Alam Bandung contributes to shaping students who are aware of environmental values, rather than focusing solely on pragmatic-materialistic attitudes. Hana Yunansah et al. (2020)
	There is consistency and relevance between the principles in the Merdeka Curriculum and Ki Hadjar Dewantara's concept of education. Both emphasize the importance of freedom (independence) for schools, teachers, and students in the learning process.	A philosophical pedagogical approach opens up opportunities for formal education to not only be academic, but also to shape environmentally conscious character—the core of eco-pedagogy. Pitri Maharani Efendi, et al. (2023)
	Nature is viewed as equal to humans, so human ecological philosophy can be used to analyze various issues related to human-environment relationships, including in urban, rural, and wilderness contexts.	Philosophy considers that ecology provides a basis for reviewing and criticizing human actions. (Ahmada et al., 2023)
	Recognizing that all knowledge has a sacred and spiritual dimension, this perspective can strengthen the foundations of environmental philosophy. Viewing knowledge as Scientia Sacra helps to present stronger ethical and religious arguments in the face of environmental crises.	Knowledge is not only focused on actions and their impacts, but also on the meaning and deep awareness of those actions, which are related to relational spiritual and sacred dimensions. (Masykur et al., 2023)

FINDINGS	KEY FINDINGS	EVIDENCE FROM STUDY / SOURCE STATEMENT
	Deontological philosophy places humans as "human rule" where they become entities of the universe that have the duty to protect nature and its contents.	Deontological philosophy views humans as having a duty to preserve and protect nature and all its contents (Sulistiyowati, 2024).
	Environmental philosophy examines the complexity of human-nature relationships with a focus on ethics, ecological evolution, and the philosophical foundations of environmental management.	By connecting various disciplines, environmental philosophy helps design more effective management strategies that focus on ecological sustainability (Alio et al., 2025).
	In religious education, ecological values are seen as part of humanity's duty to maintain the balance of nature, in line with their ancestors as caliphs on earth.	An approach that combines the philosophy of science and religious values can shape a generation that is not only academically excellent, but also has strong ecological awareness and moral responsibility. (Baharudin et al., 2024)
	Based on an analysis of the philosophy of science, the author proposes several strategic steps to overcome educational problems in Indonesia	The philosophical-scientific approach supports a holistic and sustainable educational paradigm that is conceptually compatible with the goals of eco-pedagogy to shape students who are not only cognitively intelligent, but also ethical, critical, and environmentally conscious. Muhammad Rafeli Fakhlipi, et al (2025)
	With this philosophical foundation, teachers are encouraged to design learning that is more creative, contextual, and pedagogically valuable, rather than merely transferring content. This has an impact on the development of methods, media, and evaluation strategies.	The philosophy of education held by teachers should not be anthropocentric (human-centered) alone. A holistic understanding of philosophy (encompassing the interrelationship between science, ethics, and the

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FINDINGS	KEY FINDINGS	EVIDENCE FROM STUDY / SOURCE STATEMENT
		environment) is a prerequisite for teachers to implement Samsul Pahmi et al.'s (2024) eco-pedagogy.
Character Education	The implementation of eco-pedagogy through IPAS learning contributes to the formation of students' love for the environment.	Nature has different values, processes, and dynamics; this teaches respect for nature and fellow living beings. (Eliana Yunitha Seran et al., 2024)
	The integration of character education with the philosophy of science is not merely an alternative, but a strategic necessity in today's world of education.	This approach provides an essential pedagogical framework and implementation to equip students to face the complexities of life with moral integrity and optimal intellectual intelligence (Holis, 2025).
	Character education plays an important role in developing individuals who not only have intellectual abilities but also strong moral values.	This educational philosophy serves as an important theoretical foundation for creating and implementing educational approaches that can foster moral character in students in line with existing social values (M. Jildan et al., 2024).
	By integrating the ontology, epistemology, and axiology of the philosophy of science, ecopedagogy can be transformed into a framework that systematically instills ecological awareness and moral responsibility in students, making them resilient and ethical characters in the digital age.	The philosophy of science plays an important role in building a strong and ethical educational character in the digital age. By applying philosophical values such as critical thinking, moral reflection, and responsibility, education can shape a generation that is capable of facing the challenges and negative impacts of technological developments. (A. Sari, Munir, 2024)

FINDINGS	KEY FINDINGS	EVIDENCE FROM STUDY / SOURCE STATEMENT
	The Philosophy of Science provides the principles of validity (ontological, epistemological, axiological) necessary for eco-pedagogy to become not only a learning method, but also a strong ethical and reasoning structure, producing students with a character that is responsible for environmental sustainability.	The essence of character education in elementary schools is implementation that focuses on the cognitive, moral, and behavioral development of students, so that they are able to think well (rationally), have responsibility, and behave ethically (Z. Abidin, et al., 2022).
	The Philosophy of Science acts as an "ethical and truth curator" that ensures Ecopedagogy has a valid basis and clear moral direction to shape students who are not only intelligent, but also ethical and responsible for the sustainability of the Earth.	Character education is a system that aims to instill noble values and become a culture embedded in human life (Rahayu, et al., 2022)
	The use of Essentialism educational philosophy as a foundation for character building requires a comprehensive analysis of the fundamental values and norms to be instilled. This in-depth study is crucial to ensure that the implementation of character education is focused, substantially internalized, and ultimately memperkuat kepribadian serta membentuk karakter yang kokoh pada peserta didik.	Education requires a strong philosophical foundation to achieve the goal of improving human capacity. In the Indonesian context, the selection and combination of educational philosophical schools of thought must be based on an in-depth analysis of the relevance of concepts. under current conditions, especially in relation to curriculum development (Muslim, 2020)
	Based on the philosophical foundations of science, character-based eco-pedagogy was developed as an approach that integrates knowledge, values, and actions. Character education not only shapes individual morals, but also fosters critical awareness of environmental and social issues, so that education functions as a process of humanization and ecologization of humans as a whole.	Character-based eco-pedagogy integrates knowledge, values, and actions to shape individuals who are moral and have critical awareness of environmental and social issues as a process of humanization and ecologization of humans (Nurwahidi et al., 2022).

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FINDINGS	KEY FINDINGS	EVIDENCE FROM STUDY / SOURCE STATEMENT
	The philosophy of science views humans as creatures of God, cultural beings, and citizens who live in social and ecological relationships. In eco-pedagogy, the reality of education does not only focus on the mastery of knowledge, but on the formation of character that is in harmony with religious, cultural, and Pancasila values, as well as human awareness as part of nature.	Character education is education developed based on the values of Religion, Culture, Pancasila, and National education objectives (Yusuf, 2022)
	Islamic educational philosophy in character education views human morality as positive-active or dualistic-active in nature, rather than fatalistic-passive or neutral-passive.	Islamic educational philosophy in character education views human morality as positive-active or dualistic-active in nature, rather than fatalistic-passive or neutral-passive.
	Character education from an eco-pedagogical perspective needs to be strengthened through the internalization of ethical values such as trust, respect, responsibility, care, justice, and citizenship oriented towards human relations with the environment. Character is understood as an understanding of the basic values that shape personality, which are influenced by the social and ecological environment and manifested in daily behavior that reflects concern for the desires of life.	Character education needs to be supported by instilling ethical values such as trust, respect, responsibility, caring, fairness, and citizenship. Character can be defined as the basic values that shape an individual's personality, influenced by various factors, especially the environment, and manifested in daily behavior (Aradika, et. Al, 2022).
	The philosophical perspective of science reveals that education must be able to foster critical, reflective, and creative understanding that can respond to social dynamics and changes of the times.	Education based on the philosophy of science can be an important catalyst in efforts to bring about social change that is more inclusive, sustainable, and fair for all

FINDINGS	KEY FINDINGS	EVIDENCE FROM STUDY / SOURCE STATEMENT
		members of society (Faruq & Bakar, 2025).

This study synthesizes 30 selected articles using a three-layer philosophical framework—ontology, epistemology, and axiology—to clarify how eco-pedagogy, character education, and the philosophy of science interact in shaping sustainable character education in elementary schools. Rather than presenting fragmented findings, this synthesis demonstrates how eco-pedagogy and character education primarily operate at the axiological level, while the philosophy of science provides conceptual validity and coherence across all three layers.

Ontological Dimension: Humans as Part of an Interdependent Ecosystem. At the ontological level, a substantial portion of the reviewed studies (approximately 18 of 30 articles, mostly conceptual and qualitative) emphasize a paradigm shift from an anthropocentric worldview to an ecological worldview. Humans are positioned not as rulers of nature, but as integral parts of interconnected ecosystems (Ahmada et al., 2023; Alio et al., 2025; (Yunansah et al., 2020). Several eco-pedagogical studies stress that education cannot be separated from environmental contexts, particularly in biodiversity-rich countries such as Indonesia (Wahyuni, 2022). This ontological stance underlies school practices that introduce students to flora, fauna, ecosystems, and conservation from an early age, fostering respect for nature as a living system rather than an object of exploitation. In this sense, ontology becomes the foundational paradigm that legitimizes eco-pedagogy as more than a methodological choice it is a worldview transformation. The philosophy of science strengthens this dimension by framing ecological reality as a legitimate object of scientific and ethical reflection, integrating science, religion, and environmental philosophy into a holistic understanding of reality (Ahmada et al., 2023); Masykur et al., 2023)

Epistemological Dimension: Constructing Ecological Knowledge through Contextual and Experiential Learning. The epistemological layer addresses how ecological knowledge is generated, transmitted, and internalized. Most empirical eco-pedagogical studies (around 15 of 30 articles, including qualitative studies, case studies, and limited quantitative research) report that students' ecological understanding develops most effectively through contextual, experiential, and participatory learning approaches. Studies in elementary education show that eco-pedagogy implemented through social studies, science, and IPAS learning promotes critical thinking, environmental literacy, and green behavior (Hendrawan et al., 2020; Wardatussa'idah et al., 2024; Seran et al., 2024). The use of locally grounded and digitally designed teaching materials further supports the relevance and adaptability of ecological knowledge (Margo Irianto et al., 2022). In addition, several studies (6–8 articles) highlight the integration of SDGs and Education for Sustainable Development (ESD) as an epistemological strategy that links global sustainability issues with students' daily experiences (Guo et al., 2024) From the philosophy of science perspective, this reflects an epistemology that recognizes knowledge as contextual, interdisciplinary, and value-laden rather than neutral or purely technical. Thus, philosophy of science provides epistemological legitimacy for experiential, interdisciplinary, and reflective learning methods that are central to eco-pedagogy.

The axiological dimension emerges as the most dominant and consistently emphasized layer, supported by more than two-thirds of the reviewed articles (over 20 of 30 studies). These

studies focus on values such as responsibility, care, justice, respect for nature, citizenship, and moral accountability as the core outcomes of eco-pedagogical and character education (Aradika et al., 2022; Rahayu et al., 2022; Yusuf, 2022). Eco-pedagogy is shown to directly influence pro-environmental behavior, particularly in everyday practices such as energy conservation, waste management, and recycling (Liu & Green, 2024). However, several studies also note that deeper dimensions—such as biodiversity protection, environmental advocacy, and long-term ecological responsibility—are still underdeveloped, indicating the need for sustained and structured school programs. Character education research reinforces this axiological focus by emphasizing the integration of moral, religious, cultural, and Pancasila values into environmental learning (Baharudin et al., 2024; Holis, 2025). Here, the philosophy of science functions as an ethical and truth curator, ensuring that eco-pedagogy is grounded in valid ontological assumptions, sound epistemological processes, and clear moral direction (Sari & Munir, 2024; Fakhlipi et al., 2025).

This synthesis demonstrates that: Eco-pedagogy and character education primarily "fill" the axiological dimension, shaping students' values, attitudes, and behaviors toward environmental sustainability. The philosophy of science provides conceptual validity across ontology, epistemology, and axiology, ensuring that eco-pedagogy is not merely a pedagogical trend, but a philosophically grounded educational framework. By integrating these dimensions, eco-pedagogy evolves into a holistic approach that unites knowledge, values, and action supporting the formation of students who are not only cognitively capable, but also ethically responsible and ecologically conscious.

Despite its contributions, this review has several limitations. First, most empirical studies rely on qualitative or case-based designs, with limited longitudinal and quantitative evidence measuring long-term character and behavioral change. Second, pro-environmental behavior research tends to focus on short-term and routine actions, leaving advocacy, biodiversity ethics, and systemic ecological responsibility underexplored.

Employ longitudinal and mixed-methods designs to examine the sustainability of ecological character formation. Develop measurement instruments that capture deeper axiological outcomes, such as ecological justice and moral reasoning. Explore how digital eco-pedagogy, grounded in the philosophy of science, can support sustainability education without reinforcing technocentric or anthropocentric biases.

Conclusion

This literature review suggests that the philosophy of science plays a significant conceptual role in shaping the direction and foundational values of eco-pedagogical development as a strategy for sustainable character education in elementary schools. From an ontological perspective, the philosophy of science frames humans and nature as interdependent and interconnected entities, providing a paradigm that challenges human-centered worldviews. Epistemologically, it supports learning processes that are reflective, contextual, and grounded in students' lived experiences, encouraging the construction of ecological knowledge through direct interaction with environmental and social realities (Faruq & Bakar, 2025) Axiologically, the philosophy of science emphasizes moral reasoning, ethical reflection, and ecological responsibility as essential components of education.

Across the reviewed studies, many articles (predominantly qualitative and case-based) report that the application of eco-pedagogy in elementary education is associated with increased environmental awareness, strengthened ecological consciousness, and the development of

critical thinking skills. Several studies also highlight practical implications, such as the integration of environmental values into subject matter learning, the use of context-based and experience-oriented instructional strategies, and the incorporation of local culture, spiritual values, and sustainability themes (including SDGs and ESD) into classroom practices. These findings indicate that eco-pedagogy may function not only as a teaching approach, but also as a value-oriented framework that supports the internalization of ecological ethics and responsible behavior among students.

However, this review also identifies important limitations in the existing body of literature. First, most studies rely on qualitative methods or short-term interventions, with limited longitudinal and quantitative evidence to assess the long-term impact of eco-pedagogy on students' character formation and pro-environmental behavior. Second, many empirical studies focus on routine or immediate behaviors (such as waste management and energy conservation), while broader dimensions—such as biodiversity ethics, environmental advocacy, and systemic ecological responsibility—remain underexplored. In addition, the philosophical foundations of eco-pedagogy are often discussed implicitly rather than analyzed systematically using ontological, epistemological, and axiological frameworks.

Based on these limitations, future research is encouraged to employ mixed-methods and longitudinal designs to examine the sustainability of ecological character development over time. Further studies should also develop clearer analytical instruments to assess axiological outcomes, including moral reasoning, ecological justice, and ethical decision-making. Moreover, deeper philosophical analyses are needed to explicitly articulate how the philosophy of science can strengthen eco-pedagogy as a coherent framework for sustainable character education, particularly in the context of elementary schools facing rapid technological and socio-environmental change.

References

Abidin, Z., Nurwahidin, M., & Sudjarwo. (2022). Konsep ontologi filsafat ilmu dalam pendidikan karakter di sekolah dasar. *2*(7), 2681–2694.

Adzani, I. A., Azizah, K. N., Adiwinata, N. J., & Marthania, W. (2024). Implementasi ekopedagogi dalam pembelajaran sekolah dasar. *Bahasa Dan Budaya*, *3*(1), 106–115. https://doi.org/10.55606/jpbb.v3i1.2730

Ahmada, Y. A. F., Ahmadi, R., & Ardi, M. (2023). *Simbiosis Ekologi Manusia dan Penyelidikan Filosofis*. *4*.

Alio, L., Hasim, H., Baruwadi, M. H., & Musa, W. J. (2025). *Analisis Pemetaan Bibliometrik : Filsafat ilmu dalam bidang Lingkungan*. *4*(2), 2451–2457.

Amanda, F., Sahma, P., Afifah, N., Yusuf, E., & Herlambang, T. (2024). *Peran Filsafat Teknologi Dalam Mengembangkan Kemampuan Calon Pendidik di Abad 21*. *2*(1), 577–586.

Aradika, M. K., Nurwahidin, M., Teknologi, M., Universitas, P., Dosen, S., & Universitas, F. (2022). Konsep pendidikan karakter anak dalam perspektif filsafat ilmu. *2*(7), 2621–2628.

Baharudin, B., Jufri, D., & Dalle, A. (2024). *Ekologi dan Tinjauan Filsafat Sains Pendidikan Islam*. *9*(12).

Cahya, R. S. I., Nuryani, P., & Anasta, N. D. C. (2022). Rancangan Media Pembelajaran Multimedia Interaktif Berbasis Pendekatan Ekopedagogi Sebagai Upaya Meningkatkan

Pemahaman Siswa Pada Tema 9 Subtema 1 Kelas IV Sekolah Dasar. *Jurnal Pendidikan Guru Sekolah Dasar*, *7*(1), 41–50.

Candra, D., Veri, J., Artikel, I., Resource, S. H., Candra, D., & Manejemen, M. (2025). Systematic literatur review dengan metode prisma : integrasi nilai dei dalam strategi pengelolaan sdm berkelanjutan di. *4*(3), 854–861.

Costanius, S., Gaffar, V., & Arief, M. (2024). *Jurnal Ilmiah M-Progress Jurnal Ilmiah M-Progress*. *14*, 1–11.

Dewi, R. (2021). Integrasi Pendidikan Islam Dalam Implementasi Ekologi. *Sustainable Jurnal Kajian Mutu Pendidikan*, *4*(2), 119–131. https://doi.org/10.32923/kjmp.v4i2.2175

Durrotun Nafisah, Dewi Liesnoor Setyowat, Eva Banowat, & Agustinus Sugeng Priyanto. (2019). Pendidikan Berbasis Ekopedagogik dalam Pembelajaran IPS di Era New Normal. *Prosiding Seminar Nasional Pascasarjana UNNES*, *19*(2019), 393.

Efendi, P. M., Tatang Muhtar, & Yusuf Tri Herlambang. (2023). Relevansi Kurikulum Merdeka Dengan Konsepsi Ki Hadjar Dewantara: Studi Kritis Dalam Perspektif Filosofis-Pedagogis. *Jurnal Elementaria Edukasia*, *6*(2), 548–561. https://doi.org/10.31949/jee.v6i2.5487

Fakhlipi, M. R., Purwoko, B., & Susarno, L. H. (2025). Permasalahan-permasalahan Pendidikan di Indonesia dan Upaya Mengatasinya: Perspektif Filsafat Ilmu. *JIIP - Jurnal Ilmiah Ilmu Pendidikan*, *8*(2), 1211–1218. https://doi.org/10.54371/jiip.v8i2.6841

Faruq, U., & Bakar, M. Y. A. (2025). *Pendidikan Sebagai Alat Transformasi Sosial Perspektif Filsafat Ilmu*. *1*.

Fauzi, I. (2019). *Manajemen Filsafat Pendidikan Karakter Pendahuluan*. *11*(April), 1–29.

Fitriyani et al. (2025). Thematic and integrated approach based on ecopedagogy in. *4*(1).

Gadotti, M. (2007). Education for sustainability *A critical contribution to the Decade of. 1988*, 1–12.

Guo, C., Huang, Y., Guo, C., Chen, X., Ilmu, F., & Hefei, U. N. (2024). *Penelitian tentang Integrasi Tujuan Pembangunan Berkelanjutan dan Praktik Pengajaran di Masa Depan Kursus Pendidikan Sains Guru Penelitian tentang Integrasi Pembangunan Berkelanjutan Tujuan dan Praktik Mengajar dalam Calon Guru Sains*.

Hendrawan, B., Nugraha, M. F., & Nugraha, F. (2020). Faktor-Faktor yang Mempengaruhi Kesadaran Ekologis Siswa Pada Pembelajaran Berbasis Ekopedagogik di Sekolah Dasar. *Naturalistic : Jurnal Kajian Penelitian Pendidikan Dan Pembelajaran*, *5*(1), 684–491. https://doi.org/10.35568/naturalistic.v5i1.907

Hijriyanah & Sutarna. (2023). Attadib: Journal of Elementary Education Attadib: Journal of Elementary Education SINTA 3. *Journal of Elementary Education Edisi*, *7*(1), 2614–1752.

Husban, W. Al. (2025). *The Impact of Integrating Sustainable Development Goals on Students ' Awareness and Pro- Environmental Behavior : A Case Study of Jordan*.

Husen, A., Abdillah, F., Fadlilah, D. R., Sanjaya, R., & Renaldo, A. E. (2024). *Hidup di sekolah Kapusdatin BNPB (Badan Nasional Penanggulangan Bencana) Agus Wibowo*. *2024*, 154–172.

Ichsan, I. Z., Sya, A., Sunaryo, S., Husen, A., Sigit, D. V., Rahmi, Y. L., Adlini, M. N., Titin, T., & Nurfadhilah, N. (2021). Hots-Aep of Climate Change (Hots-Aepcc) Dan Topik Bioteknologi Untuk Ekopedagogik Pada Pembelajaran Ipa. *Jurnal Biotek*, *9*(1), 11. https://doi.org/10.24252/jb.v9i1.21101

IPBES. (2019). *Biodiversity and ecosystem services The global assessment report on S*ummary for policymakers of the ipbes global assessment report on biodiversity.

IPCC. (2023). *Climate change 2023 Synthesis Report*.

Kahn, R. (2008). From Education for Sustainable Development to Ecopedagogy *: Sustaining Capitalism or Sustaining Life ? 4*(1), 1–14. https://doi.org/10.3903/gtp.2008.1.2

Kopnina, H., Black, K., & Tracey, H. (2024). Ekoliterasi dan ekopedagogi untuk keberlanjutan lingkungan dalam pendidikan.

Kusumawardani, R. R. W. A., & Kuswanto, K. (2020). Membangun kesadaran lingkungan melalui ekopedagogik pada anak usia dini berlandaskan konsep Jan Ligthart. *Jurnal Pendidikan Anak*, *9*(2), 94–99. https://doi.org/10.21831/jpa.v9i2.31997

M. Jildan, H., Habi, M., Hasim, & Bumulo, F. (2024). *Filsafat Pendidikan dalam Membentuk Karakter Siswa*. *4*, 3585–3590.

Margo Irianto, D., Herlambang, Y. T., Yunansah, H., & Wahid, R. (2022). Rancang bangun bahan ajar digital berbasis ekopedagogik approach. *Naturalistic : Jurnal Kajian Penelitian Pendidikan Dan Pembelajaran*, *6*(2), 1150–1160. https://doi.org/10.35568/naturalistic.v6i2.1813

Masykur, Z. M., Niam, S., Naim, N., Islam, U., Sayyid, N., & Rahmatullah, A. (2023). *Scientia Sacra Seyyed Hossein Nasr Perspektif Filsafat*. *25*, 166–183.

Matroni. (2024). Ekopedagogik Dalam Menumbuhkan Kesadaran Ekologis. *TA'DIB: Jurnal Pendidikan Agama Islam*, *2*(2), 176–198. https://doi.org/10.69768/jt.v2i2.50

Mintza, K. K., Hennc, L., Parkdo, J., Kurmanb, J., & Mintz, K. K. (2019). *Machine Translated by Google Sumber Daya , Konservasi & Daur Ulang perilaku sebagai moderator Machine Translated by Google*. *145*(September 2018), 11–18.

Muslim, A. (2020). Telaah filsafat pendidikan esensialisme dalam pendidikan karakter. *10*, 37–41.

Nurwahidi, M., Muhammad, I. S., & Sudjarwo. (2022). Pendidikan karakter dalam perspektif filsafat ilmu *Oleh*. *2*(1), 11–20.

Oktavia, A., Ayu, P., & Herlambang, T. Y. (2023). Manusia dan teknologi: studi filsafat tentang peran teknologi dalam kehidupan sosial. *2*(4), 13157–13171.

Pahmi, S., Winarni, W., Verianti, G., Rahmadiani, O., & Azzahra, M. (2024). Peran Filsafat Ilmu Pendidikan dalam Pengembangan Profesionalisme Guru Sekolah Dasar : Tinjauan Literatur. *6*(2), 137–144.

Pati, D., Ap, L., Lorusso, L. N., & Arch, M. S. (2018). How to Write a Systematic Review of the Literature. *11*(1), 15–30. https://doi.org/10.1177/1937586717747384

Priharsari, D., Brawijaya, U., & Korespondensi, P. (2022). Systematic literature review di bidang sistem informasi dan systematic literature review in information systems and computer engineering : a guideline. *9*(2), 263–268. https://doi.org/10.25126/jtiik.202293884

Pulkki, J., Varpanen, J., & Mullen, J. (2021). Filsafat Pendidikan Eko-Sosial: Mengekosalkan Diri yang Berpendapat. 347–364.

Purwanto, E. (2025). *Persimpangan Sains , Agama , dan Filsafat Lingkungan*. *8*(1).

Rahayu, P., Nurwahidin, M., & Sudjarwo. (2022). Problematika pendidikan karakter bangsa indonesia dalam perspektif filsafat ilmu. *2*(7), 2653–2660.

Sari, A. P., & Munir. (2024). Peran Filsafat Ilmu dalam Membangun Karakter Pendidikan di Era Digital dan Teknologi. *4*(September), 952–958.

Seran, E. Y., Aristo, T. J. V., & Ridwan, C. (2024). Pendidikan Ekopedagogik Untuk Mengembangkan Karakter Cinta Lingkungan Siswa Sekolah Dasar Melalui Pembelajaran Ipas. *Jurnal Pendidikan Dasar Perkhasa: Jurnal Penelitian Pendidikan Dasar*, *10*(1), 433–444. https://doi.org/10.31932/jpdp.v10i1.3418

Sulistiyowati, E. (2024). *Filsafat Ekologi Dan Pengetahuan Lokal Untuk Mencapai Konservasi Keanekaragaman Hayati Yang Holistik*. *7*(1), 11–23.

UNEP. (2023). *Turning off the Tap How the world can end plastic pollution and create a circular economy*.

Velempini, K. (2025). *Assessing the Role of Environmental Education Practices Towards the Attainment of the 2030 Sustainable Development Goals*.

Wahyuni, H. I. (2022). Relevansi Konsep Ekopedagogik di Era Kurikulum Merdeka Belajar: Sebuah Kajian Literatur. *Inovasi Pendidikan Dan Pembelajaran Abad 21 Serta Biodiversitas Indonesia*, 368.

Wahyuni, H. I., Shoukat, N., & Romadhon, N. (2023). Inventarisasi Pemanfaatan Tumbuhan Dan Relevansinya Sebagai Sumber Pembelajaran Ekopedagogik Berbasis Kearifan Lokal. *Didaktika Biologi: Jurnal Penelitian Pendidikan Biologi*, *7*(1), 23. https://doi.org/10.32502/dikbio.v7i1.5709

Wardatussa'idah, I., Suntari, Y., & Sarkadi. (2024). Pendekatan Perilaku Hijau Melalui Ekopedagogi Dalam Studi SosialPembelajaran Di Sekolah Dasar Di Daerah Jakarta. *Jurnal Pendidikan Tambusai*, *8*(1), 433–440.

Yuliani, S., Maryani, E., Nurbayani, S., & Email, P. K. (2024). *Machine Translated by Google Ekopedagogi sebagai Pendekatan Alternatif dalam Pengembangan Pengajaran IPS Materi di Sekolah Pesisir di Jakarta 1 * Universitas Negeri Jakarta , Indonesia . Perkenalan Jakarta memiliki wilayah pesisir yang memprihatinkan . Ek*. *10*(2), 541–552.

Yunansah, H., & Herlambang, Y. T. (2017). Pendidikan berbasis Ekopedagodik dalam Menumbuhkan Kesadaran Ekologis dan Mengembangkan Karakter Siswa Sekolah Dasar: Sebuah Telaah Kritis dalam Perspektif Pedagogik Kritis. *EduHumaniora: Jurnal Pendidikan Dasar*, *9*(1), 27–34.

Yunansah, H., Kuswanto, K., & Abdillah, F. (2020). Ekopedagogik: Analisis Pola Pendidikan Di Sekolah Alam Bandung. *EduHumaniora | Jurnal Pendidikan Dasar Kampus Cibiru*, *12*(2), 115–124. https://doi.org/10.17509/eh.v12i2.20597

Yusuf, M. (2022). *Pendidikan karakter dalam perspektif filsafat pendidikan islam*. *18*(2), 22–29.

Zeng, Y., Hallås, B. O., & Sæle, O. O. (2024). Intercultural dialogue on ecopedagogy between Daoism and Naess' ecosophy: Comparing and integrating Chinese and Western ecological wisdom. *Educational Philosophy and Theory*, *56*(12), 1229–1240. https://doi.org/10.1080/00131857.2024.2376636