Ecopedagogy and Environmental Literacy in Research Trends in Indonesia

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Abstract	This study analyzes the trend and development of eco-pedagogy literacy in Indonesia from 2016 to 2024. The method used was a Systematic Literature Review (SLR) with the PRISMA protocol, analyzing 27 articles that met the inclusion criteria. The results of this study showed 1) a significant increase in the number of publications related to eco pedagogy literacy, especially publications in 2023, 2) Qualitative research with high school students as subjects and questionnaires as research tools are often used, 3) Problem-Based Learning (PBL) and Contextual Learning (CL) are the most common learning strategies applied in eco pedagogy. In addition, environmental awareness is the theme most often associated with ecopedagogy literacy in Indonesia. The study also revealed that the Research and Development (RnD) approach is rarely applied, so there are opportunities for developing innovative learning modules and educational media that are more interactive in introducing eco-pedagogy. This research contributes to understanding how environmental education can be strengthened through eco pedagogy and encourages further research that focuses on using technology in learning to improve environmental literacy. As such, the findings are highly relevant to supporting the development of more sustainable education programs in Indonesia.
Keywords	Eco Pedagogy Literacy; Environment; Indonesia

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1. INTRODUCTION

In many parts of the world, environmental conditions are deteriorating due to a series of complex social-ecological problems (Oyedotun & Ally, 2021). These include climate change, air and water pollution, ocean acidification, soil degradation, and the decline of biodiversity (Muluneh, 2021). As the *Intergovernmental Panel on Climate Change* (IPPC) report states, Asia is experiencing damage to urban infrastructure and human health impacts caused by flooding, especially in coastal cities and more so in the Americas (Calvin et al., 2023). Humans and nature should be interconnected and form a healthy ecological ecosystem.

To address these and other complex global challenges, the United Nations (UN) has adopted the resolution *"Transforming Our World: The 2030 Agenda for Sustainable Development*," which was agreed by nearly 200 countries (Muluneh, 2021).). This resolution emphasizes 17 Sustainable Development Goals

(SDGs) designed to be achieved by 2030. The SDGs initiative is rooted in a shared global vision to create a better future economically and socially while maintaining environmental sustainability for the planet and current and future generations (Rap et al., 2022).

In Indonesia, cases related to the environment are already alarming; for example, river water pollution from the Ministry of Environment data in 2022 showed that the quality of river water in Indonesia experienced severe pollution throughout 2015-2020, especially in Java and Bali. In addition, data from the Coordinating Ministry for Human Development and Culture of the Republic of Indonesia (Kemenko PMK) revealed that as much as 7.2 million tons of waste in Indonesia is still not handled effectively, especially plastic waste, which takes millions of years to decompose. This condition is dangerous for long-term human health and endangers the earth's ecosystem.

Global issues related to the environmental crisis encourage and attract the attention of researchers, academics, policy actors, and environmental activists to do significant things to overcome the crisis through education. why is this necessary? Justice Kofi Debrah et al.'s research shows a relationship between environmental attitudes, environmental awareness, and environmental knowledge teachers convey to students through education. Although students' level of awareness and positive attitudes towards the environment do not necessarily affect participation in environmental issues, high environmental knowledge and appreciative attitudes towards the environment are important to achieve individual sustainability in global issues (Debrah et al., 2021). So, education still plays an important portion in efforts to overcome the environmental crisis (Wals & Benavot, 2017)

One way is through *eco pedagogy,* which emphasizes the relationship between humans and the natural environment through education. (Misiaszek., 2023). *Ecopedagogy* is seen as an educational approach that not only considers environmental issues in isolation but also relates them to social dynamics, politics, and global issues (Angelis., 2022). Ecopedagogy is an educational movement that aims to develop understanding, awareness, and life skills in students so that they become active individuals in preserving nature and maintaining the balance of the ecosystem (Kahn., 2010).

Ecopedagogy is not just the best teaching method or approach in environmental education; more than that, philosophically, ecopedagogy aims to build collective awareness so that individuals can be active in preserving and maintaining the surrounding nature. Nature is considered a space that gives meaning and importance to life, not just a physical environment. As a movement, eco pedagogy opposes environmental education practices that only pay attention to short-term interests, which separate humans from their environment, are not future-oriented, and do not support the concept of sustainability (Supriatna., 2016).

Furthermore, this approach intends to provide a deeper perspective and understanding of environmental issues, encourage pro-environmental actions, and build awareness of the importance of maintaining environmental sustainability. In addition, Ecopedagogy also involves applying the principles of critical education to build the skills and knowledge necessary to act responsibly toward the environment (Chaparian, 2024).,(Tinnell, 2011)

Ecopedagogy is a necessary form of transformation in education because it provides insight into the importance of a holistic and action-oriented global sustainable education to prepare students as citizens who care about the environment and are committed to maintaining environmental sustainability (Bonal & Fontdevila, 2017). In addition, eco-pedagogy can create individuals with high inner awareness and contribute to sustainable development. Ecopedagogy is an educational approach and a movement towards social change and a better environment. It is an attempt to create a generation that is not only aware of the environmental challenges faced but is also ready and able to take the necessary actions to address such issues sustainably and responsibly (Febriantie, 2023).

In Indonesia, eco pedagogy is better known as environmental education, an elaboration of the Adiwiyata program that is integrated into formal education. The two terms are considered the same

because they have the aim of developing citizens who are environmentally aware, proactive in preserving the environment, and prepare future generations for better environmental management (Sarbaini et al., 2022) and if necessary, already done as early as possible (Gaard, 2009).

Ecopedagogy has various benefits that can be felt by students, teachers, communities, and the environment as a whole, including 1) Increased environmental awareness for students and increased understanding of environmental issues and the importance of maintaining their sustainability 2) environmental problem-solving, active participation, and involvement in collective action 3) empowering students as environmentally concerned agents of change, who are ready to contribute to maintaining environmental sustainability 4) improving the quality of teacher teaching by paying attention to environmental values 5) the community can also be involved in efforts to protect the environment, thus creating collective awareness 6) to encourage environmentally friendly community practices (Grosseck et al., 2019).

Given the benefits mentioned, research conducted by Yiannis Georgio et al. recommends sustainable education with an eco-pedagogy approach. Among them are 1) A teacher professional development program based on the Adventure Learning (AL) approach, which is useful for increasing teacher perceptions of environmental awareness 2) Environmental education, which is essential for achieving goals such as problem-solving, critical engagement, sustainability, and healthy relationships with nature 3) EEC (Education for Environmental Citizenship) pedagogical approach model by offering six stages for the design and implementation of environmental education programs 4) Individualistic and collective awareness approaches (Georgiou et al., 2021).

Previous researchers by Joella L. Zocher (2020) et al. showed that implementing an eco-pedagogy approach as part of experimental education conducted in the city center through Science Strikes Back (SSB) activities could significantly contribute. SSB is designed to increase community participation in environmental management and conservation. Through SSB, students engage in experiments on water quality around them. This promotes critical thinking about water quality issues that affect the community. SSB also extends the impact of the science fair by building collaborations between students, educators, community members, and content specialists who engage in science activities throughout the year. This approach creates more lasting relationships between the environmental community and educators and connects students more deeply with environmental management in their communities. In addition, the involvement of community members and content specialists in the project introduces students to careers and real-life applications of the science content learned. (Zocher & Hougham, 2020).

Mjege Kinyota (2021) analyzed the extent to which an environmental education

course taught at a university in Tanzania explored the extent to which the course reflected the principles of *eco-pedagogy* in the context of a highly centralized curriculum. The results showed that there were challenges in fully integrating *eco-pedagogy*. Kinyota analyzed that despite efforts to teach the course using *eco-pedagogy*, the centralized curriculum limits flexibility in thoroughly adopting this approach. This research also analyzes the importance of considering the role of curriculum policy in facilitating a more holistic and sustainable approach to environmental education (Kinyota, 2021).

In this research, a collection of studies related to eco pedagogy or environmental literacy in Indonesia will be conducted by applying a systematic literature review on scientific journals that discuss the topic, published in the last 8-year period, from 2016 to 2024, and indexed in Scopus or accredited in SINTA 1 and 2. The purpose of this research is to explore: (1) The development of the number of publications on eco pedagogy or environmental literacy from 2016 to 2024, (2) The pattern of research design applied, (3) The pattern of research objects, (4) The strategy applied in the study, (5) The research instruments used, (6) The aspects associated with eco pedagogy or environmental literacy, and (7) The data analysis techniques used in the research.

2. METHODS

Research Design

This *Systematic Literature Review* (SLR) uses the PRISMA (*Preferred Reporting Items for Systematic Reviews and Meta-Analysis*) protocol. This protocol helps researchers identify review results with appropriate literature according to the research objectives through four main stages: 1) Identification, involving the process of searching and collecting all literature relevant to the research topic 2) Elimination, assessing the quality and relevance of the identified articles 3) Checking the eligibility of the collected articles 4) Interpretation of all available research evidence, to analyze and synthesize the findings of the evaluated studies and providing solutions to specific research questions (Kitchenham et al., 2009). Articles were searched using ecopedagogy literacy, environmental literacy, and Indonesia.

Data Source

The data in this study were obtained through content analysis of articles focusing on eco pedagogy literacy or environmental literacy in Indonesia, published in Scopus-indexed or Sinta 1 and 2 accredited journals. In addition, there are criteria and limitations of data eligibility applied in this study, among others:

a. Scopus-indexed or Sinta 1 and 2 accredited journals.
b. The data used are journals published between 2016 and 2024.
c. The data used is research conducted in the Indonesian region.
d. The data is related to pedagogy and environmental literacy in Indonesia.
e. Not the result of a prodding, book chapter, thesis, dissertation, or thesis

Research Instruments

The instruments applied in this study are the guidelines for content analysis found in Table 1:

Table 1. Content Analysis Guidelines

No.	Aspects	Classification
1	Research method	Qualitative, Quantitative, Mixed Methods, Research and Development (RnD), SLR and Literature Review
2	Research subject	Elementary School (SD), Junior High School (SMP), Senior High School (SMA), College Students, and Teachers
3	Research instruments	Questionnaires, interviews, tests, documents, and observations

Data Analysis

This study conducted data analysis through a systematic review using PRISMA guidelines. The analysis process began with the identification of relevant articles for the study. Once the articles were selected based on keywords, the next step was to screen the articles to eliminate those that were not relevant to the study topic. This elimination stage is done by considering the collected articles' titles, keywords, and abstracts. This process can be seen in Figure 1
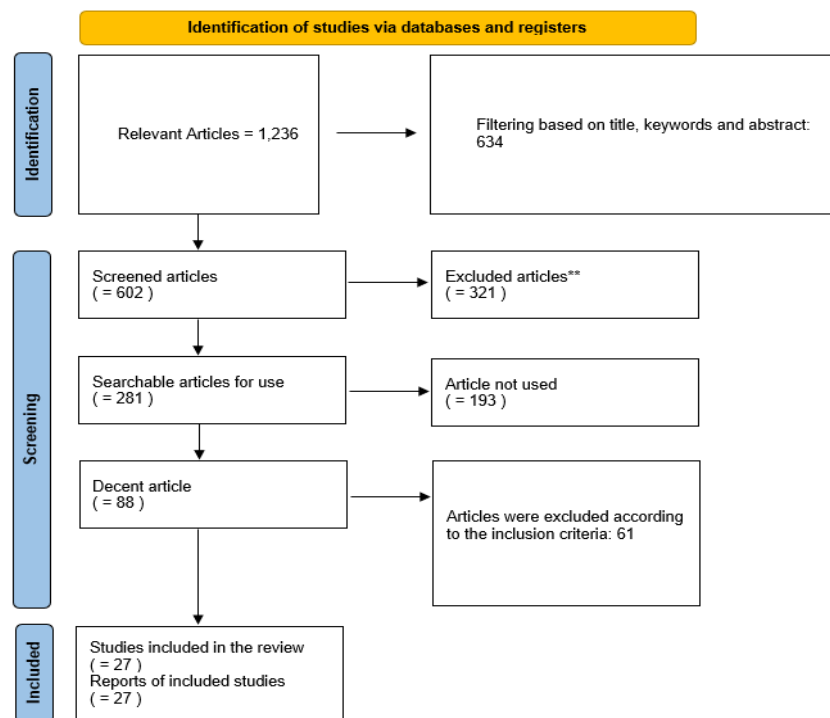
Figure 1. Identification of Studies via Databases and Registers

In the initial stage, the identification process produced 1,236 articles that were considered relevant. After filtering based on title, keywords, and abstract, the number of articles was reduced to 634. Furthermore, at the elimination or *screening* stage, 602 articles were filtered, while 321 articles were excluded because they did not meet the predetermined standards.

Of the 88 articles, 61 were excluded because they came from non-peer-reviewed sources such as *book chapters*, proceedings, and final study assignments (theses, theses, and dissertations). Finally, only 27 articles met the predetermined criteria and standards to be analyzed comprehensively. Furthermore, the 27 articles will be analyzed following the predetermined content analysis guidelines. The analysis results will be presented as bar charts and tables for further discussion.

Of the 1,236 articles identified at the start of the selection, only 2.18% (27 articles) were included in the final review. This indicates the rigorous selection process, demonstrating a focused and thorough approach to determining relevant and quality articles for review.

3. FINDINGS AND DISCUSSIONS

Frequency of Publication Every Year

The annual publication frequency results reflect the intensity of the research conducted on eco pedagogy or environmental literacy in Indonesia.

Data regarding the number of publications of articles focusing on eco pedagogy or environmental

literacy in Indonesia from 2016 to 2024, indexed by Scopus or Sinta 1 and 2, are presented as illustrations in Figure 2 below.
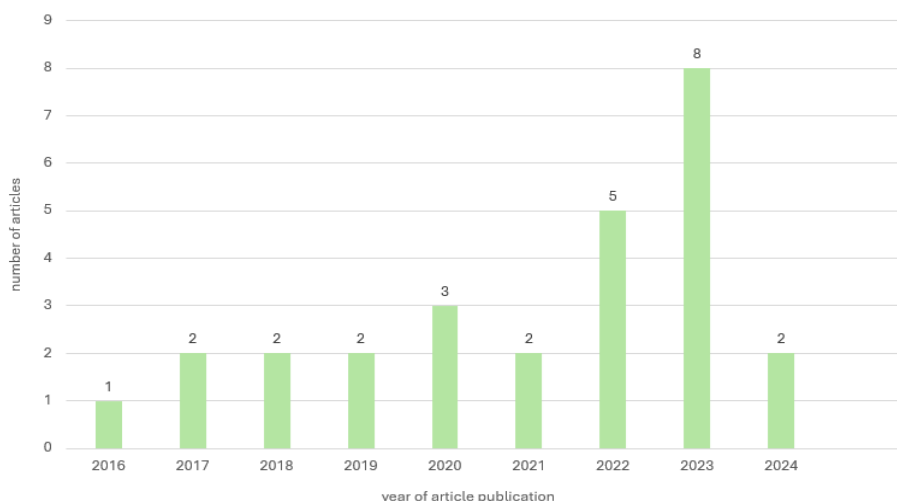
Figure 2. Number of Articles Published

Based on Figure 2, research related to ecopedagogy or environmental literacy in Indonesia in the Scopus and Sinta 1 and 2 databases was detected to appear from 2016 to 2024. The trend of article publications in 2017, 2018, 2019, 2021, and 2024 has not shown that the number of publications has not increased during that period. However, there was an increase in the number of publications in 2020, with three articles found, followed by a spike in 2022 with five articles. Furthermore, there was a significant increase and the highest number of publications in 2023, with eight articles. The pattern of the previous years shows the possibility of a continuous upward trend and the increase is fluctuating.

The increase in the number of publications in 2023 is allegedly due to the mandate from the Indonesian government that every educational institution integrates environmental issues in the curriculum as a solution to increase students' awareness and understanding of environmental issues through the Adiwiyata program, which has many similarities in principles and practices that are in line with the concept of eco pedagogy. The program addresses gaps in teaching environmental education in schools and prepares future generations for better environmental management (Sarbaini et al., 2022). Therefore, researchers in the field of education and the environment are increasingly starting to research. This increased interest can be seen in the significant spike in the number of publications by 2023.

The Research Design Applied

In this study, in addition to analyzing the number of publications per year, the dominant research approach used by researchers examining eco-pedagogy literacy or environmental literacy in Indonesia was also examined. Figure 3 presents data on the research design most often applied in eco pedagogy or environmental literacy studies.
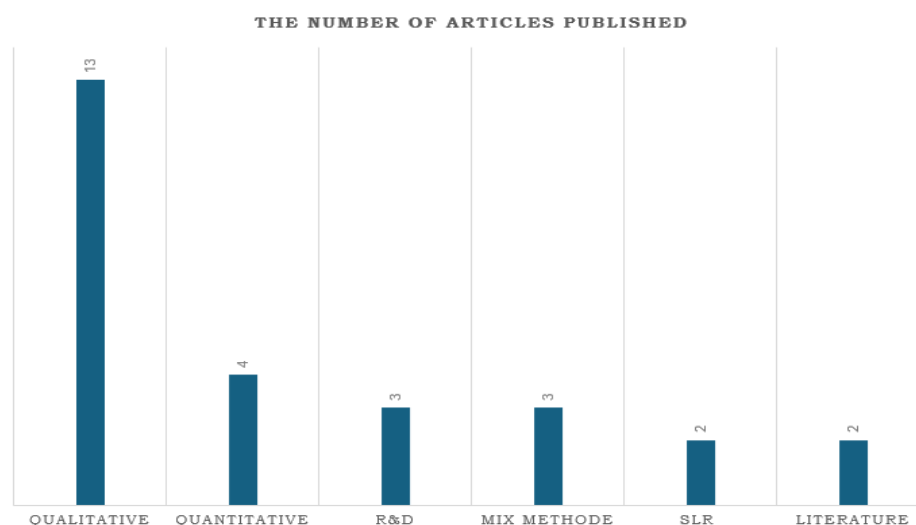
THE NUMBER OF ARTICLES PUBLISHED

Figure 3. Research Approach

Based on the data shown in Figure 3, qualitative research is the most dominant type of research. This is the trend where many studies in environmental education or eco-pedagogy use a qualitative approach. (Macura et al., 2019).

Qualitative research is often the first choice in eco pedagogy or environmental literacy studies because of its ability to understand the complexity of ecological understanding. This approach allows researchers to describe in depth how a person or student interprets and interacts with environmental issues. This ranges from a conceptual understanding of ecosystems to the practical ability to apply sustainability principles. Researchers can explore how a person or student articulates the relationship between humans and nature, how to visualize solutions to environmental problems, or how to develop a personal environmental ethic.

Qualitative research becomes a key tool in uncovering and understanding the deeper and often hidden dimensions of eco-pedagogy literacy, providing rich and contextualized insights that are difficult to achieve through quantitative research methods.

One aspect that still needs more attention is research on specific *scaffolding* strategies to improve eco-pedagogy literacy. This includes developing and evaluating innovative learning methods to deepen understanding of eco-pedagogy.

Furthermore, based on the analysis of related articles, researchers in Indonesia on eco pedagogy or environmental literacy also conduct much research using quantitative methods in addition to the dominant qualitative methods. These studies often aim to develop and evaluate valid and reliable eco pedagogy or environmental literacy measurement instruments and assess the effectiveness of eco pedagogy or environmental programs in Indonesia, referred to as Adiwiyata programs. For example, Ayu Ashari's research aims to evaluate students' cognitive aspects, attitudes, and behaviors related to environmental literacy and to provide a clearer picture of students' understanding and involvement in environmental issues. Her research uses a quantitative design using Structural Equation Modeling (SEM), which can provide useful information for schools that will design better educational programs to support environmentally friendly behavior among prospective teachers. (Rachmatullah et al., 2021). Furthermore, Nurwidodo's research evaluates the differences in environmental literacy levels between students who attend Adiwiyata and non-Adiwiyata schools. This comparative research design was used in this study. (Nurwidodo et al., 2020). Again, Wilujeng et al.'s research on the effectiveness of Education for Environmental Sustainable Development (EESD) in improving environmental literacy among students. This research design is an experiment with a *pre-test and* post-test model. (Wilujeng, et

al., 2019).

Although qualitative research dominates in eco pedagogy and environmental literacy, research using the Research and Development (RnD) approach is still relatively rare. Based on the results of the analysis, only three articles were found that discussed the development of innovative eco pedagogy or environmental learning modules and the creation of interactive educational media to increase environmental awareness. One example is Hermawan's research, which produces integrated teaching materials with the BE-RAISE learning model. (Hermawan et al., 2022), aiming to improve students' environmental literacy skills. In addition, research conducted by Gusti Izhar developed Android-based learning media to increase students' appreciation of the surrounding environment through innovative media according to the needs of students and teachers. (Izhar et al., 2022). However, it should be remembered that the usefulness of using technology as an eco-pedagogy literacy tool to support sustainability must be prioritized because, currently, many uses of technology damage the environment (Lummis, 2002).

In addition to qualitative, quantitative, and Research and Development (RnD) approaches, mixed methods research has yet to become a significant trend in eco pedagogy or environmental literacy. This approach combines the strengths of qualitative and quantitative methods to provide a more comprehensive and in-depth understanding of the phenomenon under study. This time, Mix Methode improves students' eco pedagogy or environmental literacy by developing relevant, interesting teaching materials that align with local potential. (Fahlevi et al., 2023). Similarly, Wajdi's research explains the effect of problem-based learning models with environment-based comics (PBLEC) in cultivating students' eco-pedagogy and environmental literacy awareness in Indonesia. (Wajdi et al., 2022).

The research findings show that the Research and Development (RnD) approach and *mixed methods* are rarely used in studying eco pedagogy or environmental literacy; future researchers should explore and integrate these two methods. The RnD approach can be used to develop innovations in learning modules and educational media specifically designed to improve environmental literacy. Meanwhile, *mixed methods* can provide a more comprehensive understanding by combining the strengths of qualitative and quantitative data, resulting in deeper insights and more effective practical applications. Research utilizing both methods expected to contribute to developing more holistic and innovative eco-pedagogy literacy theory and practice.
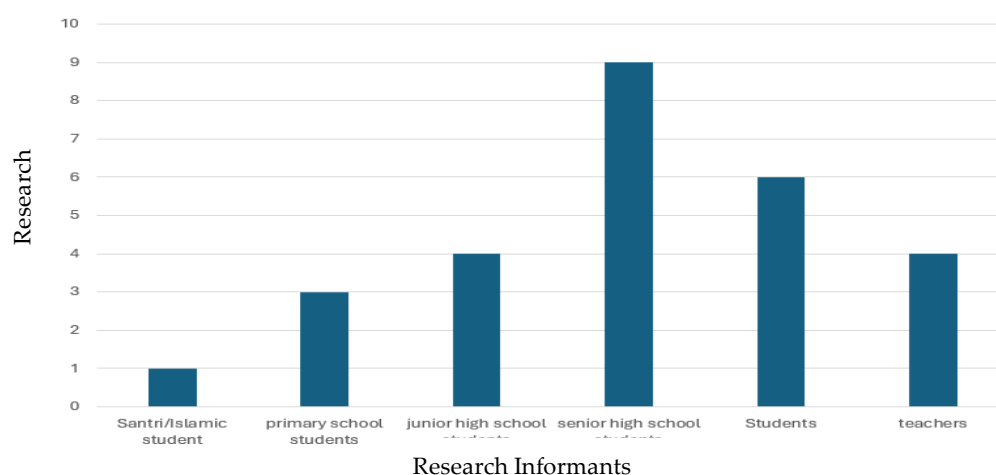
In the realm of eco pedagogy or environmental literacy, SLR and literature research has been conducted to deeply analyze relevant documents, curricula, lessons, and scholarly articles. The *systematic literature review* (SLR) approach allows researchers to identify trends, gaps, and opportunities in this field. Through SLR, the researchers were able to uncover recent developments in eco-pedagogy theory and practice, as well as identify areas that require further exploration. This approach also helps formulate new conceptual frameworks or improve existing environmental education models.

SLR and literature research in this area can explore how eco-pedagogy literacy interacts with other disciplines, such as religion, environmental awareness/sensitivity, media/technology, problem-solving skills, quality of understanding, and cognitive skills/intelligence. This could pave the way for a transdisciplinary approach to eco-pedagogy literacy. Although only two articles were found each, this could allow researchers to fill the existing knowledge gaps.

Pattern of Research Subjects/Informants

Based on the analysis, research on eco pedagogy or environmental literacy in Indonesia involves various subjects, including elementary school, junior high school, high school, university students, teachers, and santri. It can be presented in Figure 4 below:

Based on Figure 4, research on eco pedagogy or environmental literacy within the scope of the Adiwiyata program in Indonesia has been studied. High school students are the most widely used research subjects, with nine related articles found. At the higher education level, students are the second most common research subject with 6 articles. Meanwhile, research at the elementary, junior high, and teacher levels is also quite significant, with 3 and 4 articles, respectively. Meanwhile, santri as research subjects were only found in one article.

So far, the findings in this study show that research related to eco pedagogy or environmental literacy has targeted various school age groups, ranging from students and university students to santri. However, research at the level of religious institutions such as pesantren is still limited (1 article), which may indicate potential areas for further study.

The selection of research subjects is determined by various factors, one of which is the relevance of the subject to the research to be carried out. One of them as a driving factor is that in adolescence, individuals begin to develop identities and values, including environmental awareness. Senior high school (SMA) is a strategic place to instill environmental awareness values through eco pedagogy and environmental programs such as Adiwiyata, which aims to shape the character of students to care more about the surrounding environment (Utomo et al., 2023) Moreover, it contributes to the realization of critical environmental education for students. (Hanim, n.d.). Although these eco pedagogy or environmental programs do not only target high school students, it seems that the trend of informants in this study is more at the high school level.

In research methods dominated by qualitative approaches, high school students are often chosen as informants because they generally have better critical thinking skills than students at lower education levels. This allows them to understand complex environmental issues and contribute to discussions and solutions.

Research on developing ecopedagogy or environmental literacy in Indonesia at the elementary level, analyzing the importance of developing Android-based learning media. This media is specifically designed to improve environmental literacy in the context of thematic learning in elementary schools. Using technology can aid active engagement in lessons in the context of eco-pedagogy. (Voogt et al., 2013).

Learning elementary school children using Android-based technology in Indonesia is not without reason, as many elementary school children in Indonesia already have access to smartphone devices. In addition, elementary-age children are more interested in learning in a more interactive way, such as through educational games, quizzes, and animations, which can make the learning process more interesting and fun for children (Izhar et al., 2022).

Research on eco pedagogy or environmental literacy focusing on santri as informants is still rare,

possibly due to the dominance of religious topics considered more urgent or relevant in pesantren studies. Integrating spiritual values and Islamic ethics to build environmental awareness can strengthen Santri's commitment to environmental conservation. In addition, eco pedagogy in pesantren institutions is not only oriented to academic aspects but also includes direct practice in daily life. (Maslani et al., 2023). This is beneficial because direct teaching and practice effectively improve the understanding and application of concepts. (Chase & Klahr, 2017).

Research on ecopedagogy among teachers in Indonesia is still limited, despite the increasing urgency of environmental education. Teachers need adequate environmental literacy training to teach ecopedagogy materials in a way that is engaging and relevant to students. The limited research in this area opens up significant opportunities for further study, as teachers' skills in eco-pedagogy play an important role in improving students' environmental literacy and shaping sustainable behavior. (Hermawan et al., 2022).

Strategies Applied in the Study

Regarding the topic of ecopedagogy or environmental literacy in Indonesia, various types of strategies have been implemented in empirical studies. These strategies, among others, aim to discover, analyze, and improve ecological awareness and understanding and develop competence in environmental sustainability practices. This strategy in some research findings can take the form of various types of research. In this study, there is a list of strategies that are often used and appear in more than one article. The data is presented in the form of Table 2.

Table 2. Below Presents the Strategies Applied in Research Related to Ecopedagogy or Environmental Literacy in Indonesia

No.	Strategy	Number of Articles
1	Active Learning	2
2	BE-RAISE	1
3	PBL	5
4	Religion	1
5	contextual learning	3
6	Local wisdom	2
7	Integration with various subjects (Biology)	3
8	Environment-Based Learning	2
9	Course	1
10	Experiential Education	1
11	Problem-Based Learning with Environmental-Based Comic (PBLEC).	1
12	Community Partnerships	1
13	Intra- and extracurricular activities	2
14	Mobile learning	1
15	Inquiry-based Learning Model	1

Based on the results of the article review that has been carried out, the strategies that are often used are Problem Base Learning (PBL) or problem-based learning, Contextual Learning (CL) or contextual learning, and Integration with various subjects (biology). 5 and 3 articles found linking eco pedagogy or environmental literacy with PBL, CL, and integration. Then, followed by Active Learning strategies,

Local wisdom, Environmental Based Learning, and intra and extracurricular activities, each found two articles.

PBL and CL strategies have similarities in improving students' critical thinking skills (Nurfathurrahmah, 2018). As well as encouraging awareness and sensitivity to ecological literacy (Wajdi et al., 2022). One factor that encourages many studies to use these two strategies is that eco-pedagogy aims to stimulate critical thinking. (Misiaszek, 2020). A critical thinking approach is essential to develop a deep understanding of environmental and sustainability issues. (Hayati et al., 2023). This motivates researchers to conduct studies focusing on ecopedagogy or environmental literacy using PBL strategies (Fahlevi et al., 2023) or CL.

Both PBL and CL focus on developing critical thinking, problem-solving, and collaboration skills through projects that are relevant to real life, so they have a significant positive impact on learners' learning outcomes. (Sofyan & Komariah, 2016)., (Mayasari et al., 2022). No wonder it is more often used in environmental learning as a form of awareness of the character of environmental care (Badarudin, 2018).

In contrast, the least applied treatments in research related to eco pedagogy or environmental literacy in Indonesia are BE-RAISE, religion, courses, community partnerships, Inquiry-Based Learning Models, and Mobile learning with 1 article each. Therefore, future research must cover approaches that can provide new perspectives in ecopedagogy or environmental literacy, especially in the Indonesian context.

Data Collection Instruments

Research instruments are tools or devices researchers use to collect data or information needed in a study. This instrument can be a questionnaire, interview, test, observation, or document used to measure the variables under study. (Muslihin et al., 2022) A combination of these various instruments can also be used.

The data collection instruments often used in research articles on ecopedagogy or environmental literacy are depicted in Figure 5.
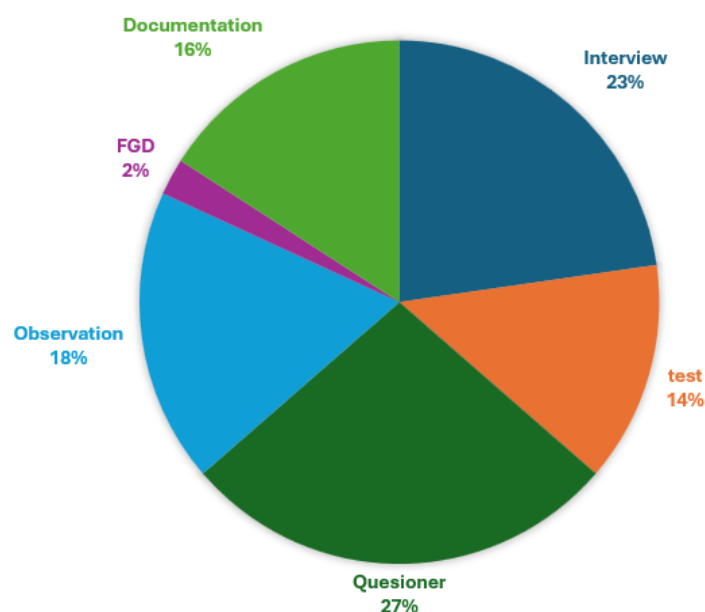
Figure 5. Pie Chart of Research Instruments in Research Related to Ecopedagogy and Environmental Literacy in Indonesia

The data displayed in Figure 5 shows that questionnaires are the most frequently used instrument in ecopedagogy and environmental literacy research. Because it aims to explore individuals' attitudes, knowledge, perceptions, and behaviors toward environmental issues. In addition, this questionnaire instrument collects information from many respondents efficiently and in a relatively short time. It is known that the use of this instrument is widespread in various types of research, whether qualitative, quantitative, mixed methods, or research and development (RnD).

The data collection of the research analysis results was not carried out separately but combined with other methods, such as interviews combined with observation, documentation combined with interviews, and so on. This data combination aims to increase the validity and accuracy of the research results so that the data obtained is more comprehensive and can provide a deeper understanding of the object under study.

Aspects Integrated in Ecopedagogy Literacy

Various studies on ecopedagogy or environmental literacy have linked other aspects. This research analyzes the trend of aspects/concepts often associated with ecopedagogy or environmental literacy. The connection between these aspects/concepts opens up opportunities for collaboration that can be done to improve eco-pedagogy literacy by considering other aspects/concepts. Thus, the research results can guide the design of the necessary learning sequences.

The following are aspects often associated with eco pedagogy or environmental literacy, including those found in more than one article, as shown in Table 3.

Table 3. Relationship between other aspects and ecopedagogy or environmental literacy in Indonesian studies.

No.	Aspect/Concept Linked	Number of Articles
1	Environmental Awareness/Sensitivity	13
2	Media/technology quality	1
3	Critical thinking skills	2
4	Religious beliefs	1
5	Commitment	2
6	Quality of understanding	3
7	Positive attitude towards the environment	1
8	Cognitive skills/intelligence	2
9	Pro-environmental behavior	1
10	Self-efficacy, gender, parental education	1

Based on the data in Table 3, the other concept most often associated with ecopedagogy or environmental literacy in research is environmental awareness or sensitivity, recorded in 13 related articles. This is reinforced by the results of Lyn Parker's research explaining that providing a better understanding of how the new curriculum in Indonesia can contribute to environmental awareness and action among the younger generation, especially in Indonesia (Parker, 2017). Moreover, eco-pedagogical literacy helps students understand and critique the concepts of 'development' and 'sustainability' through a local, global lens, which is essential for sustainable development actions. (Misiaszek, 2021).

Ecopedagogy or environmental literacy research by linking aspects of ecological awareness is more often found in the type of qualitative research, as in the research of (Lestari et al., 2023., Awaludin et al.,

2024,. Hermawan et al., 2024).

Several other concepts rarely examined in ecopedagogy or environmental literacy research in Indonesia offer opportunities for further, more diverse research. These aspects include the relationship of eco pedagogy or environmental literacy with technology, religious beliefs, intelligence/cognitive skills, commitment, critical thinking skills, quality of understanding, positive attitudes towards the environment, self-efficacy, gender, and others.

Data Analysis Technique

This study also analyzed data analysis methods often applied in eco pedagogy or environmental literacy research in Indonesia, presented in Table 4 below.

Table 4. Data analysis techniques applied in research on Indonesia's ecopedagogy literacy or environmental literacy.

No.	Data Analysis Technique	Number of Articles
1	Qualitative analysis	6
2	Matthew B. Miles	1
3	MANOVA Analysis	1
4	Smart-PLS	1
5	Simple statistics in the form of percentages	1
6	Structural Equation Modeling (SEM) is	1
7	NELA (National et al.) Score	1
8	Thematic analysis	1
9	Descriptive analysis	1
10	Triangulation of data sources	1
11	Qualitative and quantitative analysis,	3
12	Quantitative percentage analysis of the test	3
13	Document analysis	2

Based on the data presented in Table 4, the most frequently applied analysis method in ecopedagogy or environmental literacy-related research is qualitative analysis, which is used in 13 articles. This result is consistent with the research design trends discussed earlier, where ecopedagogy and environmental literacy research is often conducted to describe students' environmental awareness/sensitivity.

In addition, four articles focused on quantitative analysis were found. These articles prioritized the measurement of numerical data and the use of statistics to evaluate research results. These quantitative analyses are important because they provide strong empirical evidence, enable generalization of results, and support data-driven decision-making.

In addition, three articles use a combined approach of qualitative and quantitative analysis (*mixed methods)*, where qualitative analysis is used to understand complex contexts or phenomena. In contrast, quantitative analysis complements measurable numerical data. This combination provides a more comprehensive and in-depth understanding of the subject under study, utilizing the strengths of both methods.

In this study, two articles were found using *literature* analysis and the *Systematic Literature Review* (SLR) method using the PRISMA approach. Literature analysis aims to identify and interpret research

on environmental literacy. Meanwhile, the SLR method (PRISMA) provides a systematic framework for selecting and synthesizing evidence from environmental literacy research in the Indonesian context. NELA (National et al.) score data analysis is rarely used in research examining eco-pedagogy literacy. This NELA analysis is specifically designed to measure individuals' understanding, skills, attitudes, and behavior related to environmental issues. This assessment determines how well a person or group understands environmental concepts, can analyze environmental issues, and is motivated to take environmentally sustainable actions. Therefore, future ecopedagogy literacy research should focus more on analyzing NELA data to gain in-depth insights into the factors influencing environmental literacy levels.

4.   CONCLUSION

Findings from this study indicate that between 2016 and 2024, there was a significant increase in the volume of research on ecopedagogy or environmental literacy, with the largest spike occurring in 2023. During this period, the qualitative research approach was the most dominant method that aimed to uncover and understand the deeper dimensions of eco-pedagogy literacy.

Problem-Based Learning (PBL) is a strategy often associated with eco pedagogy or environmental literacy that can help increase ecological awareness and understanding of the impact of human actions on the environment.

Suggestions for future research are to develop information technology-based learning models or modules to develop eco-pedagogy literacy among students.

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