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Systematic Literature Review on Eco-literacy Learning in the Lower Grades of Elementary School

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Abstract: This study highlights the previous studies of eco-literacy learning in the lower grades of elementary school (grades 1-3) using a Systematic Literature Review (SLR). The data was obtained through Google Scholar, Garuda, and Science Direct. The data analysis protocol was the PSALSAR framework paired with the PRISMA protocol. The literature sources were derived from Google Scholar (644), Garuda (10), and Science Direct (65). Of the 719 literature sources, six met the inclusion criteria. The findings of the analysis were divided into three aspects: (1) the content of eco-literacy learning, (2) the methods of eco-literacy learning, and (3) the media of eco-literacy learning. This SLR study identified a research gap for future study and practical implications. For future study, key areas include researching its impact on children's cognitive and emotional development and investigating how schools manage eco-literacy resources using anthropological approaches. It is also suggested that researchers look into societal practices that influence students' environmental behaviors, teachers' science literacy, and the development of environmental education curricula. Additionally, R&D in collaborative strategies for developing eco-literacy content targeted to early-grade learners is highly suggested. The development of particular assessment methods for eco-literacy outcomes is also required. As practical implications, improving teachers' STEM abilities and organizing suitable outdoor learning areas are critical for effective eco-literacy teaching.

Keywords: eco-literacy in elementary school, lower elementary school grade, systemic literature review

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Introduction

Indonesia faces various environmental challenges, as outlined in a report by the Ministry of Environment and Forestry (Ministry of Environment and Forestry, 2023). These include land use changes, land degradation, declining surface water quality, deteriorating air quality, and insufficient waste management. Research recommends teachers carry out eco-literacy learning so that students become aware and sensitive to environmental changes and anticipate fatal environmental damage (Salimi et al., 2021).

Ecological literacy or eco-literacy is a prominent approach in campaigning for environmental awareness in education. The level of eco-literacy is vital for students to be responsible for environmental conditions (Smith, 2007). The three fundamental principles of ecology are: (1) the understanding that the basic pattern of organization in life is a network, (2) continuous cycles through the web of life, and (3) all ecological systems survive because of the flow of energy from the sun. Integrating eco-literacy in subjects strategically prepares the younger generation for a sustainable lifestyle (Alkaher & Goldman, 2017). Elementary school is critical for developing eco-literacy (Muliasari et al., 2023). Research shows that eco-literacy among students influences their behavior in protecting the environment (Syah et al., 2021; Wahyuni et al., 2020).

Nevertheless, environmental education in Indonesia tends to prioritize theory over practical implementation (Errica & Mulyadi, 2022). Although the government has implemented various school

policies and programs, several obstacles remain. These obstacles include a lack of understanding and commitment within schools, including teachers, regarding environmental education, methods of delivery that are not well-mastered by teachers, a shortage of budget and other resource support, and a lack of synergy between school communities and related institutions (Calam et al., 2022; Retnowati, 2019). Teachers in the early grades of elementary schools in Indonesia face obstacles in using computer technology-based media (Calam et al., 2022). Other research mentioned a gap between the national curriculum and teacher education and classroom practice and a lack of support in training (Mercer et al., 2023; Wibowo et al., 2022). According to a recent study, only 42.85% of primary teacher education students in Indonesia comprehend eco-literacy (Nurfurqon et al., 2024).

The growth of eco-literacy needs to be adjusted to the child's growth and development. Piaget's theory states that when aged 7-11 or 12 years, students are at the concrete operational cognitive development level, where thinking is faster or more efficient, and students can simultaneously do more than one thought. He can find logical relationships between one thing and another and can demonstrate his knowledge concretely. At this stage, students have a reduced level of egocentrism and a tendency towards animism and artificialism (Juwantara, 2019). Elementary schools generally divide the learning process into low or early classes and high classes.

The low class consists of classes 1, 2, and 3, while the high class consists of classes 4, 5, and 6 (Zulvira et al., 2021). Students in the early grades of elementary school have unique characteristics, especially active motor skills, starting to control their emotions and feeling valuable if they can help other friends. From a cognitive perspective, students in grades 1, 2 and 3 have mastered much vocabulary, are active in speaking, and can group objects. However, they have reasoning abilities that are less advanced than grade 4 and above and rely more on their own experience in explaining a phenomenon rather than exploring it in detail (Jung et al., 2020).

Elementary school students in grades 1-3 transition from preschool to school (Parker et al., 2022). In this phase, students may experience difficulties because they still feel like they are in the world of play but are also starting to be faced with academic demands such as learning achievement targets (Liswantiani et al., 2024). As a result, many experts believe play pedagogy should be included in the approach to the early phases of primary school pupils (Pyle & Danniels, 2017).

Studies on eco-literacy learning focussed on lower grades of elementary schools are still very limited. It is necessary to review research on eco-literacy learning to provide information on eco-literacy learning practices in lower grades across countries and investigate the possibility of future studies to develop content materials, methods, and media for eco-literacy learning in lower grades of elementary schools. Therefore, this article discusses the research results carried out in this scope. This study used a Systematic Literature Review (SLR) to highlight prior studies on eco-literacy learning in the lower grades in elementary school.

Methods

This research applies the Systematic Literature Review (SLR) method. SLR research identifies, reviews, interprets, critically reviews, and synthesizes several previous studies to answer relevant research questions transparently and with accountability (Lame, 2019). The steps taken in SLR-based research use the PSALSAR framework, which consists of an acronym for the following six, namely: (1) Protocol, (2) Search, (3) Appraisal, (4) Synthesis, (5) Analysis, and (6) Reports (Mengist et al., 2020). A description of the procedures applied and the results in this research are as follows:

1. Develop a protocol: determining the scope of the study

   Researchers studied previous research on eco-literacy and eco-literacy learning in elementary schools. Then, the research questions were formulated. The questions to be answered are determined as follows:

   a. What teaching materials can be developed to foster eco-literacy in elementary school students?
   b. What learning methods are appropriate to foster eco-literacy in elementary school students?
   c. What learning media is highly likely to support eco-literacy in elementary school students?
2. Literature search: determine the search strategy and database to be used

   The library search was done through the Google Scholar, Garuda, and Science Direct databases because they are easy to access and regularly updated. The search year is limited to 2019-

2023 or the last five years. The keywords used were in English and Indonesian; for example, "sekolah dasar" in Bahasa Indonesian means primary school in English. This is because the Garuda database contains many articles in Indonesian. The following are the keywords used in each database. The following are the keywords used in each database.

Table 1. Literature Search

Data Base	Keywords
Garuda	Eco-literacy, *sekolah dasar*
Google Scholar	eco-literacy, classroom action, elementary school, lower grade
Science Direct	Eco-literacy in elementary school

From the search, the total number of articles obtained was 719 from journals, proceedings, and research reports.

3. Appraisal: selection and assessment of the quality of literature

   At this stage, the researcher determines the criteria. The following is the determination of inclusion and exclusion of literature to be analyzed.

Table 2. Inclusion Criteria

Criteria	Inclusion	Exclusion
Document sources	Research articles, research reports, conference proceeding	Book/e-book, hand-out, poster, file PowerPoint
Time Range	2019-2023	Before 2019 and 2024 or after
Language	Indonesia and English	non-Indonesia and non-English
Participant	Elementary school students in first, second and third grade	Students from fourth, fifth and sixth grade of elementary school and another level of education
Research method	Classroom action research, Qualitative research, Mixed methods	Content analysis, Systematic Literature Review

Using the criteria mentioned in Table 2, researchers screen articles by looking at the title, abstract, and research methods. After obtaining articles that meet the inclusion criteria, the selected articles are read carefully to obtain a description of the title, data collection, research results, and conclusions. Data is prioritized to contain three aspects of information following the formulation of this SLR research question.

4. Synthesis: summarize and integrate the selected literature

   In this stage, the collected and appraised information is synthesized. The goal is to combine findings from various studies or data sources to identify patterns, trends, and key insights.

5. Analysis: analyze and synthesize the literature

   This stage involves a deeper analysis of the synthesized data or findings. The analysis helps to test hypotheses or answer the research questions with a focus on drawing actionable insights.

6. Reports: report the results

   At this stage the researcher report the methodology, findings, conclusions, and recommendations based on the analysis. It serves to communicate the results of the systematic review or evidence synthesis to stakeholders, policymakers, or the scientific community.

Based on this observation, ten articles were obtained consisting of 8 journal articles, one proceedings article, and one thesis. However, after reviewing the ten articles, four writings were deemed not to have met the criteria, namely that they needed to contain teaching materials and eco-literacy learning methods clearly. The PSALSAR framework cooperated with the PRISMA (Preferred Reporting Items for Systematic Reviews) protocol. Here is the flow of the SLR process is depicted in Figure 1.

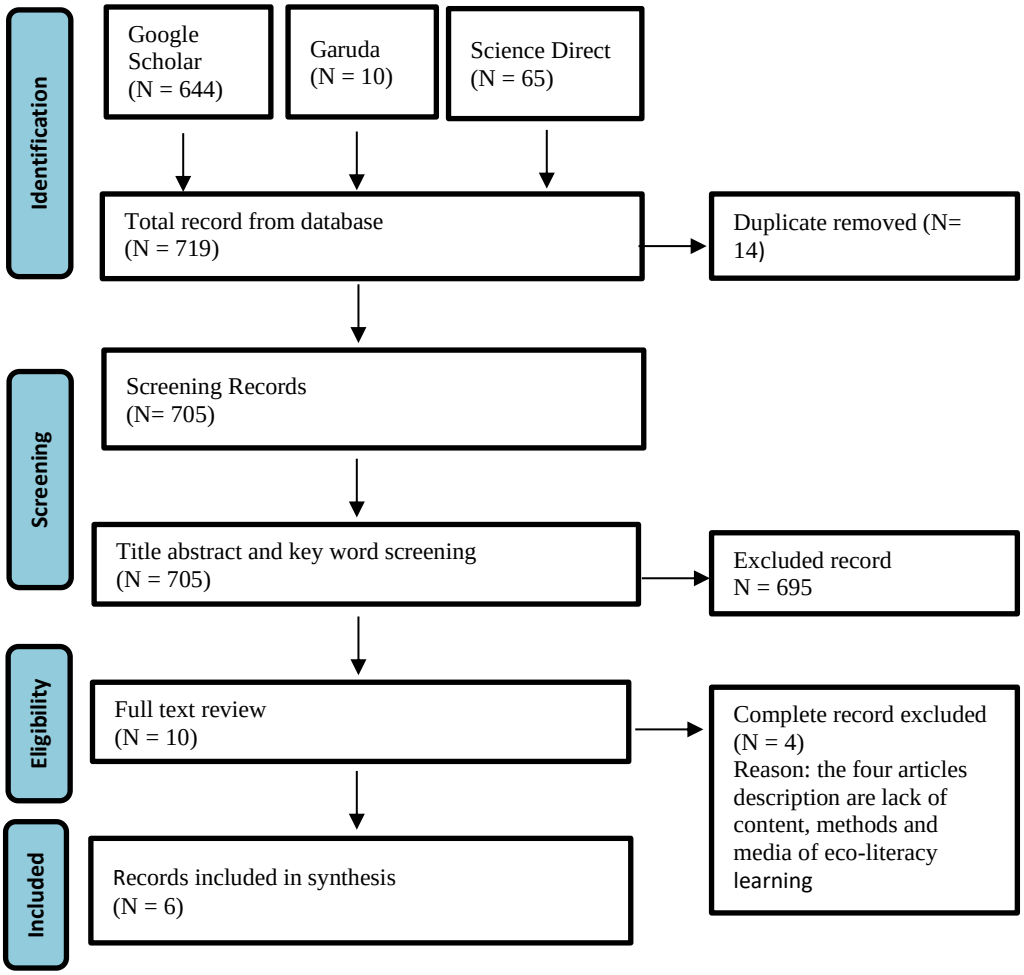

Figure 1. The Systematic Literature Review Flow Diagram (Adopted from (Pollock & Berge, 2017; Santos et al., 2021)

Results and Discussion

Results

The researcher extracted the data after selecting and assessing articles, as shown in Table 3. Six articles meet the criteria. Some research methods have been found; the most common is classroom action research. The research sites included three in Indonesia, two in Sweden, and one in the United States.

Table 3. Extraction of Data

No.	Author	Title	Document Type	Methods	Locus of Research
1	(Rosyid et al., 2019)	Improving Coastal Children Eco-Literacy in Environmental Learning Through Mangroves Storytelling	Research article	Classroom Action Research	Indonesia
2	(Muthukrishnan, 2019)	Using Picture Books to Enhance Eco-literacy of 4First-Grade Students	Research article	Classroom Action Research	USA

No.	Author	Title	Document Type	Methods	Locus of Research
3	(Häggström & Schmidt, 2020)	Enhancing children's literacy and ecological literacy through critical place-based pedagogy	Research article	Classroom Action Research	Sweden
4	(Salimi et al., 2021)	The Profile of Students' Eco-Literacy at Nature Primary School	Research article	Qualitative	Indonesia
5	(Rosidah et al., 2022)	Thematic comic to cultivate eco-literacy for young learners	Research article	R&D	Indonesia
6	(Caiman & Kjällander, 2024)	Elementary students' 'outdoor – digital'explorations in ecology - learning through chains of transduction	Research article	Classroom Action Research	Sweden

The results of the observations are synthesized in line with the research formulation that has been determined. A synthesis of various research literature is presented in Table 4.

Table 4. The Synthesized Data

No.	Author	Content of Eco-literacy Learning	Methods of Eco-literacy Learning	Media of Eco-literacy Learning
1	(Rosyid et al., 2019)	Benefits of mangrove forests and their conservation	Third-grade primary school kids watch an animated animation about mangroves. The story is heroic and emotive about mangroves' function in defending beaches from erosion and mitigating the effects of storm damage.	Picture and animation character
2	(Muthukrishnan, 2019)	Nature: flora and fauna, physical environment, climate Water cycle Rainforest Bioluminescence	The teacher begins by asking and discussing what students know about the topic presented in the picture reading book. Read a book for 5-10 minutes. The teacher explains terms/words that are still relatively foreign to students' ears. The teacher provokes students to ask questions. Teachers and students return to reading the book to find answers. Reflection (15-25 minutes) by asking students to share their understanding of the book they have read by drawing using crayons or markers The teacher checks and corrects the vocabulary or spelling of students' writing.	Picture book

No.	Author	Content of Eco-literacy Learning	Methods of Eco-literacy Learning	Media of Eco-literacy Learning
3	(Häggström & Schmidt, 2020)	Natural cycles Plant Forest function Humans and nature.	Application of critical place-based pedagogy through various types of themes/categories, including (1) forming identity, (2) interpreting relationships with nature, (3) making nature a place of learning, and (4) environmental literacy In forming an identity, learning is done by playing roles as a writer, reporter, artist, and photographer who tells stories about the environment. To help students understand their relationship with nature, the teacher asked them to retell their experiences about playgrounds and make films/recordings about trees in the forest. To make nature a place of learning, students observe and retell the results of their observations about the environment in which they are and how they feel. In the environmental literacy category, students are asked to create a narrative (including in book form), visualize it, and present it orally.	Camera, book, picture book, paint/colored pencils, playground, forest
4	(Salimi et al., 2021)	Waste and its management Water Earth and life	Assignment of tasks to be done with parents: keeping fish In the morning, students pledge called the "morning promise" that they will help friends, protect the environment, clean it, and so on. Students sometimes learn directly in their environment. Display learning videos with environmental themes Introduce students to tools, objects, and procedures that society needs relating to the environment, such as pipes, windmills, and tools for planting. Each student has an ornamental plant planted near the classroom area and takes turns watering and fertilizing the ornamental plant.	Fish, plants, fertilizer, hoes and other planting tools, videos, nature, pipes, windmills
5	(Rosidah et al., 2022)	Objects around me Plastics and their management Personal hygiene Environmental cleanliness	Learning is limited to theory (except regarding environmental cleanliness). There is still minimal practice and learning outside of class.	Book

No.	Author	Content of Eco-literacy Learning	Methods of Eco-literacy Learning	Media of Eco-literacy Learning
6	(Caiman & Kjällander, 2024)	Biodiversity Ecology	Eco-literacy learning is carried out through science lessons by applying the transduction chain. Learning activities are carried out by: Taking a specific theme, then students are asked to draw details of one of the objects/living creatures conveyed by that theme and convey what they are drawing or the meaning of the picture (for example, leaves, bird feathers) Students bring objects they have drawn (leaves and bird feathers) and then arrange them in such a way. Students then discuss the benefits of these objects for other creatures (especially animals) Students look for images on the internet similar to the objects they carry. Students download images from the internet and pair them with the objects they bring Encouraging collaborative learning, students share their observations with their peers, discussing the benefits of their studied objects. This process enables them to interpret the environment collectively.	Drawing books, parts of trees: leaves, animal body parts, Poultry feathers, images of living creatures

All authors concluded that the methods they used/observed were proven to be able to make students interested in learning. Table 4 presents the findings on learning content, learning activities, and learning media as follows:

1. Learning Content

   In terms of learning content, eco-literacy learning in elementary schools grades 1-3 has four content classifications: (1) personal hygiene and the environment, (2) biodiversity, (3) reciprocal relationships between organisms and their environment, and (4) environmental actions. In studies conducted in the United States, the materials incorporate literacy reinforcement explicitly associated with enhancing students' vocabulary.

   An analysis of three American studies and two additional studies from Sweden reveals interventions designed to achieve specific cognitive development milestones. For instance, the study by Caiman & Kjällander (2024) illustrates efforts to develop students' analytical and evaluative skills. Likewise, other research achieves sophistication in creating visual representations of trees and narratives that express individuals' emotions when immersed in the forest and integrated with nature (Häggström & Schmidt, 2020).

2. Learning Activities

   There are generally two classifications for learning activities: those conducted in the classroom and those conducted outside the classroom. Classroom-based activities include watching films, reading books, and drawing, accompanied by discussions between teachers and students and peer discussions among students. The act of reflection is highlighted explicitly in research conducted in America and Sweden.

   Two activities stand out in outdoor activity-based learning: observation and environmental practice. Salimi et al. (2021) conducted a study in Indonesia, and students were even introduced to

and taught to use planting equipment and other environmental protection products. In a study in Sweden, eco-literacy learning emphasized Environmental Literacy, which was accomplished through role-playing games and creating simple recordings to raise students' understanding of human connectivity to the environment (Häggström & Schmidt, 2020). Research in three developed countries indicates that scientific literacy is integrated with eco-literacy education. This integration is indicated in the learning process, which involves understanding, experimenting in simple ways, drawing fact-based conclusions, and interpreting the findings. Nevertheless, the six studies have not distinctly suggested the type of assessment required for eco-literacy education.

Research by Salimi et al. (2021) reveals that literacy education in Indonesia actively involves parents and promotes the development of pro-social attitudes. Specifically, parents assist children in caring for fish and preparing ornamental plants for school projects. Additionally, two of the three studies conducted in Indonesia, as illustrated in Table 4, indicate that the learning process predominantly relies on books or animated content, enhancing comprehension.

3. Learning Media

The most common educational mediums in eco-literacy learning are picture books, drawing books, and digital-based resources. Three of the six courses focused on sketching exercises relating to various subjects, including forests, trees, human anatomy, and living species in particular habitats and ecosystems. Additionally, two studies exposed pupils to physical objects, including biological specimens and agricultural instruments.

Not all media are derived from self-production; specific sources utilize readily available natural elements commonly found around homes and schools. The paramount aspect of media employed in eco-literacy education lies in its pronounced capacity to solidify the comprehension of learning content. Additionally, media featuring animated narratives with heroic plots have demonstrated notable allure among students.

Based on those three broad findings, these conclusions address the Research Question of this Systematic Literature Review (SLR).

Table 5. The Findings

No.	Research Question	Conclusion
1	What teaching materials can be developed to foster eco-literacy in elementary school students?	a. The topic can be specific or broader than these: personal hygiene and the environment, biodiversity, reciprocal relationships between organisms and their environment, and environmental actions b. Eco-literacy education can be integrated with other academic disciplines, including natural sciences, language arts, and social sciences, through a thematic approach. c. The topic is integration is indicated in the learning process, which involves understanding, experimenting even in simple ways, drawing fact-based conclusions, and interpreting the findings.
2	What learning methods are appropriate to use to foster eco-literacy in elementary school students?	a. Classroom-based activities include watching films, reading books, drawing, and discussions b. Outdoor activity-based learning is a crucial component of eco-literacy, offering students the opportunity to observe, practice in the environment, and conduct simple experiments. c. Parental involvement is essential because eco-literacy learning also aims to change the mindset and behavior of students and society in general d. Reflection is strongly needed so that eco-literacy learning can cultivate knowledge and students' awareness.The teacher introduces and applies scientific steps in the learning process

No.	Research Question	Conclusion
3	What learning media is highly likely to support eco-literacy in elementary school students?	a. The selection of learning materials should be tailored to the developmental characteristics of children aged 7-9 years who are in the early concrete operational stage according to Piagetian theory. b. Picture books, drawing books, biological specimens, agricultural tools, and digital-based sources dominate eco-literacy media. c. Teachers need to be able to tell stories so that the media used becomes "alive" and meaningful.

Discussion

The research reviews presented in the results section underscore several vital areas requiring further attention, including learning content, teaching methods, and learning media.

1. Eco-Literacy Learning Combined with Science

In terms of the learning content, eco-literacy material in the early elementary grades is close to students' daily lives. However, compared to Indonesia, teaching materials containing eco-literacy in developed countries are often integrated with science. Research in America and Sweden shows that they not only focus on building students' awareness of the environment but also provide knowledge from a scientific perspective. On the other hand, researchers in Indonesia are exploring more about local wisdom and the potential of the natural surroundings that students need to know.

In the school environment, ecology is attached to learning, such as history, language, and others (Francis, 2021). In other words, strategies to foster eco-literacy in students are not only carried out in learning directly related to the living environment, such as science, but can also be integrated into other subjects. This strategy refers to interdisciplinary learning (Sly, 2015). Learning to support eco-literacy needs to be done with active learning strategies. Project-based and experimental learning is recommended because both can stimulate students to become more internalized about the environment. Both can also improve critical thinking skills, perception, and learning performance in subjects (Sly, 2015).

Eco-literacy has its roots in biology, namely the study of the relationship between organisms and their environment (Francis, 2021). Eco-literacy has a strong connection with science literacy. Scientific literacy has many dimensions, including using science to solve problems and applying theories, concepts, and laws related to interactions in the universe (Costa et al., 2021). Research proves a project-based learning approach based on STEM (Science, Technology, Engineering, and Mathematics) can increase student eco-literacy (Indrasari & Wulandari, 2023). The discussion is focused on linking the data and the results of their analysis to the problem or research objective and the broader theoretical context. It can also be discussed as an answer to why facts are found in the data.

Scientific literacy is an integral part of the nation's progress because it is seen as fundamental regarding the quality of human resources (Ding, 2022). Success in STEM learning outcomes is a reflection of the quality of education. One of the gaps between Indonesia and developed countries regarding scientific literacy can be seen in the school ESCS index (Economic, Social and Cultural Status Index in schools). This index was the prominent predictor of scientific literacy in six countries: Turkey, Singapore, the United States, Korea, Italy, and Brazil (Kalkan et al., 2020). ESCS indicators include employment and education level of parents and availability of resources at home such as laptops, books, and private rooms (Lagravinese et al., 2019).

A curriculum that contains eco-literacy is characterized, among other things, by (1) social transformation to become less over-consumptive, (2) understanding students about the function of ecosystems and the interdependence between humans and nature, (3) introducing students to the beauty and balance of the environment as well as a sense of responsibility towards environment, (4) encourage students to observe their environment, (5) love animals, (6) integrate environmental awareness with religious/spiritual education (Smith, 2007).

2. Deductive vs Inductive Methods and Social Culture Involvement

Regarding methods for forming eco-literacy, researchers in America and Sweden emphasize reading activities, experiments, learning outside the classroom, and interpreting processes that occur in nature. It can be said that learning tends to be inquiry in nature. The characteristics of inquiry learning are the following steps: (1) explaining the inquiry process, (2) building dialogue with students, (3) forming discussion groups, (4) clarifying students' conceptions about teaching materials, inquiry methods, and behavior and (5) using learning experiences students to build new knowledge (Antonio et al., 2022).

Compared to its encounter, Indonesia's eco-literacy has shown attention to reading activities. However, the learning process outside the classroom is more focused on habituating responsible behavior towards the environment. The inductive process found in American and Swedish literature is not widely seen in Indonesian literature, even though there are already project assignments. The visible process of forming eco-literacy is still traditional. Characteristics of traditional learning include that although experimentation occurs, its nature is more to confirm information from the teacher or textbook (Jong et al., 2023). This process keeps students from looking for new information. Another characteristic of traditional learning is that learning activities do not encourage students to use evidence as a basis for conclusions. In general, the point of difference between inquiry and traditional learning is whether or not students carry out an active process to produce new knowledge, evidence of the basis for conclusions that are built, and the extent to which their conclusions are discussed and evaluated critically.

However, introducing literacy in Indonesia is unique because it is more closely linked to social culture. Other research in Indonesia conducted in kindergartens showed similar things (Juhriati et al., 2021). The influence of social culture can be seen in the involvement of parents and the introduction of figures closely related to the environment, such as farmers. This pattern is interesting, but teachers must try or add an approach using a scientific thinking framework. In other words, eco-literacy formation can be harmonized with the habituation of a scientific ethos. This ethos consists of four norms, namely: (1) communalism, (2) universalism, (3) unbiasedness, and (4) skepticism (Elhaj, 2023). The teacher's skill in expressing these four values is a determining factor so that eco-literacy learning resonates with student behavior.

When applied to humans, eco-literacy includes humans' relationships with their environment. Eco-literacy or environmental literacy is a person's skill in understanding the earth's systems objectively, not only cognitively, but also accompanied by a love of the environment, a willingness to play a role, and a soul that is aware of the importance of preserving the environment Sivek & Hungerford, 1990 in Nadiroh et al. (2019). This environmental literacy will contribute to a sustainable environment. Besides emphasizing knowledge, eco-literacy emphasizes people's attitudes and behavior towards their environment. Another definition of eco-literacy is a person's ability to recognize and interpret health and environmental systems to act appropriately to maintain, repair, and improve environmental health (Komariah et al., 2017). Another eco-literacy terminology is environmental literacy, which includes ecological knowledge and a person's ability and willingness to use this knowledge for a sustainable life (Suryanda, 2019). Based on some of the definitions explained above, eco-literacy activities focus on understanding the environment and how it is embedded in human life.

3. Big Attention Needed to the Media Development and Learning Space

Regarding the media side, the six pieces of literature show the use of concrete media, objects around students, and the selection of green open spaces that allow children to explore nature. Following the thinking abilities of children aged 7-9, the learning process needs to be fact-oriented. Students in this age range can be stimulated with concrete events and encouraged to make conclusions or generalizations (Hidayatulloh et al., 2023). Picture books can be highly beneficial for students in the early stages since they stimulate and improve brain function, as demonstrated in literacy learning in elementary school (Marzano et al., 2000). While picture books were used in most research in eco-literacy learning for early grades students, a study found that most early-grader teachers are unfamiliar with the Picture Word Inductive Model (Apriliana et al., 2022).

Based on recommendations from most of the research literature, eco-literacy learning relies not only on books or indoor activities but also on activities in outdoor spaces (Masfufah & Wibowo, 2024). However, it should be noted that when students are in nature, it is likely that they will also

carry out intense physical movements such as jumping and running. Teachers need to control this because intense physical movement for more than 15 minutes for children in early elementary school can trigger fatigue, inhibiting students' cognitive processes (Egger et al., 2018).

There are interesting things related to the findings of eco-literacy learning in Indonesia, where students are also invited to recognize simple environmental problems such as leaking water pipes (Alifah et al., 2024). Then, they are taught how to solve them. Learning activities like this align with the characteristics of children in the early elementary school grades, where they like concrete things and are also starting to grow in awareness of helping the people around them. Some of the research literature uses classroom action research that took place over a relatively short period so that the relative effectiveness of learning methods is measured over a short time or not longitudinally.

Conclusion

In conclusion, eco-literacy learning in elementary schools encompasses four key content areas: personal hygiene/environment, biodiversity, organism-environment relationships, and environmental actions. While US studies focus on reinforcing literacy and cognitive development, eco-literacy education in Indonesia emphasizes social culture and local wisdom, contrasting with more science-integrated approaches in America and Sweden. Eco-literacy teaching in developed countries follows an inquiry-based approach, while Indonesia tends to rely on traditional methods. Despite differences in teaching approaches, media used in eco-literacy, such as picture books, drawing books, and digital resources, remain similar across these regions. This review also highlights several research gaps, recommending further exploration into the effects of eco-literacy on cognitive development, emotional intelligence, and environmental behavior, as well as the integration of eco-literacy into teacher education programs. The study emphasizes the need for better-developed assessment tools and collaborative content-creation models (Mustadi et al., 2024). Practical implications include the importance of teachers' skills in developing scientifically grounded lessons and the need for schools to organize outdoor learning spaces, potentially through collaborations with local communities. This study suggests enhancing teacher capacity in STEM education and creating supportive learning environments to foster eco-literacy as a lifestyle.

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