



eISSN 3090-7012 & pISSN 3090-6822

JURNAL ILMIAH LITERASI INDONESIA

Vol. 1, No. 2, 2025

doi.org/10.63822/f3cm2745

PP. 6210-6219

Homepage <https://ojs.indopublishing.or.id/index.php/jili>

A Literature Review on Environmental Literacy Among Senior High School Students in Indonesia

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Received: 09 22, 2025 | Accepted: 10 25, 2025 | Published: 10 30, 2025

ABSTRACT

Environmental literacy has become an essential competency that senior high school students in Indonesia must possess to address sustainability challenges. This literature review aims to map the development of research on environmental literacy among high school students, including conceptual definitions, theoretical frameworks used, literacy levels based on empirical findings, and commonly applied assessment instruments. The results indicate that environmental literacy at the high school level generally falls into the moderate category, with students demonstrating relatively good basic environmental knowledge but lacking strong cognitive skills and pro-environmental behaviors. Previous studies also reveal that curriculum factors, school facilities, teacher pedagogy, family support, and exposure to digital media significantly influence the development of environmental literacy. The most widely used instruments include the MSELs, Environmental Attitude Scale (EAS), New Ecological Paradigm (NEP), as well as locally developed ESD-based questionnaires adapted to the Indonesian context. This review highlights the need for integrating Education for Sustainable Development (ESD) approaches, strengthening project-based pedagogy, and improving green school facilities to promote more comprehensive and action-oriented environmental literacy.

Keywords: literature review, environmental literacy, high school students

How to Cite:

Maimunah Ritonga, Ayu Andini, & Arif Bulan. (2025). A Literature Review on Environmental Literacy Among Senior High School Students in Indonesia. *Jurnal Ilmiah Literasi Indonesia*, 1(2), 6210-6219. <https://doi.org/10.63822/f3cm2745>



INTRODUCTION

Environmental degradation and ecological crises have become serious challenges for Indonesia, ranging from increasing waste volume, water and air pollution, forest destruction, to the threat of climate change that directly affects community life. This condition calls for systematic efforts to build ecological awareness and competence from school age, particularly among high school students who are cognitively capable of abstract, critical, and reflective thinking. At this stage of late adolescence, students have the capacity to understand the causal relationship between human activities and environmental damage, as well as to make decisions that influence ecological sustainability. Therefore, enhancing environmental literacy at the high school level has become an urgency that cannot be overlooked.

Environmental literacy is not limited to knowledge about environmental issues, but also encompasses attitudes, awareness, critical thinking skills, and the ability to act within the context of sustainability. However, various national studies indicate that the environmental literacy of Indonesian high school students remains in the moderate-to-low category, particularly in the dimensions of action competence and concrete pro-environmental behavior (Sari & Waluyo, 2021; Rahmawati, 2022). Meanwhile, students' attitudes and knowledge tend to be higher but have not yet been internalized into daily behavior. This knowledge–action gap has become one of the key problems in school-based environmental education.

The gap may be attributed to multiple factors, including the limited integration of environmental issues into the curriculum, the lack of participatory and contextual learning methods, and the insufficient facilities and school programs that support ecological behavior. In addition, most schools still position environmental education as supplementary material rather than as a core competency that all students must possess. This condition results in uneven and unstructured development of environmental literacy across different schools, causing students' potential to understand and engage in environmental action to remain underdeveloped.

In the context of 21st-century education, environmental literacy is even more crucial because it relates to global competencies, character, and systems thinking skills. UNESCO encourages countries, including Indonesia, to integrate Education for Sustainable Development (ESD) into all levels of education as an approach to developing a generation capable of making decisions based on ecological, social, and economic sustainability perspectives. ESD provides a solid conceptual framework for analyzing students' environmental literacy holistically, particularly in understanding the relationship between knowledge, skills, values, and actions. Accordingly, literature reviews on students' environmental literacy need to be positioned within a broader sustainability framework.

Based on these needs, this literature review aims to map the current state of environmental literacy among Indonesian high school students, examine the conceptual approaches used in previous research, and identify measurement instruments as well as factors influencing students' levels of environmental literacy.

RESEARCH METHOD

This study employed a literature review method to explore, analyze, and synthesize previous research on environmental literacy among high school students in Indonesia. This method was selected because it enables the researcher to gain a comprehensive understanding of the development of concepts, empirical findings, and factors influencing environmental literacy drawn from various scholarly sources. A literature



review does not involve direct field data collection; instead, it examines scientific materials that have already been published.

The process of gathering sources was carried out by searching journal articles, academic books, conference proceedings, and research reports published within the last 10–15 years. The databases used included Google Scholar, DOAJ, Garuda, and several university repositories. Keywords used in the search included *environmental literacy*, *literasi lingkungan*, *high school students*, *environmental education*, and *education for sustainable development (ESD)*. Relevant sources were then selected based on their alignment with the topic, the context of senior high school education, and their contribution to understanding environmental literacy.

After the sources were collected, the researcher conducted content analysis to identify key patterns, such as definitions of environmental literacy, measured components, instructional approaches employed, and findings from previous studies on the environmental literacy levels of high school students. The analysis also included tracing the theoretical frameworks used by researchers, including UNESCO's Education for Sustainable Development (ESD) framework.

All findings were then thematically synthesized to construct a comprehensive overview of the environmental literacy of Indonesian high school students. This thematic synthesis approach allowed the researcher to organize categories and relationships among findings, thereby addressing the research objective—namely describing the developments, challenges, and opportunities in fostering environmental literacy at the senior high school level.

RESULTS AND DISCUSSION

The Concept of Environmental Literacy

Environmental literacy is a fundamental concept in modern education that relates to an individual's ability to understand the reciprocal relationship between humans and their environment, as well as the awareness of how human activities impact ecosystem sustainability. According to Roth (1992), environmental literacy includes basic environmental knowledge, sensitivity to ecological issues, and the ability to participate in decision-making processes that support environmental conservation. This concept highlights that literacy is not merely cognitive but also encompasses affective dimensions and real-life actions. In the context of education, environmental literacy is viewed as a competency that must be developed systematically so that students are prepared to face both global and local ecological challenges.

The concept of environmental literacy has expanded significantly with the emergence of various international theoretical frameworks that emphasize pro-environmental behavior as the ultimate goal of learning. Hollweg et al. (2011) outline four key dimensions of environmental literacy: environmental knowledge, environmental attitudes and concern, cognitive skills such as critical thinking and problem-solving, and pro-environmental behavior. These four components are interconnected and form a structure of ecological competence that enables students not only to understand environmental issues theoretically but also to apply this understanding in their daily lives. This model has become one of the major references in environmental literacy research at both international and national levels.

In Indonesia, efforts to strengthen environmental literacy have become increasingly prominent through national education policies, including the implementation of the Merdeka Belajar curriculum,



which emphasizes contextual learning, character development, and the strengthening of sustainability values. Environmental literacy is integrated through various instruments such as Environmental Education (PLH), the Pancasila Student Profile Strengthening Project (P5), the Adiwiyata program, and the incorporation of environmental issues into subjects such as Biology, Geography, and Sociology. This approach reflects a shift in which environmental literacy is no longer treated as supplementary content but as a cross-disciplinary competency that must be internalized throughout the educational process. Through this integration, students are expected to understand environmental issues within both local and global contexts.

Furthermore, the development of environmental literacy at the senior high school level is closely linked to UNESCO's Education for Sustainable Development (ESD) framework, which emphasizes the interconnectedness of ecological, social, and economic dimensions. The ESD approach encourages students to think systemically, make sustainable decisions, and engage in real actions to solve environmental problems. Thus, environmental literacy becomes an integral part of sustainability education, where schools serve as learning ecosystems that cultivate ecological values, skills, and behaviors. Integrating environmental literacy with the ESD framework opens opportunities for schools to build a stronger environmental culture and to shape a generation that is more environmentally conscious and responsible for the future of the planet.

Models or Theoretical Frameworks of Environmental Literacy for Senior High School Students

a. Roth's Framework

The environmental literacy framework developed by Roth (1992) is one of the most classical and widely referenced theoretical foundations in environmental education studies. Roth explains that environmental literacy develops through four major levels: nominal, functional, conceptual, and operational. At the nominal level, learners merely recognize basic environmental terms without deep understanding; at the functional level, they begin to understand simple concepts and can recall information. The conceptual level is characterized by the ability to understand relationships among ecological concepts and to critically assess environmental issues. The highest level, operational, reflects learners' ability to engage directly in actions and decision-making related to environmental issues. This framework is highly relevant for senior high school students because it can be used to assess the gradual development of ecological competence while providing insight into the extent to which students are capable of thinking and acting responsibly toward the environment.

b. Environmental Literacy Model (ELM) – Hollweg Model.

The Environmental Literacy Model (ELM) developed by Hollweg et al. (2011) is one of the most comprehensive and widely used frameworks in environmental literacy research in Indonesia. This model emphasizes four main dimensions of environmental literacy: environmental knowledge, environmental attitudes and sensitivity, cognitive skills such as critical thinking and problem-solving, and pro-environmental behavior. These four dimensions are considered complementary and essential for forming learners with complete ecological competence. The ELM provides a robust framework for researchers and educators in developing measurement instruments, designing curricula, and evaluating the effectiveness of environmental education programs. For senior high school students who are in the stage of formal cognitive



development, this model helps map the components that need to be strengthened so that they can understand environmental issues holistically and act based on that understanding.

c. UNESCO's Education for Sustainable Development (ESD) Framework

UNESCO's Education for Sustainable Development (ESD) framework positions environmental literacy as a key element in building sustainability competencies. ESD promotes the development of systemic thinking, creativity, reflective action, and decision-making that considers ecological, social, and economic sustainability. In the context of high school students, the ESD framework provides direction for integrating environmental literacy across all subjects and school activities—not merely by adding content, but by shifting learning paradigms toward sustainability values, collaborative work, and real action. ESD also emphasizes behavioral transformation by linking environmental knowledge with values, competencies, and active student participation. This framework is highly relevant in Indonesia as it aligns with the Merdeka Curriculum and the Pancasila Student Profile, which **emphasize collaboration, critical reasoning, and ethical engagement with nature.**

d. Local Adiwiyata-Based Model

The Adiwiyata-based local model is an implementation framework for environmental education developed by Indonesia's Ministry of Environment and Forestry (KLHK) to build environmentally oriented school culture. In this model, environmental literacy is developed not only through classroom instruction but also through daily habits, school policies, community participation, and the management of environmentally friendly facilities and infrastructure. The Adiwiyata program emphasizes four main components: environmentally oriented school policies, curriculum implementation based on environmental education (PLH), participatory activities involving the entire school community, and facility management that supports ecological behavior. This model is relevant for senior high school students because it provides direct experience in sustainability practices such as waste management, greening activities, water conservation, and environmental action programs. Thus, Adiwiyata serves as a contextual model that strengthens environmental literacy through a structured and sustainable green school culture.

Environmental Literacy of Senior High School Students in Indonesia: Findings from Previous Studies

1. Environmental Knowledge

National studies consistently show that the environmental knowledge of Indonesian senior high school students falls within the moderate category, with stronger mastery of basic issues such as waste management, air and water pollution, and the impacts of climate change on daily life. However, understanding of more complex ecological concepts—such as interactions among ecosystem components, biogeochemical cycles, and the systemic links between human activities and environmental change—remains limited. Studies by Sari and Waluyo (2021) and Harbi (2022) reveal that this gap stems from environmental topics being taught only partially and with insufficient emphasis on scientific reasoning. Furthermore, most students acquire environmental knowledge through informal experiences, social media, or unstructured school activities rather than through in-depth classroom instruction. As a result, their knowledge tends to be factual rather than conceptual and applicative—falling short of what is required to address 21st-century environmental challenges.

2. Environmental Attitudes



Students' attitudes toward the environment are generally positive, reflected in their willingness to maintain school cleanliness, their belief that nature should be preserved, and their concern for local environmental issues. However, many studies have found that these positive attitudes do not always translate into real behavior; a significant attitude–behavior gap persists (Putri & Darmadi, 2020; Rahmawati, 2022). This gap is influenced by several factors, including limited opportunities for students to participate in ecological activities, inconsistency in environmentally friendly practices at school, and the lack of strong role models among teachers and the surrounding community. Moreover, students' positive attitudes are often emotional rather than grounded in reflective understanding or long-term commitment to sustainability, preventing them from becoming part of a deeper ecological identity.

3. Cognitive Skills

Cognitive skills—particularly critical thinking, the ability to analyze environmental cause–effect relationships, and evidence-based decision-making—represent the weakest component of environmental literacy among Indonesian high school students. Research by Fadilah (2021) and Yusuf et al. (2022) indicates that only a small proportion of students can logically connect environmental phenomena with their causal factors or propose solutions that are coherent and grounded in sustainability principles. One key cause is the dominance of rote learning over scientific inquiry, problem-based learning, or ESD-oriented approaches that challenge students to analyze real-world environmental problems. Additionally, the limited integration of environmental issues across subjects prevents students from developing systemic perspectives. This condition highlights the need for pedagogical approaches that foster higher-order reasoning, enabling students to understand and respond to environmental issues more critically and argumentatively.

4. Pro-environmental Behavior

The pro-environmental behavior of senior high school students generally remains limited to simple actions, such as disposing of waste properly or turning off lights when not in use. However, participation in more meaningful ecological activities—such as managing school waste banks, engaging in conservation efforts, joining digital environmental campaigns, or participating in action-based projects—remains low, as reported by Fitriani and Nasution (2022) and Lestari (2023). One barrier is the lack of structured environmental habituation programs and insufficient institutional support for action-based initiatives. Moreover, green school policies such as *Adiwiyata* are not always implemented consistently, preventing the development of a strong ecological culture. These findings reinforce the idea that fostering ecological behavior cannot rely solely on knowledge or attitudes; it requires a learning environment that provides opportunities for real action, hands-on experience, and consistent sustainability practices at both school and community levels.

Factors Influencing Environmental Literacy Among Senior High School Students

1. Curriculum and Learning

The curriculum plays a fundamental role in shaping the level of environmental literacy among senior high school students, particularly through the integration of environmental issues into subject matter, action-based projects, and co-curricular activities that foster a holistic understanding of sustainability. Schools that implement environmentally friendly curricula—such as through the *Adiwiyata* program or the *Pancasila Student Profile Strengthening Project (P5)*—generally demonstrate higher levels of



environmental literacy because learning processes emphasize the development of conceptual knowledge, ecological attitudes, and decision-making skills (Sari & Waluyo, 2021; Rahmawati, 2022). Curricula designed with contextual approaches and aligned with Education for Sustainable Development (ESD) have also been shown to encourage students to understand connections between global issues, local realities, and personal actions, resulting in more meaningful and life-relevant learning.

2. School Facilities and Environment

The availability of physical facilities that support environmental learning—such as green open spaces, educational gardens, waste banks, composting units, and well-equipped science laboratories—significantly contributes to enhancing students' environmental literacy. A clean, orderly school environment that consistently adopts ecological practices offers students direct experiences to observe, practice, and develop ecological skills in a sustainable manner. Research by Fitriani and Nasution (2022) shows that schools with more complete green facilities have higher levels of student ecological participation, as students regularly engage in activities such as waste management, plant maintenance, and environmental monitoring. Adequate facilities also create a learning atmosphere that supports the formation of pro-environmental behavior.

3. Teacher Roles and Pedagogy

Teachers serve as central agents in the development of environmental literacy, as the choice of pedagogical strategies greatly influences how students understand and respond to environmental issues. Innovative learning approaches—such as project-based learning, inquiry-based learning, and outdoor learning—have been shown to improve students' critical thinking, problem-solving skills, and ecological awareness (Fadilah, 2021; Lestari, 2023). Teachers who act as facilitators and role models for ecological behavior also exert substantial influence on shaping students' environmental attitudes and values. When teachers integrate environmental issues across subjects and provide opportunities for students to conduct direct environmental investigations, learning becomes more active, reflective, and action-oriented.

4. Parental and Community Support

Family and community environments play important roles in strengthening—or weakening—the environmental literacy that students acquire at school. Parents who practice household waste management, energy conservation, or involvement in conservation activities provide strong reinforcement of ecological behavior for students. A study by Putri and Darmadi (2020) shows that students from families with pro-environmental habits exhibit more consistent ecological behaviors than those who do not receive similar role models at home. Furthermore, community support—through environmental campaigns, youth organization activities, and student involvement in village or neighborhood clean-up programs—creates a social ecosystem that reinforces the development of ecological identity.

5. Media Exposure and Digital Information

Students' access to environmental information through digital media—whether via social media, news portals, or educational content—plays a significant role in increasing their awareness, knowledge, and concern for sustainability issues. Exposure to educational videos, online environmental campaigns, and global trends such as zero-waste movements or climate activism provides students with broader knowledge than what formal schooling alone can offer (Harbi, 2022; Yusuf et al., 2022). Digital information also allows students to develop critical thinking skills by engaging with current issues such as climate change,



deforestation, and plastic pollution. However, digital literacy remains essential to ensure that students can distinguish valid information from environmental misinformation.

Commonly Used Instruments for Measuring Environmental Literacy

1. Middle School Environmental Literacy Survey (MSELS)

The Middle School Environmental Literacy Survey (MSELS) is the most widely used instrument in environmental literacy research in Indonesia because it has a comprehensive structure that includes environmental knowledge, attitudes, cognitive skills, and ecological behavior. Although it was originally developed for middle school students in the United States, the instrument has been extensively adapted by Indonesian researchers to align with local social, cultural, and curricular contexts, ensuring its validity and reliability when used at the senior high school level. These adaptations allow researchers to assess environmental literacy holistically and compare findings across regions. MSELS is effective in generating rich quantitative data, particularly for mapping students' environmental literacy profiles and identifying components that require enhancement through educational interventions (Rahardjo & Samosir, 2021; Dewi, 2022).

2. Environmental Attitude Scale (EAS)

The Environmental Attitude Scale (EAS) is an instrument for measuring environmental attitudes, focusing on individuals' beliefs, feelings, and tendencies regarding environmental issues. In the context of senior high school students, EAS is used to determine the extent to which students have a positive orientation toward environmental preservation and to assess affective aspects that may influence pro-environmental behavior. The instrument is commonly used in Indonesian research because it is easy to implement, clearly structured, and adaptable to local contexts without altering its conceptual meaning. EAS helps researchers understand the dynamics of students' ecological attitudes, including emotional and moral factors that contribute to the formation of environmental behavior (Lubis & Marlina, 2020; Yuliana, 2023).

3. New Ecological Paradigm (NEP)

The New Ecological Paradigm (NEP) is an instrument designed to measure an individual's environmental worldview—that is, their perspectives on the relationship between humans and the environment. NEP is considered essential in environmental literacy research because it provides insights into students' ecological orientation, whether they tend to be anthropocentric or ecocentric. At the senior high school level, NEP is widely used to assess students' critical awareness of sustainability, including their beliefs about ecosystem limits, human dominance over nature, and the necessity of ecological balance. In Indonesia, NEP has been adapted into the local language and contextualized to more accurately capture students' environmental worldviews. The instrument is highly useful for predicting students' pro-environmental tendencies and assessing the effectiveness of environmental education programs (Nugraha & Setiawan, 2021; Amanda, 2023).

4. Local ESD-Based Questionnaires

Local questionnaires based on Education for Sustainable Development (ESD) are instruments developed by Indonesian researchers to assess environmental literacy according to UNESCO standards, particularly related to sustainability competencies, ecological values, and action-oriented abilities. These instruments are designed to be more contextual by considering local culture, region-specific environmental issues, and the integration of the Merdeka Belajar curriculum. A major advantage of ESD-based



questionnaires is their flexibility—researchers can tailor the indicators to fit school needs, the Adiwiyata program, or environment-based projects. These instruments are widely used in recent studies because they capture elements of environmental literacy not included in Western instruments, such as local wisdom values and community-based sustainability practices (Suryani & Harefa, 2022; Widodo, 2024).

CONCLUSION

This literature review affirms that the environmental literacy of senior high school students in Indonesia still requires serious attention, particularly in the areas of cognitive skills and pro-environmental behavior, which have not developed optimally despite students' generally adequate basic environmental knowledge. Theoretical frameworks such as Roth (1992), the Environmental Literacy Model, and UNESCO's ESD framework provide strong conceptual foundations for understanding and assessing environmental literacy. Findings from various national studies show that the success of environmental literacy development is strongly influenced by curriculum integration, the quality of teacher pedagogy, the availability of green school facilities, family involvement, and exposure to digital media. Measurement instruments such as MSELS, EAS, NEP, and ESD-based questionnaires serve as essential tools for obtaining a comprehensive picture of students' environmental literacy. Overall, this review highlights the need for collaborative strategies among schools, teachers, families, and communities to build a stronger ecological culture, as well as the importance of further intervention-based research to strengthen action-oriented dimensions and sustainability practices among students.

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