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Learning Models of Environmental Literacy for Sustainability

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Abstract

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Enhancing environmental awareness through education is a fundamental aspect in supporting the achievement of the Sustainable Development Goals (SDGs). Environmental literacy, which involves the mastery of knowledge, skills, attitudes, and active participation in ecological issues, plays a crucial role in shaping a generation with ecological insight and a strong sense of sustainability responsibility. This article aims to examine the implementation of environmental literacy learning models using the *Systematic Literature Review* (SLR) approach, focusing on environmental education, particularly in the Indonesian context and its relevance to the SDGs. The findings indicate that environmental literacy makes a significant contribution to increasing awareness and sustainable behavior among learners, especially through experiential learning, field-based projects, and curriculum integration. However, challenges remain, including limited resources, weak policy implementation, and low community participation. This review emphasizes the importance of innovation in environmental literacy learning models that can address the complexity of ecological issues while encouraging transformation toward a more sustainable society.

1. Introduction

The current global environmental crisis has become a pressing issue that demands the active involvement of all levels of society, including the world of education. Climate change, ecosystem degradation, pollution, and the loss of biodiversity are major challenges that affect the sustainability of human life on Earth (Elisha & Felix, 2020). Recognizing this, the international community has placed education as one of the main keys to achieving the Sustainable Development Goals (SDGs). Education for Sustainable Development (ESD) emphasizes empowering individuals with the knowledge, skills, attitudes, and values that enable them to contribute to creating a sustainable future for the environment, the economy, and society. The relevance of education to the SDGs is clear in the fourth goal, namely Quality Education (SDG 4), which also serves as the foundation for achieving various environmental targets such as climate action, life on land, and life below water.

In Indonesia, environmental problems have their own complexity. Water, air, and soil pollution from industrial waste and household garbage are increasing along with population growth and urbanization. Deforestation and forest fires trigger the loss of biodiversity while increasing greenhouse gas emissions (Singh, 2022). On the other hand, land use change worsens the risk of natural disasters such as floods and landslides, which are often aggravated by the low capacity for environmental governance. The problems of clean water crisis and waste accumulation also pose a serious threat to public health and the sustainability of both marine and terrestrial ecosystems. The complexity of these issues shows how important the role of

environmental education is in fostering awareness and active public participation to overcome these ecological challenges.

Education contributes significantly to shaping sustainable mindsets and behaviors. Through a curriculum that integrates environmental education, students not only gain theoretical knowledge but are also trained to develop critical and creative thinking skills to find solutions to environmental problems. Experiential learning processes, such as field projects, recycling activities, conservation, and participatory research, can increase students connection to their environment. This kind of education prepares individuals to adopt a responsible lifestyle, manage resources wisely, and act as agents of change in creating a sustainable society.

In this context, environmental literacy emerges as a key concept. Environmental literacy is defined as an individuals ability to understand, appreciate, and act based on knowledge about the living environment. This literacy involves an understanding of ecological processes, the interconnectedness of environmental components, and the ability to make decisions and take actions that are in line with the principles of sustainability. A number of studies emphasize that environmental literacy not only covers cognitive aspects but also affective dimensions, practical skills, and active participation in environmental conservation efforts (Fang et al., 2022). Thus, environmental literacy can be seen as a foundation for building a generation that is more sensitive to environmental issues and ready to contribute to global sustainability.

Along with the increasing urgency of environmental problems, various environmental literacy learning models have been developed. This model focuses on

providing direct experience to students through project-based learning methods, field exploration, and participation in conservation activities. The advantage of this approach is its ability to connect academic concepts with everyday reality, making learning more meaningful and applicable. Research shows that students involved in environmental literacy learning models tend to have a higher ecological awareness and are more encouraged to take real action in their daily lives. However, the implementation of this model still faces challenges, especially related to limited resources, policy support, and a school culture that does not fully support environmental education.

2. Literature Review

The concept of environmental literacy has been a major focus in the academic world for the past few decades, but its urgency has increased in the context of the global environmental crisis and the sustainable development agenda. According to Biswas (2020), environmental literacy involves a conceptual understanding of ecological systems, value awareness, and the ability to act ethically towards the environment. In its development, environmental literacy is seen not only as a cognitive competence but also as a practical skill and affective commitment that encourages real action to protect the environment. This perspective was later developed within the framework of Education for Sustainable Development (ESD), which emphasizes the link between education, active participation, and behavioral change towards sustainability (Algurén, 2021).

A number of studies highlight the importance of environmental literacy-based learning models in increasing student awareness and involvement. Damopolii et al. (2024) show that the integration of environmental projects, field research, and active participation in conservation activities can improve students understanding of ecological issues and encourage them to take sustainable action. This is in line with the findings of Hayati (2020) which emphasize that direct learning experiences are more effective than learning that only focuses on knowledge transfer. In other words, environmental literacy is effective when applied through a participatory approach that connects academic concepts with real-life contexts.

In the Indonesian context, various studies affirm the relevance of environmental literacy in facing local challenges such as deforestation, pollution, natural disasters, and waste management. Shutaleva et al. (2021) emphasize that low environmental literacy in the community contributes to consumptive behavior and minimal participation in environmental preservation. Therefore, environmental education through literacy is considered a strategic strategy to increase public awareness and support the achievement of the SDGs. Furthermore, Djirong et al. (2024) identified that although there have been environmental-based curriculum initiatives, limited resources, lack of teacher training, and minimal policy support often hinder the effectiveness of implementation.

At the global level, a study by Ahmad (2024) highlights that successful environmental literacy models usually emphasize an interdisciplinary approach, combining science, social studies, and humanities. This kind of approach allows students to understand the links between ecological, social, and economic aspects,

so that they are able to make more comprehensive decisions. In addition, Derkach et al. (2023) show that environmental literacy integrated into project-based learning can improve 21st-century skills such as critical thinking, collaboration, and innovation.Thus, environmental literacy can be understood as an educational strategy that not only aims to equip students with knowledge but also to change their behavioral patterns and values.

3. Methods

This research uses the Systematic Literature Review (SLR) method as an approach to compile and analyze various studies on environmental literacy in education. This method was chosen because it allows researchers to obtain a comprehensive, structured, and transparent overview of the development of studies relevant to the topic. SLR focuses on the identification, selection, analysis, and synthesis of literature based on certain criteria so that the results obtained are not only descriptive but also provide a conceptual contribution to the field of study.

The initial stage of the research begins with the process of identifying literature through searching reputable academic databases on Google Scholar. The keywords used in the search include "environmental literacy", "education for sustainable development", "environmental education model", "sustainable development goals", and "Indonesia". In addition, the selected articles must be published in peer-reviewed journals, international proceedings, or official reports of educational institutions and environmental organizations.

The next stage is the selection of literature by applying inclusion and exclusion criteria. Articles included in the inclusion category are those that explicitly discuss the application of environmental literacy in the context of formal and non-formal education and have a connection with the sustainable development agenda. Meanwhile, literature that has no empirical basis, is not relevant to education, or is duplicative is excluded from the analysis. The selection process is carried out in layers, starting with screening titles and abstracts, then continuing with a full review of the article text. From this process, a number of core articles were obtained that were used as primary data sources in the study.

The analysis stage is carried out by extracting key information from the selected articles, including the research objectives, methods used, main findings, and contribution to the development of environmental literacy. The collected data is then categorized based on themes, such as learning models, implementation strategies, the impact on student behavior, and the challenges faced. The synthesis process is carried out narratively to present patterns, gaps, and research trends that can be a basis for recommendations. With this approach, the research is expected to provide a comprehensive mapping of the condition of environmental literacy in education, including the effectiveness of existing models, implementation barriers, and future directions for development.

4. Results and Discussion

4.1 The Effectiveness of Environmental Literacy Models in Education

The results of the literature review show that environmental literacy models have significant effectiveness in increasing the understanding, awareness, and skills of students regarding environmental issues. Based on the analysis of the articles reviewed, environmental literacy is seen not just as the delivery of knowledge about ecology or scientific concepts, but also as a means of transforming values, attitudes, and behaviors. In this case, environmental literacy functions as a holistic educational approach that integrates cognitive, affective, and psychomotor dimensions (Hermawan et al., 2022). Students are not only invited to understand environmental problems but are also given real experience to participate in environmental conservation efforts, for example through tree planting projects, waste management, and energy conservation.

One of the main advantages of this model is its ability to provide contextual learning experiences. For example, research by Damopolii et al. (2024) confirms that the integration of environmental-based projects into the curriculum can help students connect academic concepts with the socio-ecological realities they face every day. This is in line with the findings of Hayati (2020) which show that field-based learning is more effective than conventional learning in building environmental awareness. This concept is in harmony with the experiential learning approach that emphasizes the importance of active involvement in real situations to strengthen understanding.

The effectiveness of the environmental literacy model is also seen in its contribution to the development of 21st-century skills. A study by Derkach et al. (2023) shows that when students are involved in environmental project-based learning, they not only understand ecological problems but also develop skills in collaboration, critical thinking, creativity, and problem-solving. Thus, environmental literacy can be a bridge between environmental education and the demands of global competencies that are relevant in the modern era. Ahmad (2024) even emphasize that a successful environmental literacy model is interdisciplinary, connecting natural sciences, social sciences, and humanities perspectives so that students are able to understand the complexity of environmental problems more comprehensively.

In addition, environmental literacy is proven to be able to foster pro-environmental behavior. Shutaleva et al. (2021) emphasize that students who have a good understanding of environmental literacy are more likely to participate in real actions, such as reducing the use of single-use plastic, saving energy, and participating in social activities related to environmental preservation. In a broader context, environmental literacy can be the basis for the formation of a sustainable school culture, where all school members participate in creating an environmentally friendly learning ecosystem. However, the effectiveness of this model is still influenced by various factors, including teacher support, school policies, and the availability of facilities and infrastructure. Djirong et al. (2024) note that although many environmental literacy programs have been implemented, the main obstacles faced are the limited capacity of teachers to integrate environmental issues into learning and minimal consistent policy support. Therefore, the success of

environmental literacy implementation is not only determined by students but also by the entire educational ecosystem. In other words, effective environmental literacy requires a collaborative approach involving teachers, educational institutions, the community, and the government. By paying attention to these results, it can be concluded that the environmental literacy model plays an important role in improving the quality of education while making a real contribution to the achievement of the Sustainable Development Goals (SDGs). Through appropriate integration, environmental literacy can be a driver in shaping a generation that is ecologically aware, critical, and able to act to preserve the Earth.

4.2 Challenges and Future Directions of the Environmental Literacy Model

Although various studies show that environmental literacy has great potential in shaping ecological awareness, its implementation in the field still faces various challenges. These challenges are structural, cultural, and technical, so they require a sustainable development strategy so that this model can provide optimal impact. One of the most common obstacles is the limited capacity of teachers. Many teachers have not received adequate training to integrate environmental literacy concepts into subjects, so the implementation tends to be normative and less applicable. As noted by Djirong et al. (2024), without strong pedagogical support, environmental literacy programs have the potential to become just additional activities without sustainability.

In addition to the teacher factor, policy issues are also a serious challenge. Although there are government initiatives to include environmental issues in the curriculum, their implementation is often inconsistent. Educational policies still

place more emphasis on narrow cognitive achievement rather than the development of character and ecological awareness. This means that environmental literacy has not been fully integrated as a core part of formal education. In fact, environmental literacy requires strong regulatory support and incentives for schools that successfully implement it consistently (Spinola, 2021). The next challenge is the limited facilities and infrastructure. Many schools, especially in rural areas, do not have adequate facilities to support project-based learning or field research. Limited access to learning resources, laboratories, and technology is a serious obstacle to the development of environmental literacy.

In addition, the consumptive culture in society also influences. Students often experience a contradiction between the school's message that encourages environmentally friendly behavior and daily practices in society that are still negligent of environmental issues, such as the use of single-use plastic or minimal waste management. However, the future direction of environmental literacy remains promising. A number of studies show that the integration of digital technology can be a solution. For example, the use of educational applications, virtual simulations, or online learning platforms allows students to understand environmental issues in a more interactive and contextual way. In addition, collaboration between schools, universities, NGOs, and local communities can strengthen the implementation of environmental literacy. This collaborative approach allows for the creation of a learning ecosystem that is not only limited to schools but also involves the wider community (Lake et al., 2022). Going forward, the development of environmental literacy needs to be directed towards an interdisciplinary approach that connects

environmental issues with social, economic, and cultural aspects. This is in line with the idea of Ahmad (2024) who emphasize the need for environmental education to be cross-disciplinary so that students can understand the complexity of ecological problems.

In addition, environmental literacy also needs to place more emphasis on the development of 21st-century skills, such as problem-solving, collaboration, and innovation, which are relevant to the current global dynamics. Thus, although it still faces challenges, environmental literacy still has great prospects to develop as a transformative educational model. The key lies in strengthening teacher capacity, policy consistency, infrastructure support, and community involvement. If these factors can be overcome, environmental literacy will not only improve the quality of education but also become an important strategy in building a sustainable society that is oriented towards environmental sustainability.

5. Conclusion

The results of the systematic review on environmental literacy learning models show that this approach has a crucial role in shaping students knowledge, attitudes, and skills related to environmental issues. Environmental literacy is not just a conceptual understanding of ecosystems and the impact of human activity on nature, but also includes the formation of values and practical skills to participate in environmental preservation. Through direct experience, such as field research, conservation projects, and involvement in community programs, students can connect theory with practice so that their ecological awareness develops holistically.

The main findings from the literature confirm that the effectiveness of environmental literacy is highly dependent on three main factors, namely teacher capacity, consistency of educational policy, and infrastructure support. The obstacles still encountered include limited training for educators, weak regulations, and minimal supporting facilities in schools. However, the opportunities for developing this model are very large through the integration of digital technology, collaboration with local communities, and an interdisciplinary approach that connects environmental aspects with socio-economic dimensions.

Thus, environmental literacy can be seen as a transformative strategy to achieve the Sustainable Development Goals, especially in fostering an ecologically-aware generation. Education oriented towards environmental literacy is expected to produce agents of change who are not only aware of ecological problems but are also committed to taking real action to preserve the Earth.

References

Ahmad, R. (2024). Integrating Environmental Education with Social Studies: An Interdisciplinary Framework. *Frontiers in Interdisciplinary Educational Methodology*, *1*(3), 117-126.

Algurén, B. (2021). How to bring about change a literature review about education and learning activities for sustainable development. *Discourse and Communication for Sustainable Education*, *12*(1), 5-21.

Biswas, A. (2020). A nexus between environmental literacy, environmental attitude and healthy living. *Environmental Science and Pollution Research*, *27*(6), 5922-5931.

Damopolii, I., Nunaki, J. H., Jeni, J., Rampheri, M. B., & Ambusaidi, A. (2024). An integration of local wisdom into a problem-based student book to empower students conservation attitudes. *Participatory Educational Research*, *11*(1), 158-177.

Derkach, T. M., Bilianska, M. M., & Yaroshenko, O. G. (2023). Project-based learning as an approach to enhance ecological component in professional education. *Educational Technology Quarterly*, *2023*(4), 481-497.

Djirong, A., Jayadi, K., Abduh, A., Mutolib, A., Mustofa, R. F., & Rahmat, A. (2024). Assessment of student awareness and application of eco-friendly curriculum and technologies in Indonesian higher education for supporting sustainable development goals (SDGs): A case study on environmental challenges. *Indonesian Journal of Science and Technology*, *9*(3), 657-678.

Elisha, O. D., & Felix, M. J. (2020). The loss of biodiversity and ecosystems: a threat to the functioning of our planet, economy and human society. *International Journal of Economics, Environmental Development and Society*, *1*(1), 30-44.

Fang, W. T., Hassan, A. A., & LePage, B. A. (2022). Environmental literacy. In *The living environmental education: sound science toward a cleaner, safer, and healthier future* (pp. 93-126). Singapore: Springer Nature Singapore.

Hermawan, I., Suwono, H., Paranit, A. A. I., & Wimuttipanya, J. (2022). Student's Environmental Literacy: An Educational Program Reflections for a Sustainable Environment. *Journal of Biological Education Indonesia (Jurnal Pendidikan Biologi Indonesia)*, *8*(1), 1-9.

Lake, D., Motley, P. M., & Moner, W. (2022). Completing the CiCLE: long-term assessment of community-involved collaborative learning ecosystems for social innovation in higher education. *Social Enterprise Journal*, *18*(1), 28-50.

Shutaleva, A., Martyushev, N., Nikonova, Z., Savchenko, I., Abramova, S., Lubimova, V., & Novgorodtseva, A. (2021). Environmental behavior of youth and sustainable development. *Sustainability*, *14*(1), 250.

Singh, S. (2022). Forest fire emissions: A contribution to global climate change. *Frontiers in Forests and Global Change*, *5*, 925480.

Spínola, H. (2021). Environmental culture and education: A new conceptual framework. *Creative Education*, *12*(5), 983-998.