Innovation Journal for Educational Research, 2024, 1 (1), 28-50
E-ISSN: xxxx.xxxx
P.ISSN: xxxx.xxxx

Environmental Education in the Independent Learning Curriculum: A Literature Review on Learning Innovations and Strengthening Students' Ecological Awareness

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ABSTRACT

Environmental education in the Independent Learning Curriculum plays a crucial role in shaping students' ecological awareness and supporting ecosystem sustainability. This article examines the opportunities for integrating environmental education into the Merdeka Belajar Curriculum with the aim of enhancing students' understanding of the importance of preserving nature. Based on a literature review, the article presents various innovative approaches to environmental learning, such as project-based learning, problem-based learning, and the use of technology, which can enrich students' learning experiences. Challenges in implementing environmental education, including limited resources, teacher training, and limited curriculum support, are also discussed. Case studies from schools that have successfully implemented environmental education show a positive impact on students' ecological awareness. This article also highlights the importance of collaboration with local communities, governments, and related institutions to enrich students' learning experiences, as well as the role of local wisdom in strengthening the relevance of environmental education within the local cultural and environmental context. As a recommendation, further efforts are needed in the development of a more integrated curriculum, more intensive teacher training, and the utilization of technology to support more effective and impactful environmental learning.

Keywords: *environmental education; ecological awareness; Merdeka Belajar Curriculum*

INTRODUCTION

In a global context, various reports indicate an increase in environmental threats due to climate change, deforestation, pollution, and excessive exploitation of natural resources. In Indonesia, the exploration of natural resources, particularly the coal and oil industries, significantly contributes to greenhouse gas emissions and deforestation (Judijanto et al., 2023). These environmental issues highlight the urgency of raising

Citation in APA style: Furkan, Lukman, Junaidin, Asbah, and Syamsul hidayat. (2024). Environmental Education in the Independent Learning Curriculum: A Literature Review on Learning Innovations and Strengthening Students' Ecological Awareness. *Innovation Journal for Educational Research, Vol. 1* (1), 28-50.

Received October, 2024; Revised November, 2024; Accepted Dcember, 2024

DOI: xxxx.xxxx.xxxx

environmental awareness, particularly through education. Of course, this also makes environmental education highly relevant to be included in the school curriculum so that students have a deeper understanding of the ecological challenges faced.

Several studies show that environmental education is very important for developing a generation that is environmentally conscious and capable of addressing ecological challenges. Integrating environmental topics into the school curriculum, particularly in subjects such as Citizenship Education and Indonesian Language, can effectively enhance students' awareness and responsibility towards environmental preservation (Ludiya, 2024). In addition, the Merdeka Belajar Curriculum initiated by the Ministry of Education, Culture, Research, and Technology opens opportunities for the integration of environmental education into the formal learning system. This approach is in line with the Sustainable Development Goals, particularly regarding climate action and quality education (Arwan, 2022). This curriculum offers flexibility for schools to develop learning materials that meet local and global needs. Studies also show that students exposed to environmental issues in their learning demonstrate more positive attitudes and actions towards the environment, including involvement in conservation activities (Ludiya, 2024).

Then, environmental education can be incorporated as part of the subjects or thematic learning projects. This step is in line with the Sustainable Development Goals (SDGs), particularly Goal 13, which addresses climate change, and Goal 4, which focuses on inclusive and equitable quality education.However, environmental education in schools faces challenges such as the loss of students' ecological knowledge and limited training for teachers (Labobar & Kapojos, 2023). And also, the low commitment of the government and schools, as well as the less innovative teaching methods, still need to be addressed. Therefore, integrating environmental literacy into the education curriculum is very important. The consistent implementation of that curriculum can maintain students' environmental knowledge and concern, which positively impacts environmental sustainability (Maresi & Basoeki, 2024). Here is where the role of the Merdeka Belajar Curriculum becomes important, as it allows teachers to innovate in teaching methods that are relevant to the local environmental context. Moreover, the Merdeka Belajar Curriculum provides opportunities for teachers to innovate in teaching methods that are relevant to the local environmental context (Silvia & Tirtoni, 2023).

On the other hand, environmental character education is an important effort in shaping students' attitudes and behaviors towards their surroundings (Purwanti, 2017). Through a holistic approach that involves students in real activities such as tree planting and waste recycling, it can enhance their sense of responsibility towards the environment (Ismail, 2021). This learning process can enhance students' sense of responsibility towards nature, strengthen their empathy towards other living beings, and encourage them to take concrete actions in preserving the environment.

Environmental education can also serve as a means to introduce local cultural values relevant to nature conservation. Many indigenous communities in Indonesia possess local wisdom in preserving the environment, such as subak in Bali, mangrove conservation in Kalimantan, and awig-awig in Lombok. The integration of these values into the Merdeka Belajar Curriculum can enrich students' understanding of the relationship between humans and nature while also strengthening their cultural identity. Because local wisdom plays an important role in environmental preservation and education in Indonesia.

Ecological values in local wisdom can enhance awareness and positive attitudes towards the environment (Niman, 2019).

Recent research also shows that integrating environmental issues into subjects such as Citizenship and Social Studies can effectively foster environmental awareness and responsible behavior among students. Furthermore, a problem-based learning approach using global environmental issues has been proven to significantly improve students' environmental attitudes (Munisah et al., 2018). This means that this integration will foster a positive attitude towards students, resulting in graduates who can adopt environmentally friendly behaviors.

However, the success of implementing environmental education in the Merdeka Belajar Curriculum greatly depends on the support of various parties, including the government, schools, communities, and families.

The government needs to provide training for teachers, develop learning modules, and ensure the availability of supporting facilities. Schools must commit to creating a learning environment that supports environmental education, such as adopting eco-friendly policies and integrating this learning into the school curriculum.

Meanwhile, families and communities also play an important role in supporting environmental education. Parents can be role models by adopting an environmentally friendly lifestyle at home, such as reducing plastic waste or conserving energy. The local community can partner with schools in providing real learning environments, such as city parks, conservation forests, or waste management sites. This collaboration can strengthen the impact of environmental education on students.

Furthermore, environmental education not only serves as a learning instrument but also as a medium to build collective awareness in facing global environmental challenges. By teaching students about the importance of environmental sustainability from an early age, it is hoped that they can grow into agents of change capable of inspiring their communities to preserve the ecosystem.Well-designed environmental education research can foster a generation that is more concerned with sustainability. Approaches such as project-based learning and hands-on activities in creating green schools have shown promise in developing environmental ethics and critical thinking skills among students (Munisah et al., 2018) .

In the context of Indonesia, environmental education is also relevant to local challenges such as waste management, deforestation, and marine ecosystem degradation. Environmental-based learning can be designed to address these issues, for example, through projects that involve students in beach clean-up campaigns, forest rehabilitation, or coral reef conservation. This aligns with the Merdeka Belajar Curriculum in Indonesia, which emphasizes project-based learning, in line with the demands of 21st-century education and the development of student competencies (Alhayat et al., 2023). With this approach, environmental education not only becomes part of the curriculum but also part of the solution to environmental problems. Because integrating environmental themes into language learning can reduce student boredom, enhance social relationships, and increase awareness of local environmental issues (Julianti, 2021) . The implementation of this curriculum requires teachers to enhance their planning, execution, and evaluation skills to effectively facilitate student learning and address contemporary challenges (Alhayat et al., 2023).

Therefore, it is important for educators to continuously innovate in developing learning strategies that are relevant to students' needs and future environmental challenges. By utilizing the flexibility offered by the Merdeka Belajar Curriculum, schools can create more meaningful, contextual, and impactful learning that contributes to the formation of an environmentally conscious generation.

Environmental education within the Merdeka Belajar Curriculum is not just an option, but an urgent necessity to ensure the sustainability of ecosystems and the future of upcoming generations. With an innovative and collaborative approach, this education can become a strong foundation in building students' ecological awareness. Collaboration between schools, families, communities, and the government is the key to the successful implementation of this environmental education.

LITERATURE REVIEW

Environmental Education (PLH) aims to increase environmental awareness, knowledge and action among students (Fadilah & Belakang, 2023). The focus is on developing ecological understanding, encouraging sustainable behavior, and encouraging participation in environmental programs. Teachers play an important role in implementing PLH, fostering a sustainable lifestyle, and instilling environmental ethics (Nurzaelani, 2017). Effective implementation of PLH involves experience-based learning, school and community support, and social interaction (Rahayu et al., 2024). However, there are challenges in implementing PLH, including inadequate implementation of teaching plans and a lack of specialized human resources. Despite these obstacles, PLH remains an important tool for developing an environmentally conscious and socially responsible generation. The integration of PLH in the education system, especially at the elementary school level, is very important to overcome current and future environmental challenges (Fadilah & Belakang, 2023).

2.1. Philosophical Framework for Environmental Education

Environmental Education (PLH) is rooted in the principles of sustainability and involves cognitive, affective and behavioral dimensions, making it an important element in the modern curriculum (Firdaus, 2020). The implementation of PLH faces challenges in elementary schools so it requires research to increase students' understanding of environmental concepts. The development of contextually based PLH teaching materials is very important, so as to enable students to learn independentlybased on real environmental issues. The integration of PLH as a local content curriculum in schools aims to create an environmentally conscious culture and equip students with skills to protect and preserve the environment. Assessment of student character development at PLH uses authentic methods including assignments, reports and observations (Hidayanti et al., 2018).

2.2. Independent Learning Curriculum: Opportunities for Environmental Education

The Merdeka Belajar curriculum introduces the Pancasila Student Profile Strengthening Project (P5), which covers themes such as sustainable lifestyles and allows the integration of local and global issues (Makrifah et al., 2023). This curriculum emphasizes project-based learning (PjBL), align with the demands of 21st century education and prioritize collaboration and problem solving skills (Alhayat et al., 2023). Implementation of P5 is flexible in content, timing and assessment, allowing students to

learn relevant themes and take concrete action. For example, waste sorting projects for first graders and local food processing have been developed. The curriculum also supports Education for Sustainable Development, as exemplified by the biogeochemical cycles project for secondary school students (Roihanah et al., 2022).

2.3. Local Wisdom as a Media for Environmental Education

Recent studies highlight the importance of integrating local wisdom into environmental education in Indonesia, especially in the Merdeka Belajar curriculum. Incorporating local traditions into P5 projects can strengthen students' connections with local culture and environmental conservation (Annisha, 2024). This integration improves the learning experience and strengthens educational pillars such as character development, cognitive, emotional, social and aesthetic aspects. Environmental education based on local wisdom exemplified by the Minahasa mapalus culture can be a benchmark for understanding environmental concepts in various communities (Rusilowati et al., 2015). Furthermore, integrating local wisdom values into elementary school mathematics education is in line with the 2013 curriculum and can help preserve cultural values and national character (Nuraini, 2018). Local wisdom is considered the main capital for community development without disrupting adaptive social structures towards the natural environment. This approach creates a meaningful learning experience by connecting education with real life situations (Asriati, 2022).

METHODS

The methodology of this article uses a literature review approach to explore various concepts and findings related to environmental education within the context of the Independent Learning Curriculum (Snyder, 2019) states that a literature review is a research methodology aimed at collecting and synthesizing previous research and analyzing several expert overviews written in the text..The author collected various relevant literature sources, such as journal articles, books, research reports, and government policies on environmental education and the Merdeka Belajar Curriculum. These sources were selected based on their credibility and relevance in delving into the discussed topic, namely environmental-based learning innovations and strengthening students' ecological awareness.

RESULTS

Environmental education is a learning process aimed at enhancing the understanding, awareness, and responsibility of individuals and collectives towards the environment both now and in the future. This education is not only related to theoretical knowledge but also involves the development of attitudes, skills, and actions that support environmental preservation

Environmental education is a learning process aimed at enhancing the understanding, awareness, and responsibility of individuals and collectives towards the environment both now and in the future. This education is not only related to theoretical knowledge but also involves the development of attitudes, skills, and actions that support environmental preservation. In a broader sense, environmental education aims to build an ecologically conscious society capable of contributing to the sustainability of this planet. The main objectives of environmental education are to enhance knowledge, skills,

and attitudes that support environmental preservation and to solve current and future environmental problems. Moreover, environmental education aims to raise awareness that each individual has an important role in maintaining the balance of nature, whether through simple actions like managing waste or collective actions like supporting environmentally friendly policies.

Environmental education also aims to develop critical and analytical skills that enable individuals to understand and address environmental challenges. These skills include the ability to identify environmental problems, analyze their causes, and formulate applicable solutions. Thus, environmental education not only provides theoretical insights but also encourages active participation in preserving nature.

Its relation to ecosystem sustainability is very close, as environmental education promotes sustainability principles. Sustainability refers to the efforts to meet the needs of the current generation without compromising the ability of future generations to meet their own needs. In this context, environmental education serves as a means to internalize sustainability values in individuals from an early age, so that they grow into a generation that is caring and responsible towards the environment.

One important aspect of environmental education is learning about ecosystems. Ecosystems are systems of interaction between living organisms and their physical environment, which depend on each other. Environmental education helps students understand how ecosystems work, from the food chain to biogeochemical cycles, and how human activities can affect that balance.

Environmental education plays a crucial role in building cross-generational ecological awareness. Integrating environmental values into the school curriculum, especially in subjects like Citizenship Education, can effectively enhance students' understanding and responsibility towards environmental preservation. In the global context, environmental education supports the achievement of the Sustainable Development Goals (SDGs), particularly Goal 13 on climate action and Goal 15 on life on land. Through this education, students are taught to understand global environmental issues, such as climate change, biodiversity loss, and land degradation, as well as their roles in addressing these challenges.

In Indonesia, environmental education is highly relevant, considering that the country has abundant natural resources but also faces significant challenges in protecting its ecosystems. Through environmental education, students are encouraged to recognize and love Indonesia's biodiversity, while also understanding the threats it faces, such as deforestation, pollution, and the exploitation of natural resources.

Environmental education can also serve as a means to involve the community in environmental preservation. By promoting community-based learning, this education enables collaboration between schools, communities, and the government to address local environmental issues. For example, tree planting activities or beach clean-ups can be tangible forms of environmental education that involve the participation of all parties.

Furthermore, environmental education contributes to instilling the value of environmental care character, which can be implemented through routine activities at school, such as class duty, placement of trash bins, and tree planting. For example, students who are taught to care for plants or clean the school environment will learn about the importance of cooperation in achieving common goals. Then, the Adiwiyata

Mandiri Program at the high school level is also effective in shaping an environmentally caring character through various intramural and extracurricular activities.

In the context of curriculum changes, environmental education is increasingly relevant to be integrated into the Independent Learning Curriculum. This curriculum provides flexibility for educators to develop learning materials that are relevant to local and global needs, including environmental issues. Environmental education can be incorporated as part of project-based learning, which allows students to learn while taking real actions to preserve the environment. Environmental education also plays a role in building cross-generational awareness. By involving students, teachers, and parents in environmental activities, this education can create a domino effect that strengthens ecological awareness in the community. Schools can also cultivate environmental ethics through teaching, creating green school environments, and providing appropriate facilities.

For example, students who learn about waste management at school can bring those habits home and influence their families to also care about the environment. Overall, environmental education is one of the most effective tools for addressing increasingly complex environmental challenges. By providing understanding, building awareness, and encouraging concrete actions, environmental education can help create a society that is more responsible towards the environment, while also ensuring the sustainability of ecosystems for future generations.

DISCUSSION

5.1. The Importance of Ecological Awareness

Ecological awareness refers to an individual's understanding and concern for environmental issues, as well as the willingness to act to maintain the sustainability of nature. This awareness includes understanding the impact of human activities on ecosystems, the importance of conserving natural resources, and the role of individuals in maintaining the balance of nature. In a world increasingly affected by climate change, pollution, and other environmental damage, ecological awareness becomes key to creating better change.

Environmental education plays a very vital role in shaping ecological awareness from an early age. Through learning based on the principles of sustainability, students are given the opportunity to develop a deeper understanding of the relationship between humans and nature. However, there are several factors that influence students' ecological awareness, including curriculum policies, facilities, student attitudes, and teaching methods (Hendrawan et al., 2020). This education provides a broader understanding of the importance of maintaining ecosystems to ensure their sustainability for future generations.

The growing ecological awareness among students is not only limited to theoretical knowledge but is also followed by changes in attitudes and behaviors. Effective environmental education can inspire students to change their habits to be more eco-friendly, such as reducing the use of single-use items, recycling, or participating in greening activities. Thus, this education equips students with skills and attitudes that support the preservation of nature in their daily lives.

The importance of ecological awareness is also evident from its impact on the decisions made by individuals in the future. For example, students who have a high awareness of environmental issues tend to choose a more sustainable lifestyle, such as opting for eco-friendly transportation, consuming organic food, or supporting ethically produced products. These decisions, although seemingly small, have a significant impact on global environmental preservation efforts.

The increase in ecological awareness has driven more environmentally friendly policies, such as the ban on single-use plastics or the increased use of renewable energy, and ecological intelligence encompasses understanding and appreciation of nature and life itself, with green consumerism being a key indicator (Kecerdasan et al., 2020). This shows that ecological awareness is not only important at the individual level but also at the collective level. Environmental education plays a role in fostering this awareness, which in turn influences political and social decisions related to environmental policies.

Environmental education also serves to foster empathy towards nature. Students are taught to see the world not only from a human perspective but also from the viewpoint of other living beings that share this planet. This understanding creates a deeper connection with nature, fostering a sense of responsibility to protect biodiversity and reduce the damage that can occur due to the exploitation of natural resources.

In the global context, ecological awareness becomes more important with the increasingly urgent environmental challenges, such as climate change, pollution, and ecosystem degradation. Environmental education provides students with the tools to understand these issues more deeply and think about the solutions that can be taken. A high level of ecological awareness will help them become agents of change capable of facing increasingly complex environmental challenges.

Finally, environmental education plays a crucial role in ensuring that ecological awareness is not only temporary but becomes part of the character and identity of students. By fostering an environmentally conscious mindset, environmental education can equip future generations to face environmental challenges with full responsibility and commitment. This ecological awareness, if widely applied, will create positive changes in the way we interact with nature and manage the Earth's resources sustainably.

5.2. Opportunities for Integrating Environmental Education into the Merdeka Belajar

Curriculum The Merdeka Belajar Curriculum, designed with flexibility to meet the needs of students and local contexts, offers great opportunities to integrate environmental education into the learning process. One of the main characteristics of this curriculum is the project-based learning approach, which allows students to learn through the exploration of real issues around them, including environmental challenges. This curriculum offers flexibility for teachers and students to explore knowledge and skills relevant to their local context, encouraging critical thinking and problem-solving abilities (Nadiyah & Tirtoni, 2023). Thus, environmental education can become one of the relevant, in-depth, and directly impactful project themes in students' lives.

Flexibility in the Merdeka Belajar Curriculum provides educators with the freedom to design learning according to local needs and potential. In areas with pressing environmental issues, such as deforestation, river pollution, or waste management, educators can utilize these topics as learning materials. Thus, students not only understand the theory about the environment but also learn practical ways to address it.

This curriculum also emphasizes the strengthening of the Pancasila Student Profile, one of whose dimensions is "Global Diversity." This dimension is relevant to environmental education, as it teaches students to be aware of global issues, such as climate change and sustainability. With the integration of environmental education, students can learn to become individuals who care about the future of this planet, both locally and globally.

The interdisciplinary approach supported in the Merdeka Belajar Curriculum provides another opportunity to integrate environmental education. Subjects such as Science, Social Studies, Indonesian Language, and Cultural Arts can be synergized to discuss environmental issues from various perspectives. For example, students can learn about the impact of climate change through experiments in Science, understand its social causes in Social Studies, and convey environmental messages through art or literacy in Indonesian Language.

This curriculum also promotes competency-based learning, where students are trained to develop 21st-century skills, such as critical thinking, collaboration, and creativity. Environmental education can be an ideal context for developing these skills. For example, through environmental problem-solving projects, students are encouraged to think critically about innovative solutions and work together in teams to implement them. On the other hand, the increasing digitalization of learning in the Merdeka Belajar Curriculum can also be utilized for environmental education. Online learning platforms and digital technology can be used to introduce global environmental issues to students, such as through interactive simulations or virtual visits to areas affected by climate change. This provides a richer and more in-depth learning experience for students.

Community involvement in learning, which is also one of the principles in the Merdeka Belajar Curriculum, opens up opportunities to integrate environmental education by involving various parties, such as local governments, NGOs, and local communities. For example, students can collaborate with environmental organizations on projects such as critical land rehabilitation or waste management. This involvement not only enriches learning but also strengthens the relationship between schools and the community.

The Merdeka Belajar curriculum supports context-based learning, which provides great opportunities to strengthen environmental education. Each region in Indonesia has unique environmental issues, such as coral reef management in coastal areas or forest protection in mountainous regions. By incorporating these local issues into the curriculum, students can learn to love and preserve the environment around them. The Merdeka Belajar curriculum emphasizes context-based learning and the integration of environmental education through the Pancasila Student Profile Strengthening Project (P5) (Tapung, 2022).

One of the relevant themes in P5 is environmental sustainability, where students are invited to understand, plan, and take real actions to preserve the environment. For example, schools can initiate plastic waste reduction projects or greening campaigns, which not only educate students but also have a positive impact on the surrounding environment.

Overall, the Merdeka Belajar Curriculum provides a strong foundation for making environmental education an integral part of the learning process. By leveraging flexibility,

project-based approaches, and community engagement, environmental education can provide relevant, contextual, and transformative learning experiences. This step is not only important for raising students' ecological awareness but also for creating a generation capable of facing global environmental challenges in the future.

5.3. Challenges in Implementing Environmental Education

Although environmental education has great potential in shaping students' ecological awareness, its implementation in the field does not always go smoothly. One of the main challenges faced in the implementation of environmental education is the limitation of resources. Many schools, especially those located in remote or underdeveloped areas, do not have adequate facilities to support environmental-based learning. Resources such as relevant textbooks, educational props, or access to technology that enables project-based learning are hard to find in many places. Without adequate resources, environmental education is difficult to deliver effectively.

In addition to the limitations of physical resources, another challenge often faced is the lack of adequate training for teachers. Environmental education requires an interdisciplinary and project-based approach, which may not be easily understood or implemented by teachers who are not trained in these methods. Many teachers do not yet have in-depth knowledge of environmental issues and how to teach them effectively to students. Therefore, training and professional development for educators are crucial to ensure that they have the skills and knowledge needed to teach environmental education well.

The existing curriculum also poses one of the main challenges in the implementation of environmental education. Although the Merdeka Belajar Curriculum provides room for flexibility, many national-level curricula do not yet fully support the integration of environmental education. Material about the environment is often taught only as a separate topic in certain subjects, without a comprehensive approach that connects environmental issues with students' daily lives. This makes it difficult for students to see the connection between the theory learned in class and the real-world realities they face.

The lack of support from government policies is also one of the obstacles in the implementation of effective environmental education. In many regions, although there are regulations stating the importance of environmental education, its implementation is not accompanied by sufficient resources or an emphasis on a curriculum that is more adaptive to environmental issues. Without strong policy support, environmental education programs are often neglected or receive insufficient attention from local or central governments.

Another challenge is the low awareness and participation of the community regarding the importance of environmental education. In many cases, the community has not fully realized the importance of environmental education in shaping sustainable character and mindset. This lack of awareness can hinder support for environmental programs in schools. If the community does not understand the urgency of environmental education, they tend to be less supportive of initiatives related to nature conservation or sustainability. In fact, from the above problem, if it can be addressed and implemented using several methods that can be applied, including character education (Ratri & Atmojo, 2024) and creative game-based learning to enhance students'

understanding of the environment (Kospa et al., 2020). It greatly supports the emergence of a society that is aware of environmental improvement.

In addition, there is also the challenge of changing the mindset and attitudes of students that have already been formed. Many students grow up in environments that are less concerned with environmental issues, and they may not be immediately motivated to participate in activities related to nature conservation. Environmental education, although it can provide information and knowledge, takes time to truly change students' behaviors and habits in their daily lives. Therefore, environmental education must be designed in such a way as to motivate and build positive habits related to environmental preservation.

The lack of involvement from the private sector and non-governmental organizations in environmental education programs in schools is also a problem. Although many private institutions and NGOs have beneficial environmental programs, they often do not collaborate directly with schools to introduce or implement these programs. However, collaboration between the private sector, government, and community is crucial to provide students with a more diverse and practical learning experience, as well as to support broader environmental conservation efforts.

The implementation of education in remote areas of Indonesia faces various geographical and infrastructural challenges. The limited access to information, educational facilities, and infrastructure are the main obstacles in the implementation of an effective curriculum (Fitri et al., 2024).Moreover, the lack of educational facilities that can provide direct experiences, such as botanical gardens, national parks, or conservation sites, makes it difficult for students to learn in a more engaging and hands-on manner.This condition affects class sizes, learning environments, and educational equity (Sumual et al., 2023).

Lastly, the challenges in measuring and evaluating environmental education outcomes also need to be considered. Because environmental education not only teaches theoretical knowledge but also shapes students' attitudes and behaviors, proper evaluation to measure the achievements of this education becomes more complex. Measurement not only focuses on cognitive aspects but also on changes in students' behavior regarding environmental care, which are difficult to measure with traditional evaluation methods. To address this disparity, increased investment in infrastructure, teacher training programs, curriculum adjustments to local contexts, and community involvement in curriculum implementation are needed (Novita, 2020). A holistic and sustainable evaluation is necessary to ensure that environmental education can have a significant impact on students.

5.4. Innovative Approaches in Learning

Project-based learning (PBL) is an innovative approach in environmental education that can enhance students' experiences and learning outcomes. PBL allows students to engage in projects directly related to environmental issues, encouraging active learning and problem-solving skills (Munisah et al., 2018). In PBL, students are given the opportunity to work on projects directly related to environmental issues. For example, they can get involved in reforestation activities at school or in the community, or organize campaigns to reduce plastic waste. Projects like these allow students to learn through hands-on practice, making the knowledge they acquire more applicable and relevant to

the real challenges faced by society. PBL can be applied at various levels of education and subjects, including social sciences and economics, to develop environmental awareness and critical thinking skills (Antula & Londa, 2023).

Problem-based learning is also a very effective approach in teaching environmental education. In this method, the method encourages students to explore, assess, interpret, and synthesize information, resulting in various forms of learning outcomes (Lion et al., 2022). Students are confronted with complex environmental issues, such as pollution, climate change, or habitat destruction, and are asked to seek creative and innovative solutions. This approach aligns with the principle of learning by doing, allowing students to build knowledge through real-world experiences (Lion et al., 2022). Additionally, PBL fosters character development and global awareness by addressing contemporary issues and encouraging students to seek information about current global phenomena.

Additionally, experiential learning is another highly beneficial method in environmental education. In this approach, students learn through direct field experiences, such as visiting conservation areas, national parks, or locations affected by environmental damage. Through these experiences, students can see and directly feel the threatened natural conditions, as well as understand the impact of human activities on the environment. Experiential learning makes education more vibrant and contextual, and strengthens students' emotional bonds with the environment they study.

The application of technology in environmental education is also becoming an increasingly popular innovative approach. For example, the use of applications or digital platforms that allow students to monitor environmental conditions, such as air quality or global temperature. This technology not only provides accurate data but also allows students to engage in data analysis, study environmental change patterns, and propose technology-based solutions. The use of this technology can also involve concepts such as computer programming or the use of IoT (Internet of Things) devices in environmental monitoring, enabling students to learn how to combine science with technological innovation.

In addition, learning based on cross-disciplinary collaboration can enrich students' perspectives on environmental issues. In this approach, students not only learn about the biological or geographical aspects of environmental issues but also understand the social, cultural, and economic implications. For example, the issue of climate change can be discussed from a physics perspective, but it can also be examined in a social and economic context, such as its impact on poor communities or developing countries. The collaboration between subjects helps students understand the complexity of environmental issues and how each discipline contributes to more holistic solutions.

To further encourage active student participation in environmental education, community-based learning methods are also very effective. In this approach, students work directly with the local community to solve environmental problems faced by that community. For example, they could get involved in waste management programs, or help educate the community about the importance of biodiversity. Community-based learning introduces students to the real world and encourages them to apply their knowledge to make a positive impact in society.

One equally interesting approach is game-based learning, which uses game elements to convey environmental education concepts. Through educational games, students can

learn about ecosystems, the impact of pollution, or the importance of conservation in a fun and engaging way. Such games can be tailored to the students' level of understanding and serve as a tool to introduce difficult concepts in a more easily comprehensible manner. Game-based learning also encourages students to think critically and strategically in overcoming the challenges present in the game, which in turn can be applied in real life. In addition, case-based learning is also an effective approach in teaching environmental education. In this method, students are given real case studies regarding specific environmental issues, such as coral reef damage, plastic pollution, or climate change. They are asked to analyze the cases, explore existing solutions, and suggest steps that can be taken to address the problems. Case studies help students develop critical and analytical thinking skills, as well as strengthen their understanding of the impact of each decision made on the environment.

Lastly, innovative approaches in environmental education must also consider the diversity of students' learning styles. By integrating various approaches that can adapt to individual needs, such as visual, kinesthetic, and auditory learning, environmental education can be more readily accepted by different types of students. The integration of these diverse learning styles allows students to be more actively engaged and to directly experience the benefits of environment-focused learning. With a holistic approach, students not only gain broader knowledge but also experience a deeper involvement with environmental issues relevant to their lives.

5.5. The Role of Technology in Environmental Learning

Technology plays an increasingly important role in supporting environment-based learning, providing students with more effective tools to understand complex environmental issues. The use of digital media, such as videos, animations, and interactive presentations, can make difficult-to-understand environmental concepts easier to digest. For example, documentary videos about climate change or habitat destruction can provide a clear visual representation of the impact of human activities on the environment. This digital media not only conveys information in an engaging way but also enriches students' understanding through more vivid visual experiences.Research shows that digital media technology can significantly enhance environmental education. Videos, animations, and interactive simulations have been proven to enhance students' motivation, engagement, and understanding of complex environmental concepts (Listiana, Mina, Herlinawati, 2024).

In addition, environment-based learning applications are increasingly being used to provide a more interactive learning experience. Applications like ecosystem simulations allow students to see how changes in one element, such as pollution or deforestation, can affect the entire ecosystem. Such applications give students the opportunity to experiment with different scenarios and observe the outcomes, reinforcing their understanding of ecosystem balance and the importance of sustainability. This technology also provides the opportunity to access real-time information, such as air quality data or global temperatures, making learning more relevant to real-world conditions. With this technology, students can explore environmental issues that might not be directly experienced, such as historical events (Hadi, 2017). The application of technology-based learning media has been proven to enhance learning effectiveness,

increase student motivation, and improve overall learning outcomes (Listiana, Mina, & Herlinawati, 2024).

Technology-based collaborative platforms also play a significant role in expanding collaboration among students, teachers, and even the community outside of school in solving environmental problems. Platforms like Google Classroom, Edmodo, or Microsoft Teams allow students to work together on projects focused on environmental issues, share ideas, discuss, and generate solutions that can be applied in the real world. These platforms accelerate the process of collaboration and communication, enabling students to engage in global or local projects without being hindered by geographical or time constraints. Digital media not only conveys information in an engaging manner but also enriches students' understanding through immersive visual experiences (Barri et al., 2018).

Technology also enables location-based learning through the use of GPS devices and map-based applications. For example, students can use applications to map areas exposed to pollution or monitor changes in environmental quality around them. The use of map-based technology allows students to learn directly from data collected in the field and relate that information to the theories studied in class. By using field data, students can see the direct connection between theory and practice, as well as gain deeper insights into environmental issues.

In the context of environmental education, technology also enables virtual observations and experiments. For example, students can visit national parks or conservation areas around the world through virtual tours that can be tailored to their curriculum. With virtual tours, students can explore biodiversity, marine ecosystems, or tropical rainforests without having to leave their classroom. This technology provides a highly valuable experience, especially for schools that do not have direct access to these locations, while also introducing students to the beauty of nature and the importance of environmental conservation.

The use of technology in environmental education also supports data collection and analysis. Students can use various technological tools, such as sensors to measure temperature or humidity, or IoT (Internet of Things) devices to monitor air and water quality. These tools allow students to engage in scientific experiments that collect data directly from their surrounding environment. The data obtained can then be analyzed to draw conclusions, solve problems, and suggest concrete steps that can be taken to address existing environmental challenges.

In addition, technology enables the development and distribution of more extensive learning materials. By using websites, blogs, and learning applications, materials related to environmental education can be accessed by students anywhere and anytime. This addresses the issue of limited access that often occurs in remote areas or schools lacking resources. For example, textbooks or scientific articles on environmental issues can be uploaded to an online platform and accessed by students without being limited by physical copies or printing costs. This material can also be updated periodically to include the latest issues in the field of the environment.

Finally, technology can enhance students' awareness and actions towards environmental issues through gamification. Game-based learning, such as simulations that teach how to manage natural resources or reduce carbon footprints, gives students

the opportunity to learn while playing. These games are often designed to provide challenges that mimic real-world situations, such as managing energy or dealing with natural disasters, allowing students to see the impact of every decision they make. Gamification makes learning more enjoyable and encourages students to think strategically about creative ways to address environmental issues.

5.6. Ecological Awareness: Definition and Purpose

Ecological awareness is an important aspect of environmental education, involving an understanding of environmental issues and the impact of human actions on ecosystems (Muliastrin, 2019). This involves environmental knowledge, which positively correlates with students' environmental awareness, with a contribution of 8.89% (Uge et al., 2019). For students, ecological awareness is the first step towards behavioral changes that support the sustainability of nature and life. By building this awareness from an early age, they are more likely to adopt an environmentally friendly lifestyle and be responsible towards the planet. The goal of building ecological awareness is to create a generation that is caring, knowledgeable, and able to act effectively in facing environmental challenges. Environmental education plays a significant role in this process, providing the information and skills needed for students to recognize their roles in preserving and conserving nature.

With increased ecological awareness, students will not only have a better understanding of environmental issues but also develop a proactive attitude towards engaging in nature conservation actions, such as waste reduction, efficient energy use, and biodiversity preservation. Developing this awareness, schools can implement the Adiwiyata program and integrate problem-based learning models into social studies subject (Kecerdasan et al., 2020) . Ecological character education can be based on the Tri Hita Karana philosophy, which emphasizes a harmonious relationship between humans and nature. The development of ecological literacy, which includes knowledge, attitudes, and positive actions towards the environment, can begin in elementary school and involve the three centers of education: family, school, and community (Wijaya, 2020).

5.7. Strategies to Strengthen Students' Ecological Awareness

To enhance students' ecological awareness, various innovative learning strategies can be applied. One effective approach is the direct involvement of students in environmental projects. This project can involve simple activities such as planting trees at school, cleaning the beach, or creating an organic garden. These activities allow students to see and feel the direct impact of their actions on the environment. In addition, this environmental project provides students with the opportunity to collaborate, develop a sense of responsibility, and apply the knowledge they have learned in class. These approaches aim to develop attitudes and behaviors that are responsible towards the environment, including instilling cleanliness, mutual cooperation, and discipline (Munisah et al., 2018). Thus, students are expected to become agents of change in promoting environmental conservation efforts in schools, families, and communities (Kospa et al., 2020).

Experiential learning is also a very effective strategy for strengthening ecological awareness. Creative methods such as games can make it easier for students to understand environmental material comprehensively. Through direct experiences, students can observe environmental phenomena occurring around them. For example,

taking students to national parks or nature conservation areas to observe flora and fauna, or visiting places affected by pollution and environmental damage. These experiences not only enrich their understanding but also inspire them to protect and care for nature. By witnessing the beauty and damage firsthand, students will become more aware of their role in preserving the environment.

Moreover, the integration of environmental values into daily learning is also very important in building ecological awareness. Teachers can relate environmental topics to other subjects, such as mathematics, language, and art. For example, in mathematics lessons, students can study data on air pollution or the impact of climate change. In Indonesian, they can write stories or essays about the importance of nature conservation. In this way, learning about the environment is not separate from the students' daily lives, but becomes an integral part of the entire educational process.

To deepen ecological awareness, a collaborative approach between schools, communities, and families is also very important. Teachers can involve parents in environmental conservation activities conducted at school. For example, holding joint workshops on waste management or discussing ways to reduce plastic use at home. By involving families in the environmental learning process, ecological awareness is not limited to the classroom but can extend to students' daily lives.

Project-based learning also provides students with the opportunity to design and implement solutions for environmental problems they encounter in their surroundings. For example, students can work together in teams to design solutions to reduce pollution in their school or create campaigns to reduce plastic waste in the community. Such projects not only raise their awareness of environmental issues but also teach them important skills such as problem-solving, creativity, and teamwork.

In addition to direct involvement in the project, the use of technology can enhance students' ecological awareness. Through applications and digital platforms, students can access data on climate change, biodiversity, and other environmental issues. Technology allows students to observe environmental phenomena in real-time, providing them with a more concrete picture of the situations occurring in the world. For example, by using air pollution or global temperature tracking applications, students can see how weather changes and pollution affect their daily lives.

Value-based education can also strengthen students' ecological awareness. Teachers can teach the importance of values such as empathy towards living beings, social responsibility, and ecological justice. By building a character that cares for the environment, students not only develop knowledge but also a deep attitude towards nature conservation. These values, if consistently applied in daily life, will encourage students to act more wisely in maintaining the sustainability of the earth. Biospheric, altruistic, and egoistic values positively influence sustainable consumption behavior, with ecological attitudes mediating this relationsh (Berkelanjutan, 1979). These findings underscore the importance of environmental education in shaping individual behavior and societal policies towards sustainability.

Another approach is through the use of case studies and group discussions. Teachers can present various case studies involving global or local environmental issues for discussion with students. Through this discussion, students can see various perspectives on the solutions that might be taken and how they can contribute to solving these

problems. It also gives them space to develop critical and analytical thinking skills, which are essential for understanding complex environmental issues.

Overall, building students' ecological awareness is not just about providing information, but also about engaging them in a process that allows them to feel connected to nature and understand their role in preserving it. With these various strategies, students not only learn about the importance of the environment but also about how they can make sustainable positive changes in their world.

5.8. Environmental Education Practices in Various Schools

In Indonesia, several schools have successfully integrated environmental education into the Merdeka Belajar Curriculum, which provides more flexible space to adapt learning according to local needs and conditions. Environmental education has been integrated into school curricula in Indonesia, including through the Merdeka Curriculum which offers flexibility in learning (Mantaka et al., 2017). For example, Sekolah Alam Indonesia in Jakarta adopts nature-based education principles that not only teach students about sustainability but also instill a sense of responsibility towards the ecosystem. In this school, learning activities are not limited to the classroom alone, but rather combine outdoor activities, such as planting trees, maintaining river cleanliness, and observing wildlife. This provides students with hands-on experiences that reinforce their understanding of the importance of environmental conservation.

Another school that demonstrates good practices is several junior high schools in Bali, which implement an environmental education program integrated with science lessons. Here, students are given the opportunity to conduct direct research on local environmental issues, such as waste management, air pollution, and water conservation. Through these projects, students not only learn about environmental theory but also experience the real impact of human actions on nature. The impact is very positive on the students' ecological awareness, making them more concerned about the condition of their surrounding environment. Research shows a significant relationship between the level of knowledge and pro-environmental behavior, although the contribution is still relatively low (Maresi & Basoeki, 2024).

In rural areas, many schools have also successfully adapted environmental education principles with an approach that is more connected to students' daily lives. For example, several schools utilize school land to develop school gardens managed collaboratively by students. This garden serves as a learning space that teaches students how to cultivate plants organically and understand the importance of biodiversity. Through these activities, students not only learn about theory but also develop practical skills that they can apply at home or in their community. Some elementary schools in Indonesia have successfully integrated environmental education into the curriculum through practical approaches connected to the students' daily lives. The utilization of school land to create gardens and creative parks has become an effective strategy in teaching students about environmental preservation and biodiversity (Ni'mah, 2019). For example, after participating in the school garden program, several students initiated a plastic waste reduction program in the school environment, involving the entire school community. This shows that environmental education can foster a greater sense of responsibility towards nature, even at a level beyond just the classroom.

This activity not only raises environmental awareness but also develops students' practical skills in planting and waste management (Ni'mah, 2019). Contextual learning by utilizing the school environment has proven effective in improving student learning outcomes and activities on biodiversity topics (Munisah et al., 2018). Additionally, the implementation of the rule to bring lunch to school serves as an applicative means in environmental education, providing practical experiences for elementary school students (Firdaus, 2020).

5.9. Collaboration with the Community and Government

Collaboration between schools, local communities, and the government plays a very important role in enriching students' learning experiences in the context of environmental education. One successful example of collaboration is the "Green School" program organized by the Ministry of Environment and Forestry of the Republic of Indonesia. This program involves various parties, including schools, local governments, and the local community, to create a greener and more sustainable environment. In this program, students are tasked with designing and managing green open spaces around the school, which are then involved in various social and environmental activities.

In addition, collaboration with local government can also help provide the necessary resources and infrastructure to support environmental education activities. For example, in the city of Surabaya, the local government collaborates with schools to implement a school-based waste management program. In this program, students are involved in waste collection, sorting, and recycling, and are educated about the impact of waste on the environment. This collaboration has a positive impact, not only on student awareness but also on the surrounding community, as the policy is extended to the community level.

Collaboration with the local community also provides a more contextual learning experience for students. In several regions of Indonesia, schools collaborate with communities to preserve local biodiversity. For example, in Kuta Village, Bali, local schools collaborate with local farmer groups to teach students about environmentally friendly sustainable farming techniques. Such collaboration allows students to learn directly from communities that are experienced in maintaining the sustainability of natural resources, as well as deepening their understanding.

In addition, collaboration with non-governmental organizations (NGOs) also enriches students' learning experiences. NGOs such as Greenpeace Indonesia or Walhi often collaborate with schools to hold seminars, workshops, or field activities focused on global and local environmental issues. Through this collaboration, students can gain broader insights into issues currently developing at the international level, as well as concrete steps that can be taken to address these problems.

5.10. Local Wisdom in Environmental Education

Integrating local wisdom into the environmental education curriculum provides a more contextually relevant approach within the diverse cultural landscape of Indonesia. Studies show that integrating traditional practices such as the Subak irrigation system in Bali can teach students about sustainability, ecosystem balance, and cooperation (Mantaka et al., 2017). This integration aligns with the current curriculum, particularly in thematic learning in elementary schools (Nuraini, 2018). This system not only supports sustainable agriculture but also maintains the balance of the local ecosystem. By studying

subak, students not only understand the concept of irrigation but also appreciate the values of cooperation and sustainability that have been passed down by their ancestors.

In other areas, such as the Baduy tribe in Banten, local wisdom values related to forest conservation and natural resource management can also be incorporated into environmental education. The Baduy tribe has a tradition of maintaining forest conservation with strict prohibitions against logging and excessive natural resource exploitation. This approach can be used in the curriculum to teach students about the importance of maintaining a balanced and sustainable natural ecosystem. Through this understanding, students not only gain knowledge about sustainability but also about the importance of preserving existing traditions to support the survival of both humans and nature.

Teaching about the values of local wisdom can also involve culture-based learning that integrates local customs with ecological knowledge. For example, in areas that still have strong customs such as the Dayak community in Kalimantan, students can be taught about customs that protect forests and rivers as part of the cultural heritage that must be preserved. By incorporating local wisdom into the learning process, students can understand that environmental preservation is not only a global responsibility but also a part of their identity and culture.

In addition, the use of local folklore or myths related to nature can be an interesting way to convey environmental messages to students. In many regions of Indonesia, there are folktales that depict a harmonious relationship between humans and nature, such as the story of Dewi Sri, who symbolizes the fertility of the land and agriculture. These stories can be used to cultivate a sense of love and respect for nature, as well as to teach students about the importance of maintaining the balance of nature for the survival of humanity. Integrating local wisdom into environmental education also provides students with the opportunity to understand how traditional societies have long had sustainable ways of managing their natural resources. By appreciating and learning from this local wisdom, students can better value sustainability policies that are relevant to their own cultural contexts, making the learning experience more meaningful and effective.

CONCLUSION

Environmental education in the Merdeka Belajar Curriculum plays a very important role in shaping students' ecological awareness, which in turn can support ecosystem sustainability. Through innovative approaches, such as project-based learning, experiential learning, and technology, environmental education not only imparts knowledge but also encourages students to actively participate in preserving nature. Good practices implemented in various schools in Indonesia show that environmental education can create positive changes, both in theoretical understanding and in the actual actions of students towards environmental preservation. However, the implementation of environmental education in the curriculum still faces challenges, such as limited resources, teacher training, and lack of support from the existing curriculum. To address this, further efforts are needed from the government, schools, and society to create an educational ecosystem that supports sustainability. One important step is to strengthen training for teachers so that they have adequate competence in teaching environmental topics in an engaging and relevant manner for students.

Collaboration between schools, communities, and the government is crucial to enriching students' learning experiences. By integrating local wisdom and cultural values into environmental education, students will find it easier to understand and appreciate the importance of sustainability within their local context. Additionally, active community involvement in environmental education activities can provide direct experiences that reinforce students' understanding of the impact of every action on nature. As a recommendation, the development of a more integrated and locally-contextualized environmental education curriculum should continue to be encouraged. Support from various parties, including local governments, NGOs, and the private sector, is crucial to strengthen the implementation of effective environmental education. In addition, the application of technology in learning must also be maximized to create a more interactive and in-depth learning experience, so that students not only understand environmental theory but are also inspired to contribute to nature conservation efforts.

Declaration of Conflicting Interests
There is no conflict of interest regarding the article publication

Acknowledgments
Thank you to the Universitas Muhammadiyah Mataram for supporting this research.

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