The Importance of Green Education in Indonesia: An Analysis of Opportunities and Challenges

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Abstract
This study aimed to explore the importance of green education in Indonesia by investigating the opportunities and challenges that arise from a literature review. Learner constructivism emphasizes students’ active involvement in exploring environmental concepts, whereas critical thinking enables them to analyze, synthesize, and evaluate information to make sound judgments. There are several opportunities to implement green education in Indonesia, particularly to address environmental challenges, promote sustainability, and foster the development of environmentally conscious individuals. However, there are challenges in implementing green education, such as limited resources, insufficient teacher training, and resistance to change. In the future, green education should be integrated into educational curricula and programs to foster environmental awareness, promote sustainable practices, cultivate critical thinking skills among learners, and minimize actions that harm the environment.

INTRODUCTION

Environmental problems are increasingly concerning and have affected various elements of life, including microorganisms, animals, plants, and humans. This process is characterized by the emergence of various environmental damage, ranging from climate change to loss of biodiversity, resource depletion, and pollution, as well as the emergence of various diseases originating from the environment [1]. Environmental problems occur as a result of high industrialization, technological changes and advances, irresponsible consumption patterns, and lack of environmental awareness among the public [2]. It is important to address these issues, as they have a detrimental impact if these challenges are not controlled.

Massive environmental degradation has led to significant changes, such as climate change, characterized by a high accumulation of greenhouse gases, largely caused by human activities such as burning fossil fuels, deforestation, and industrialization processes. This has resulted in rising global temperatures, extreme weather events, melting ice sheets, and rising sea levels, posing threats to ecosystems, livelihoods, and vulnerable communities worldwide, including Indonesia [1], [3], [4]. Indonesia is one of the countries experiencing environmental degradation challenges characterized by a high incidence of diseases originating from the environment (e.g., dengue fever, chikungunya, zika, yellow fever, etc.) [5]–[7]; waste problems (such as increased generation of organic and nonorganic waste; increased landfill fires due to excess methane gas; and diseases due to leachate contamination from landfills) [8]; and increasing airborne heatwaves, which have resulted in changes in animal bionomics and the emergence of emerging and re-emerging diseases [9], [10].

Another problem faced by people in Indonesia due to the impact of environmental degradation is the loss of biodiversity. Irresponsible consumption patterns, such as habitat destruction, overexploitation of natural and...
biological resources, pollution, and invasive species, have led to significant declines in plant and animal species. The loss of biodiversity not only disrupts ecosystems but also threatens food security, medicinal resources, and overall ecological balance [11]. A lack of awareness and understanding of environmental issues among individuals and communities, low environmental literacy, and poor management practices are the root causes of these problems [12], [13]. To overcome this, increasing the understanding and application of the concept of green education at all levels is highly important.

Green education has emerged as a medium for fostering environmental awareness, nurturing learner constructivism, and developing critical thinking skills among learners from primary to higher education [4]. Green education aims to instill environmental awareness, sustainability principles, and environmentally friendly practices in learners beginning at an early age [14]. Green education fosters a sense of responsibility and encourages individuals to make informed and sustainable choices in their daily lives. By fostering a generation that values and understands the importance of environmental conservation, it can significantly minimize environmental degradation and combat climate change. Moreover, this approach can inspire innovative solutions and policies that prioritize sustainability across various sectors, thus contributing to a healthier and more sustainable future for all individuals. This review aims to explore the importance of green education by investigating its relationship with environmental awareness, the constructivism of learners at different levels of education, and critical thinking in environmental problem-solving efforts. This review also examines the opportunities and challenges of implementing green education in Indonesia, especially the sectoral roles in combating climate change and environmental degradation, as well as the implementation of green education at all levels of the education system in Indonesia. This information is useful as a reference for policymakers to develop the concept of green education in education units.

METHOD

This review is based on a literature review that aims to analyze scientific articles that discuss the importance of implementing green education, especially in Indonesia, and the evidence of the benefits of implementing this concept at the educational level. The selected articles were sourced from the Scopus, Web of Science, Science Direct, and EBSCO databases related to the research objectives. In this review, all the information was filtered, summarized, and descriptively analyzed to identify the research objectives. The results of this study are presented in narrative form.

RESULT AND DISCUSSION

Concept of green education in formal education

Green education is a comprehensive approach used by individuals, learners, and communities that aims to foster environmental awareness; cultivate responsible behavior in terms of consumption patterns; and equip individuals with the knowledge, skills, and practices needed to address current environmental problems and anticipate undesirable environmental changes [15], [16]. Green education is an educational model that utilizes nature as a learning resource so that students are proactive and adaptive to environmental problems, with emphasis on the principles of independence, responsibility, courage, and empathy for the use of the environment as a common need [3]. The provision and application of green education serve as catalysts for creating a sustainable future by instilling a deep understanding of future environmental challenges and encouraging proactive solutions. The concept encompasses various aspects of formal education, community engagement, and hands-on experiences to nurture a generation that is environmentally conscious and prepared to face complex ecological issues [2].

The concept of green education contains three dimensions that must be implemented to produce a safe, comfortable, and sustainable environment. These three dimensions include the environment (education that focuses on the environment), the environment (education that focuses on the environment), and the environment (education that focuses on the environment itself). These three pillars, if implemented in a balanced manner, have a positive effect on fostering sensitivity and awareness of the environment and its problems, including providing adaptive solutions that can be realized among students from elementary school to university [17]. Based on this pillar, environmental education helps students develop sensitivity to the events (environmental changes) around them. Environmental education increases the understanding of the natural, physical, and social systems that make up the environmental system, while environmental education motivates individuals to work to improve their environment. Thus, all learning activities must be related to increasing the knowledge and understanding of concepts, skills, and attitudes toward the environment through the implementation of green education in educational units [11], [18], [19].
The concept of green education can be used to realize sustainable development in various fields. Green education focuses on three abilities that individuals must have for the realization of sustainable development: increasing awareness of the environment, increasing practices and skills in environmental management ranging from simple to complex, and increasing the ability to think critically and solve problems that occur in the household environment to the global level [20], [21]. In terms of increasing environmental awareness, the concept of green education seeks to provide knowledge about environmental issues, such as climate change, pollution, deforestation, and loss of biodiversity, which are central problems in Indonesia. By providing a solid understanding of these challenges, individuals are empowered to make decisions and take actions to minimize their ecological footprint. This awareness goes beyond recognizing the problem but also fosters a sense of responsibility toward nature [22].

Green education emphasizes the importance of cultivating good environmental management practices and skills. This involves teaching practical strategies for sustainable living, sustainable management of natural resources, maximum waste reduction, and conservation of biological and animal resources. By integrating these practices into curriculum and educational programs, individuals can develop a proactive approach to environmental management in their daily lives. Individuals learn to adopt eco-friendly habits, encourage energy efficiency, and participate in initiatives that contribute positively to the environment [22], [23]. Figure 1 presents an overview of the application of the concept of green education in Indonesia.

This is also supported by the ability to think critically and the problem-solving skills possessed by each individual. The application of the concept of green education in formal education starting from the basic level (elementary school), middle level (junior and senior high school), and advanced level (college) will increase individuals' ability to think about the environment and encourage them to analyze environmental issues from various perspectives. Through this approach, capital can foster a deeper understanding of the complexity of individual involvement in solving environmental problems. Adnyana's research [24] revealed that the concept of green education must be applied from basic to advanced levels and carried out through curriculum modifications to address individual concerns about improving the environment in a consistent and integrated manner according to the level of education. Through experiential learning and hands-on activities, individuals are encouraged to explore real-world environmental challenges, design innovative solutions, and critically evaluate the effectiveness of the

Figure 1. An overview of the application of the concept of green education in Indonesia.
approaches they understand in formal education [25]. This approach will certainly foster a mindset of resilience and high adaptability and be able to overcome the dynamic and complex nature of environmental problems.

Incorporating green education into the formal school system enables individuals to become environmentally literate and prioritize activities that do not damage environmental conditions, including promoting conservation efforts. This approach encourages monodisciplinary, interdisciplinary, and multidisciplinary learning approaches to link courses or subjects, such as science, geography, economics, law, ethics, engineering, and mathematics, to provide a holistic view of environmental issues [12], [17], [24], [26]. By integrating green education across various disciplines, individuals can develop a comprehensive understanding of the interrelationship between human actions and the current and future conditions of the environment, including the species that exist within it. Its multifaceted approach not only imparts knowledge but also instills values, shapes attitudes, and empowers individuals to become responsible and active contributors to a sustainable future [25], [27].

Furthermore, the implementation of green education extends beyond the classroom, reaching out to the community and fostering partnerships with local, multinational, and international organizations. This encourages active participation in environmental conservation projects, enhances community initiatives, and supports sustainable development programs [13], [28]. Such involvement not only strengthens community bonds but also instills a sense of collective responsibility for environmental conservation. The benefits of green education go far beyond individual awareness and actions. It plays a critical role in shaping policies and driving societal changes toward sustainability [29]. When environmentally conscious individuals become leaders, policymakers, and innovators, they advocate policies that prioritize environmental protection and encourage sustainable practices at the local, national, and global levels in the future [20]. Thus, the implementation of green education is a unique concept that can foster environmental awareness, encourage good management practices, foster critical thinking, and encourage proactive problem solving, paving the way for a more sustainable and resilient future. Integrating green education into various aspects of society is key to creating a world in which humans coexist harmoniously with nature and realize sustainable development practices.

Learner Constructivism and Critical Thinking

Learner constructivism and critical thinking are integral components of effective education, especially in the green education context. They play an important role in shaping how individuals perceive, interpret, and interact with their knowledge and environmental issues. Learner constructivism refers to the theory that individuals actively construct their own understanding and knowledge of the world through experience and reflection [3], [26]. In the context of green education, learner constructivism emphasizes students’ active involvement in exploring environmental concepts that allow them to interact directly with the environment. Furthermore, green education can be personalized, which leads learners to customize their learning experiences and accommodate various learning styles so that they can build an understanding based on personal experiences and perspectives in the field. Learner constructivism encourages reflection on environmental issues, allowing students to question, investigate, and develop their understanding through an inquiry-based learning approach. This approach fosters a deeper understanding of personal connections with environmental concepts [25], [30], [31].

Critical thinking involves analyzing, synthesizing, and evaluating information to make sound judgments. Critical thinking is essential in green education to address complex environmental challenges. Students learn to analyze environmental issues from multiple perspectives, consider evidence, and develop innovative solutions to sustainability problems [32]. In addition, learners are expected to critically evaluate information related to environmental issues, including scientific data, media reports, and policy statements. This approach empowers them to consider potential consequences and make environmentally responsible decisions both individually and collectively. Through critical thinking in green education, students are encouraged to become active, informed citizens. They engage in discussions, debates, and initiatives that contribute to environmental awareness and the advocacy of sustainable practices.

Theoretical and practical framework for implementing green education in Indonesia

Implementing green education in Indonesia at all levels is critical for addressing pressing environmental challenges and promoting a sustainable future. The implementation of green education in Indonesia highlights the importance of its roots and theoretical and practical frameworks before it can be implemented at all levels of education [29]. Green education focuses on the skills, knowledge, awareness, and values required of environmentally responsible citizens [4], [12], [33]. In addition, it contributes to a more sustainable future by fostering a generation that is aware of environmental issues and efforts to control and improve them. Green education at all levels is essential for Indonesia to mitigate environmental challenges, promote sustainable development, and create a greener
and more prosperous society. This was initiated by the high burden of environmental damage experienced by all regions of Indonesia, which has become a scary specter without massive solutions [3], [14].

The implementation of green education at all levels in Indonesia is initiated by a theoretical framework that has been built to solve environment-related problems and is globally agreed upon; this framework includes the following: (a) Sustainable Development Goals (SDGs): The United Nations' SDGs provide a theoretical foundation for green education. By incorporating SDG targets into the curriculum, students can gain a comprehensive understanding of environmental issues and learn how to contribute to sustainable development [20], [34]. (b) The importance of ecological literacy: Ecological literacy focuses on developing students' understanding of ecological systems and their interdependencies [12], [33], [35]. By integrating ecological principles into the curriculum, students become aware of the environmental impacts of human actions and develop a sense of responsibility toward nature [34], [36]. (c) Environmental education theories: The theoretical framework of environmental education, including concepts such as place-based education, experiential learning, and systems thinking, provides a basis for designing effective green education programs [37]. These theories emphasize the importance of hands-on experience, critical thinking, and a holistic approach for solving environmental problems [21], [36], [38].

Furthermore, to develop and achieve the objectives expressed in the theoretical framework, a practical framework was developed that included the following steps: (a) Curriculum integration: Green education should be integrated into the national curriculum at all levels of education, from primary to tertiary. This integration can be achieved by including environmental themes and concepts in various subjects, such as science, social studies, arts and humanities, and engineering. This ensures that every student is exposed to environmental knowledge and skills [39]–[41]. (b) Teacher training and professional development: Teachers need adequate training and professional development opportunities for effective implementation of green education. Workshops, seminars, and courses should be organized to enhance teachers' knowledge of environmental issues, teaching methodologies, and appropriate use of teaching resources. This approach equips educators with the skills to engage students with meaningful environmental learning experiences. (c) Repair and upgrading of environmental infrastructure: Schools, educational institutions, and colleges should prioritize the creation and maintenance of environmental infrastructure such as parks, recycling facilities, and renewable energy systems. These practical elements provide students with tangible examples of sustainable practices and enable them to actively participate in green initiatives [16], [42]. (d) Community engagement: Green education should extend beyond the classroom and involve community engagement. Collaboration with local organizations, businesses, and government agencies allows students to apply their knowledge to a real-world context. Community projects, field trips, and environmental campaigns foster a sense of environmental stewardship and empower students to make positive changes to their communities. (e) Assessment methods: These methods should be aligned with the goals of green education. In addition to conventional examinations, performance-based assessments, portfolios, and project-based evaluations allow students to demonstrate their understanding of environmental concepts and showcase their ability to apply sustainable practices in practical scenarios [2], [43].

Opportunities to Implementing Green Education in Indonesia

The implementation of green education provides many opportunities to address environmental challenges, promote sustainability, and foster the generation of environmentally conscious individuals in Indonesia, particularly in the fight against climate change and environmental degradation. The country's diverse ecosystems and pressing environmental issues offer a platform for integrating green education across different sectors and levels of society. Key opportunities for implementing green education in Indonesia include the following: (a) curriculum integration: green education can be integrated across subjects, incorporating environmental themes into various disciplines, such as science, social sciences, and even arts or economics [24]. This approach provides a holistic understanding of environmental issues and their relationships with various aspects of life. (b) Outdoor education and field trips: By utilizing Indonesia's rich biodiversity, students can make field trips to national parks, conservation areas, or local ecosystems. Experiential learning in a natural setting fosters a deeper appreciation of nature and instills environmental stewardship. (c) Technology-based learning utilizing technology such as virtual reality simulations or educational apps can provide immersive experiences, allowing students to explore environmental concepts and witness the impact of human actions on the environment. (d) Community partnerships, which involve collaboration with local communities, NGOs, and environmental organizations, allow students to participate actively in community-based projects. This involvement instills a sense of responsibility and encourages practical solutions to local environmental problems; (e) international partnerships: collaboration with global educational institutions and participation in international programmes encourage the exchange of best practices, resource sharing, and exposure to diverse perspectives on environmental issues; and (f) government support and policy implementation.
government initiatives and policies that prioritize green education in national curricula and education systems can significantly improve its integration and ensure its sustainability across schools and institutions.

Challenges in Implementing Green Education in Indonesia

The implementation of green education in Indonesia faces various challenges stemming from infrastructure, socioeconomic, and systemic factors. Overcoming these barriers is critical for effectively integrating environmental education into the curriculum and the national education system. The main challenges that may be experienced include limited budget allocations for education, hampering the development of comprehensive environmental education programmes, resource materials, and educators [44]. The lack of funding hinders the implementation of practical initiatives. Furthermore, many educators lack sufficient training in environmental education methodologies and may feel ill prepared to integrate green education into their teaching. Continuous professional development programmes are required to improve student skills and confidence [28], [45].

The absence of a standardized and structured curriculum limits the uniform implementation of green education at all educational levels. In addition, the absence of specific assessment methods for environmental learning poses challenges for evaluating student understanding. Furthermore, there are disparities in infrastructure and access to educational resources between urban and rural areas. Remote areas often face difficulties accessing the up-to-date educational materials and technologies required for effective green education. This is also influenced by Indonesia's diverse cultural landscape, which requires a curriculum sensitive to different cultural beliefs and practices. Tailoring environmental education as culturally relevant across regions is challenging [3], [23], [28].

During its implementation, the public may still lack the challenge of low awareness and understanding of environmental issues. There is a need for extensive awareness campaigns to garner support and create collective change in attitudes toward environmental management. Although there are policies that support environmental education, their implementation and enforcement at the grassroots level may be inadequate. Better coordination between government agencies, educational institutions, and stakeholders is required for effective implementation. Furthermore, high levels of socioeconomic disparity may cause individuals and communities to prioritize pressing economic needs over environmental concerns. Overcoming these challenges requires a multifaceted approach involving government support, community engagement, teacher training, curriculum development, and commitment to integrating green education at all levels of Indonesia’s educational system. Overcoming these hurdles is critical for fostering citizenry who is environmentally conscious and capable of addressing pressing environmental issues.

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CONCLUSION

The implementation of green education in Indonesia holds promise for fostering an environmentally conscious society and for addressing pressing environmental issues. However, it is important to address the challenges hindering its widespread implementation. Improving teacher training, allocating adequate resources, and developing a standardized curriculum that incorporates environmental themes are important steps in fostering a generation capable of combating climate change and environmental degradation through the lens of green education. Further research is required to determine the effectiveness of green education in fostering environmental awareness and improving environmental management practices.

REFERENCES


Author declaration
Author contributions and responsibilities

The authors made major contributions to the conception and design of the study. The authors took responsibility for data analysis, interpretation and discussion of results. The authors read and approved the final manuscript.

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