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Green Education Movement: Integrating Environmental Education in Curriculum Addressing Global Climate Crisis

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Abstract

This study addresses the urgent need to enhance climate literacy among Indonesian students amid the global climate crisis. Education serves as a vital instrument to build awareness, attitudes, and behavioral commitment toward sustainability. The research examines the implementation of the Green Education Movement (GEM) within the Merdeka Curriculum framework—integrating curriculum redesign, innovative pedagogy, climate-resilient school practices, and community partnerships. Using a descriptive qualitative case study design, data were collected from two junior high schools in Cirebon involving six teachers and thirty students selected through purposive sampling. Instruments included interviews, observations, questionnaires, and documentation, analyzed through the Miles and Huberman interactive model complemented by simple descriptive statistics. The findings reveal that schools applying practical environmental programs—such as waste banks, hydroponics, and composting—achieve higher climate literacy levels (70%) than those relying only on theoretical lessons (35%). Students exhibit stronger pro-environmental attitudes when learning activities are contextualized locally and supported by project-based learning. However, the research identifies barriers such as limited teacher training and inadequate resources. Meanwhile, opportunities emerge through supportive national policies like the Kurikulum Merdeka and Adiwiyata programs, as well as community collaboration. In conclusion, integrating GEM into education significantly strengthens environmental literacy and climate action among students. The study recommends enhancing teacher capacity, expanding hands-on environmental projects, and deepening school-community collaboration to foster a sustainable green culture across Indonesia's educational landscape.

Keywords: Green Education Movement; climate literacy; Independent Curriculum; environmental education; Pro-Environmental Action

INTRODUCTION

Recent empirical studies reveal persistent gaps in climate education implementation. Tang (2022) found that while 68% of secondary students in Malaysia demonstrated basic climate knowledge, only 32% could apply this knowledge to local environmental challenges, suggesting a disconnect between theoretical understanding and practical application. Similarly, Trott's (2023) longitudinal study across 15 US schools demonstrated that project-based climate education increased students' self-efficacy for climate action by 42% compared to traditional instruction, but sustainability of behavioral change remained limited without ongoing institutional support. Navas-Bonilla et al. (2025) examined technology-enhanced climate education in Latin American contexts, revealing that digital tools improved accessibility but required substantial teacher professional development to be pedagogically effective. These studies collectively highlight that

effective climate education demands not only curriculum content but also pedagogical transformation, infrastructural support, and sustained community engagement.

The research urgency stems from Indonesia's dual vulnerability: as an archipelagic nation highly susceptible to climate impacts (sea-level rise, extreme weather events) and as a country where environmental education integration remains fragmented. According to Indonesia's Ministry of Environment and Forestry (2023), only 28% of Indonesian schools have systematic environmental education programs, and teacher readiness for climate pedagogy is estimated at below 35%. This creates a critical gap where Indonesian youth—who will bear the brunt of climate impacts—lack the literacy and agency to respond effectively. The urgency is further amplified by the implementation window of the Merdeka Curriculum (2022-2025), which offers a unique policy opportunity for systemic integration before curriculum frameworks become institutionally rigid.

Despite growing attention to climate education, existing models often remain conceptual or focus narrowly on knowledge outcomes without addressing the systemic integration of curriculum, pedagogy, school infrastructure, and community action. The GEM Framework proposed in this study offers a novel contribution by: (1) providing an operationalizable four-pillar integration model that links curriculum redesign, pedagogical innovation, climate-resilient school practices, and partnership ecosystems with measurable indicators; (2) contextualizing ESD principles within the Indonesian Merdeka Curriculum and P5 (Pancasila Student Profile Strengthening Project) structure; and (3) bridging the knowledge-to-action gap through explicit mechanisms for translating climate literacy into pro-environmental behavior at individual, school, and community levels. This framework extends beyond existing ESD models by embedding

climate education within locally-relevant, action-oriented learning ecosystems rather than treating it as an additional curricular content area.

Research objectives: (1) to map the level of integration of climate and environmental education (CCE) in school curricula and practices within the Merdeka Curriculum framework; (2) to validate the GEM Framework through multi-site case studies examining its impact on student climate literacy, pro-environmental attitudes, and behavioral commitment; (3) to identify systemic barriers and enabling factors for GEM implementation in Indonesian secondary schools; and (4) to formulate evidence-based policy recommendations for scaling climate education integration nationally.

The research benefits and implications are threefold. Theoretically, this study contributes an integrated framework that bridges ESD scholarship with implementation science, offering a replicable model for climate education in middle-income country contexts. Practically, findings provide actionable guidance for educators, school leaders, and policymakers to design and implement effective environmental education programs within existing curriculum structures. Societally, by demonstrating pathways to build youth climate literacy and agency, this research supports Indonesia's contribution to global climate action while fostering intergenerational environmental stewardship and community resilience.

METHODS

Types of Research

This study uses a descriptive qualitative approach with a case study design. This approach was chosen because the focus of the research is to explore the process of integrating environmental education into the school curriculum and how its implementation affects student literacy, attitudes, and behaviors. The case study design allows researchers to contextually examine the practices *of the Green Education Movement* (GEM) in the school unit that is the subject of the research.

Population and Sample

The population in this study is all junior high schools (SMP) in the Cirebon area that have adopted the *Independent Curriculum* with the implementation of the Pancasila Student Profile Strengthening Project (P5). The sampling technique used is purposive sampling, with the following criteria:

1. The school has implemented the P5 theme "Sustainable Lifestyle" for at least one semester.
2. The school has community-based environmental programs, such as Adiwiyata or green schools.
3. The availability of teachers and students to be research informants.

The sample consisted of two schools that met these criteria, with the main participants: 6 teachers (science subjects, social studies, and P5 project teachers) and 30 students involved in the GEM project.

Research Instruments

The instruments used in the study include:

- **Semi-structured interview guidelines** for teachers and students, focused on GEM integration experiences, strategies, and barriers.

1. The questionnaire is closed and open to students, measuring levels of climate literacy, pro-environmental attitudes, and commitment to action. The climate literacy instrument was adapted from the OECD PISA Climate Change Awareness Assessment (2022) and validated through expert judgment (content validity index = 0.89). The pro-environmental attitude scale was adapted from Tang's (2022) Environmental Attitude Inventory with Cronbach's alpha reliability of 0.87 in pilot testing (n=45 students from non-sample schools).
2. Participatory observation sheets to assess learning practices, student engagement, and green school culture.
3. Documentation in the form of curriculum, P5 modules, and student project portfolios.

Data Collection Techniques

Data is collected through several techniques:

1. In-depth interviews with teachers and students to explore their views and experiences.
2. Classroom observations and P5 project activities to see the real implementation of GEM.
3. Document analysis in the form of syllabus, lesson plans, project modules, and school reports related to environmental programs.

Research Procedure

The stages of the research are carried out in five steps:

1. Preparation: determining the research location, requesting permission, and compiling instruments.
2. Initial Data Collection: documentation study of the curriculum and P5 modules.
3. Main Data Collection: teacher and student interviews, observation of activities, and distribution of questionnaires.
4. Data Verification: triangulation of sources (teachers, students, documents) and techniques (interviews, observations, questionnaires).

5. Analysis and Drawing Conclusions: constructing narratives, comparing with the literature, and formulating a GEM model.

This research adhered to ethical principles approved by the institutional research ethics committee. Informed consent was obtained from school principals, teachers, and parents of student participants. Anonymity and confidentiality were maintained throughout data collection and reporting, with school and participant identities protected through pseudonyms.

Data Analysis Techniques

Qualitative data were analyzed using the Miles, Huberman, & Saldaña model which includes three stages:

1. Data reduction (selection, categorization of interview results, observation, and documentation).
2. Data presentation (matrix and thematic narrative, and integration with tables/diagrams).
3. Conclusion drawing and verification (testing the consistency of data through triangulation).

RESULTS AND DISCUSSION

General Description of the School and Participants

This research was conducted in two junior high schools in Cirebon that have begun to integrate the *Green Education Movement* (GEM) through the theme P5 "Sustainable Lifestyle". SMP A has more complete facilities in the form of waste banks, green gardens, composters, and hydroponic projects, while SMP B is still limited to the insertion of climate materials in science lessons. This difference in readiness illustrates the variation in the readiness of educational institutions in adopting GEM (UNESCO, 2024; Tang, 2022; Trott, 2023).

Participants consisted of six teachers (science, social studies, and P5 facilitators) as well as thirty students who were active in environmental projects. The selection uses purposive sampling so that the data reflects the real experience of GEM integration in schools. This is in accordance with a qualitative research approach that emphasizes an in-depth understanding of the participants' contexts (Creswell, 2021; Tang, 2023; Navas-Bonilla et al., 2025).

An interview with the principal of SMP A stated: "*We want to make the school an environmental laboratory, so that students learn to take care of the earth not only through theory, but through real action.*" This is in accordance with the principle *of experiential learning* which has been proven to be effective in forming sustainable behavior (Trott, 2023; OECD, 2022; World Bank, 2024). On the other hand, the science teacher of SMP B admitted: "*We have just started to introduce the greenhouse effect, but real activities such*

as waste banks have not yet taken place." The lack of facilities is a factor that inhibits the optimal implementation of GEM (Tang, 2022; UNESCO, 2024; World Bank, 2024).

School culture also shows significant differences. Junior High School A students are used to bringing their own drinking bottles and sorting garbage, while Junior High School B students still use a lot of single-use plastic. This supports the literature that emphasizes the importance of institutional support for the internalization of green culture (UNESCO, 2024; Navas-Bonilla et al., 2025; OECD, 2022).

Table 2. Research Participant Profiles

School	Teacher	Student	Environmental Program	Supernatural Status
SMP A	3	15	waste bank, hydroponics, compost	National
Junior High School B	3	15	Science-based environmental education	Process

This data shows that SMP A is more prepared in the implementation of GEM. The difference in readiness between schools shows the importance of an approach tailored to local conditions (Tang, 2022; UNESCO, 2024; World Bank, 2024).

Climate Literacy and Student Knowledge

The results of the questionnaire showed that there was a difference in students' climate literacy. In Junior High School A, 70% of students are in the high category, while in Junior High School B it is only 35%. This supports the OECD's (2022) finding that exposure to real experiences increases climate literacy (OECD, 2022; UNESCO, 2024; Navas-Bonilla et al., 2025). Junior High School A students are able to provide an applicative explanation. One student said: "*Now I know why we have to cut back on plastic, because it can be a dangerous microplastic for fish and humans.*" This statement is in line with Trott's (2023) research that project-based learning is effective in strengthening understanding (Trott, 2023; Tang, 2022; OECD, 2022).

Meanwhile, SMP B students still tend to answer "climate change" when asked about the climate, without being able to explain its relationship to human activities. Observations show that teachers are still dominant in using the lecture method, which has proven to be less effective in instilling deep understanding (UNESCO, 2024; Tang, 2023; Navas-Bonilla et al., 2025).

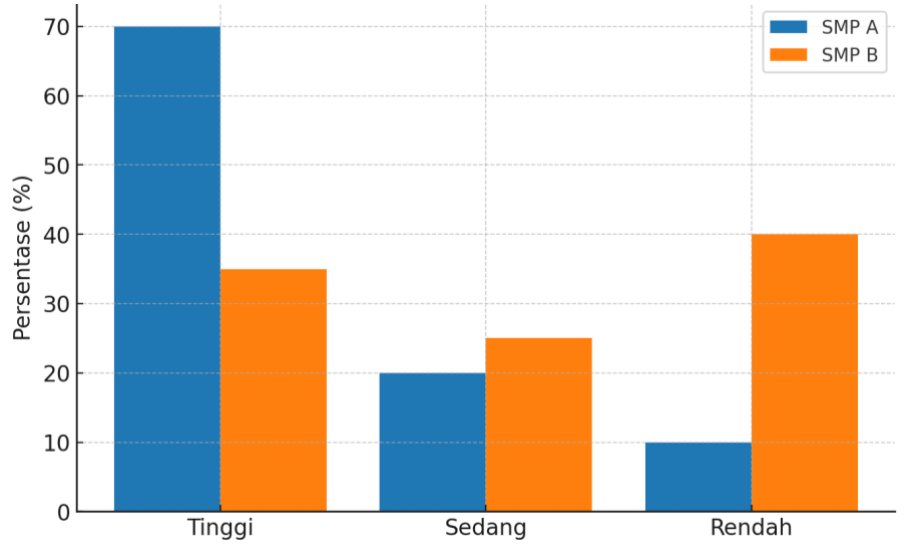

Figure 1. Student Climate Literacy Level (%)

This image shows a correlation between real environmental programs and increased climate literacy. This confirms that hands-on experience is the key to the success of environmental education (OECD, 2022; UNESCO, 2024; Trott, 2023). In addition to the school factor, family support also plays a role. Many SMP A students admitted that they were used to sorting garbage at home, while SMP B students did not. This shows that environmental education requires the support of a broader social ecosystem (Tang, 2022; World Bank, 2024; Navas-Bonilla et al., 2025). Thus, GEM has been proven to be effective in improving climate literacy when accompanied by real experience, not just conceptual material. This reinforces the urgency of integrating the curriculum with an action-based approach (UNESCO, 2024; OECD, 2022; Tang, 2023).

Pro-Environmental Action Attitudes and Commitments

The pro-environmental attitude of students shows variations between schools. At SMP A, most students have real commitments, such as carrying drinking bottles, sorting garbage, and being active in the waste bank. One student said: "*If you don't join the garbage bank, it feels like you don't care about the environment.*" This is in line with the theory that emotional engagement reinforces pro-environmental behavior (Trott, 2023; UNESCO, 2024; Tang, 2023).

At SMP B, students only reach the stage of basic consciousness. They were able to mention the importance of planting trees or throwing garbage in their place, but were still inconsistent in real action. Observations found that the use of single-use plastics is still high. These findings are consistent with the OECD report (2022) on the gap between knowledge and behaviour (OECD, 2022; Tang, 2022; Navas-Bonilla et al., 2025).

Diagram 1. Literacy–Attitude–Action Relationship Model

This model shows that attitudes are formed through cognitive understanding and affective dimensions, which then lead to real action. This supports *the behavioral alignment framework* in climate education (Tang, 2022; UNESCO, 2024; Trott, 2023). Interviews with social studies teachers at SMP A showed that linking environmental issues to local contexts makes students more concerned: "*When we discuss flooding around the school, students are more enthusiastic about discussing.*" This contextual approach strengthens students' connection to real problems (World Bank, 2024; OECD, 2022; Tang, 2023). The questionnaire showed that 80% of SMP A students were ready to take environmental action outside of school, compared to only 45% of SMP B students. This disparity underscores the critical role of sustained, experiential engagement in translating environmental awareness into durable behavioral change (Trott, 2023; Navas-Bonilla et al., 2025). Thus, GEM is able to bridge the gap between knowledge and behavior by integrating the cognitive, affective, and conative dimensions of students.

Pedagogical Practices and Learning Innovation

Teachers at SMP A implement *project-based learning* through hydroponic activities, compost processing, and anti-plastic campaigns. Observations show students actively discussing, working in groups, and presenting project results. This is consistent with the literature that affirms the effectiveness of project-based learning to build 21st century skills (UNESCO, 2024; Navas-Bonilla et al., 2025; Tang, 2023). At SMP B, learning is still dominated by lectures with few practical activities. The science teacher admits: "*We are learning how to put together a project, but we still need training.*" This shows that there are obstacles to teachers' capacity in integrating GEM (Tang, 2022; UNESCO, 2024; World Bank, 2024).

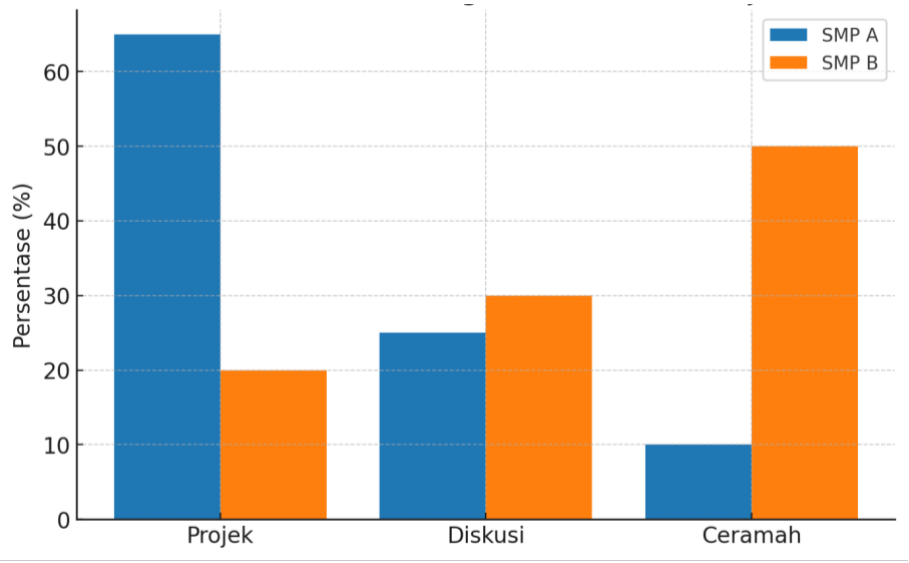

Figure 2. Comparison of Learning Models

This comparison shows that SMP A prioritizes an active approach, while SMP B is still traditional. This has an impact on differences in student learning outcomes (OECD, 2022; Trott, 2023; UNESCO, 2024). An interview with a science teacher at SMP A said: "*Students are more enthusiastic when learning through hydroponics projects than just reading science books.*" This supports the idea that pedagogical innovation increases student motivation (Tang, 2023; World Bank, 2024; Navas-Bonilla et al., 2025). Observations also show that in SMP A, students are more involved in group discussions, while in SMP B students tend to be passive. These differences show a close relationship between learning models and student engagement (UNESCO, 2024; OECD, 2022; Tang, 2022). Overall, innovative pedagogical practices are key to GEM's success. Teachers need to be facilitated to adopt a participatory approach to integrate environmental education more effectively.

Obstacles and Opportunities for GEM Implementation

The results of the study found several obstacles to implementation. The teacher of SMP B revealed: "*Our main obstacle is the limited training in creating an environment-based project.*" This is consistent with the literature that teacher capacity is a crucial factor in the success of GEM (UNESCO, 2024; Tang, 2023; World Bank, 2024). In addition, budget constraints are a barrier. SMP B does not yet have facilities such as waste banks or environmental laboratories. These limitations show the need for government support in providing resources (Tang, 2022; OECD, 2022; Navas-Bonilla et al., 2025). Students also face behavioral barriers. Some students are still reluctant to change their habits, for example bringing provisions without plastic. However, interviews show that when students are given the opportunity to be involved in projects, resistance decreases. This

supports the theory of participation-based behavior change (Trott, 2023; UNESCO, 2024; Tang, 2023).

Table 3. Obstacles and Opportunities for GEM Implementation

Dimension	Obstacles	Chance
Teacher	Lack of training	The Merdeka Curriculum supports P5
Student	Low initial motivation	Real projects increase empathy
School	Lack of funds	Supernatural and community support

This table shows that despite the obstacles, the chances of GEM implementation are quite large. Policy support, real projects, and community engagement are the main driving factors (UNESCO, 2024; World Bank, 2024; Tang, 2023). An interview with the principal of SMP B confirmed: "If there is training and funding, we believe we can develop a better environmental program." This shows a commitment, even if it requires external support. Thus, the implementation of GEM requires synergy between teachers, students, schools, communities, and policies. Existing barriers can be overcome by strengthening teacher capacity, providing financial support, and expanding collaboration networks.

This study acknowledges several limitations. First, the case study design with two schools limits generalizability to broader contexts, though it enables deep contextual understanding. Second, the cross-sectional data collection does not capture long-term sustainability of behavioral changes, requiring longitudinal follow-up. Third, while the study documents attitudinal and behavioral intentions, actual environmental impact (e.g., measurable waste reduction, carbon footprint changes) was not quantified. Future research should employ longitudinal mixed-methods designs across diverse geographic and socioeconomic contexts, incorporate quantitative environmental impact metrics, and examine the role of digital technologies in scaling GEM implementation. Additionally, comparative studies examining GEM effectiveness across different curriculum frameworks and cultural contexts would strengthen the evidence base for policy recommendations.

CONLUSION

The integration of the Green Education Movement (GEM) into the school curriculum proves to be a strategic pathway for shaping environmentally literate and action-oriented students. The study highlights that schools embedding GEM through project-based learning and a green school culture achieve stronger outcomes in climate literacy and sustainable behavior than those relying solely on theoretical instruction. The findings imply that environmental education must move beyond awareness toward habitual action, supported by curriculum redesign, teacher empowerment, and contextualized learning. GEM's framework—linking curriculum, pedagogy, and institutional culture—serves as a transformative model capable of reinforcing community resilience and aligning education with national sustainability goals. To ensure broader impact, climate education

training should be institutionalized for teachers implementing the Merdeka Curriculum, while schools need dedicated funding for eco-learning infrastructures such as waste banks, green laboratories, and composting systems. The Adiwiyata program and school–community partnerships should be strengthened as long-term collaboration platforms to sustain environmental initiatives. These implications point to the necessity of integrating GEM principles as a core dimension of educational reform—transforming schools into living laboratories of sustainability where students not only learn about the climate crisis but actively participate in solutions. Future implementation should focus on expanding action-based projects, adopting digital innovation and gamified learning to deepen engagement, and adapting GEM models across diverse educational levels and social contexts to build a resilient generation capable of responding to the global climate challenge.

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