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INTEGRATING GREEN EDUCATION INTO SCIENCE LEARNING TO FOSTER ENVIRONMENTAL AWARENESS IN ELEMENTARY SCHOOLS

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ABSTRACT

This study aims to describe the integration of green education into science learning as an effort to foster environmental awareness among elementary school students. The research employed a descriptive qualitative approach involving a science teacher and fourth-grade students at Elementary School in Magetan District. Data were collected through observation, in-depth interviews, and documentation, and analyzed using the Miles and Huberman model, which includes data reduction, data display, and conclusion drawing. The findings reveal that science learning integrated with green education is characterized by contextual, experiential, and environmentally oriented learning activities. The learning process includes planning environment-based project modules, implementing active learning strategies, and conducting authentic assessments covering cognitive, affective, and psychomotor domains. The integration of green education has been shown to increase students' environmental awareness and behaviors, such as properly disposing of waste, conserving water and energy, and participating in school greening programs. Therefore, integrating green education into science learning is an effective strategy to cultivate ecological character and support sustainable education at the elementary school level.

Keywords: science learning, green education, environmental awareness, elementary school

A. INTRODUCTION

Education serves as a strategic foundation capable of shaping individuals' perspectives and lifestyles. As a key element in the development of a nation's civilization, education plays a central role in determining the quality of society (Maskalan et al., 2020). The education sector is also regarded as a strategic means to transform community thinking and lifestyle patterns (Nizaar et al., 2022). More than merely a mechanism for delivering knowledge, education represents a complex and multidimensional system that encompasses interconnected

intellectual, spiritual, and social dimensions (Enakrire, 2021).

The international community's attention to environmental issues has increased in response to the impacts of global climate change. The growing complexity of environmental problems—such as climate change, water and air pollution, deforestation, and the energy crisis—necessitates a transformation of education toward a paradigm of sustainable development.

This educational policy is expected to broaden students' knowledge and understanding as the nation's next generation regarding the environment, while also guiding changes in their attitudes and behaviors toward understanding and addressing environmental issues (Arifudin in Rosanti et al., 2022). Through environmental education, students are expected to develop an understanding that fosters awareness and proactive behavior in protecting and preserving the environment (Sahabuddin et al., 2024).

Education plays a key role in fostering ecological awareness and environmentally friendly behavior from an early age (Alwasi et al., 2023). Learning about love for the environment in the early stages of life is considered essential for cultivating awareness and responsibility toward nature (Rosyida, 2025). Therefore, elementary school students need to receive environmental education in a systematic manner (Wati et al., 2021). Ideally, learning at the elementary level should not only focus on the transmission of knowledge but also serve as a means of character building and nurturing environmental awareness. This approach aligns with the vision of the Merdeka Curriculum, which emphasizes character development and student competencies through project-based learning, formative assessment, and the strengthening of the Pancasila Student Profile (Lestari et al., 2025).

In Indonesia, although policies and curricula supporting environmental-based education have been implemented, students' awareness and understanding of the importance of environmental conservation remain relatively low. This condition highlights the need for more effective educational efforts, particularly at the elementary school level, to instill sustainability values from an early age (Maulana et al., 2024).

However, in practice, education in Indonesia still faces significant challenges in integrating environmental awareness values into the curriculum and daily school activities. Field observations indicate a gap between the intended goals and the actual implementation of learning. The science learning process in elementary schools remains dominated by conventional approaches that focus solely on academic outcomes, with minimal integration of sustainability values. Students tend to understand scientific concepts theoretically without relating them to their surrounding environmental context. As a result, ecological competence and environmental awareness have not yet developed optimally.

Elementary school students have not yet demonstrated pro-environmental behaviors in their daily activities, such as waste management and water conservation. This condition indicates that science learning still requires innovation to foster environmental awareness through meaningful and applicable strategies. As a formal educational institution, schools are expected to provide opportunities to cultivate environmental awareness while serving as a fundamental foundation for achieving sustainable development (Alwasi et al., 2023).

One approach considered relevant in addressing these challenges is Green Education, which emphasizes learning about environmental stewardship and its application in students' daily lives (Ramadhani & Sunarya, 2024). Through Green Education, students are taught to care about environmental issues by engaging in learning activities and positive practices aimed at maintaining environmental quality (Nizaar, 2022). This approach encourages children to become proactive and adaptive in responding to environmental problems by instilling values such as courage, independence, responsibility, and empathy in the use of natural resources for the common good (Karmilasari et al., 2020).

Green Education is a concept that encourages all members of the school community to develop a lifestyle that is more caring and responsible toward environmental preservation (Mumu et al., 2024). By integrating Green Education into learning activities at the elementary

school level, students are guided to cultivate a sense of care and responsibility for the environment, enabling them to address various environmental issues while fostering a spirit of green entrepreneurship as an implementation of the green economy concept in the future (Alwasi et al., 2023).

The integration of Green Education in science learning not only strengthens the cognitive aspect through contextual understanding of scientific concepts but also fosters students' affective and psychomotor domains through direct experiences and reflection on environmental issues. Moreover, this approach aligns with the principles of active learning, which emphasize active student engagement, collaboration, and project-based problem solving, as highlighted in constructivist theory. Character education that promotes environmental awareness is expected to become ingrained in students' attitudes, enabling them to transform their behavior toward greater environmental responsibility (Mihratun et al., 2022).

Based on the above explanation, this research is essential to provide a scientific solution to the low level of environmental awareness among elementary school students through the development of a science learning model integrated with Green Education. The purpose of this study is to describe the implementation of science learning that integrates Green Education in enhancing environmental awareness. This research is expected to provide a theoretical contribution to the development of science education as well as a practical contribution for elementary school teachers in designing learning activities oriented toward sustainable education.

B. METHOD

This study employed a qualitative descriptive approach to provide an in-depth depiction of the implementation of science learning integrated with Green Education and its impact on students' environmental awareness. This approach was chosen because it allows the researcher to understand educational phenomena naturally through direct interaction with the research subjects.

The research was conducted at an elementary school in Magetan District that has implemented a green school program. The location was selected purposively based on the

school's active involvement in environmental awareness activities. The research subjects included the fourth-grade teacher, fourth-grade students, and the school principal as a supporting informant. A purposive sampling technique was used to ensure that the selected informants were highly relevant to the focus of the study.

The focus of this research includes three aspects: (1) the process of science learning integrated with Green Education, (2) teachers' strategies in instilling environmental awareness values, and (3) changes in students' attitudes and behaviors toward the environment.

Data were collected through participatory observation, in-depth interviews, and documentation. Observations were conducted on learning activities and environmental programs, interviews were used to explore teachers' and students' perceptions, while documentation included lesson plans, teaching modules, and activity photos. The researcher served as the primary instrument, supported by observation, interview, and documentation guidelines.

Data were analyzed interactively following the Miles & Huberman model, as cited in Sahabuddin (2024), which includes data reduction, data display, and conclusion drawing. Data validity was ensured through source and method triangulation, as well as member checking with informants.

The research was conducted in three stages: (1) preparation, which included a preliminary study and instrument development; (2) implementation, involving field data collection; and (3) analysis and reporting of research findings.

Through this method, the study is expected to provide a comprehensive overview of the implementation of science learning integrated with Green Education and its contribution to fostering environmental awareness among elementary school students.

C. Result And Discussion

Result

The results of the study show that the implementation of science learning integrated with Green Education in elementary schools in Magetan District has been carried out systematically and in a well-planned manner, encompassing three main components: learning planning,

learning implementation, and learning evaluation.

At the learning planning stage, based on observations and interviews with the fourth-grade teacher, it was found that the teacher had developed learning tools that integrate Green Education concepts into science subjects. This planning was realized through the design of teaching modules featuring environmental themes such as waste management, recycling, water conservation, and plant preservation. The modules were developed using project-based learning (PjBL) and discovery learning approaches, which emphasize active student engagement in exploratory activities and environmental problem-solving.

The teacher also developed competency achievement indicators that combine cognitive, affective, and psychomotor aspects. For instance, the knowledge indicator includes the ability to explain the concept of recycling, the attitude indicator reflects concern for environmental cleanliness, and the skill indicator measures the ability to process waste into simple creations. Documentation results show that the learning tools were designed in accordance with students' characteristics and support the achievement of the Pancasila Student Profile.

In addition, the teacher prepared environment-based learning media such as recycling posters, mini ecosystem maps, and environmental reflection journals. This well-planned preparation aimed to ensure that learning not only focused on cognitive aspects but also instilled affective and psychomotor values that reflect environmental awareness.

Furthermore, the learning implementation stage was carried out through contextual and experience-based activities. During the introductory activities, the teacher linked science material to local environmental issues familiar to students, such as the abundance of plastic waste around the school or excessive water usage. This approach aimed to build students' initial awareness of the importance of maintaining ecological balance. The teacher began the lesson by stimulating students' awareness of environmental issues through guiding questions, educational videos, or simple case studies.

During the core activities, the teacher engaged students in hands-on

experiences such as sorting organic and inorganic waste, making simple compost, and planting ornamental or vegetable plants in the school yard. Students were divided into small groups to observe plant growth. Next, students conducted environmental observations around the school, such as identifying types of waste, assessing garden conditions, or locating areas that needed reforestation, and then prepared reports based on their findings.

The learning process was carried out collaboratively, with students actively discussing, cooperating, and solving environmental problems they encountered. The teacher acted as a facilitator, guiding students to discover scientific concepts through direct field experiences. This approach helped students understand the relationship between scientific concepts and environmentally friendly behavior.

Observation results showed that students demonstrated high enthusiasm in participating in these activities. They actively engaged in discussions, worked cooperatively in groups, and showed initiative in improving their surroundings. For example, some student groups carried out activities such as planting ornamental plants and creating pots from recycled materials. Students also participated in the green class program, which involved taking turns maintaining the cleanliness and beauty of their classrooms.

The teacher served as a facilitator, guiding students in connecting real-life experiences with scientific concepts. Throughout the learning activities, the teacher integrated values of ecological literacy such as responsibility, empathy toward living beings, and the importance of maintaining ecological balance.

During the closing activities, students reflected on their learning experiences. The teacher facilitated a question-and-answer session and encouraged students to write personal commitments to practice environmentally friendly behaviors, such as bringing their own water bottles, saving electricity, or avoiding littering.

The evaluation stage was carried out authentically by assessing students' knowledge, attitudes, and skills. The teacher used assessment instruments such as attitude observation rubrics, project

assessment sheets, and student reflection journals. Based on the evaluation results, there was a significant improvement in indicators of environmental awareness. Students became more disciplined in waste disposal, actively maintained classroom cleanliness, developed awareness of using resources efficiently, and actively participated in school cleanliness activities.

The evaluation results showed a significant increase in students' ecological awareness. Before the learning intervention, most students were not accustomed to sorting waste and paid little attention to school cleanliness. After participating in science learning integrated with Green Education, students demonstrated noticeable behavioral changes, such as actively maintaining cleanliness, planting trees, and becoming small agents of change within the school environment.

Interview results indicated that students felt enthusiastic about participating in science learning because the activities were practical, enjoyable, and meaningful. Students reported gaining a better understanding of the importance of environmental protection and had begun to apply environmentally friendly behaviors at home. The school principal explained that this program was not only implemented within the school environment but also integrated into students' daily lives together with their parents and the surrounding community. This approach helped learners understand the importance of maintaining overall cleanliness and health, which forms an integral part of developing environmental awareness and character in schools.

Furthermore, interviews with teachers revealed that integrating Green Education into science learning helped students understand the connection between science and real life, while fostering a sense of responsibility toward nature. Teachers also stated that this approach encouraged students to become more active, enthusiastic, and motivated in their learning.

Overall, the findings indicate that integrating Green Education into science learning creates a meaningful, contextual, and character-oriented learning process that nurtures environmental awareness. The integration of sustainability values into the learning process serves as a

strategic step toward building an ecological culture in elementary schools.

Discussion

The findings of this study affirm that science learning integrated with Green Education can serve as an effective means of fostering environmental awareness among elementary school students. Instilling concern for the environment should begin at an early age so that learners can be shaped from the outset to become more sensitive to and appreciative of their surroundings (Sahabuddin et al., 2022). Through environmental education, students can understand the steps necessary to minimize environmental damage, particularly within the school environment. In order for this knowledge to serve as a foundation for daily life, positive habits must be instilled from an early age (Asri et al., 2020; Swadayaningsih, 2020).

Providing appropriate environmental education to children through the habituation of positive behaviors will have a greater impact on their lives and on environmental sustainability in the future. Introducing environmental education from an early age is crucial, as this period represents a golden stage when children begin to shape their character through various forms of stimulation they receive (Syahrial et al., 2021).

This aligns with the concept of Education for Sustainable Development (ESD), which emphasizes the role of education as a key driver in promoting change toward sustainable behavior (Vioreza et al., 2023). By integrating Green Education values, students not only gain theoretical understanding of scientific concepts but are also trained to apply them through concrete actions that support environmental preservation. In addition, students develop their abilities in creativity, problem-solving, and innovative thinking to address emerging challenges in both environmental and social contexts (Permana et al., 2023).

The integration of Green Education into lesson planning enables teachers to design learning processes that are contextual and relevant to students' lives. Effective planning includes the selection of environmental themes, active learning methods, and authentic assessments that measure not only cognitive aspects but also affective and psychomotor domains. At the planning

stage, teachers designed project-based and inquiry-based learning activities that guide students to explore environmental phenomena directly. This approach is consistent with constructivist theory, which emphasizes the active role of learners in constructing their own understanding. Students are expected to collect information, interpret it, and relate it to prior experiences to deepen their comprehension of the subject matter (Suryana et al., 2022). Research findings by Syam (2024) support this result, indicating that learning which integrates sustainability values through environmental projects can foster students' ecological awareness and sense of social responsibility.

In this study, teachers employed the Project-Based Learning (PjBL) model as the main strategy, as it positions students as active subjects who construct knowledge through real-life project activities. The application of environmentally oriented PjBL can enhance students' critical thinking, collaboration, and social responsibility. Thus, Green Education–based science lesson planning provides a strong foundation for simultaneously developing scientific competence and ecological character.

At the implementation stage, experiential learning activities such as environmental observation, plant cultivation, and waste management successfully increased students' active engagement. This indicates that Green Education is capable of fostering high levels of learning engagement, as stated by Syam et al. (2024), who found that active student participation in environmental-based activities positively influences the development of ecological awareness and ecological action.

The implementation of learning that involves direct experiences—such as environmental observation, waste management, and greening activities—proved effective in fostering students' ecological awareness. Project-based or outdoor learning activities help students understand the connection between scientific concepts and real environmental phenomena.

Observation results also revealed increased student engagement during the lessons. They became more active in asking questions, participating in discussions, and collaborating on environmental

projects. Through this learning process, students not only acquired scientific concepts but also internalized values of care, responsibility, and environmental discipline.

The improvement in students' environmental awareness is consistent with the findings of Alwasi et al. (2025), which state that Green Education–based learning can foster a shift in students' behavior from mere understanding to concrete action. Students not only learn about the importance of environmental conservation but also apply it in their daily lives. Individual awareness of environmental conditions and quality is crucial for the sustainability of human life, as a balanced ecosystem creates a comfortable and livable environment (Amalia et al., 2021).

In addition, the use of contextual media such as recycling posters and reflection journals helps students understand the impact of human behavior on the environment. The use of environmentally oriented media is considered effective in facilitating meaningful learning (Putri et al., 2021), as it enables students to connect scientific concepts with real-world environmental issues.

Authentic learning evaluation serves as a key component in assessing the success of Green Education integration. Assessments that encompass cognitive, affective, and psychomotor aspects provide a comprehensive picture of students' achievements. The findings of this study indicate that students not only showed an increase in environmental knowledge but also demonstrated tangible changes in attitudes and behaviors, such as developing habits of waste sorting and energy conservation.

These behavioral changes indicate that Green Education–based science learning can foster the formation of students' ecological character. This is in line with the research of Wahyuni & Kurniawan (2022), which found that science learning that systematically embeds sustainability values has a significant influence on the environmental awareness behavior of elementary school students.

These findings also support the strengthening of the Pancasila Student Profile, particularly in the dimensions of faith and piety to God Almighty with noble character, critical reasoning, and mutual cooperation.

Through Green Education–oriented learning, students learn to appreciate God's creation by engaging in environmental stewardship, thinking critically about ecological issues, and collaborating in environmental project activities. Thus, science learning integrated with Green Education not only develops scientific literacy but also ecological literacy, which supports the national education goals toward sustainability.

Overall, the findings of this study affirm that the implementation of science learning integrated with Green Education serves as an effective strategy for fostering environmental awareness in elementary schools. This approach not only develops students' academic intelligence but also nurtures their ecological character and sense of responsibility toward environmental sustainability.

Thus, the integration of Green Education in science learning has proven to be both relevant and effective within the context of primary education. Teachers play a crucial role as facilitators who connect scientific concepts with sustainability values, while students become active agents in developing pro-environmental behaviors. Therefore, this learning model is worth developing and replicating in other elementary schools as an effort to cultivate a generation with ecological insight and environmental stewardship.

E. Conclusion

Science learning integrated with Green Education has been proven effective in fostering students' environmental awareness. Through a contextual, active, and experience-based learning approach, students not only understand scientific concepts but also internalize the values of environmental conservation. The implementation of this learning includes environmentally themed project-based planning, active learning strategies during instruction, and authentic assessments that evaluate knowledge, attitudes, and skills. The results indicate an improvement in pro-environmental behaviors, such as maintaining cleanliness, conserving resources, and participating in school green initiatives. Therefore, integrating Green Education into science learning at the elementary level serves as an effective strategy for developing ecological character and realizing sustainable education.

Based on the findings of this study, the following recommendations are proposed For Elementary School Teachers: It is recommended to integrate Green Education values into science learning continuously through project-based learning and discovery learning approaches, enabling students to learn through direct experience and cultivate environmental awareness.

For Schools: Schools are encouraged to support the implementation of environment-based learning by providing supporting facilities such as educational gardens, waste banks, and eco-school programs that involve the entire school community.

For Future Researchers: Future studies are expected to develop Green Education-based learning models with a broader scope, involving cross-disciplinary collaboration or applying quantitative approaches to measure the increase in environmental awareness more objectively.

With strengthened policies and support from all stakeholders, the implementation of Green Education-integrated science learning has the potential to become an effective strategy for shaping a young generation that is ecologically literate, responsible, and committed to environmental sustainability.

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