

Implementation of Environment-Based Science Education to Enhance Environmental Awareness in High Schools

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Article Info

Article history:

Received 27-02-2025

Revised 24-03-2025

Accepted 09-04-2025

Keyword:

Environmental awareness,
Environmental concern,
implementation of
environmental education,
Science education

ABSTRACT

This research explores the implementation of Environment-Based Science Education (EBSE) to enhance environmental awareness in high schools. With mounting concerns over environmental degradation and increasing climate change, educating future generations about environmental issues and instilling a sense of responsibility towards the environment has become crucial. High schools serve as pivotal platforms for shaping students' attitudes towards the environment, making them ideal for EBSE implementation. The research methodology utilizes a narrative literature review approach, employing Google Scholar to identify relevant articles published between 2020 and 2024. Selection criteria include relevance to high school science education, a focus on environmental education, and its impact on environmental awareness. Findings indicate that EBSE is effective in improving environmental awareness, fostering environmental concern, enhancing academic performance, and scientific process skills. EBSE has been successfully integrated into high school science subjects. Further development of EBSE in high schools, including within science subjects and educational levels, is necessary. The use of innovative teaching methods and educational resources should be encouraged to cultivate environmental awareness from early childhood to adulthood. Integrating EBSE into the curriculum can empower students to proactively address environmental challenges.



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INTRODUCTION

The rapid degradation of our natural environment has brought environmental issues to the forefront of global concerns. From climate change and deforestation to pollution and loss of biodiversity, these challenges demand immediate and sustained action. Education plays a crucial role in fostering an understanding of these issues and cultivating a sense of responsibility towards the environment. Schools serve as foundational platforms for instilling environmental values and knowledge in young minds.

High schools, in particular, are pivotal in shaping the attitudes and behaviors of young individuals who will become the future stewards of our planet. Adolescence is a formative period during which students develop critical thinking skills and begin to form their worldviews. The implementation of environment-based science education is a strategic approach to enhance environmental awareness among high school students. This method integrates environmental concepts into the science curriculum, promoting an interdisciplinary understanding that goes beyond traditional classroom learning.

By immersing students in real-world environmental challenges and solutions, environment-based science education aims to develop critical thinking, problem-solving skills, and a deeper appreciation for the natural world. This approach not only teaches scientific principles but also emphasizes the interconnectedness of ecological systems and human activities. Students learn to analyze the impact of human actions on the environment and explore sustainable practices.

Furthermore, environment-based science education encourages experiential learning, where students engage in hands-on activities such as field trips, ecological projects, and community-based

conservation efforts. These experiences help solidify their understanding and commitment to environmental stewardship. Through such immersive learning, students are more likely to retain knowledge and develop a personal connection to the environment.

As time progresses, the human population continues to grow rapidly, leading to increased human activities that can impact climate change. One of the significant challenges faced in this era of globalization is environmental issues, which are further exacerbated by escalating environmental degradation and pollution due to the proliferation of industrial factories, waste management issues, and various other factors. Researchers such as Anam et al. (2017) and Herliza and Winarsih (2022) highlight that human activities, as noted by Santoso (2016), significantly influence global climate by elevating the concentration of greenhouse gases that obstruct solar radiation from entering the Earth, resulting in unchecked global warming and climate change. Major greenhouse gases like carbon dioxide, as elucidated by Kusumawati et al. (2023), are the primary contributors to global warming on Earth.

In this context, instilling environmental awareness in students becomes highly crucial. One proposed approach is through science education focusing on local environmental issues faced by students. The learning process can serve as a platform to instill environmental care character through the utilization of various relevant teaching media, thus reinforcing the significance and impact of the learning process. Character education becomes a crucial aspect as it not only shapes academically intelligent students but also molds individuals of integrity and responsibility. As emphasized by Indra and Yanti (2021), the cultivation of good character serves as a fundamental cornerstone in education.

Scientific literacy encompasses the abilities, skills, and competencies that students possess, which include knowledge and understanding of scientific concepts and processes. This literacy enables students to identify and acquire new knowledge, explain scientific phenomena, and draw conclusions about the natural world based on environmental changes caused by human activities. According to Jeramat (2019), integrating problem-based learning that focuses on environmental issues can instill a sense of environmental responsibility in students. This approach promotes the formation of knowledge and awareness, encouraging students to actively participate in environmental conservation.

Science education fundamentally involves the study of natural phenomena, with much of the science curriculum content related to human life experiences. Learning that closely relates to students' daily lives facilitates a better understanding of scientific concepts (Syafrita et al., 2021). In this context, a literature review on environment-based science education has been conducted to explore its implementation and how it can enhance students' environmental awareness.

Moreover, integrating environment-based learning into science education helps bridge the gap between theoretical knowledge and practical application. When students engage with real environmental issues, they develop critical thinking and problem-solving skills. These skills are crucial for analyzing and addressing complex environmental problems. By contextualizing science education within environmental challenges, students can see the relevance of their learning, which enhances their engagement and motivation. This approach also encourages interdisciplinary learning, as environmental issues often involve various disciplines such as biology, chemistry, and physics. Students learn to approach problems holistically, understanding the interconnectedness of different fields of science. This comprehensive understanding is essential for developing innovative solutions to environmental problems.

Ultimately, environment-based science education aims to cultivate a generation of environmentally literate individuals who are not only knowledgeable but also proactive in their efforts to protect and preserve the natural world. This educational approach aligns with global efforts to promote sustainable development and environmental stewardship, preparing students to be responsible citizens and effective leaders in addressing future environmental challenges.

Natural Sciences involve the systematic exploration of the natural world. Therefore, IPA encompasses not only the mastery of a body of knowledge, such as facts, concepts, or principles, but also the process of discovery. Science education aims to provide students with opportunities to learn about themselves and their surroundings while exploring further applications in everyday life. Science learning becomes more meaningful when educators connect the material to students' local environments and emphasize the importance of environmental awareness.

Effective science education enhances students' academic understanding and develops critical thinking, problem-solving skills, and the ability to apply knowledge in real-world contexts. This can be

achieved through an environment-based learning approach, where students are encouraged to observe, analyze, and find solutions to environmental problems around them. For example, students can engage in field research projects exploring the impact of local pollution, or they can develop conservation initiatives within their communities.

Additionally, the use of technology and interactive learning media can enrich students' learning experiences. Virtual simulations, educational videos, and other digital tools can help students understand complex environmental phenomena in an engaging and comprehensible manner. Thus, students learn not only through theory but also through hands-on experiences that deepen their understanding of the relationship between humans and the environment.

The importance of character education should also not be overlooked. According to Indra and Yanti (2021), education aims not only to intellectually enrich students but also to shape good character and attitudes. In the context of environmental education, this means instilling a sense of responsibility, care, and commitment to preserving nature. Educators should act as facilitators, guiding students in understanding the impact of human behavior on the environment and inspiring them to actively participate in conservation efforts.

According to Darmiayati Zuchdi, learning that connects to the students living environment or real-world situations around them makes education more meaningful. Therefore, science education should emphasize the investigation of events and phenomena occurring in the students local environment. The teaching methods or models employed by teachers significantly impact students environmental awareness. One effective model for fostering environmental concern is environment-based learning, particularly on topics related to environmental pollution. This model leverages the natural surroundings as a learning resource, aiming to cultivate students' awareness and concern for their local environment.

The importance of linking education to the local environment not only enhances the relevance of the taught material but also motivates students to actively participate in protecting and preserving their environment. For instance, students can be involved in local research projects studying the impact of pollution on local ecosystems or in greening activities around the school. These hands-on experiences enrich students' understanding of scientific concepts and foster proactive attitudes in addressing environmental issues.

Moreover, the use of environment-based learning methods can enhance students' critical thinking and problem-solving skills. By confronting real environmental problems, students are encouraged to think analytically and creatively in finding sustainable solutions. Additionally, involvement in environmental projects can also improve their collaborative and leadership skills, as these projects often require teamwork and good coordination.

Thus, environment-based science education not only imparts scientific knowledge but also instills values of environmental care and responsibility. Through this approach, students are expected to become not only academically intelligent individuals but also responsible citizens actively engaged in environmental conservation. This approach aligns with the goals of character education, which emphasizes the development of positive attitudes and values such as care, responsibility, and integrity, which are crucial in facing future environmental challenges.

Overall, integrating science learning with local environmental issues, using appropriate technology, and emphasizing character education can create a holistic and meaningful learning experience for students. This approach not only helps students better understand scientific concepts but also prepares them to become responsible and caring individuals dedicated to the future of our planet.

RESEARCH METHODS

The research method, which is a literature review on the implementation of environment-based science education to enhance environmental awareness in high schools, begins with the identification stage of relevant literature sources. Various academic databases such as PubMed, Google Scholar, and leading educational journals are utilized to search for suitable literature. Selection criteria are established to choose literature relevant to the research topic, including relevance to science education in high schools, focus on environmental education, and discussions on its influence on environmental awareness. Literature search is systematically conducted using relevant keywords such as "environment-based science education", "high school", and "environmental awareness".

In this literature review, a narrative literature review approach is employed. The process of searching for articles is conducted through the Google Scholar platform, utilizing the keyword "environment-based science education" within the timeframe spanning from 2020 to 2024. This step aims to identify recent and relevant articles pertaining to the research topic. Additionally, by focusing on articles published within this specific timeframe, the review aims to capture the latest developments and insights in the field of environment-based science education.

After relevant articles are identified based on their abstracts and titles, the selection and assessment stage of literature is carried out to evaluate their relevance to the research topic. Articles meeting the selection criteria are then chosen to be included in the literature review. Selected articles are then comprehensively analyzed to identify key findings related to the implementation of environment-based science education in high schools and its impact on environmental awareness. Synopses of each article are compiled to understand their contributions to the understanding of the research topic.

Based on the literature analysis conducted, the literature review is composed by summarizing the key findings from the selected articles. The literature review will discuss trends, strategies, benefits, and challenges related to the implementation of environment-based science education in high schools to enhance environmental awareness.

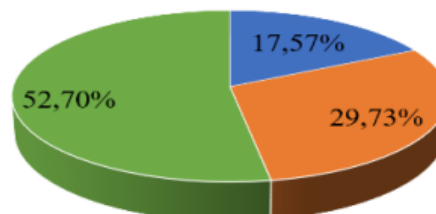
RESULTS AND DISCUSSION

The cultivation of environmental care character can be integrated into the learning process. One approach is through the utilization of instructional media, thus making learning more meaningful. Character education is essential because education not only fosters academic intelligence but also requires students to exhibit good character and manners (Prananda, 2020). Meaningful learning aids students in enhancing their understanding of the subject matter they are studying. Environment-based learning can be implemented using various objects in the surrounding environment and utilized as instructional media related to the curriculum. Consequently, learners will develop a sense of curiosity, sharpened creativity, and increased awareness of the environment. The presence of environment-based science education can enhance students' mastery of the subject matter and elevate their attention to the surrounding environment (Sumaryani & Sunita, 2022).

Methods and media in science education vary significantly. Their application in subjects such as Chemistry, Physics, Biology, and General Science involves different methods and media tailored to the curriculum being taught. Particularly in environment-based science education, methods and media involving the environment in the learning process are employed with the primary goal of fostering environmental care attitudes among students.

The method of environment-based science education has been implemented across all science subjects in high school. The approach applied in environment-based science education involves inviting students to explore their surroundings by completing a project or solving a problem and conducting experiments. These methods are integrated with aspects beyond the environment, such as technology, social studies, mathematics, and ethnosciences, which utilize the potential of local resources. These methods are integrated with supportive learning media.

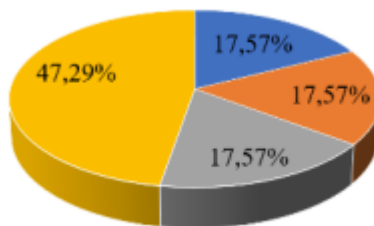
Based on the table above, environment-based science education media are applied in Chemistry, Biology, and General Science subjects. The media utilized in environment-based science education include both dry and wet media, utilizing the potential of local resources in an environment. The use of environment-based learning media can enhance students' curiosity about objects around them and promote environmental concern through the imagination and critical thinking of students.



Picture 1 School level with environment-based science learning

Description: blue (elementary school), orange (junior high school), green (senior high school).

Environment-based science education still holds great potential for further development. In advancing environment-based science education, it is essential to examine its implementation across various school levels and disciplines within the field of science. By considering the research trends in developing environment-based science education, its refinement will be more effective. This refinement aims to cater to the diverse learning needs of students.



Picture 2 The subjects in environment-based science education

Description: blue (chemistry), grey (biology), orange (physics), yellow (science).

Environment-based science education is implemented across various subjects such as Chemistry, Physics, Biology, and General Science. The application of environment-based science education is most prominent in the General Science subject. This is due to the fact that at the elementary and middle school levels, science subjects are not yet separated into distinct subjects. However, at the high school level, all three science subjects have equally adopted environment-based science education. This demonstrates a more balanced integration of environmental concepts across the science curriculum at the high school level.

Furthermore, the implementation of environment-based science education is not limited to theoretical discussions in classrooms; rather, it extends to practical applications through laboratory experiments, field trips, and community-based projects. This hands-on approach allows students to engage directly with environmental issues and solutions, thereby enhancing their understanding and appreciation of the natural world. Moreover, such experiential learning opportunities foster a sense of responsibility and empowerment among students, motivating them to become active participants in environmental conservation efforts both within and beyond the classroom.

In each stage, there are environmental-related learning achievements within the context of science subjects. This underscores that environment-based science education approaches can be adapted for all levels of education, from elementary to high school. When implementing this approach, students are encouraged to become acquainted with and interact with their surrounding environment. The media and methods used in this learning leverage objects present in students' environments. The aim of these activities is to enhance environmental care attitudes among students. Several studies have indicated that environment-based science education approaches can enhance various aspects of attitudes and skills in students from elementary to high school levels.

Research on environment-based science education aims primarily to foster environmental care attitudes. Additionally, this form of learning has been shown to yield various outcomes, including enhanced academic performance, scientific process skills, creativity, critical thinking abilities, as well as scientific and environmental literacy. Apart from the results depicted in the diagram, studies suggest that environment-based science education can also train students in problem-solving, improve conceptual understanding, enhance student autonomy, and foster ecopreneurship among students. These additional benefits highlight the holistic impact of environment-based science education, not only on students' academic achievements but also on their personal development and readiness to tackle real-world environmental challenges.

CONCLUSION

Based on the implementation of environment-based science education, it is evident that this form of education plays a crucial role in enhancing environmental awareness among high school students. Through this approach, students not only acquire scientific knowledge about the environment but also develop caring attitudes and responsibilities toward the environment. Literature reviews indicate that environment-based science education methods have several significant benefits. In addition to increasing environmental awareness, this approach also contributes to improving students'

academic performance, scientific process skills, creativity, and critical thinking abilities. Furthermore, environment-based science education also has a positive impact on training students in problem-solving, enhancing conceptual understanding, increasing student autonomy, and fostering environmental entrepreneurship.

This conclusion highlights the importance of integrating environment-based science education into the high school curriculum as a strategy to produce a generation more environmentally conscious and prepared to face global environmental challenges in the future. Thus, environment-based science education is not just about understanding scientific concepts but also about shaping attitudes, values, and skills needed to preserve and conserve the environment for a sustainable future. The implementation of environment-based science education has proven effective in enhancing environmental care attitudes, learning outcomes, scientific process skills, critical thinking abilities, scientific creativity, science and environmental literacy, conceptual understanding, and problem-solving skills. Environment-based science education has been applied at the elementary, middle school, and high school levels in subjects such as Chemistry, Biology, Physics, and Integrated Science.

In the future, there is a need to further develop environment-based science education across various science subjects. Its development can still be expanded to all levels of schooling and across various subjects. The use of media and methods for environment-based science education should be implemented from elementary to high school levels to instill environmental care attitudes from early childhood to adulthood.

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