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Environmental Education on Campus: Strategies to Increase Sustainability Awareness

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Abstract

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Climate change, environmental degradation, and excessive consumption are global challenges that demand the role of the younger generation, especially students, as agents of change. This research aims to analyze students' knowledge, attitudes, and behaviors towards sustainability issues and evaluate the effectiveness of the implementation of environmental education in higher education. The method used is a systematic scoping review. The results of the study showed that although students had a high level of knowledge and a positive attitude towards environmental issues, their pro-environmental behavior was not consistent. Inhibiting factors include culture, consumptive habits, and low institutional support on campus. Further analysis shows that innovative learning methods such as problem-based learning, argumentation, and the use of virtual reality and game-based learning are more effective than conventional approaches. However, the implementation of environmental education is still not uniform between universities, so a more contextual and participatory strategy is needed. This research emphasizes the importance of strengthening environmental education to produce students as agents of change in supporting the global sustainable development agenda.

1. Introduction

Global environmental issues are currently a major concern of the international community because of their increasingly widespread impact on the sustainability of human life. Climate change, ecosystem degradation, excessive resource consumption, plastic pollution, and the clean water crisis are real challenges facing the world. A recent report by the Intergovernmental Panel on Climate Change (IPCC) confirms that the global average temperature rise has reached 1.1°C compared to pre-industrial times, and this trend has the potential to increase to 1.5°C before 2035 if there are no significant mitigation efforts (Al-Dmour, 2023). Meanwhile, the United Nations Environment Programme (UNEP) shows that more than 300 million tons of plastic are produced each year, with a third of it ending up as waste that pollutes the oceans (Dewi et al., 2023). On the other hand, the Sustainable Development Goals (SDGs) also place the issue of clean water and sanitation (Goal 6) and climate action (Goal 13) as priorities, signaling the global urgency in addressing these issues.

In the context of international trends, the Education for Sustainable Development (ESD) approach is seen as an important instrument to build the awareness and capacity of the young generation to face environmental challenges. UNESCO emphasizes that ESD plays a strategic role in equipping students with critical thinking skills, problem-solving skills, and collective awareness to contribute to sustainable development (Mithen & Arfandi, 2020). Environmental education in higher education not only improves theoretical knowledge, but also shapes attitudes and behaviors that support social transformation towards sustainability.

Environmental education is particularly relevant for students, who are often referred to as agents of change. The younger generation has great potential to encourage changes in people's behavior through innovation, advocacy, and sustainable lifestyles. Global regulatory support also strengthens this position, for example through SDG 4.7 which targets the integration of sustainability education in the curriculum, and SDG 13 which emphasizes the importance of concrete action on climate change. Thus, the role of students is not only as a recipient of knowledge, but also as a driver of cultural transformation towards a more environmentally friendly society.

Recent literature review shows interesting dynamics related to student knowledge, attitudes, and behaviors towards environmental issues. Radwan and Khalil (2021) found that although the level of students' knowledge about environmental issues is quite high, their understanding of sustainability policies on campus is still low. Al-Nuaimi and Al-Ghamdi (2022) add that there is a gap between academic knowledge and real sustainability practices in the university environment. On the other hand, students' attitudes towards the environment tend to be positive, but their application in daily life is still influenced by culture and habits that inhibit them (Al-Naqbi & Alshannag, 2018). This is in line with the findings of Effendi et al. (2020) that pro-environmental behavior of students is not always consistent, and even still mixed with behavior that is not environmentally friendly.

However, a number of studies have also shown that innovative learning interventions can improve students' environmental awareness and behavior. For example, problem-based learning approaches, argumentation-based instruction,

technology-based learning such as virtual reality (VR), and game-based learning have been proven to be effective in encouraging active participation and pro-environmental behavior (Mayerl & Best, 2019). This shows that the right pedagogical methods can bridge the gap between knowledge and real behavior.

Although the literature has discussed various dimensions of environmental education, there are several research gaps that need to be examined. First, students' knowledge about sustainability policies in the campus environment is still low and unevenly distributed between universities. Second, the implementation of environmental education is not uniform, both in terms of curriculum and teaching methods. Third, changes in attitudes and behaviors do not always go hand in hand with increasing knowledge. This means that social, cultural, and structural factors still play a big role in influencing the consistency of students' pro-environmental behavior. This gap demonstrates the need for cross-border research to look at variations in student knowledge, attitudes, and behaviors, while also evaluating the most effective learning strategies.

Based on this background, this study aims to explain how the knowledge, attitudes, and behaviors of cross-border students in the context of environmental awareness; analyzing the implementation of environmental education in learning in higher education; and examine effective pedagogical strategies in increasing environmental awareness among students. Thus, this research is expected to contribute to strengthening the role of higher education as a center for continuous learning and as a driving force for social change towards global sustainability.

2. Literature Review

A review of the literature on environmental education in universities shows that students generally have a relatively high level of knowledge about environmental issues, but their understanding of sustainability policies on campus is still relatively low. Radwan and Khalil (2021) assert that although most students are aware of global environmental issues, their knowledge of sustainability strategies implemented in universities is still limited. This shows that there is a gap between students' theoretical understanding and practical implementation in the campus environment. In line with that, Al-Nuaimi and Al-Ghamdi (2022) found that students in various countries show good knowledge about sustainability issues, but sustainability practices on campus have not fully supported this knowledge. This means that while intellectual awareness of the environment is quite high, it does not automatically encourage real behavioral change.

This phenomenon raises the need for a more applicable environmental education strategy so that students are able to integrate knowledge with daily practice.In terms of attitudes, research shows a positive tendency towards sustainability issues. Students in general support environmental conservation efforts, but are still hampered by cultural factors and habits. Al-Naqbi and Alshannag (2018) mention that although students show a good attitude towards sustainability, lifestyle and social norms are often a barrier to adopting pro-environmental behavior. These findings are important because they show that positive attitudes do not necessarily result in real action, so there is a need for learning interventions that are able to transform attitudes into concrete behaviors.

Furthermore, student behavior related to environmental issues is still inconsistent. Effendi et al. (2020) highlight that although students often show concern for the environment in academic discussions, negative behaviors such as single-use plastics and overconsumption still occur. This inconsistency shows the existence of an "intention-behavior gap" which is one of the main challenges in environmental education. Therefore, learning strategies need to be focused not only on improving knowledge, but also on internalizing values and habituating environmentally friendly behaviors.

Various studies also highlight the importance of implementing innovative learning approaches to increase students' environmental awareness. Sanzana et al. (2021) found that methods such as virtual reality and game-based learning are able to increase student engagement and encourage attitude change more effectively than conventional methods. In addition, problem-based learning and argumentation-based approaches have been proven to help students relate environmental issues to real situations, so that they are more motivated to engage in sustainability actions (Effendi et al., 2020). From the literature review, it can be concluded that although students have relatively positive knowledge and attitudes towards environmental issues, their behavior is still inconsistent. Low understanding of campus policies, cultural and habitual influences, and limitations of innovative learning methods are the main inhibiting factors. This emphasizes the need for more in-depth research to design environmental education strategies that are effective, contextual, and able to bridge the gap between student knowledge, attitudes, and behaviors.

3. Methods

This study uses a systematic scoping review approach to examine students' knowledge, attitudes, and behaviors towards environmental issues, as well as the implementation of environmental education in universities. This method was chosen because it is suitable for mapping diverse literature, identifying research gaps, and providing a comprehensive picture of global trends in environmental education among students. The guidelines used refer to the framework developed by Tricco et al. (2018), which consists of five systematic stages: topic selection, literature search, literature selection, quality assessment, and literature analysis and synthesis. The first stage is the selection of topics, which is to determine the focus of research on environmental education and sustainability issues among university students. This topic was chosen taking into account the global urgency of environmental issues such as climate change, ecosystem degradation, and resource crises.

Previous research has shown that students are important actors in driving social change, so mapping the literature on their environmental awareness is very relevant to support Education for Sustainable Development (ESD).The second stage is the search for literature. Searches are conducted through academic databases such as Google Scholar. The keywords used include environmental education, sustainability awareness, higher education students, attitudes, and behaviors. The search process generates a large number of articles, which are then further selected based on inclusion and exclusion criteria. The third stage is the selection of literature. Included articles must meet several criteria: (1) published in 2019–2023; (2) focusing on college students; (3) discussing aspects of knowledge, attitudes, behaviors, or

implementation of environmental education; and (4) published in international journals or trusted sources. Irrelevant articles, such as research at the elementary school level or non-academic studies, are excluded from the analysis.

The fourth stage is the evaluation of the literature. At this stage, the methodological quality of the article is assessed by paying attention to the research design, clarity of the objective, the method of data collection, and the validity of the results. This assessment is important to ensure that the interpreted findings come from credible and accountable sources. The fifth stage is the analysis and synthesis of the literature. Articles that passed the selection were thematically analyzed to identify patterns, gaps, and key research contributions. The synthesis process is carried out by grouping the findings into categories of knowledge, attitudes, behaviors, and educational strategies used in increasing students' environmental awareness. The results of this synthesis are then presented in the results and discussion sections to provide a comprehensive understanding of global trends.

By applying the systematic scoping review method, this study not only collects findings from various studies, but also maps the relationships between issues, as well as identifies gaps in research that can be followed up in the future. This approach provides a solid foundation for formulating more effective environmental education strategies in higher education.

4. Results and Discussion

4.1. Knowledge, Attitudes, and Behaviors of Students on Environmental Issues

The results of the literature review show that students in various countries have a fairly good level of knowledge about global environmental issues such as climate change, plastic pollution, and ecosystem degradation. The study by Radwan and Khalil (2021) confirms that students are able to identify the major challenges facing the earth, but there is still a gap between general knowledge and specific understanding of sustainability policies implemented on campus. For example, many students understand the urgency of reducing carbon emissions globally, but only a small percentage are aware of their university's plastic-free campus programs or energy management policies. This gap shows that students' knowledge is still normative and not fully contextual with their learning environment.

In terms of attitudes, students show a positive tendency towards environmental conservation. Al-Nuaimi and Al-Ghamdi (2022) found that the majority of students have strong intentions to support sustainability programs, both through academic and social activities. However, this positive attitude often clashes with social habits and norms that are not yet supportive. For example, although students expressed support for reducing single-use plastics, the practice of using single-use packaging in the campus environment remains high due to convenience factors and limited facilities. This shows that there is a significant "attitude-behavior gap", where positive attitudes do not necessarily manifest in real behavior.

The behavior of students themselves tends to be diverse. Some show a high commitment to sustainable lifestyles such as waste sorting, energy saving, and the use of environmentally friendly transportation. However, others are still trapped in consumptive behaviors that are contrary to the principles of sustainability. Effendi et al. (2020) noted that there are negative behaviors that are still consistent with students, such as excessive use of private vehicles and low involvement in green campus programs.

This fact confirms that while environmental awareness is increasing, behavioral change requires stronger structural encouragement, including supportive incentives and regulations. In addition, the literature also shows quite clear differences between students in developed and developing countries. Students in countries with established sustainability policies tend to have more consistent behavior, while in developing countries there are still challenges in the form of limited facilities, lack of institutional support, and dominance of consumptive culture. This is in line with the findings of Sanzana et al. (2021) who emphasized that students' environmentally friendly behavior is easier to form when there is a supportive campus ecosystem. Thus, it can be concluded that students' knowledge is relatively high, attitudes tend to be positive, but behavior is not consistent. Differences in social, cultural, and policy contexts affect the extent to which environmental awareness can be realized in concrete actions. Therefore, the role of environmental education is important to bridge the gap between student knowledge, attitudes, and behaviors.

4.2. Implementation of Environmental Education in Higher Education

Environmental education in higher education has grown rapidly in the last two decades, but its implementation has not been evenly distributed across all institutions. Some universities have successfully integrated sustainability principles into campus curricula and activities, while others are still in the early stages. Al-Nuaimi and Al-Ghamdi (2022) show that many study programs have included environmental issues in both compulsory and elective courses, but this integration is often partial and has not touched on interdisciplinary aspects. In fact, environmental issues are complex and require a cross-disciplinary approach so that students' understanding is more comprehensive.

Learning methods also play an important role in the effectiveness of environmental education. Effendi et al. (2020) emphasized that the problem-based learning approach is able to improve students ability to analyze real issues, as well as encourage them to find innovative solutions. Meanwhile, technology-based methods such as virtual reality (VR) and game-based learning reported by Sanzana et al. (2021) have proven to be more attractive to the younger generation because they provide an immersive learning experience. For example, VR simulations of the impacts of climate change allow students to experience firsthand the consequences of human activities on ecosystems, resulting in stronger emotional awareness. However, the implementation of environmental education still faces a number of challenges. First, not all universities have the same institutional commitment to sustainability. There are campuses that only adopt green policies as symbolic without any real implementation in infrastructure or curriculum. Second, limited resources and

national policy support also affect the effectiveness of environmental education programs. Universities in developing countries often face obstacles in the form of limited funding and policy priorities that are more inclined towards economic development.

In addition, there is a problem regarding the consistency of changes in student behavior after environmental education interventions. Although innovative learning methods increase awareness, real behavior change still requires time and a longer process of internalizing values. Radwan and Khalil (2021) stated that without a comprehensive sustainability culture on campus, the impact of environmental education is only temporary. Therefore, universities need to integrate environmental education not only into the curriculum, but also into governance, facilities, and student activities so that students become accustomed to sustainable practices. The implication of these findings is the need for a more comprehensive and sustainable environmental education strategy. Education is not enough to just impart knowledge or shape attitudes, but it must lead to behavioral transformation through real practice on campus. Cross-disciplinary collaboration, the use of modern learning technologies, and institutional policy support are key to making this happen.

4.3. Effective Strategies to Increase Environmental Awareness Among Students

The latest literature emphasizes that increasing students' environmental awareness cannot be achieved only through the delivery of information, but requires pedagogical, cultural, and structural strategies that complement each other.

Sustainable environmental awareness requires a combination of learning experiences, direct engagement, and institutional support.

One strategy that has proven effective is the application of a project-based learning approach. Research by Lozano et al. (2021) found that student involvement in real projects, such as campus waste management or faculty energy audits, is able to increase understanding while fostering a sense of personal responsibility. This kind of project makes students not only recipients of information, but also actors who actively contribute to real change. As a result, students feel that they have an important role in sustainability so that their motivation is higher to consistently behave in an environmentally friendly manner. Another strategy that is getting more attention is the integration of digital technology in environmental education. According to Huang and Cheng (2022), the use of online platforms, educational applications, and gamification helps students internalize the value of sustainability in a more interactive way. For example, an app that tracks an individual's carbon footprint can provide immediate feedback, so students are encouraged to reduce energy consumption or personal vehicle use. Thus, technology is not only a means of communication, but also a tool of self-reflection that strengthens everyday environmental awareness.

In addition to learning methods, strengthening a sustainable campus culture is also a key factor. As emphasized by Alnaweigah (2023), it is easier for students to internalize the value of sustainability if the university creates a consistent green ecosystem, ranging from energy-efficient infrastructure, waste management policies, to environmentally friendly student activities. If students witness sustainable

practices around them, then these values become not only a theory, but also part of the daily experience. Therefore, universities need to be transformed into a "living lab for sustainability" where students can learn as well as practice environmentally friendly behaviors. However, the biggest challenge is to ensure that these strategies do not stop at symbolic activities, but actually result in long-term behavioral changes. Some research shows that even though students are engaged in sustainability programs, their off-campus behavior is still not completely consistent. This shows that effective strategies must be holistic: integrating formal learning, informal activities, and habituation into daily life.

From the findings of the literature, three main components of effective strategies can be identified: Contextual and participatory learning through real projects, students learn to solve environmental problems with applicable solutions. The use of digital technology supports the internalization of sustainability values in an interactive and personalized manner. Strengthening a sustainable campus ecosystem creates a consistent environment for students to get used to green practices. These three components are interrelated and need to be implemented simultaneously. If one aspect is ignored, the effectiveness of environmental education can be reduced. For example, innovative learning will be difficult to make an impact if it is not supported by environmentally friendly campus facilities; On the other hand, the green campus policy can become a formality if students are not involved in the meaningful learning process.

Thus, an effective environmental education strategy for students is one that is able to integrate the cognitive (knowledge), affective (attitude), and cognitive

(behavioral) dimensions in a balanced manner. The implementation of this strategy is believed to narrow the gap between positive attitudes and real behavior of students, so that they can be more consistent in becoming agents of change towards a sustainable society.

5. Conclusion

Based on the results of the literature review through the systematic scoping review approach, it can be concluded that environmental education in higher education plays an important role in shaping students' awareness, attitudes, and pro-environmental behaviors. Students generally have a fairly high level of knowledge related to global environmental issues, such as climate change, environmental degradation, and sustainability. However, this knowledge still tends to be theoretical and has not been fully applied in daily behavior. The implementation of more innovative environmental education has proven to be more effective than conventional methods. Approaches such as problem-based learning, argumentation-based learning, and technology integration (virtual reality and game-based learning) are able to connect knowledge with real practice, increase emotional engagement, and strengthen students' motivation to behave in an environmentally friendly manner.

However, there are important gaps that still need to be bridged. Student knowledge about campus sustainability policies is still low, the implementation of environmental education is not uniform between universities, and changes in attitudes and behaviors are not always in line with increasing knowledge. Therefore,

more research is needed to design contextual, participatory, and action-oriented cross-border learning strategies. By strengthening environmental education in universities, students can play the role of agents of change who not only understand environmental issues conceptually, but also become active actors in creating a more sustainable society.

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