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Synergy Analysis between Environmental Awareness, Student Participation, and Campus Policies in Waste Reduction and Energy Efficiency at Bina Sarana Informatika University

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

This research aims to analyze the synergy between three key elements of environmental awareness, student participation, and campus policy in the context of waste reduction and energy efficiency at Bina Sarana Informatika University. The method applied is descriptive observation, where data is collected through field notes in various campus locations as well as in-depth interviews with students. The results indicate that high environmental awareness among students

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contributes significantly to their active participation in waste management programs and efficient energy use practices. In addition, campus policies that support environmental initiatives were shown to play an important role in increasing student involvement. This synergy between environmental awareness, student participation, and campus policies contributes to the creation of a more sustainable campus environment. The findings also provide strategic recommendations to strengthen environmental education programs and increase student engagement in sustainability-focused campus policies, thereby encouraging more environmentally responsible behavior in the future.

Keywords: Environmental awareness; student participation; campus policy; waste reduction; energy efficiency.

1. INTRODUCTION

1.1 Background

In today's modern era, environmental issues are becoming increasingly urgent and require serious attention from all parties, including higher education institutions. Universitas Bina Sarana Informatika as an educational institution that has an important role in shaping the character and knowledge of students, has the responsibility to implement sustainable practices. However, the reality faced today shows that environmental awareness among students and the implementation of campus policies related to waste reduction and energy efficiency are still not optimal. Many students are less involved in environmental activities and are not fully aware of the impact of their behavior on the environment.

This situation creates an urgent need to increase environmental awareness and active participation of students in sustainability initiatives. Through this research, a strong synergy emerges between environmental awareness, student participation, and campus policy. With this synergy, Universitas Bina Sarana Informatika can become a pioneer in waste reduction and energy efficiency efforts, creating a cleaner and more sustainable campus environment.

The long-term goal is to create a culture of environmental awareness among students, where each individual not only understands the importance of waste management and efficient energy use, but also actively participates in existing programs. In addition, campus policies that support sustainable practices should be strengthened and consistently implemented.

To achieve this goal, there needs to be concrete steps involving all stakeholders on campus, including students, lecturers, and management.

1.2 Problem Statement

How synergies between environmental awareness, student participation, and campus policies contribute to waste reduction and energy efficiency efforts at Universitas Bina Sarana Informatika.

1.3 Research Objective

To analyze the synergy between environmental awareness, student participation, and campus policies in supporting waste reduction and energy efficiency efforts at Universitas Bina Sarana Informatika.

1.4 Benefits of Research

This research is useful for providing in-depth insight to Universitas Bina Sarana Informatika regarding the importance of synergy between environmental awareness, student participation, and campus policies in creating sustainable practices, so that effective strategic measures for waste reduction and energy efficiency can be implemented in the campus environment.

1.5 Problem Limitations

Some limitations are important to note in this study so that the focus and depth of analysis can be maintained. First, the geographical context of this research is limited to the environment of Universitas Bina Sarana Informatika. Second, the research subject will be focused on active students at Universitas Bina Sarana Informatika. Third, in terms of research time, data collection will be limited to one academic semester, namely odd 2024/2025.

Furthermore, this study focused on the variables of interest, namely three main variables: environmental awareness, student participation, and campus policies. In addition, the type of data

used in this study was collected through direct observation. Finally, in terms of the policies studied, this research only examines policies that have been implemented on campus related to waste reduction and energy efficiency.

2. LITERATURE REVIEW

2.1 Environment Awareness

Environmental awareness among students is an important aspect in creating a generation that cares about sustainability issues and environmental impacts. Students, as agents of change, have great potential to influence people's behavior and implement environmentally friendly practices in their daily lives [1].

Environmental awareness refers to an individual's understanding of environmental issues and their impact on human health, ecosystems, and well-being [2]. Students who have high environmental awareness tend to be more sensitive to issues such as pollution, climate change, and natural resource management. This awareness not only affects individual behavior, but can also drive collective action within the campus community and wider society.

Several factors can influence the level of environmental awareness among university students. Formal education that provides an understanding of the importance of sustainability and environmental issues can increase awareness [3]. In addition, personal experiences, such as being involved in environmental activities, can deepen understanding and commitment to environmental conservation. Social media and environmental campaigns also play a role in disseminating information and building awareness.

Environmentally conscious students tend to engage in activities that support sustainability, such as waste management programs, use of renewable energy, and conservation of water resources. They may lead initiatives on campus, such as single-use plastic reduction campaigns, tree planting, or recycling programs. This involvement not only benefits the environment, but also strengthens the sense of community among students.

Although environmental awareness among university students is increasing, there are still challenges that need to be overcome. Some students may feel that environmental issues are too big for individuals to tackle, thus reducing their motivation to participate. In addition, the lack of facilities and support from educational institutions may hinder students' efforts to take concrete actions.

2.2 Student Involvement

Student participation in environmental awareness has become one of the key factors in the effort to create a more sustainable world. Students, as the next generation and agents of change, have an important role to play in raising awareness of increasingly pressing environmental issues. Their involvement in various environmental activities and initiatives not only has a positive impact on the environment, but also shapes their character and leadership [4].

When students are involved in programs that focus on environmental conservation, they not only learn about the importance of maintaining the ecosystem, but also gain practical experience that can strengthen their knowledge. Activities such as tree planting, waste reduction campaigns, and recycling are concrete examples where students can contribute directly. Through these activities, they can see the real impact of their actions, increase their sense of responsibility, and encourage others to join in.

Participation in environmental activities also encourages students to collaborate and network with peers and the community. Through student organizations or environmentally-focused study groups, they can discuss, share ideas, and plan larger initiatives [5]. This creates a deep sense of solidarity and care for the environment, and facilitates the development of invaluable leadership skills.

2.3 Campus Policies

The environmental awareness policy among the academic community integrates environmental awareness into every aspect of campus life, encourages active student participation, and creates a more sustainable environment.

First of all, the campus will implement a comprehensive environmental education program. The curriculum will be updated to include courses that address sustainability and environmental impacts. Through seminars and workshops involving experts in the environmental

field, students will be provided with in-depth knowledge and the necessary skills to deal with complex environmental issues [6].

Furthermore, for waste management, the campus will implement an efficient waste separation system throughout the campus area [7]. Separate bins for organic, plastic, and paper waste will be provided to encourage recycling. In addition, a recycling program will be launched, where students are invited to participate in recycling collection competitions, with attractive incentives as encouragement.

Plastic reduction campaigns are also an important part of this policy. The use of single-use plastics will be banned in campus areas, with eco-friendly alternatives provided. Students will be involved in educational campaigns to raise awareness about the negative impact of plastics on the environment.

Student participation is encouraged through the formation of environmental organizations that focus on sustainability issues. The campus will provide resources and support for projects proposed by students, encouraging them to engage in community service activities, such as tree planting and river cleaning.

To ensure the sustainability of this policy, the campus conducts periodic environmental audits. Audit results will be published to increase transparency and accountability, and to identify areas of improvement needed.

2.4 Waste Reduction

Waste reduction is an increasingly pressing issue in the context of global environmental awareness. Every year, millions of tons of waste are generated, with most of it ending up in landfills, polluting soil and water, and contributing to climate change. In this regard, waste reduction is not only important to keep the environment clean, but also to create a healthier and more sustainable ecosystem.

Waste reduction can be understood through the concept of Reduce, Reuse, and Recycle (3R) [8]. This principle emphasizes the importance of reducing the amount of waste generated (reduce), reusing items that are still suitable for use (reuse), and recycling materials for reuse (recycle). The implementation of the 3R principle can significantly reduce the volume of waste generated, which in turn helps reduce pollution and negative impacts on the environment [9].

In this context, environmental awareness plays a vital role. Students, as the next generation, are expected to have a high awareness of environmental issues, including waste management. Research shows that individuals who have good environmental awareness tend to be more active in taking action to reduce waste. Environmental education programs conducted in educational institutions are one of the effective ways to build this awareness. Through participation in activities such as plastic reduction campaigns, recycling, and environmental cleanups, students can learn about the impact of their actions and encourage their friends to do the same.

In addition, campus policies also contribute greatly to shaping environmental awareness. By implementing policies that support waste reduction, such as a ban on single-use plastics and the provision of recycling facilities, campuses can create an environment that supports environmentally friendly practices. These policies not only guide students in behaving well towards the environment, but also increase their participation in sustainability-oriented activities).

From the perspective of the wider community, waste reduction is also a collective responsibility. Public awareness of the importance of waste reduction can be generated through public campaigns and continuous education. Community involvement in waste reduction programs such as recycling bazaars or waste-free communities will further strengthen this awareness.

2.5 Energy Efficiency

Energy efficiency is an increasingly important concept in discussions about sustainability and environmental awareness. With increasing global energy demand and the challenge of climate change, energy efficiency is one of the key solutions to reduce greenhouse gas emissions and conserve natural resources. In simple terms, energy efficiency means using less energy to provide the same level of output, be it in the form of lighting, heating, cooling, or the use of electrical appliances.

One of the main reasons why energy efficiency needs attention is the significant impact that energy consumption has on the environment [10]. According to the International Energy Agency, the energy sector accounts for nearly 75% of total greenhouse gas emissions

worldwide. By improving energy efficiency, we can reduce the amount of energy required to perform our daily activities, thereby contributing to the reduction of carbon emissions and environmental pollution.

In the context of education, energy efficiency awareness among students is critical. Students, as agents of change, have the potential to adopt and disseminate energy efficiency practices both on campus and in their communities. Through educational programs that educate about the importance of energy efficiency, students can learn how to optimize energy use in their daily lives. For example, the use of LED lights, electronic devices labeled as energy efficient, and energy saving techniques in the use of household appliances are simple steps that can be implemented to reduce an individual's carbon footprint.

Campus also play an active role in promoting energy efficiency. Many educational institutions have implemented policies that encourage the use of renewable and efficient energy. For example, the use of solar panels to meet the electricity needs of campus buildings and the implementation of energy-efficient technologies in lighting and cooling systems. Such initiatives not only reduce energy consumption, but also provide students with tangible examples of how environmentally responsible actions can be taken in practical ways.

Involving students in energy efficiency programs on campus can increase their awareness of environmental issues. Activities such as energy audits, energy saving competitions, and energy use reduction campaigns are some of the ways to engage students directly. Research shows that active participation in such activities can strengthen their awareness of the impact of energy consumption on the environment [11].

2.6 Framework for Thinking

In an effort to create a sustainable campus environment, it is important to understand the relationship between environmental awareness, student participation, and campus policies. These three elements interact with each other and form a synergy that can lead to waste reduction and increased energy efficiency at Universitas Bina Sarana Informatika.

First of all, environmental awareness is a key cornerstone in this process. High awareness among students about environmental issues, such as the impact of waste and energy use, encourages them to take action. In this context, environmental education is key to improving students' understanding. With a curriculum that educates about the importance of waste management and energy efficiency, students can realize their responsibility to the environment and commit to contribute.

Furthermore, student participation determines the effectiveness of waste reduction and energy efficiency efforts. When students have good awareness, they are more likely to get involved in various environmental activities, such as recycling programs, waste reduction campaigns, and energy saving initiatives. This active participation not only has a direct impact on waste reduction and more efficient energy use, but also creates a culture of environmental care within the campus. Student involvement in these activities can build a stronger community and support each other in achieving sustainability goals.

On the other hand, campus policies also play an important role. Policies that support waste reduction and energy efficiency should be implemented to create an environment conducive to student participation. For example, by implementing regulations that prohibit the use of single-use plastics and providing recycling facilities, campuses can encourage students to behave more responsibly. In addition, policies that encourage the use of energy-efficient technologies, such as solar panel installations, can serve as tangible examples for students of how institutions support sustainability efforts.

In this framework, the interaction between the three elements-environmental awareness, student participation, and campus policies-creates a synergy that strengthens waste reduction and energy efficiency efforts. High environmental awareness triggers active participation, while supportive policies provide a framework that allows these two elements to go hand in hand. Through this synergy, Universitas Bina Sarana Informatika can build a more sustainable community, where every individual plays an active role in preserving and protecting the environment.

3. RESEARCH METHOD

3.1 Research Type

In this research, the approach taken is a qualitative research method. This type of

research was chosen because the main objective is to deeply understand the dynamics that occur between environmental awareness, student participation, and campus policies in the context of waste reduction and energy efficiency [12].

The research design uses data collection techniques such as participatory observation, and analysis of campus policy documents. Direct observation in the campus environment to observe existing practices, both in terms of waste management and energy use [13].

Data analysis was conducted thematically, by identifying patterns that emerged from the data collected. Researchers grouped information according to relevant themes, such as the level of environmental awareness, forms of student participation, and the effectiveness of campus policies.

3.2 Population and Sample

In this study, the population in focus is all active students at Universitas Bina Sarana Informatika in the 2024/2025 odd semester. With a diverse number of students from various study programs, as many as 38,058 students. From this population, the sample taken consists of 100 students [14].

3.3 Data Collection Technique

In this research, the data collection techniques that will be used are designed to explore in-depth information about the synergy between environmental awareness, student participation, and campus policies at Universitas Bina Sarana Informatika. There are several methods that will be applied to ensure the data obtained is comprehensive and relevant, namely by participatory observation in the campus environment to gain a better understanding of ongoing practices. Researchers directly observe activities related to waste management and energy use, such as recycling programs, energy saving.

Document analysis was conducted by reviewing policies that have been implemented on campus regarding waste reduction and energy efficiency. The documents are in the form of official regulations, annual reports, and educational materials provided by the campus.

3.4 Research Instrument

Details of the research instruments used are as follows:

1. Participatory Observation

The observation instrument covers waste management and energy use practices in the campus environment, including:

a. Separate bins for organic and inorganic waste.
b. Use of energy-efficient lighting in public spaces.
c. Student participation in clean-up activities or environmental campaigns.

2. Document Analysis

The analyzed documents include:

a. Official environmental policies published by the university.
b. Educational materials provided by the campus to increase environmental awareness.

4. RESULTS AND DISCUSSION

Data obtained from observation, and document analysis provided a comprehensive picture of environmental awareness, student participation, and campus policies. This data was analyzed to assess the relationship and synergy between the three variables under study.

1. **Data Description:** The data collected includes respondents consisting of 100 active students at Universitas Bina Sarana Informatika. 70% of the respondents showed a good level of environmental awareness, with many of them understanding the impact of waste management on the ecosystem. In addition, field observations showed the existence of waste management practices on campus, such as separate bins for organic and inorganic waste.
2. **Environmental Awareness Analysis:** The analysis shows that environmental awareness among students is quite high. Observations show that many students are actively involved in activities related to environmental issues, such as recycling campaigns and environmental education. This awareness seems to be driven by programs organized by the campus and information they obtain from various sources, including social media. However, some students also revealed that there is still room for improvement, especially in

terms of in-depth understanding of more complex environmental issues.

3. **Analysis of Student Participation:** Student participation in waste reduction and energy efficiency programs varies. Although many students expressed interest in participating, the data showed that only about 40% of them were actively involved in the activities. Observations show that motivational factors, such as peer encouragement and campus incentives, strongly influence the level of participation. Some students wanted more opportunities to be involved in sustainability-focused programs.
4. **Campus Policy Analysis:** Campus environmental policies show a strong commitment to waste reduction and energy efficiency. Official documents and annual reports show that the campus has implemented several policies, such as energy-efficient use. However, the analysis also revealed that the implementation of these policies still faces challenges, especially in terms of socialization to students and consistent implementation in the field.
5. **Synergy between the Three Variables:** Synergy analysis between the three variables showed a mutually supportive relationship. High environmental awareness among students contributes positively to their participation in environmental programs. Conversely, good campus policies help raise students' awareness about the importance of waste management and efficient energy use. However, there is a gap between existing policies and the level of student participation. To create a more effective synergy, a more holistic approach is needed that involves continuous education, increased incentives for students, and better socialization of the policies implemented.

5. CONCLUSION AND SUGGESTION

5.1 Conclusion

Based on the analysis of the data obtained, it can be concluded that there is a mutually supportive relationship between the three variables, which collectively contribute to the achievement of sustainability goals in the campus environment.

First, environmental awareness among students proved to be quite high. This suggests that students have a good understanding of environmental issues and the impact of their behavior. Nonetheless, there is still a need to increase more in-depth and specific knowledge about the various environmental challenges faced.

Secondly, student participation in activities related to waste reduction and energy efficiency shows variation. Although many students are interested in getting involved, only a small percentage actually actively participate. Motivational factors, support from the campus, and available opportunities are key in increasing this participation.

Third, campus policies related to the environment, which have been implemented, show a strong commitment to creating a more sustainable environment. However, challenges in the implementation of this policy still need to be overcome, especially in terms of socialization and student involvement in the decision-making process related to the policy.

Overall, this research confirms that to achieve more effective waste reduction and energy efficiency, there needs to be a stronger synergy between environmental awareness, student participation, and campus policies. Collaborative efforts and continuous dialogue between all parties on campus are essential to create more innovative and impactful programs. Recommendations for improving environmental education programs, developing incentives for students, and better socialization of existing policies will be strategic steps to achieve more optimal sustainability at Universitas Bina Sarana Informatika.

5.2 Suggestion

Based on the findings of this research, here are some suggestions that can build and improve synergies between environmental awareness, student participation, and campus policies in waste reduction and energy efficiency efforts at Universitas Bina Sarana Informatika:

1. Development of environmental education programs by organizing more intensive and integrated environmental education programs, including workshops, seminars, and training on waste management and efficient energy use. This will help improve students' understanding of environmental issues and encourage action.

2. Increase student participation by organizing competitions or competitions related to innovations in waste management and energy efficiency. Rewarding students or groups that successfully demonstrate positive impacts can be an effective incentive.
3. Better socialization of the policy, by ensuring that students understand the policy, as well as its implications for the environment. The use of social media, posters, and discussion forums can be good tools for information dissemination.
4. Collaboration with external organizations by establishing partnerships with environmental organizations and local communities to develop waste reduction and energy efficiency programs. These collaborations not only enrich students' knowledge, but also provide valuable practical experience.
5. Student empowerment in policy, by involving students in the decision-making process related to campus environmental policies can increase their sense of ownership and responsibility. Student forums can be formed to provide input and ideas related to existing policies and programs.
6. Continuous, regular monitoring and evaluation of the policies and programs implemented is essential. This will help the campus to understand the effectiveness of the policy, as well as identify areas that need improvement.
7. The implementation of environmentally friendly technologies, such as the use of digital-based waste management systems and energy-saving devices across campus, can support waste reduction and energy efficiency efforts more effectively.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declares that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during writing or editing of this manuscript.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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