Green Campus Implementation: Comparative Analysis of Social and Technological Academic Community Behavior and Perception at Bali State Polytechnic

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Abstract. This study examines the factors that influence the implementation of the green campus concept in a university environment. Through a graphical analysis of the influence of various aspects, including waste management, water conservation, transportation management, and the behavior and perception of the academic community, it was found that a holistic approach is essential to realizing a sustainable campus. The results show that factors such as the use of technology, education, behavioral change, and supporting infrastructure have significant roles. The knowledge and values individuals hold also strongly influence behavior and perceptions related to environmental sustainability. This study concludes that the success of green campus implementation depends on integrating various strategies, including comprehensive education programs, the development of environmentally friendly infrastructure, supportive policies, and the active involvement of the entire academic community. The proposed recommendations include developing sustainable education programs, investing in infrastructure, formulating policies encouraging environmentally friendly behavior, and periodically evaluating program effectiveness. This study provides a foundation for developing more effective strategies for realizing a sustainable and environmentally friendly campus.

Keywords: Academic Community Behavior, Environmental Sustainability, Green Campus

1 Introduction

Environmental problems are common problems that require synergy from all elements of society, including the academic community. The community highly anticipates academics and forward-thinking about environmental problems because good environmental quality will support a good life. The academic community has great potential for building integrated, comprehensive, and sustainable environmental management. Therefore, it is necessary to develop a concept that can unite all elements in an environmental management system; from this system, it is hoped that it can build awareness about the importance of environmental management. A green campus in the context of environmental conservation is not just a campus environment filled with green trees. A

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green campus is an extent to which campus residents can utilize the resources available on the campus environment effectively and efficiently, for example, using paper, stationery, electricity, water, land, waste management, etc. A green campus is a space that can create a clean, relaxed, and comfortable environment and supports a climate of life that, in every activity, has the minor possible negative impact on the environment and integrates environmental science into policies, management, and activities of the tri dharma of higher education.

Based on UI GreenMetric 2016, there are six indicators of green campus success: arrangement and infrastructure, energy and climate change, waste, water, transportation, and education. According to (Puspadi, 2016), a green campus is helpful as a micro-economic service, resource conservation, campus tourism, a mini model of sustainable higher education management, and improving health, work products, and learning outcomes. Previous research was conducted by (Suci et al. 2017). The application of the concept of an environmentally friendly campus (green campus) in a deep ecology review at the Muhammadiyah University of Surakarta campus states that the application of the concept of an environmentally friendly campus (green campus) at the UMS campus is by the principles of an environmentally friendly campus but has not been fully integrated based on UI GreenMetric World University 2013, the application of the concept of an environmentally friendly campus has also not been running by the idea of deep ecology but has the potential to be further developed by making clear regulations by the organizers of activities on campus. Furthermore, Salampessy's research (2015), developed the concept of providing and utilizing green open spaces on sustainable campuses by raising the case of green campuses. In addition, Azmi's research (2016), on the implementation of the green school program (Adiwiyata) in Padang City stated that environmental conditions in the development of Green Schools in Padang City were relatively good, and there were obstacles in terms of costs. The existing conditions for implementing green on the Bali State Polytechnic (PNB) campus are no proper waste sorting. The final waste disposal site is inadequate to accommodate all the waste generated on campus. The recommendation to collect plastic waste has only recently been made, and landfills have been made at several points. An electric vehicle charging station has also been provided on campus but has not been used optimally because not many academics use electric cars/motorcycles. The PNB campus has also implemented water conservation by planting plants such as teak trees and several large plants at several points in the campus area. There are also several grass fields used for ceremonies and sports fields. There are also corridors connecting one building to another, which should be used as a means of transportation between buildings. A policy for walking in the campus area should be created, considering the campus area is not too large. One of the Bali State Polytechnic departments has also implemented energy conservation using solar panels as electrical energy.

The authors argue that environmental education itself, and on the other hand, the higher intrinsic motivation of committed students who voluntarily participate in environmental education, especially at the university level (Zyadin et al., 2014). Environmental education at university seems to be a critical factor in shaping pro-environmental knowledge and behavior. Students' lack of knowledge about what to

learn is more significant than their pro-environmental attitudes (Indrayanti, 2022). The expectations of their students will not only support their institutional goals but will also contribute to the development of active students who can value and prioritize health (Holt et al., 2015). Other research results show pro-sustainable development attitudes among (social) business students (Bask et al., 2020). While other research shows that almost all architecture (technology) students consider sustainability a critical aspect of their education, 30% of students consider it a negligible or unimportant aspect from universities that implement it (Boarin et al., 2019). Based on the results of this study, it is deemed necessary for researchers to conduct research on the behavior and perceptions of technology and social students at the Bali State Polytechnic campus to determine the differences in their behavior and perceptions as a reference for designing an integrated green campus implementation model in the PNB campus environment.

Based on the explanation above, this study was conducted to determine the behavior and perceptions of academics and students majoring in technology and social sciences toward implementing the green concept in the campus environment, considering the importance of environmental issues. Implementing the green campus concept requires a change in the educational paradigm that integrates environmental sustainability into the curriculum and campus operations and significant investment in environmentally friendly infrastructure. This change also requires transforming the organizational culture and behavior of the academic community, increased collaboration between stakeholders, and the development of new policies that support sustainable practices. These implications indicate that realizing a green campus is not just a physical change but a comprehensive transformation in how higher education institutions operate and interact with their environment. It requires long-term commitment, continuous evaluation, and adaptation to change.

2 Methodology

This study uses a quantitative method with a survey, a research method based on the philosophy of positivism, which is used to research a specific population or sample, data collection using research instruments, and quantitative/ statistical data analysis to test the established hypothesis. Survey research is research conducted on large or small populations. However, the data studied is from samples taken from the population to find relative events, distributions, and relationships between sociological and psychological. The philosophy of positivism views reality/symptoms/phenomena as being classifiable, relatively fixed, concrete, observable, and measurable, and the relationship between symptoms is causal. The research was conducted on a particular representative population or sample. This research is deductive; it answers the formulation of the problem using concepts or theories to formulate a hypothesis. The hypothesis is then tested through field data collection. Data collection uses a research instrument in the form of a questionnaire. Furthermore, the collected data will be analyzed quantitatively using inferential statistics to conclude whether or not the formulated hypothesis is proven.

2.1 Data Collection Methods

This study uses survey and interview methods to implement the research later. Survey research is defined as a quantitative study that examines the behavior of an individual or group. Survey research uses questionnaires as a data collection tool (Sandu, 2015). The objectives of this survey research are analyze and describe in detail the influence of the academic community's behavior and perceptions on the implementation plan for the green concept in the technology and social department of the Bali State Polytechnic anda analyze and explain the causal relationship between independent and dependent variables through hypothesis testing. To find out the answer to the initial hypothesis regarding the relationship between independent and dependent variables, whether it has a positive or negative relationship.

2.2 Data analysis methods

The data analysis method using Structural Equation Modeling (SEM) combines path and regression analysis, allowing researchers to simultaneously test a series of interrelated relationships between measured variables and latent constructs (Hair et al., 2010). SEM is a complex multivariate analysis involving several independent and dependent variables that are interrelated to form a model. In SEM, it cannot be said that there are independent variables and dependent variables because an independent variable can be a dependent variable in another relationship. SEM can be categorized into two models: structural and measurement. The structural model is a model that describes the relationships that exist between latent variables. At the same time, the measurement model describes the relationship between the observed variables (indicators) and the underlying latent variables (Solimun, 2017).

2.3 Hhypothesis formulation

The hypothesis used in this study is an associative hypothesis (relationship), which is a statement that shows an assumption about the relationship between two or more variables (Sugiyono, 2020). If described, the framework of the linear regression model above is as follows:

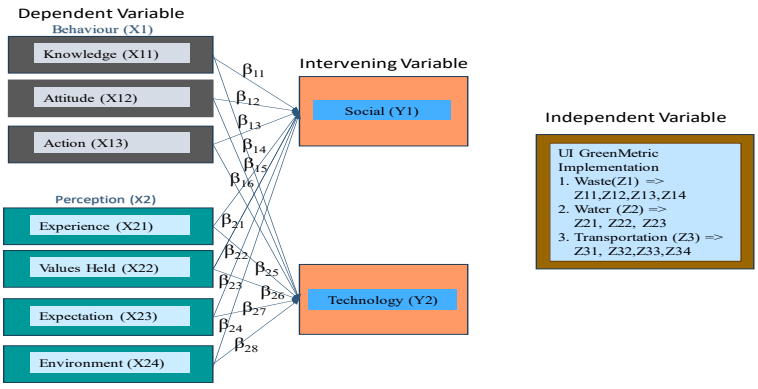

Figure 1. Conceptual framework of SEM method

3 Result and Discussion

3.1 Result

Deciding decisions on influential variables is based on the provision that if the ρ value <0.10 (alpha 10%), it can be considered weakly significant. Furthermore, if the ρ value <0.05 (alpha 5%), then the variable is significant, and if the ρ value <0.01 (alpha 1%), then the variable is declared highly significant. The following is a model of the results of hypothesis testing:

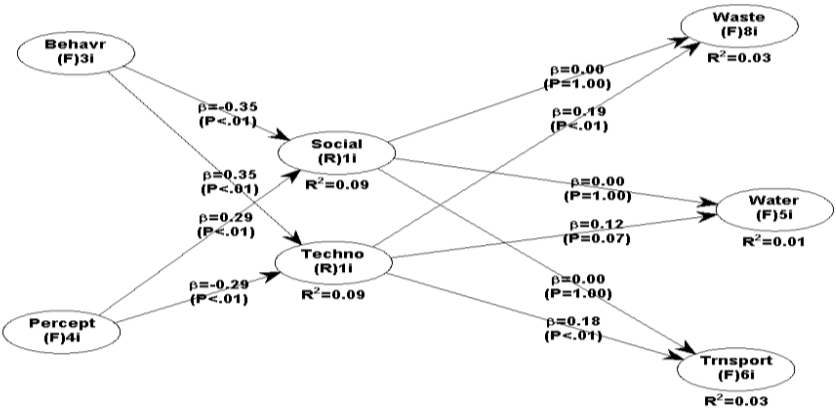

Figure 2. SEM model analysis results

Based on the SEM (Structural Equation Modeling) model image above, here is a summary of the analysis: behavior has a negative and significant effect on the academic community of the social department (β = -0.35, p <0.01), a positive and significant effect on the academic community of the technology department (β = 0.35, p <0.01). At the same time, perception has a positive and significant effect on the academic community of the social department (β = 0.29, p <0.01) and a negative and significant effect on the academic community of the technology department (β = -0.29, p <0.01). The influence of the academic community on the application of waste obtained the following results: The academic community of the social department influences the implementation of waste management positively and significantly (β=0.19, p<0.01). In contrast, the influence of the academic community of the technology department influences the implementation of water management (β=0.12, p=0.07) and transportation positively and significantly (β=0.18, p<0.01). Let us look at the strength of the relationship between these variables. It can be seen that the most substantial relationship is the relationship between behavior and the academic community of the social and technology departments (|β|=0.35). The weakest significant relationship is between the technology department's academic community and the transportation management implementation (β=0.18). The social and technology academic community variables act as intervening variables, transmitting the effects of behavior and perceptions to the outcome variables. However, this mediation effect is relatively weak, which may explain why the R^2 for the endogenous variables (waste management,

water conservation, and transportation management) is very low (0.01-0.03). This suggests that other important factors not included in this model influence the outcome variable more. To see the influence of each variable, you can see the following graphs.

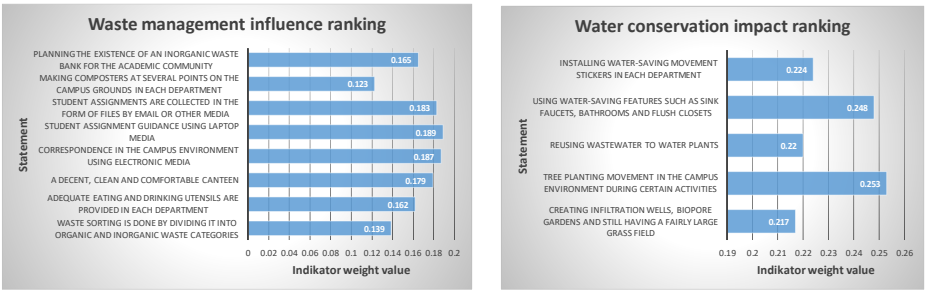

Figure 4. Waste and water impact rating

Based on the presented influence graph, it can be concluded that waste management in the academic environment requires a comprehensive approach with several key factors that have a significant influence. Student assignment guidance using laptop media emerged as the most influential factor, with an indicator value of 0.189, followed by the use of electronic media for correspondence on campus (0.187). Interestingly, the creation of composters at several points on campus had the lowest influence (0.123) but remained part of the waste management strategy. This graph shows that an approach that integrates technology, infrastructure, and environmental policies is critical to creating an effective waste management system in the academic environment, with a particular emphasis on digitalization and the use of technology in daily academic activities. The water conservation influence ranking graph displays the influence ranking of various water conservation efforts on campus. The movement to plant trees on campus has the highest influence, with an indicator value of 0.253, followed by water-saving features such as sink and bathroom faucets, with a value of 0.248. The creation of infiltration wells, biopore gardens, and similar facilities has the lowest influence but is still important, with a value of 0.217. Overall, the data suggest that an adequate water conservation approach involves a combination of reforestation, water-saving technologies, education, water recycling, and water absorption infrastructure. The differences in scores across efforts are relatively small, indicating the importance of a holistic approach to campus water conservation strategies.

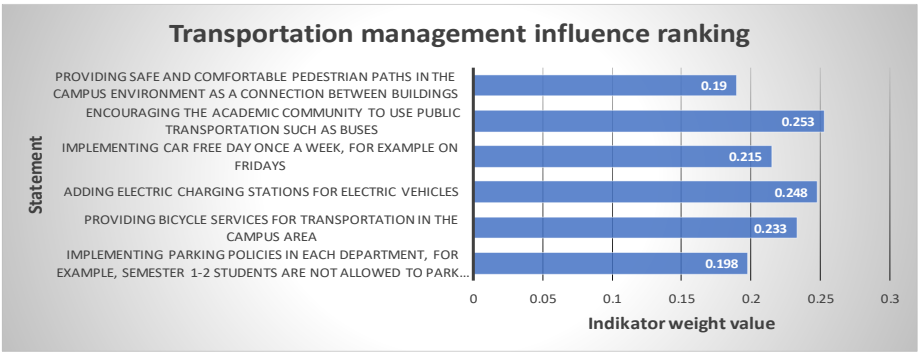

Figure 5. Transportation management influence ranking

This graph shows the ranking of the influence of various transportation management strategies in the campus environment. The strategy with the highest influence encourages academics to use public transportation, such as buses, with an indicator value of 0.253. Meanwhile, providing safe and comfortable pedestrian paths as a connection between buildings has the lowest but still significant influence (0.19). These data indicate that effective transportation management strategies on campus involve encouraging public transportation, infrastructure for environmentally friendly vehicles, and policies that encourage reducing private vehicle use.

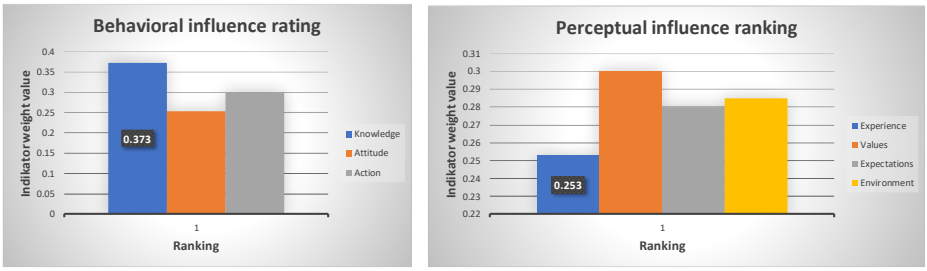

Figure 6. Behavioral and perceptual influence ranking

The behavior graph displays the ranking of the influence of three aspects of behavior in the context of implementing the green campus application program. The "Knowledge" aspect has the most significant influence, with a weight indicator value of 0.373, indicating that understanding and insight are the most significant factors. "Action" is in second place with a weight indicator value of around 0.30, indicating that real action also plays an important role. "Attitude" is in third place with a weight indicator value of around 0.25, indicating that although necessary, a person's way of thinking or views has a relatively minor influence than knowledge and action. This graph highlights the importance of education and information provision (knowledge), followed by practical implementation (action) and the formation of a supportive mindset (attitude) in influencing behavior toward a program or policy.

The perception graph shows the ranking of the influence of various factors on perception. The "Embedded values" factor has the most significant influence, with a weight indicator value of around 0.30, indicating that personal principles greatly influence how a person views something. "Environment" is in second place with a value of around 0.285, indicating the importance of the surrounding context in forming perception. "Expectation" is in third place with a value of around 0.28, indicating that a person's hopes or anticipations also play a significant role. "Experience" has the lowest influence but is still vital with a weight indicator value of 0.253, indicating that past events also contribute to perception formation. This graph highlights that a person's perception is formed by a complex combination of internal values, environmental influences, expectations, and personal experiences, with embraced values playing the most dominant role.

3.2 Discussion

Significant differences existed in how social and technology students responded to the issues measured regarding behavior and perception. One of the most exciting findings was the gap between perception and behavior across the two departments. Social students had more positive perceptions but negative behaviors, while technology students had the opposite. Environmental issues impacted technology students significantly, perhaps because of their direct relevance to technology. The department had a strong influence on both student behavior and perceptions. This suggests that education at the department level significantly impacts how students view and respond to specific issues. Given the significant differences between the two departments, there is great potential for mutually beneficial collaboration. Campuses could consider developing cross-departmental programs that combine the strengths of each: the solid social perspective of the social department with the practical orientation of the technology department. Collaborative projects between the two departments could help balance the perceptions and behaviors of students. Based on this, an integrated model can be designed to implement a green campus in the three aspects studied: waste management, water conservation, and transportation management.

4 Conclusion

Based on a comprehensive analysis of various aspects of green campus implementation, it can be concluded that realizing a sustainable campus requires a holistic and multidimensional approach. Key factors such as waste management, water conservation, transportation management, and the behavior and perception of the academic community are interrelated and play an essential role in the success of this initiative. Knowledge, values adopted, and actual actions from all campus elements are the main foundations of change. Implementing environmentally friendly technology, sustainable education, and supportive policies must go hand in hand to create an environmentally conscious campus ecosystem. The success of a green campus is not only measured by physical changes but also by the transformation of the culture and mindset of the campus community. Therefore, a long-term commitment, periodic

evaluation, and continuous adaptation to dynamic environmental challenges are needed. Thus, a green campus is a goal and a sustainable process that contributes significantly to environmental conservation and sustainable development globally.

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