Modeling sustainability competencies, institutional support and environmental awareness on university students' sustainability intentions

Christian Jake Arnejo [1] [iD], Krishelle C. Capuno [1] [iD], Jasthine C. Lobitania [1] [iD], Justine Remando [1] [iD],

Margie Y. Soco [1] [iD], Romel Cayao Mutya [1*] [iD]

[1] College of Education, Arts and Sciences, Cebu Technological University-Danao Campus, PHILIPPINES

***Corresponding Author:** romel.mutya@ctu.edu.ph

ARTICLE INFO	ABSTRACT
	This study examines the relationships among sustainability competencies, institutional support, environmental awareness, and behavioral intentions among university students at Cebu Technological University–Danao Campus. Guided by the Theory of Planned Behavior and Social Cognitive Theory, this cross-sectional study collected data from 315 randomly selected students through a structured questionnaire using a five-point Likert scale, designed to measure each construct with validated items adapted from prior studies. Data were analyzed using Structural Equation Modeling (SEM) to test the hypothesized relationships and assess model fit. Results showed strong institutional support (Mean = 4.23, SD = 0.56) and high behavioral intentions toward sustainability (Mean = 4.25, SD = 0.52). Sustainability competencies (Mean = 4.13, SD = 0.60) did not have a significant direct effect on environmental awareness ($\beta = 0.03$, $p = 0.740$) but had a strong positive effect on institutional support ($\beta = 0.45$, $p < 0.001$). Institutional support significantly influenced environmental awareness ($\beta = 0.52$, $p < 0.001$), which in turn positively impacted behavioral intentions ($\beta = 0.67$, $p < 0.001$). These findings indicate that institutional support mediates the relationship between sustainability competencies and environmental awareness, ultimately enhancing behavioral intentions. Based on these results, the study recommends strengthening institutional policies and programs to support sustainability education and initiatives, as such support plays a critical role in translating competencies into increased environmental awareness and sustainable behaviors among students. **Keywords:** behavioral intentions, environmental awareness, institutional support, sustainability competencies, partial least squares structural equation modeling (PLS-SEM)

INTRODUCTION

In recent years, global interest in sustainability and environmental awareness has intensified, particularly within the educational sector. Universities have emerged as key institutions in cultivating sustainability competencies among students. Environmental education is now recognized as fundamental to achieving sustainable development, with higher education institutions (HEIs) playing a critical role in preparing students for a more sustainable future (Boca & Saraçlı, 2019). These institutions foster sustainable development goals (SDGs) by embedding sustainability-related values and beliefs into the student experience (Wei & Chen, 2024).

A recent survey by Atrius (2023), titled "Sustainability in higher education: How higher education is making an impact on net zero and sustainability goals," revealed that 45% of students consider environmental sustainability when selecting a college, and 85% believe it should be prioritized. In the Philippines, data from the Philippine Statistics Authority (2024) indicates that over 31,000 students enrolled in environment-related programs during the 2022–2023 academic year, with females representing 57.6% of these enrollees. This trend reflects the growing interest of Filipino youth in environmental education.

Scholars have underscored the importance of integrating sustainability competencies into higher education. Redman and Wiek (2021) identified essential skills such as systems thinking and anticipatory abilities, which are critical for understanding and addressing complex socio-environmental issues. Brundiers et al. (2021) emphasized that sustainability education must transcend theoretical knowledge and foster critical thinking and problem-solving skills. These

competencies are vital for equipping future leaders with the capacity to advance the SDGs. In the Philippine context, embedding sustainability competencies into university curricula can improve environmental awareness and enable students to address localized sustainability challenges more effectively.

Despite increasing attention to environmental education, there remains limited understanding of the specific sustainability competencies possessed by Filipino university students and how these competencies influence their environmental awareness and related behaviors. While previous studies in the Philippines have primarily focused on measuring general environmental awareness, few have investigated the development of sustainability competencies as distinct, measurable skills, nor examined their structural relationships with institutional support and behavioral intentions. This gap in knowledge limits the ability to evaluate and improve the effectiveness of current sustainability education programs.

To address this limitation, the present study adopts a cross-sectional mixed-methods design, combining quantitative surveys with qualitative focus group discussions. This approach allows for a more nuanced exploration of how sustainability competencies are cultivated within local university contexts and how they interact with institutional factors to shape environmental awareness. Grounded in established theories such as the Theory of Planned Behavior and Social Cognitive Theory, this research develops and tests a structural model illustrating the interrelationships among sustainability competencies, institutional support, environmental awareness, and behavioral intentions. By advancing a theoretically informed and contextually relevant model, the study aims to provide evidence-based insights that can guide educators and policymakers in enhancing sustainability education and fostering more effective environmental engagement in Philippine higher education institutions.

Hypothesis Development and Literature Review

Sustainability competencies play a vital role in enhancing students' environmental awareness. These competencies, which encompass knowledge, attitudes, and skills, enable students to critically understand and address pressing environmental challenges. The integration of critical thinking into sustainability education is essential for fostering informed and proactive individuals (Shutaleva, 2023). According to Chang and Kidman (2025), a transdisciplinary educational approach is necessary to effectively develop these competencies. Chavula et al. (2024) emphasize that sustainability-focused skills cultivate a sense of responsibility, reinforcing students' commitment to environmental stewardship. Based on these arguments, the following hypothesis is proposed:

H1: Sustainability competencies have a significant direct effect on environmental awareness.

Beyond their impact on awareness, sustainability competencies also strengthen institutional support mechanisms. These competencies include system thinking, which enables students to grasp the interconnections between social, economic, and environmental systems (Demssie et al.,

2021). Institutions play a pivotal role in promoting these skills through green training and sustainability initiatives, which in turn shape organizational behavior and culture (Yafi et al., 2021). As Miller et al. (2022) observe, personal values aligned with sustainability often drive institutional engagement. This leads to the next hypothesis:

H2: Sustainability competencies have a significant direct effect on institutional support.

Institutional support is essential for embedding sustainability into campus life. It establishes a foundation of policies, programs, and resources that promote environmental responsibility. Research by Diaz-Fernandez et al. (2024) shows that competencies fostered within academic institutions can enhance sustainability efforts across organizational domains. Universities must equip students with the tools to participate in research, planning, and advocacy through strategic and systems thinking (Cebrián et al., 2025). Naderi et al. (2022) note that such support empowers students to contribute meaningfully to sustainability initiatives. Consequently:

H3: Institutional support has a significant direct effect on environmental awareness.

Environmental awareness, in turn, significantly influences behavioral intentions. It plays a crucial role in shaping these intentions by equipping individuals with the knowledge and understanding needed to make informed decisions about their environmental impact. Research suggests that people's beliefs, values, and assumptions influence the relationship between environmental awareness and pro-environmental behavior (Tamar et al., 2021). When individuals possess a high level of environmental knowledge, they are more likely to value environmental responsibility (Pan et al., 2018). Moreover, studies indicate that environmental consciousness partially mediates the connection between instrumental and terminal values and behavioral intentions (Kautish & Sharma, 2021). By promoting a sense of accountability, increased environmental awareness motivates individuals to adopt behaviors that positively affect the environment. Thus, it is hypothesized that:

H4: Environmental awareness has a significant direct effect on behavioral intentions.

Figure 1 presents the study's conceptual framework, which examines how sustainability competencies, institutional support, and environmental awareness interact to influence students' behavioral intentions toward sustainability. The model hypothesizes that sustainability competencies directly enhance environmental awareness (H1) and institutional support (H2), while institutional support further strengthens environmental awareness (H3). In turn, greater environmental awareness is expected to lead to stronger behavioral intentions (H4). Grounded in the Theory of Planned Behavior and Social Cognitive Theory, the framework highlights both direct and mediating relationships, aiming to provide a comprehensive understanding of how educational and institutional factors shape pro-environmental behavior among university students.
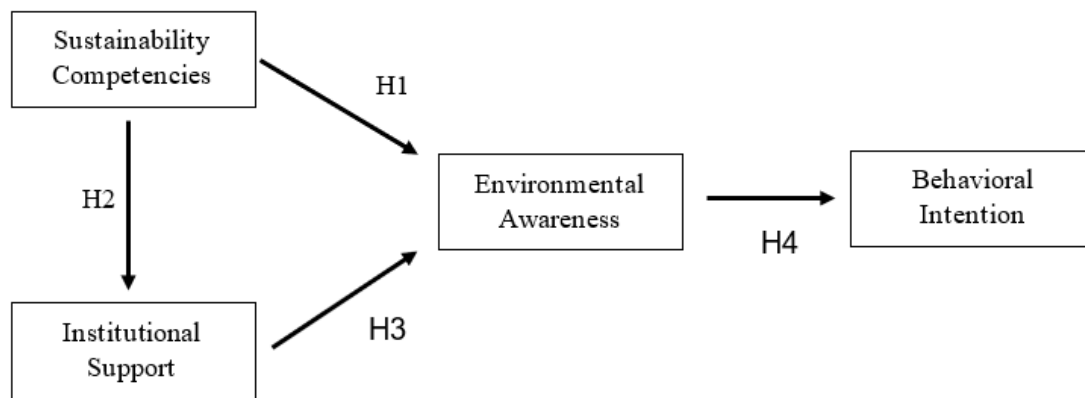
Figure 1. Proposed model of the study (Source: Authors' own elaboration)

Table 1. Distribution of the respondents (n=336)

Category	n	%
Gender		
Male	108	32.14
Female	228	67.86
Age		
18 yrs. old and below	63	18.75
19-21 yrs old	121	36.01
22-24 yrs old	107	31.85
25 yrs old and above	45	13.39
Year Level		
First Year	86	25.60
Second Year	105	31.25
Third Year	63	18.75
Fourth Year	82	24.40
College Department		
College of Education, Arts and Sciences	94	27.98
College of Engineering	77	22.92
College of Technology	86	25.60
College of Management and Entrepreneurship	79	23.51

MATERIALS AND METHODS

Design

The study employed a cross-sectional research design to gather data from university students at a single point in time. This approach effectively identifies the prevalence of sustainability skills and environmental awareness among students without altering their environment or influencing their responses. Using Structural Equation Modeling (SEM), the research examines complex relationships between students' sustainability competencies, environmental awareness, institutional support, and behavioral intentions. This design is particularly suitable for identifying patterns in students' knowledge and behaviors related to sustainability, as it allows researchers to analyze correlations among variables without manipulating any conditions. Moreover, it is quicker and more cost-effective than longitudinal studies, which involve data collection over long periods (Kim, 2021).

Respondents

The respondents in the study were 336 college students in a state university in Cebu, Philippines. **Table 1** presents the demographic profile of the respondents in terms of gender, age, year level, and college department. It shows that most were female, and the largest group falls within the 19-21 age range. Regarding year level, the second-year students comprise the largest proportion of respondents, followed by the first year. When categorized according to college department, most belong to the College of Education, arts, and Sciences, followed closely by the College of Technology. This distribution reflects a diverse student sample across different demographics and academic backgrounds. According to Hair et al. (2021a), when conducting Structural Equation Modeling (SEM), a common guideline is to have a minimum of 10 respondents per indicator or question to ensure stable and reliable results. With 19 questions and 336 respondents, the sample size exceeds the recommended ratio, providing sufficient statistical power for analysis. This supports the findings' validity and enhances the model tested's generalizability.

Instrument

A structured questionnaire was developed to measure sustainability competencies, institutional support, environmental awareness, and behavioral intentions among university students. The instrument was based on previously validated tools from the literature, ensuring its content validity. For environmental awareness, items were adapted from Kaur Sra (2020) and focused on students' knowledge and attitudes regarding environmental issues. The indicators included an understanding of the causes and consequences of environmental problems, awareness of the impact of human actions on the environment, and recognition of the importance of environmental protection. Behavioral intention was measured using items from Marcos-Merino et al. (2020), which assessed students' willingness and intention to engage in pro-environmental behaviors. Indicators included the intention to adopt sustainable practices in daily life, willingness to participate in sustainability-related initiatives, and commitment to making environmentally responsible choices. All items across the constructs were measured using a five-point Likert scale ranging from 1 ("Not Aware") to 5 ("Very Much Aware"). Initially comprising 40 items, the questionnaire was refined through confirmatory factor

Table 2. Measurement model assessment results

Constructs	Items	FL	Cronbach	CR	AVE
Behavioral Intentions	BI1	1.008	0.934	0.942	0.699
	BI2	0.784			
	BI3	0.771			
	BI4	0.914			
	BI5	0.736			
	BI6	0.767			
Environmental Awareness	EA1	0.715	0.825	0.832	0.617
	EA2	0.804			
	EA3	0.833			
Institutional Support	IS1	0.836	0.899	0.904	0.646
	IS2	0.75			
	IS3	0.766			
	IS4	0.878			
	IS5	0.744			
Sustainability Competencies	SC1	0.792	0.914	0.916	0.680
	SC2	0.869			
	SC3	0.814			
	SC4	0.882			
	SC5	0.760			

Note: FL = factor loadings; AVE = average variance extracted; α = Cronbach's alpha; CR = composite reliability; BI = Behavioral Intentions; EA = Environmental Awareness; IS = Institutional Support; SC = Sustainability Competencies

analysis, ultimately retaining 20 items with strong factor loadings and validity, which accurately captured the underlying constructs of the study.

Data Gathering Procedure and Ethical Consideration

Before the study, a transmittal letter was submitted to the research instructor for approval. Upon receiving the instructor's endorsement, the proposal was forwarded to the campus director for final authorization. Once institutional approvals were secured, an invitation and an informed consent form outlining voluntary participation, confidentiality, and the option to withdraw were provided to each respondent, along with a research outline describing their rights as participants. Questionnaires were distributed personally, via email, and through digital platforms to ensure flexibility and convenience in responding. This process ensured that the research adhered to ethical standards, safeguarding the rights and well-being of all involved. This follows Republic Act 10173, commonly known as the Data Privacy Act, which ensures the integrity of the research while being respectful and protective of the rights of the participants.

Data Analysis

The data collected to examine the interplay of sustainability competencies, institutional support, and environmental awareness on university students' behavioral intentions for sustainability were analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM) version 4. PLS-SEM was selected because of its effectiveness in modeling complex relationships among multiple latent constructs and its suitability for exploratory and predictive research in social sciences (Hair et al., 2021; Henseler et al., 2015; Ringle et al., 2024). This method facilitates a comprehensive assessment of both the measurement model—evaluating the reliability and validity of constructs such as sustainability competencies, institutional support, and environmental awareness—and the structural model, which tests the hypothesized pathways affecting students' behavioral intentions towards

sustainability. Key steps included assessing indicator reliability, internal consistency, convergent validity, and discriminant validity to ensure the constructs accurately represent the underlying theoretical concepts. Subsequently, the structural model was evaluated to determine the significance and strength of relationships among variables, as well as the model's overall predictive relevance. This approach allowed for a clear understanding of how these factors collectively influence behavioral intentions towards sustainable practices among university students.

RESULT AND DISCUSSION

Evaluations of validity and reliability were crucial in confirming the study's conclusions. Confirmatory factor analysis was used in the study to find common technique bias. To avoid common method bias, the model must meet acceptable convergent and discriminant validity requirements (Kock et al., 2021). The measurement model assessment results in **Table 2** indicate the reliability and validity of the constructs used in the study. The Measurement Model Assessment Results table evaluates various constructs using key metrics:

1. factor loadings (FL),
2. Cronbach's alpha (α),
3. composite reliability (CR), and
4. average variance extracted (AVE).

Factor loadings (FL) for all items exceed the recommended threshold of 0.70, demonstrating strong individual item reliability (Hair et al., 2021). Cronbach's alpha (α) values range from 0.825 to 0.934, above the acceptable limit of 0.70, indicating good internal consistency among the items (Nunnally & Bernstein, 2018). Similarly, composite reliability (CR) values exceed 0.80 across all constructs, further supporting the reliability of the measurement model. The average variance extracted (AVE) values are above the 0.50

Table 3. Descriptive statistics and correlations of the variables

Variables	Mean	SD				
Sustainability Competencies	3.93	0.82	1			
Institutional Support	3.84	0.71	.666**	1		
Environmental Awareness	3.88	0.73	.627**	.927**	1	
Behavioral Intentions	3.92	0.73	.672**	.783**	.839**	1

**. Correlation is significant at the 0.01 level (2-tailed)

Table 4. Results of the path analysis

Hypothesis	Path	Beta (β)	T values	p-values	Result
H1	SC → EA	0.009	0.331	0.740	Not Supported
H2	SC → IS	0.660	19.238	0.000	Supported
H3	IS → EA	0.938	47.079	0.000	Supported
H4	EA → BI	0.842	48.169	0.000	Supported

Note: BI = Behavioral Intentions; EA = Environmental Awareness; IS = Institutional Support; SC = Sustainability Competencies

threshold, confirming that each construct captures a sufficient level of variance from its indicators. Behavioral Intentions (BI) exhibit the highest reliability (CR = 0.942), while Environmental Awareness (EA) has the lowest but still acceptable CR value of 0.832. These findings establish the reliability and convergent validity of the measurement model, ensuring that the constructs are measured accurately.

Descriptive Statistics and Correlations of the Variables

Table 3 reveals strong, statistically significant positive correlations among sustainability competencies, institutional support, environmental awareness, and behavioral intentions, suggesting these variables are interrelated in promoting sustainable behavior. Institutional support and environmental awareness are highly correlated (r = .927**), indicating that students are more environmentally aware when institutions actively promote sustainability (Melekis & Woodhouse, 2015). Likewise, behavioral intentions are strongly linked to sustainability competencies (r = .672**) and environmental awareness (r = .839**), which aligns with Ajzen's (1985) Theory of Planned Behavior, which posits that attitudes and competencies shape intentions. These findings imply that enhancing institutional mechanisms and environmental education can strengthen students' commitment to sustainability (Casarejos et al., 2017). From an educational perspective, integrating sustainability into the curriculum and fostering supportive environments may cultivate long-term pro-environmental behaviors. Therefore, schools and universities must recognize their vital role in shaping eco-conscious citizens through strategic support systems and experiential learning opportunities.

Path Analysis

The influence of the independent variables on the dependent variable is tested using a structural model (Hair et al., 2021b). The path coefficients of the structural model indicate that the three hypotheses are supported (H2, H3, H4), and only 1 is not supported (H1). The results are summarized in **Table 4** and **Figure 2**. The path analysis results indicate that sustainability competencies (SC) do not have a direct significant effect on environmental awareness (EA), as evidenced by a beta coefficient (β) of 0.009, t-value of 0.331, and p-value of 0.740, leading to the rejection of Hypothesis 1 (H1). However, SC significantly influences institutional

support (IS) with a β of 0.660, t-value of 19.238, and p-value of 0.000, supporting Hypothesis 2 (H2). This suggests that while individual competencies in sustainability may not directly enhance environmental awareness, they play a crucial role in strengthening institutional frameworks that support sustainability initiatives. This aligns with findings from a study on green managerial awareness, which demonstrated that managerial awareness significantly influences environmentally responsible production through green human resource management and environmentally friendly employee behavior (Ahmad et al., 2021; Saeed et al., 2019; Tuan, 2022).

Sustainability Competencies

Further, institutional support positively impacts environmental awareness, with a β of 0.938, t-value of 47.079, and p-value of 0.000, confirming Hypothesis 3 (H3). This highlights the critical role institutional support plays in fostering environmental awareness among students. In this study, institutional support encompasses specific practices and policies such as implementing green campus initiatives (e.g., waste segregation programs, energy-saving campaigns), integrating sustainability topics into curricula, providing access to sustainability-related workshops and seminars, and encouraging student participation in environmental clubs and community outreach programs. These efforts create an enabling environment that promotes awareness and motivates sustainable behaviors. Similar findings have been reported where institutional policies and practices significantly influence students' environmental awareness and behaviors (Chen et al., 2025; Janmaimool & Khajohnmanee, 2019). Moreover, environmental education research highlights that institutional factors like green campus initiatives and robust support systems are key drivers in cultivating students' green intentions that translate into sustainable behaviors (Frizon et al., 2024; Yi, 2021).

Lastly, environmental awareness significantly influences behavioral intentions (BI), as indicated by a β of 0.842, t-value of 48.169, and p-value of 0.000, supporting Hypothesis 4 (H4). This finding suggests that heightened environmental awareness leads to stronger intentions to engage in pro-environmental behaviors. This is consistent with studies showing that environmental awareness significantly influences students' environmental behaviors (Bozoglu et al., 2016; Tekin & Gunes, 2018), and the perception of
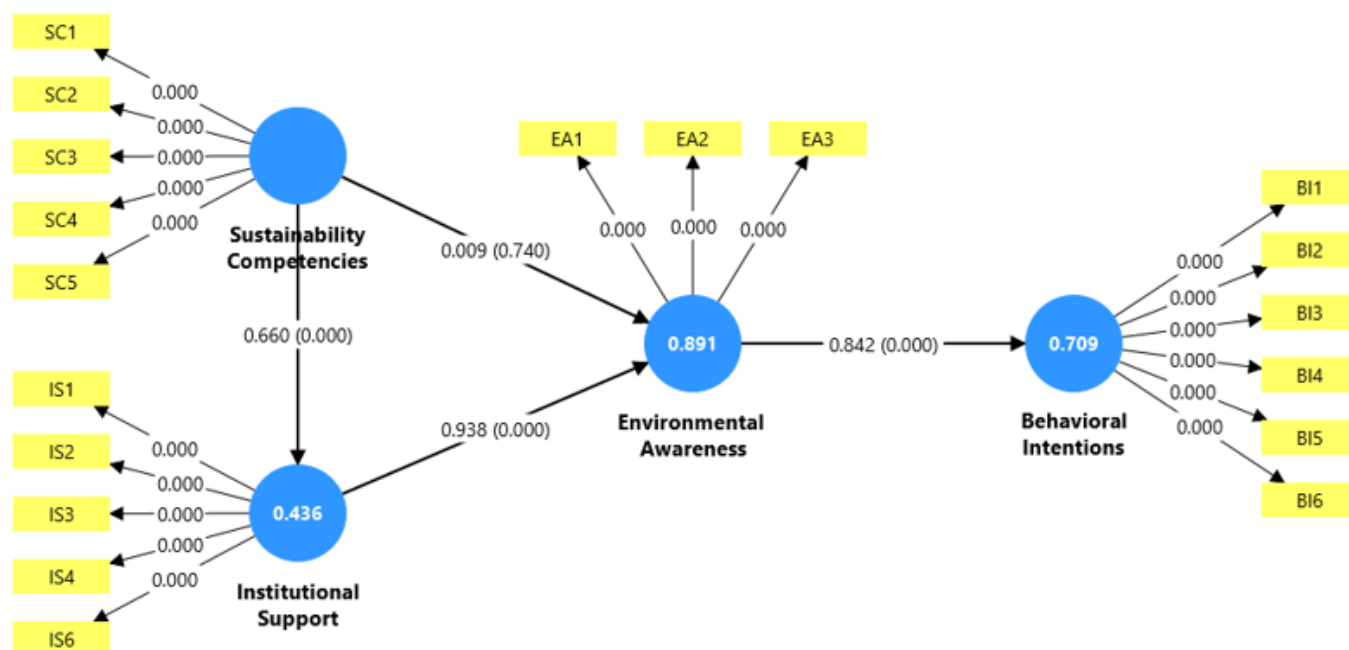
Figure 2. Final model (Source: Authors' own elaboration, using Smart PLS-SEM)

Table 5. Path coefficients of mediation analysis

Path	Beta (β)	T values	p-values	Result
Sustainability Competencies → Environmental Awareness→ Behavioral Intentions	0.008	0.330	0.741	Not Supported
Institutional Support → Environmental Awareness→ Behavioral Intentions	0.790	34.253	0.000	Supported
Sustainability Competencies → Institutional Support → Environmental Awareness	0.619	18.299	0.000	Supported

institutional environmental performance moderates this relationship. These findings highlight the importance of institutional support in enhancing environmental awareness, which fosters stronger behavioral intentions toward sustainability.

Path Coefficients of the Mediation Analysis

Table 5 presents the path coefficients for the mediating effects of institutional support and environmental awareness. The analysis reveals that sustainability competencies do not significantly influence behavioral intentions through environmental awareness (β = 0.008, p = 0.741), indicating that knowledge alone may be insufficient to motivate sustainable behavior—consistent with earlier studies that highlight the gap between awareness and action (Wiek et al., 2015). Conversely, institutional support has a strong, significant indirect effect on behavioral intentions through environmental awareness (β = 0.790, p < 0.001), underscoring its critical role in fostering environmentally responsible behavior, as supported by prior research emphasizing the importance of institutional frameworks in translating awareness into action (Cebrián et al., 2012; Wiek et al., 2015). Additionally, sustainability competencies significantly affect environmental awareness when mediated by institutional support (β = 0.619, p < 0.001), reinforcing findings from Tilbury (2011) that institutional support systems amplify the impact of individual knowledge and skills. Unlike some previous studies focusing primarily on individual

competencies, this study highlights the necessity of integrating institutional strategies—such as supportive policies, green initiatives, and incentive systems—with curriculum design to effectively promote and sustain sustainable behavioral intentions among university students.

CONCLUSION AND RECOMMENDATIONS

This study concludes that institutional support plays a crucial role in enhancing environmental awareness and shaping students' behavioral intentions toward sustainability, directly addressing the research problem of how sustainability competencies translate into real-world actions. The analysis showed that sustainability competencies alone do not have a direct effect on awareness or intentions but become significantly influential when supported by institutional factors, highlighting the importance of environments that enable students to apply their knowledge effectively. Insights gathered also reflect how institutional initiatives—such as sustainability training and campus programs—provide the practical context needed to turn competencies into behavior. A key implication is that knowledge must be paired with strong institutional backing to foster genuine awareness and motivate sustainable practices among students. One limitation of the study is the use of self-reported measures, which may introduce bias and affect the reported levels of awareness and intention. Future investigations should explore other pathways through which sustainability competencies

influence environmental awareness, given the absence of a direct link in this study. Since institutional support emerged as a significant mediator, it is vital for policymakers and educators to enhance sustainability programs and policies within institutions. Strengthening such frameworks—through targeted projects, educational workshops, and incentive systems—can elevate awareness and encourage long-term behavioral change. Moreover, examining these dynamics over time could provide a deeper understanding of how competencies and institutional factors interact to shape sustainability-related behaviors. Fostering robust institutional environments is key to developing a more environmentally conscious and proactive generation.

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