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Environmental Sustainability: From Awareness to Action. A Case Study from Greek Universities

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ABSTRACT

Understanding the relationship between environmental knowledge, attitudes, and behaviors is essential for promoting sustainable practices, especially among young adults. Despite growing global concern about environmental issues, a persistent gap remains between what individuals know, how they feel about these issues, and how they act. This study examines that gap by exploring how environmental knowledge and attitudes influence sustainable behavior among university students in Greece. Drawing on preliminary findings from a pilot survey, this study investigates the extent to which students' knowledge is related to their attitudes and engagement in pro-environmental actions. The results revealed a notable knowledge gap, yet environmental knowledge was positively associated with both attitudes and behaviors. While attitudes were also linked to behavior, they did not mediate the relationship between knowledge and action. These findings suggest a direct connection between environmental knowledge and sustainable behavior, highlighting the complexity of the knowledge–attitude–behavior dynamic. The study offers a valuable foundation for future research and practical insights for developing more effective educational programs and sustainability initiatives.

Keywords: Environmental Awareness, Environmental Engagement, Environmental Knowledge, Knowledge-Action Gap, Pro-environmental Behavior.

INTRODUCTION

Environmental awareness refers to an individual's cognitive understanding of environmental issues and the urgency of protecting the planet [1-2]. This awareness encompasses not only factual knowledge but also a level of internalization that influences one's attitudes and behaviors [3]. It is a foundational concept in understanding how environmental knowledge and attitudes can influence actions related to sustainability. Recent studies emphasize that environmental education, when delivered in a clear and practical way, can significantly influence behavior. When people understand not only the rationale behind but also the practical implementation of environmental action, they are more likely to integrate sustainable practices into their lives [1,4]. Knowledge appears to be a more consistent predictor of pro-environmental behavior than attitude alone.

While various educational initiatives and campaigns have aimed to raise awareness about issues such as climate change, deforestation, and pollution, knowledge alone does not always translate into action. Previous studies have highlighted a consistent discrepancy between environmental awareness and actual behavior, often described as the knowledge–attitude–behavior (KAB) gap or the behavior–impact gap (BIG) [5]. For example, individuals may express concern about climate change but continue engaging in high-carbon activities, indicating that awareness or attitude alone may be insufficient for behavioral change [6]. Bridging this gap requires not only knowledge but also personal engagement and actionable understanding [7].

Generation Z, having grown up in a fast-paced, tech-driven era, is particularly relevant in this context. Their decision-making is often shaped by digital trends, speed, and immediacy, which can influence how they engage with environmental issues [1,8]. Although this generation often expresses high concern for the environment, their actions do not always reflect these values. This inconsistency—often referred to as the "green gap"—reflects the disconnect

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between intention and action [3]. Factors such as social norms and perceived behavioral control can affect their environmental behaviors, including recycling and sustainable consumption [9]. Moreover, Gen Z consumers are often skeptical and tend to respond negatively to greenwashing tactics, thereby reinforcing their distrust of sustainability claims made by brands [10]. Lack of transparency around Environmental, Social, and Governance (ESG) practices leads many to doubt the authenticity of brands' sustainability efforts [11, 12]. Still, Generation Z holds significant potential as a driver of sustainability. Their active presence on social media platforms and increasing exposure to environmental content enhance their awareness, potentially influencing more eco-conscious purchasing and lifestyle decisions [13]. Their role in shaping societal norms around sustainability is crucial, especially as they are the generation most likely to be affected by environmental degradation [14].

Given this landscape, the present study aims to investigate the relationship between environmental knowledge, attitudes, and behavior among university students in Greece. By analyzing how these variables interact, the research seeks to contribute to the broader academic discussion on the knowledge–attitude–behavior gap and compare the findings with those of previous studies. This comparison will provide insight into how the patterns observed in the Greek university context align with or diverge from international research on sustainable behavior among young adults.

LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

Environmental knowledge is widely recognized as a key factor in shaping pro-environmental attitudes and influencing environmentally responsible behaviors. Numerous studies have found a statistically significant relationship between environmental knowledge and sustainable behavior, indicating that individuals who possess more knowledge are more likely to engage in environmentally responsible actions [15-17]. For example, Kim et al. [18] developed a model that reveals a direct relationship between a tourist's environmental knowledge and responsible behaviors in nature-based tourism contexts, further supporting the notion that knowledge influences action.

However, the relationship between knowledge and behavior is often not straightforward. Many scholars argue that attitudes serve as a critical mediating factor in this relationship. Dopelt et al. [19] found that the influence of knowledge on behavior weakens when attitudes are taken into account, suggesting that knowledge does not automatically lead to behavioral change. Pe'er et al. [20] similarly emphasized that emotional and value-based components—reflected in attitudes—are essential for converting knowledge into behavior.

These findings support the Knowledge-Attitude-Behavior (KAB) model, which proposes that knowledge influences attitudes, which in turn influence behavior. Despite critiques of its simplicity, the model remains widely used and empirically supported. A strong linear connection between environmental knowledge and attitudes has been confirmed [21-22], while attitudes have consistently been shown to foster environmentally responsible behaviors [23-25].

Building on this foundation, our research adopts the KAB model as a framework to explore the dynamics of environmental awareness. Specifically, we propose the following hypotheses:

H1: Environmental knowledge has a positive influence on pro-environmental attitudes.

H2: Pro-environmental attitudes have a positive influence on environmentally responsible behaviors.

H3: Environmental knowledge has a direct, positive effect on pro-environmental behaviors.

H4: Attitudes mediate the relationship between environmental knowledge and behavior.

These hypotheses aim to test whether knowledge exerts both direct and indirect effects on behavior by forming attitudes.

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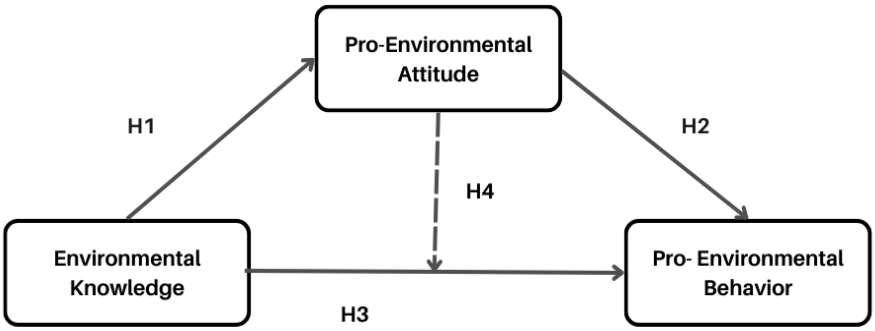

Figure 1. Conceptual framework based on the Knowledge-Attitude-Behavior (KAB) model

This model illustrates the hypothesized relationships tested in the study, where environmental knowledge directly and indirectly (via attitudes) influences pro-environmental behavior.

In support of these propositions, previous studies have shown that knowledge enables individuals to evaluate environmental issues more effectively, develop coherent views, and act accordingly [26]. Levine and Strube [27] found that ecological knowledge significantly predicted pro-environmental attitudes, while Patwary et al. [28] demonstrated that such knowledge fosters ecocentric values, which in turn drive sustainable consumption. Similarly, environmental education initiatives have been effective in enhancing knowledge and improving conservation attitudes [29].

An important consideration in this discussion is the distinction between objective knowledge (factual understanding) and subjective knowledge (perceived understanding). Janmaimool and Khajohnmanee [30] suggest that this distinction deepens our understanding of how individuals internalize environmental information. Interestingly, some studies have found that subjective knowledge can be a stronger predictor of behavior than objective knowledge. People who believe they are knowledgeable often show greater willingness to act [31-32], which adds a layer of complexity to the knowledge-behavior link.

The mediating role of attitudes in the KAB model has been highlighted in several studies. Dopelt et al. [19] noted that while knowledge is essential, it is positive attitudes that more directly improve pro-environmental behavior, emphasizing that knowledge alone may not be sufficient to instigate behavioral change. This pattern has been echoed in other contexts as well. For instance, Ceylan [33] found that sustainability attitudes significantly predicted green behaviors, and Alfonsius and Gilbert [34] observed that environmental knowledge shaped purchasing attitudes, which in turn influenced eco-friendly buying choices. Jadgal et al. [35] and Yasaroh et al. [36] also confirm the KAB pathway in broader domains of environmental literacy.

However, complexity exists within the KAB model, as not all studies find direct correlations between knowledge and behavior. Hermawan et al. [37] found that the knowledge-behavior link was weaker than the attitude-behavior link, highlighting that attitudes may be more effective levers for behavior change. Rezaei et al. [38] further argue that focusing solely on knowledge may not be sufficient and that interventions should prioritize shaping positive environmental attitudes. Additional evidence supports this view, suggesting that environmental knowledge initially seemed to influence green purchasing intentions; however, the effect became statistically insignificant once attitudes were controlled for, especially among Generation Z [39]. This finding strengthens the argument that attitudes mediate the impact of knowledge on behavior, suggesting that interventions targeting attitudes may be more effective in shaping environmental actions.

This insight highlights the knowledge-attitude-behavior gap, which refers to the disconnect between what individuals know, how they feel, and their actual behavior. Bashirun and Noranee [40] found no significant correlation between environmental knowledge and attitudes and actual environmental practices in the workplace in their study on employee green behavior. This emphasizes the complexity of translating awareness and positive sentiment into real-world action. Similarly, Kozar and Connell [41] observed that although participants had relatively high environmental knowledge, their sustainable apparel purchasing behaviors were limited. Irfany et al. [42] further reported that while

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knowledge shaped positive attitudes among Muslim Gen Z consumers, it did not always translate into eco-conscious behavior. These inconsistencies underscore that while knowledge and attitudes are important, behavior is also influenced by contextual, structural, and motivational factors. Bridging the gap between knowing, feeling, and doing requires a multifaceted approach that not only informs and persuades but also empowers individuals and removes barriers to action.

In summary, environmental knowledge is a key driver of pro-environmental attitudes and behaviors, but its impact is not always direct or sufficient. The KAB model offers a useful framework for examining these relationships. By testing the proposed hypotheses, this research seeks to clarify the extent to which knowledge influences behavior directly and indirectly through attitudes, providing insight into how environmental awareness can be more effectively translated into meaningful, sustained behavioral change.

METHODOLOGY

This study employed a quantitative cross-sectional, pilot research design using a structured questionnaire to examine the relationships among university students' environmental knowledge, pro-environmental attitudes, and pro-environmental behavior. Data were collected in April 2025 during scheduled university classroom sessions. Participation was voluntary and anonymous; students were requested to complete all three sections of the questionnaire:

Environmental Knowledge was assessed using a multiple-choice quiz. Some of these items were adapted from Zwickle and Jones [43], while additional items were developed by the researchers to better align with the study's specific aims. The questions were designed to assess factual understanding rather than self-perceived knowledge. Topics covered include core issues in environmental sustainability, as well as current challenges such as circular economy practices and national climate policy targets. Participants' scores were recorded as a percentage of correct responses.

Pro-environmental attitudes were measured using 10 Likert-scale items (1 = strongly disagree to 5 = strongly agree) adapted from previously validated instruments in the environmental psychology literature [44-46]. These items explored the participants' concerns about environmental issues, personal responsibility, and support for environmental action.

Self-reported pro-environmental behaviors were assessed using 12 Likert-scale items based on prior validated questionnaires that capture everyday environmentally responsible practices, including recycling, energy-saving actions, and environmental advocacy [44- 45, 47-48].

All items were adapted from previously validated instruments, ensuring content and construct validity. Minor modifications were made to the wording to suit the target population and research context while maintaining each item's original meaning. Internal consistency was evaluated using Cronbach's alpha. The pro-environmental attitude scale (10 items) demonstrated acceptable reliability (α = .716), while the behavior scale (12 items) showed high reliability (α = .861), indicating that both scales were suitable for further analysis.

Although the Likert scales yield ordinal data, given the number of response categories (five or more), they were treated as continuous variables in the analysis, in line with established research practices [49-50]. This allowed for the use of parametric tests such as linear regression.

Table 1. Overview of questionnaire

Section	Type of questions
Environmental knowledge	Multiple-choice quiz assessing factual knowledge on sustainability, circular economy, and climate policy.
Pro-environmental attitudes	10 Likert-scale items (1 = strongly disagree to 5 = strongly agree) on concern, responsibility, and support.
Pro-environmental behavior	12 Likert-scale items on self-reported behaviors (e.g., recycling, energy-saving, advocacy)

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Data was analyzed using SPSS. Descriptive statistics were calculated first. Due to the small sample size and non-normality in the attitude variable, Spearman's rank-order correlation was used to examine bivariate relationships. The following hypotheses were tested through linear regression and mediation analysis:

H1: Environmental knowledge positively predicts pro-environmental attitudes.

H2: Pro-environmental attitudes positively predict pro-environmental behaviors.

H3: Environmental knowledge directly predicts pro-environmental behaviors.

H4: Pro-environmental attitudes mediate the relationship between environmental knowledge and pro-environmental behaviors.

Before the regression analyses, assumptions such as linearity, normality of residuals, homoscedasticity, and independence of errors were evaluated through diagnostic plots and the Durbin-Watson statistic.

To test H4, a mediation analysis was conducted using the PROCESS macro for SPSS (Model 4; [51]), with environmental knowledge as the independent variable, pro-environmental behavior as the dependent variable, and attitudes as the mediator. Bootstrapped confidence intervals were used to evaluate the significance of the indirect effect.

Finally, Spearman's rank-order correlation was employed as a non-parametric alternative to Pearson's correlation, due to violation of normality in the attitude variable, as indicated by the Shapiro-Wilk test ($p = .037$). Correlation strengths were interpreted according to Cohen's [52] guidelines.

RESULTS

Sample Characteristics and Descriptive Statistics

The pilot sample included 54 young adults (59.3% female, 40.7% male) aged 18–28. Most participants (87%) held a high school diploma, and 13% a university degree.

Table 2. Demographics

Demographic Variable	Category	Frequency (N)	Percentage (%)
Gender	Male	22	40.7%
	Female	32	59.3%
	Total	*54*	*100.0%*
Age Group	18–28 years old	54	100.0%
	Total	*54*	*100.0%*
Educational Level	High School Degree	47	87.0%
	University Degree	7	13.0%
	Total	*54*	*100.0%*

Descriptive statistics were calculated for environmental knowledge, pro-environmental attitude, and pro-environmental behavior (see Table 2). The results indicated that participants had relatively low environmental knowledge ($M = 41.46$, $SD = 15.51$), yet reported moderately high attitudes ($M = 3.77$, $SD = 0.57$) and behaviors ($M = 3.68$, $SD = 0.50$) on 5-point Likert scales. This contrast already suggests a potential disconnect between environmental knowledge and engagement, a core issue explored further.

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Table 3. Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Knowledge score	54	8	83	41.46	15.513
ProEnvironmentalAttitude_Total	54	2.40	4.75	3.7685	.57320
ProEnvironmentalBehavior_Total	54	2.50	4.67	3.6795	.49787
Valid N (listwise)	54				

Correlational Analysis

Due to the non-normal distribution of the attitude variable (Shapiro-Wilk $p = .037$), Spearman's rank-order correlations were used:

Environmental knowledge and pro-environmental attitude: $r_s = .66$, $p < .001$ (strong positive)

Environmental knowledge and behavior: $r_s = .54$, $p < .001$ (moderate positive)

Attitude and behavior: $r_s = .41$, $p = .002$ (moderate positive)

Table 4. Spearman's Correlation Matrix Among Environmental Knowledge, Attitudes, and Behaviour

Spearman's rho		Environmental Knowledge	Environmental Attitudes	Environmental Behaviour
Environmental Knowledge	Correlation Coefficient	1.000	.662**	.538**
	Sig. (2-tailed)	–	< .001	< .001
	N	54	54	54
Environmental Attitudes	Correlation Coefficient	.662**	1.000	.413**
	Sig. (2-tailed)	< .001	–	.002
	N	54	54	54
Environmental Behaviour	Correlation Coefficient	.538**	.413**	1.000
	Sig. (2-tailed)	< .001	.002	–
	N	54	54	54

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

Hypothesis Testing

H1: Environmental knowledge → Pro-environmental attitudes

A linear regression analysis examined whether environmental knowledge significantly predicted pro-environmental attitudes. The regression model was statistically significant, $F(1, 52) = 33.52$, $p < .001$, explaining 39.2% of the variance in pro-environmental attitudes (adjusted $R^2 = 38.0\%$). The prediction equation was: Pro-environmental attitudes = 2.81 + 0.023 × (Knowledge score).

Environmental knowledge was a significant positive predictor of pro-environmental attitudes, $\beta = 0.626$, $t(52) = 5.79$, $p < .001$, indicating that higher environmental knowledge is associated with stronger pro-environmental attitudes.

H1 supported. Higher environmental knowledge was associated with stronger pro-environmental attitudes.

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H2: Pro-environmental attitudes → Pro-environmental behavior

The regression model was statistically significant, $F(1, 52) = 9.28$, $p = .004$, explaining 15.1% of the variance in pro-environmental behavior (adjusted $R^2 = 13.5\%$). The prediction equation was: Pro-environmental behavior = 2.41 + 0.34 × (Pro-environmental attitudes).

Pro-environmental attitudes were a significant positive predictor of pro-environmental behavior, $\beta = 0.389$, $t(52) = 3.05$, $p = .004$, indicating that individuals with stronger pro-environmental attitudes tend to engage more in pro-environmental behaviors.

H2 supported. Stronger attitudes predicted more pro-environmental behaviors.

H3: Environmental knowledge → Pro-environmental behavior

The regression model was significant, $F(1, 52) = 12.61$, $p < .001$, accounting for 19.5% of the variance (adjusted $R^2 = 18.0\%$).The prediction equation was: Pro-environmental behavior = 3.09 + 0.014 × (Knowledge score).

Environmental knowledge was a significant positive predictor of pro-environmental behavior, $\beta = 0.442$, $t(52) = 3.55$, $p < .001$, indicating that higher environmental knowledge is associated with greater engagement in pro-environmental behaviors.

H3 supported. Higher knowledge was linked to more frequent pro-environmental behaviors.

H4: Mediation – Attitudes mediating the relationship between knowledge and behavior

Mediation analysis using PROCESS (Model 4) showed that the total effect of environmental knowledge on pro-environmental behavior was statistically significant, $B = 0.014$, $SE = 0.004$, $t(52) = 3.55$, $p < .001$. When attitudes were included in the model as a mediator, the direct effect of knowledge remained statistically significant, $B = 0.011$, $SE = 0.005$, $t(51) = 2.05$, $p = .046$. However, the indirect effect of knowledge on behavior through attitudes was not statistically significant, 95% CI [−0.0018, 0.0101], indicating no evidence of mediation. Thus, while environmental knowledge predicts both attitudes and behavior, the mediating role of attitudes in this relationship was not supported.

H4 is not supported. Although attitudes predicted behavior, they did not significantly mediate the knowledge-behavior link.

DISCUSSION

These findings contribute to the ongoing discussion on the knowledge-attitude-behavior (KAB) gap in environmental psychology. While a partially linear relationship among the variables was observed, the lack of a significant mediation effect suggests that the path from knowledge to behavior is more complex than traditionally assumed.

The strong association between environmental knowledge and attitudes (H1) contrasts with prior studies [53-54], which reported weak or non-significant correlations. This divergence may reflect cultural, contextual, or generational differences, especially considering the rising public discourse around environmental issues. Nonetheless, the present findings support earlier arguments [55-56], emphasizing that while knowledge may be necessary, it is insufficient to shift attitudes or drive behavioral change. Similarly, studies [27-28] found that ecological knowledge significantly predicted pro-environmental attitudes, reinforcing the idea that knowledge can help shape value-based orientations and environmental awareness.

Regarding the direct effect of environmental knowledge on behavior (H3), the results align with previous researchers [57-58], who reported similar moderate associations. In contrast, studies [59-60] highlight the limitations of knowledge-based interventions, particularly when factors such as environmental values, self-efficacy, or social norms are not addressed. These findings suggest that although environmental knowledge has a measurable effect on behavior, it is not the sole determinant. The current study aligns with these findings, yet suggests that other factors, such as emotional engagement or perceived control, may also play a significant role in shaping environmentally responsible behavior.

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The non-significant mediation of attitudes (H4) reinforces findings [61-63], which argue that behavioral outcomes depend not only on what individuals know or feel but also on affective, normative, and contextual factors. Emotional engagement, environmental identity, and perceived behavioral control may all act as stronger mediators or moderators in the knowledge-behavior dynamic. These results support the arguments [37- 38], which suggested that attitudes alone might not be sufficient to generate behavior change. This underscores the significance of addressing both cognitive and emotional components in interventions designed to promote pro-environmental behavior.

Finally, the moderate correlation between attitudes and behavior (H2) confirms previous work [64], who noted that while positive attitudes support environmentally responsible behavior, they are not the sole drivers. This further illustrates the importance of multi-dimensional interventions beyond awareness-raising, focusing on strengthening motivation, opportunity, and behavioral capacity. These findings echo the Theory of Planned Behavior [65], which positions attitudes as just one component of a broader set of behavioral determinants, alongside subjective norms and perceived control.

CONCLUSIONS AND RECOMMENDATIONS

Key Findings and Implications

This pilot study confirmed that environmental knowledge, attitudes, and behavior are interrelated. However, the absence of a significant attitude mediation effect highlights the non-linear and complex nature of the knowledge-to-action pathway. While environmental knowledge significantly predicted both pro-environmental attitudes and behaviors, attitudes did not serve as a mediator between the two.

One possible explanation is that environmental knowledge may directly influence behavior, without necessarily requiring a change in attitudes. Individuals who are well-informed about environmental issues might engage in pro-environmental actions based on a sense of responsibility, awareness, or moral obligation, even if their attitudes are not deeply held or fully aligned with their behaviors.

Another explanation could be that the attitude-behavior link may be shaped by additional unmeasured variables, such as social norms, perceived behavioral control, emotional engagement, or situational constraints, which were not included in the current model. These external and internal factors may either enhance or inhibit the translation of knowledge and attitudes into concrete behavioral outcomes. Moreover, it is worth considering that the relatively small sample size may have limited the statistical power needed to detect a significant indirect effect, potentially obscuring subtle mediating relationships.

This raises questions about the adequacy of educational programs that depend heavily on cognitive components without fostering emotional and behavioral engagement. The findings indicate that while environmental knowledge can influence attitudes, this is insufficient to create consistent behavioral change. Other factors—such as emotional engagement, perceived behavioral control, and contextual or normative influences—may be more crucial in motivating action. Therefore, interventions promoting pro-environmental behavior should embrace a more holistic approach, addressing cognitive and affective components to effectively bridge the knowledge-attitude-behavior gap.

Practical Recommendations for Educational and Institutional Sustainability Initiatives

In light of the findings, reorienting sustainability education and institutional practices is necessary to foster more meaningful and lasting pro-environmental behavior. Traditional approaches focusing primarily on transmitting environmental knowledge must evolve toward more holistic and participatory models [66].

First, environmental education should move beyond merely disseminating facts and embrace experiential learning, critical reflection, and value-based discussions [67]. This approach enables learners to connect cognitively and emotionally with environmental issues, increasing their sense of relevance and personal responsibility.

Second, fostering self-efficacy among students is essential. Educational programs should include practice-based assignments, real-world problem-solving, and exposure to positive role models who demonstrate sustainable behavior [58,68]. Students who feel that their actions matter are more likely to adopt and maintain environmentally responsible habits.

Third, sustainability should be integrated across all academic disciplines. Environmental thinking must not be confined to the natural sciences; it should inform fields such as economics, design, law, and the humanities. A transdisciplinary approach enhances the visibility and applicability of sustainability principles in diverse contexts [69-70].

Fourth, peer and community involvement are vital in shaping norms and behaviors. Institutions can support peer-led initiatives and collaborative projects that promote collective engagement and make sustainable behavior the social norm within academic communities [71-72].

Finally, educational content and strategies must be adapted to different levels of cognitive development and prior knowledge. A one-size-fits-all approach is unlikely to be effective; instead, sustainability education should be differentiated and inclusive, meeting students where they are in their learning journey [73-74].

By implementing these recommendations, educational institutions can move closer to bridging the knowledge-attitude-behavior gap and cultivating a generation of critically aware, emotionally engaged, and action-oriented citizens.

LIMITATIONS AND FUTURE RESEARCH DIRECTIONS

As this is a pilot study, the small and homogeneous sample limits generalizability. Future research should include larger, more diverse samples, longitudinal designs to examine causal effects, the inclusion of additional constructs such as values, identity, and social influence, and behavioral measures beyond self-reports. Ultimately, future research must adopt holistic models that combine cognition, emotion, and context to better understand and promote sustainable behavior.

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