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The Impact of Environmental Conservation Courses on University Students' Pro-Environmental Behaviors

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Abstract. This study examines the impact of university environmental conservation courses on students' pro-environmental behavioral intentions using the Theory of Planned Behavior (TPB). Structural equation modeling (SEM) was employed to analyze data from 296 valid student responses. Results indicate that participation in environmental courses (ECP) significantly enhances students' attitudes (AT), subjective norms (SN), and perceived behavioral control (PBC) toward environmental conservation. Additionally, AT, SN, and PBC exhibit significant positive effects on behavioral intention (BI), reinforcing the predictive power of TPB. The findings highlight the role of environmental education in fostering students' environmental responsibility, increasing social support perception, and strengthening confidence in their ability to engage in sustainable practices. By integrating environmental education into university curricula, institutions can cultivate environmentally conscious behaviors and contribute to long-term sustainability goals. This study underscores the necessity of promoting and expanding environmental education to enhance students' environmental engagement and encourage proactive environmental actions in broader societal contexts.

Keywords: Environmental Education, Pro-Environmental Behavior, Structural Equation Modeling, Theory of Planned Behavior.

1. INTRODUCTION

Taiwan's diverse topography and climatic variations have fostered a rich biodiversity, with many species endemic to the region. However, rapid industrialization and population growth have led to habitat degradation and the endangerment of numerous species, underscoring the urgent need for conservation strategies (Chou & Tang, 2016). In 2010, Taiwan enacted the Environmental Education Act to emphasize pollution mitigation and enhance public awareness, understanding, and engagement in environmental issues (Horng et al., 2024). Hsu and Feng (2019) argue that environmental education plays a crucial role in shaping public attitudes and behaviors toward conservation, asserting that increased environmental knowledge and pro-environmental attitudes positively contribute to conservation efforts in Taiwan.

A growing number of higher education institutions are incorporating environmental stewardship initiatives into their University Social Responsibility (USR) frameworks, aligning them with academic curricula (Vásquez Tomás et al., 2023; Vergara, 2023). Ivanova and Martínez de la Torre (2020) emphasize that environmental education is a fundamental component of USR, highlighting the need to integrate environmental issues into curricula to drive research on sustainable development. Environmental conservation courses aim to raise students' awareness of ecological challenges, promote sustainable practices, and foster attitudes consistent with conservation ethics. For instance, Sookngam et al. (2021) found that students in Thailand who participated in environmental education programs demonstrated significantly improved knowledge of conservation topics, including soil, water, and forest preservation. Similarly, Brown et al. (2020) reported that Indonesian students enhanced their understanding of local biodiversity after engaging in such educational programs. Su and Chen (2023) further suggest that participation in these courses leads to substantial improvements in students' environmental literacy. These findings highlight the critical role of educational institutions in preparing future generations to address pressing environmental concerns.

The impact of environmental conservation courses on university students' behaviors is multifaceted, influencing their awareness, attitudes, and actions. While numerous studies indicate that students who take such courses gain greater environmental awareness and develop positive attitudes, their actual engagement in pro-environmental behaviors remains limited. This underscores the complexity of behavior change, which is shaped by both internal and external factors (Jamaludin et al., 2023; Rubić & Pavelić, 2023; Genovese, 2022; Erwinsyah, 2022). To better understand the transition from intention to behavior, this study employs the Theory of Planned Behavior (TPB) to systematically examine how students' participation in environmental conservation courses influences their pro-environmental behaviors. This theoretical framework facilitates an exploration of the interactions among attitudes, subjective norms, and perceived behavioral control in shaping students' intentions and subsequent actions in environmental contexts.

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2. LITERATURE REVIEW

The Theory of Planned Behavior (TPB) is a widely recognized framework in social psychology that explains human behavior through the interplay of attitudes, subjective norms, and perceived behavioral control (PBC). Developed as an extension of the Theory of Reasoned Action (TRA) by Ajzen and Fishbein, TPB addresses TRA's limitations by incorporating PBC to account for factors that may facilitate or hinder behavior, thereby enhancing the model's predictive power (Mahyarni, 2013; Kiriakidis, 2017). Over the decades, TPB has been extensively applied across various fields, with its empirical robustness validated through numerous studies, solidifying its status as a reliable framework for behavior prediction (Lee & Vincent, 2021). This study adopts TPB as its conceptual framework to analyze the effects of university students' attitudes, subjective norms, and perceived behavioral control on their environmental behaviors in the context of environmental course participation.

2.1. Environmental Curriculum Participation (ECP) and Attitudes (AT)

Multiple studies have demonstrated that students' participation in environmental courses significantly influences their environmental attitudes. For example, Li et al. (2024) assert that environmental education substantially enhances students' pro-environmental attitudes. Syed Abdullah (2020) argues that environmental courses provide immersive experiences that deepen students' connection with nature, positively shaping their environmental attitudes and behaviors. Janmaimool and Khajohnmanee (2019) found that students who took environmental courses exhibited significantly stronger pro-environmental attitudes than those who did not. Accordingly, this study proposes the following hypothesis:

Hypothesis 1 (H1): Environmental Curriculum Participation (ECP) has a significant effect on attitude (AT).

2.2. Environmental Course Participation (ECP) and Subjective Norm (SN)

Mueller et al. (2018) found that subjective norms were the strongest predictor of students' intention to participate in environmental sustainability organizations, suggesting that engaging in environmental courses enhances students' inclination toward environmental behavior. Additionally, Ting and Cheng (2017) argue that environmental courses significantly influence subjective norms by fostering a sense of social responsibility and community engagement, ultimately strengthening students' commitment to environmental protection. Therefore, this study proposes the following hypothesis:

Hypothesis 2 (H2): Environmental Curriculum Participation (ECP) has a significant effect on subjective norms (SN).

2.3. Environmental Curriculum Participation (ECP) and Perceived Behavioral Control (PBC)

Participation in environmental courses can enhance students' perceived control over environmental actions, thereby strengthening their intention and execution of pro-environmental behaviors (Hsu, 2004; Lin et al., 2021; Smith-Sebasto, 1995; Tsai & Tan, 2022). Additionally, PBC mediates the relationship between attitudes and intentions (Lin et al., 2021), reinforcing the link between intentions and behavior by boosting individuals' confidence in their ability to act environmentally responsibly (Mak et al., 2020; Yuriev et al., 2020). Kotyza et al. (2024) highlight that PBC is a crucial predictor of environmental behavioral intentions within the TPB framework. Accordingly, this study posits the following hypothesis:

Hypothesis 3 (H3): Environmental Curriculum Participation (ECP) has a significant effect on perceived behavioral control (PBC).

2.4. Attitudes (AT) and Behavioral Intentions (BI)

Numerous studies confirm that attitudes significantly influence behavioral intentions. For example, Bharti et al. (2024) found that consumer attitudes toward green products play a crucial role in shaping purchase intentions. Rahmawati et al. (2024) suggest that university students' environmental attitudes are key determinants of behavioral intentions. De Vera et al. (2023) also indicate that residents' attitudes strongly influence their intention to engage in environmental behaviors, with positive attitudes fostering sustained pro-environmental actions. Based on these findings, this study proposes the following hypothesis:

Hypothesis 4 (H4): University students' environmental attitudes (AT) have a significant effect on their behavioral intentions (BI).

2.5. Subjective Norms (SN) and Behavioral Intentions (BI)

Empirical studies highlight the impact of subjective norms on behavioral intentions. For instance, Rahmawati et al. (2024) found that subjective norms significantly shape university students' pro-environmental intentions. Febrianto et al. (2024) revealed that subjective norms influenced by family and peers play a crucial role in consumers' decisions to choose eco-friendly accommodations. Xu et al. (2022) further emphasize that subjective norms strongly affect consumers' intention to purchase green products, underscoring the role of social influence in promoting environmentally responsible consumption. Thus, this study proposes the following hypothesis:

Hypothesis 5 (H5): University students' subjective norms (SN) have a significant effect on their behavioral

intentions (BI).

2.6. Perceived Behavior Control (PBC) and Behavioral Intentions (BI)

Behavioral intention is a core component of the Theory of Planned Behavior (TPB), representing motivational factors that influence actual behavior. Stronger intentions are associated with a higher likelihood of executing the intended behavior (Hagger, 1998). According to La Barbera and Ajzen (2018), behavioral intentions are affected by attitudes toward the behavior, subjective norms, and perceived behavioral control (PBC). Notably, PBC can moderate the influence of attitudes and subjective norms on intentions, enhancing or weakening these effects depending on the level of perceived control. Sniehotta et al. (2006) suggest that perceived behavioral control serves as a self-regulatory process that bridges the gap between behavioral intentions and actual behavior. Wang and Mangmeechai (2021) identified behavioral control as a critical factor influencing behavioral intentions and facilitating the implementation of environmental behaviors. Therefore, this study posits the following hypotheses:

Hypothesis 6 (H6): Perceived behavioral control (PBC) among university students participating in the course has a significant effect on behavioral intentions (BI).

3. METHODOLOGY

3.1. Research Framework

This study employs the Theory of Planned Behavior (TPB) as the theoretical framework to investigate college students' behavioral intentions following their participation in environmental conservation courses. Figure 1 presents the research framework, illustrating the structural relationships among the variables.

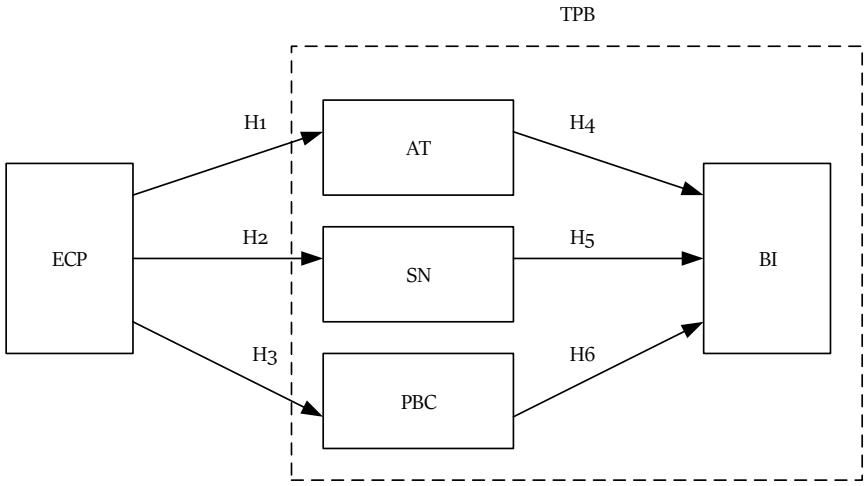

Figure 1: Research framework.

3.2. Questionnaire Design

The questionnaire items were developed based on a comprehensive review of relevant literature and utilized a five-point Likert scale, where 5 represents "strongly agree" and 1 represents "strongly disagree." The demographic information collected included students' gender, academic year, monthly income (including pocket money), and college classification. Table 1 presents the detailed questionnaire design.

Table 1: Constructs or variables and their corresponding statements of measurement included in the questionnaire

Construct/Variable	Measuring Items
Attitude (AT)	AT1: I believe everyone has a responsibility to protect the environment.
	AT2: I am willing to change my daily habits to protect the environment.
	AT3: I believe protecting the environment is crucial for future generations.
	AT4: I am willing to spend more to reduce environmental pollution.
	AT5: I believe environmental actions can improve the quality of life.
	AT6: I believe participating in environmental courses raises environmental awareness.
	AT7: Participating in environmental courses increases my sense of responsibility for environmental protection.
	AT8: Environmental courses have made me realize the significant impact of individual actions on the environment.
	AT9: After participating in environmental courses, I am more concerned about environmental issues.
Subjective Norms (SN)	SN1: My family and friends think that attending environmental courses is important for protecting the environment.
	SN2: People I respect encourage me to participate in environmental activities.
	SN3: Society believes that people should be responsible for the environment.
	SN4: Society believes our generation should focus more on environmental issues.
Perceived Behavioral Control (PBC)	PBC1: After attending environmental courses, I find it easier to engage in environmentally friendly behaviors.
	PBC2: I am capable of taking actions to protect the environment.
	PBC3: Even without external help, I can make environmentally friendly choices.
	PBC4: I have enough knowledge and resources to protect the environment.
	PBC5: When needed, I can influence others to engage in environmentally friendly actions.
Behavioral Intention (BI)	BI1: I intend to implement the environmentally friendly behaviors I learned in the environmental courses in the future.
	BI2: I feel that participating in environmental courses will make me more concerned about environmental issues.
	BI3: Participating in environmental courses motivates me to engage in environmental protection activities.
	BI4: I would recommend my friends to participate in environmental courses.

3.3. Sample Size and Composition

A total of 350 questionnaires were distributed to college students, with 322 responses collected. After data screening, 296 valid questionnaires were retained, while 26 were deemed invalid. The demographic distribution of the respondents was as follows: 153 males (51.69%) and 143 females (48.31%); 178 students from the Faculty of Management and Humanities (60.14%) and 118 students from the Faculty of Science, Engineering, and Information Sciences (39.86%). In terms of academic level, 154 respondents were freshmen and sophomores (52.03%), while 142 were juniors and seniors (47.97%). Additionally, in the environmental course participation project, this study asked college students about the number of hours they attended environmental courses (5.81 hours on average) and the number of field practice activities (1.18 times).

3.4. Statistical Analysis

To analyze the proposed model, this study employed structural equation modeling (SEM), which offers significant advantages in multivariate analysis. SEM allows for the simultaneous examination of multiple relationships and is particularly effective in explaining the causal structure within the Theory of Planned Behavior (TPB). Since TPB constructs—attitude, subjective norm, and perceived behavioral control—are latent variables that cannot be directly measured, they must be estimated indirectly through observed variables. The SEM measurement model effectively links observed indicators to these latent constructs, ensuring the reliability and validity of the measurement. SEM is therefore well-suited for this study, as it facilitates an in-depth understanding of the complex relationships among psychological constructs within the TPB framework, providing valuable insights into college students' behavioral decision-making following their participation in environmental courses.

4. RESULT

4.1. Reliability and Validity of the Model

To evaluate the reliability and validity of the measurement model, this study first employed Cronbach's α coefficient to assess the internal consistency among items. The Cronbach's α values ranged from 0.828 to 0.910, significantly exceeding the recommended threshold of 0.7 (Bagozzi & Yi, 1998), indicating strong reliability. Additionally, the study examined the discriminant and convergent validity of the measurement model to ensure the appropriateness of each construct. Average variance extracted (AVE), composite reliability (CR), and factor loading values were utilized as key evaluation criteria. The results indicated that CR values ranged from 0.885 to 0.926, surpassing the recommended minimum standard of 0.6 (Chin et al., 1997), demonstrating sufficient composite reliability for each construct. The AVE values ranged from 0.583 to 0.734, exceeding the minimum requirement of 0.5 (Bagozzi & Yi, 1998), confirming that the model met the criteria for convergent validity. Furthermore, all factor loading values exceeded the recommended threshold of 0.6 (Chin et al., 1997), further

substantiating the validity of the model.

Table 2: Results for factor loading, reliability, and validity.

Constructs	Items	Factor Loading	Cronbach's α	CR	AVE
Attitude (AT)	AT1	0.794	0.910	0.926	0.583
	AT2	0.791			
	AT3	0.793			
	AT4	0.774			
	AT5	0.790			
	AT6	0.713			
	AT7	0.745			
	AT8	0.723			
	AT9	0.741			
Subjective norms (SN)	SN1	0.755	0.828	0.885	0.658
	SN 2	0.769			
	SN 3	0.865			
	SN 4	0.850			
Perceived behavioral control (PBC)	PBC1	0.804	0.840	0.888	0.614
	PBC2	0.730			
	PBC3	0.788			
	PBC	0.817			
	PBC5	0.775			
Behavioral intention (BI)	BI1	0.863	0.879	0.917	0.734
	BI2	0.856			
	BI3	0.862			
	BI4	0.847			

Note: CR: Composite reliability; AVE: Average variance extracted.

4.2. Correlation

Table 3 presents the mean values, standard deviations, and correlation coefficients among the study constructs. The data revealed a significant positive correlation between college students' participation in environmental courses (ECP) and attitude (AT), subjective norm (SN), and perceived behavioral control (PBC), indicating that higher frequency or duration of ECP participation corresponded to a stronger impact on AT, SN, and PBC. Additionally, AT, SN, and PBC exhibited significant positive correlations with behavioral intention (BI), suggesting that when college students hold more positive environmental attitudes, perceive stronger social norms, or possess greater behavioral control, their intentions toward environmental protection behaviors are correspondingly strengthened.

Table 3: Correlations between variables

Variable	Mean	Standard Deviation	1	2	3	4	5
1. AT	3.926	.5748	1.000				
2. SN	3.465	.6768	0.565 **	1.000			
3. PBC	3.657	.6269	0.613 **	0.683 **	1.000		
4. BI	3.518	.6995	0.475 **	0.650 **	0.744 **	1.000	
5. ECP	3.492	1.3842	0.244 **	0.363 **	0.461 **	0.464 **	1.000

Note: **$p < 0.01$.

4.3. Structural Model and Hypothesis Testing

Following the research framework, this study employed the maximum likelihood (ML) estimation method in SEM to test five latent constructs: one exogenous construct (ECP) and four endogenous constructs (AT, SN, PBC, and BI). Figure 2 and Table 4 illustrate the correlations among the constructs and observed variables, revealing positive and significant relationships among all variables. Regarding hypothesis testing, the model's goodness-of-fit indices were as follows: goodness-of-fit index (GFI) = 0.83, root mean square error of approximation (RMSEA) = 0.08, standardized root mean square residual (SRMR) = 0.06, normed fit index (NFI) = 0.95, comparative fit index (CFI) = 0.97, and parsimonious normed fit index (PNFI) = 0.85. All indices met or exceeded recommended thresholds, indicating an acceptable measurement model with strong model fit and robustness in both the measurement and structural models. The six research hypotheses were tested using SEM analysis, further supporting the causal relationships proposed in the research model. The findings demonstrate that participation in environmental conservation courses indirectly enhances students' behavioral intentions through the mediating effects of attitudes, subjective norms, and perceived behavioral control, aligning with the core principles of the Theory of Planned Behavior (TPB).

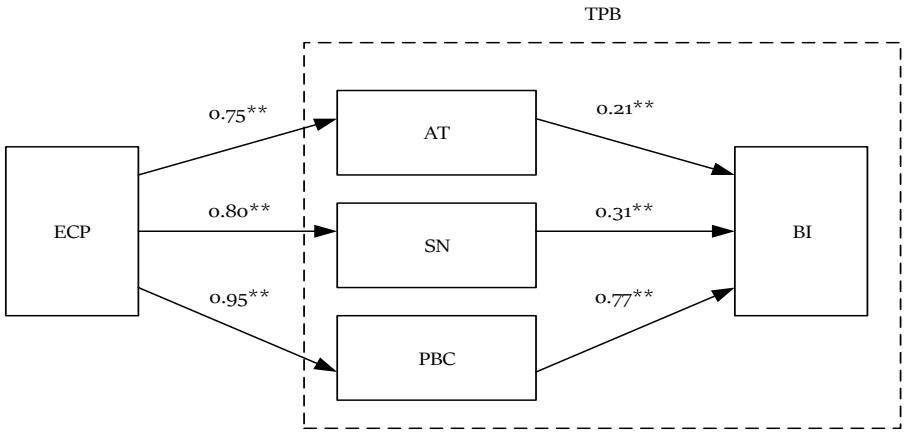

Figure 2: Paths within the hypothesis model. Solid lines denote established hypotheses.
Note: *** $p < 0.001$.

Table 4: Path analysis results and hypothesis verification.

Hypothesis	Hypothesized Path	Path coefficient	Results
H1	ECP→AT	0.75 ***	Supported
H2	ECP→SN	0.80 ***	Supported
H3	ECP→PBC	0.95 ***	Supported
H4	AT→BI	0.21 ***	Supported
H5	SN→BI	0.31 ***	Supported
H6	PBC→BI	0.77 ***	Supported

Note: *** $p < 0.001$.

5. FINDINGS

The results of this study indicate that participation in environmental conservation courses (ECP) significantly enhances students' attitudes (AT), subjective norms (SN), and perceived behavioral control (PBC) regarding environmental protection. This suggests that such courses cultivate a greater sense of responsibility toward environmental issues while reinforcing social support from family, friends, and the broader community. Furthermore, frequent engagement in these courses fosters students' confidence in their ability to undertake environmentally responsible behaviors, thereby increasing the likelihood of action. Moreover, attitudes (AT), subjective norms (SN), and perceived behavioral control (PBC) exhibit significant positive effects on behavioral intentions (BI). Specifically, students with more favorable attitudes, stronger subjective norms, and higher perceived behavioral control demonstrate greater intentions to engage in pro-environmental behaviors. Path analysis through structural equation modeling further substantiates these relationships, confirming that attitudes, subjective norms, and perceived behavioral control serve as key antecedents of behavioral intention. In summary, integrating environmental conservation courses into university curricula not only enhances students' environmental awareness but also encourages proactive engagement in environmental protection efforts, thereby contributing to sustainable societal development. These findings underscore the pivotal role of educators in shaping students' environmental behaviors—not only by fostering awareness but also by motivating active participation in environmental initiatives. Therefore, expanding and deepening environmental education should be prioritized as a crucial strategy for elevating society's overall environmental consciousness and action.

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