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Environmental Education and Pro-environmental Behavior among University Students in Nanchang: An Extended TPB-SEM Model

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Abstract

Environmental education plays an important role in promoting sustainable behavior, although environmental knowledge does not always translate into action. Drawing on the Theory of Planned Behavior (TPB), this study examines how Environmental Education relates to university students' Pro-environmental Behavior through Pro-environmental Attitude, Green Social Norm Perception, Perceived Green Behavioral Control, and Behavioral Intention. Data from 350 students in Nanchang, China, were collected using convenience sampling and analyzed through CFA, SEM, and 2,000-resample Bootstrap mediation analysis. The structural model demonstrated a good fit ($\chi^2/df = 1.113$, CFI = .990, RMSEA = .018). Environmental Education was positively associated with the three TPB antecedents and Pro-environmental Behavior. All three antecedents were positively associated with Behavioral Intention. Perceived Green Behavioral Control showed the strongest association with Behavioral Intention ($\beta = .362$), and the pathway through Perceived Green Behavioral Control and Behavioral Intention produced the largest indirect effect (.103). Three indirect pathways were statistically significant. The findings support integrating environmental education with TPB mechanisms in higher education.

Keywords: *Environmental education; Theory of Planned Behavior; Pro-environmental behavior; University students; Structural equation modeling*

1. Introduction

1.1 Research background

Environmental degradation, climate change, and resource scarcity are global challenges that threaten sustainable development and human well-being. Governments, international organizations, and educational institutions have increasingly emphasized sustainable lifestyles and environmentally responsible actions. Universities play an important role in this process by generating knowledge, cultivating future professionals, and helping students develop environmental awareness, values, and responsibility. Environmental education is therefore an important means of strengthening young people's capacity for sustainable development and promoting environmentally responsible behavior (Lim et al., 2022; Wu & Shen, 2016).

Previous research has shown that environmental education can improve environmental knowledge, strengthen sustainability-related values, and increase willingness to participate in environmental protection activities. However, environmental

knowledge and awareness do not always translate into actual pro-environmental behavior. This inconsistency suggests that psychological factors may influence how educational experiences are translated into behavioral intentions and actions. Therefore, examining the psychological mechanisms underlying this relationship is important for understanding the behavioral effects of environmental education.

The Theory of Planned Behavior (TPB) is frequently used to explain human behavior. According to TPB, attitudes, subjective norms, and perceived behavioral control influence behavioral intentions, which subsequently influence actual behavior(Ajzen, 1991). Previous studies have applied TPB to various environmental behaviors, including recycling, energy conservation, and environmentally responsible consumption (Armitage & Conner, 2001; Bamberg & Möser, 2007; Steg & Vlek, 2009). In higher education, environmental education extends beyond the transmission of environmental knowledge by providing students with opportunities to develop environmental values, social awareness, and behavioral skills through courses, campus sustainability projects, and environmental activities.

Nanchang was selected as the study setting because it provides a substantial higher-education context for examining these relationships. As the capital of Jiangxi Province, Nanchang has 55 higher education institutions and approximately 800,000 college students, providing a large and diverse population for examining environmental attitudes, social influences, perceived behavioral control, and behavioral intentions among university students (Nanchang Municipal Bureau of Commerce, 2025). In addition, Nanchang has implemented a Green School Initiative that promotes ecological education, green campus practices, resource conservation, waste management, student participation, and green innovation, providing a relevant institutional context for examining how environmental education may influence students' pro-environmental behavior(Nanchang Municipal Education Bureau, 2022). Focusing on university students in Nanchang therefore enables this study to examine the relationship between environmental education and pro-environmental behavior within a clearly defined higher-education context and to further investigate the psychological mechanisms proposed by TPB.

1.2 Research Gap and Purpose

Previous studies have widely examined environmental education, pro-environmental behavior, and the Theory of Planned Behavior (TPB). Environmental education has been shown to improve environmental knowledge, values, and awareness, while TPB research has demonstrated the importance of attitude, subjective norms, and perceived behavioral control in explaining behavioral intention. However, relatively few studies have integrated environmental education with the three core psychological constructs of TPB and behavioral intention within a single model to explain pro-environmental behavior. In addition, limited research has examined the psychological pathways through which environmental education is associated with students' behavioral intention and actual pro-environmental behavior, particularly in the context of higher education in Nanchang, Jiangxi Province.

To address these gaps, this study applies the Theory of Planned Behavior to examine the relationships among Environmental Education, Pro-environmental Attitude, Green Social Norm Perception, Perceived Green Behavioral Control, Pro-environmental Behavioral Intention, and Pro-environmental Behavior.The study further examines the mediating pathways linking Environmental Education to Pro-environmental Behavior via Pro-environmental Attitude, Green Social Norm Perception, and Perceived Green Behavioral Control, followed by Pro-environmental Behavioral Intention, among university students in Nanchang.

1.3 Research Questions

RQ1: How is Environmental Education associated with university students' Pro-environmental Behavior in Nanchang?

RQ2: How do Pro-environmental Attitude, Green Social Norm Perception, and Perceived Green Behavioral Control influence university students' Pro-environmental Behavioral Intention?

RQ3: What are the serial mediation pathways linking Environmental Education to Pro-environmental Behavior through Pro-environmental Attitude, Green Social Norm Perception, and Perceived Green Behavioral Control, followed by Pro-environmental Behavioral Intention?

1.4 Research Objectives

The purpose of this study is to examine the relationship between Environmental Education and university students' pro-environmental behavior in Nanchang within the TPB framework.

Specifically, this study aims to:

1.Examine the relationship between Environmental Education and university students' Pro-environmental Behavior in Nanchang.

2.Investigate how Pro-environmental Attitude, Green Social Norm Perception, and Perceived Green Behavioral Control influence Pro-environmental Behavioral Intention.

3.Examine the serial mediation pathways linking Environmental Education to Pro-environmental Behavior through Pro-environmental Attitude, Green Social Norm Perception, and Perceived Green Behavioral Control, followed by Pro-environmental Behavioral Intention.

1.5 Research Significance

This study contributes theoretically by integrating Environmental Education with the three TPB-based psychological constructs, Behavioral Intention, and Pro-environmental Behavior within a single structural model. It also provides empirical evidence from university students in Nanchang, Jiangxi Province. Practically, the findings may support universities in combining environmental education with experiential learning, sustainability activities, and student-led green innovation, including eco-innovation and social-enterprise initiatives. These entrepreneurial implications represent potential extensions because green entrepreneurial intention was not directly examined in this study.

2. Literature Review

2.1 Environmental Education

Environmental education is widely recognized as an important component of education for sustainable development. It aims to improve individuals' environmental knowledge, values, attitudes, and behavioral skills and to encourage environmentally responsible actions(Wu & Shen, 2016). In higher education, environmental education can be delivered through environmental courses, campus sustainability activities, experiential learning, and other practical activities that provide students with opportunities to understand and apply environmental knowledge.

Environmental education is not limited to the transmission of environmental knowledge. Previous research suggests that educational experiences can strengthen environmental values, awareness, motivation, and engagement in environmental activities (Bamberg & Möser, 2007; Findler et al., 2019; Lim et al., 2022). However, environmental knowledge alone does not necessarily lead to consistent pro-environmental behavior. Psychological factors may determine how educational experiences are translated into behavioral intentions and actual behavior.

2.2 Pro-environmental Behavior and Behavioral Intention

Pro-environmental behavior refers to actions that help protect the environment and support sustainable development, such as saving energy, reducing waste, recycling, choosing environmentally friendly products, and participating in environmental activities (Kaiser et al., 2007; Stern, 2000). However, environmental knowledge and awareness do not always lead directly to actual pro-environmental behavior, as behavioral outcomes may also depend on individuals' psychological factors and environmental conditions (Kollmuss & Agyeman, 2002).

Within the Theory of Planned Behavior (TPB), Pro-environmental Behavioral Intention represents an individual's readiness and motivation to perform environmentally responsible behaviors and is an important immediate predictor of actual behavior (Ajzen, 1991). Previous research suggests that behavioral intention is influenced by attitudes, social norms, and perceived behavioral control and is associated with a greater likelihood of adopting sustainable practices(Bamberg & Möser, 2007; Steg & Vlek, 2009).

2.3 TPB-based Psychological Determinants of Pro-environmental Behavioral Intention

According to the Theory of Planned Behavior, attitude, subjective norm, and perceived behavioral control jointly shape behavioral intention (Ajzen, 1991). In this study, these constructs are represented by Pro-environmental Attitude, Green Social Norm Perception, and Perceived Green Behavioral Control.

Pro-environmental Attitude reflects students' evaluations of environmentally responsible behavior. Environmental education may strengthen favorable attitudes by improving environmental understanding and sustainability-related values, while more positive attitudes may increase students' willingness to engage in pro-environmental actions (Ajzen, 1991; Bamberg & Möser, 2007).

Green Social Norm Perception reflects perceived expectations and support from teachers, friends, classmates, and other relevant social groups. Environmental education and campus sustainability activities may reinforce such norms by increasing social exposure to environmentally responsible practices, thereby strengthening Behavioral Intention (Ajzen, 1991; Bamberg & Möser, 2007).

Perceived Green Behavioral Control refers to students' perceived ability, resources, and opportunities to perform pro-environmental behavior. Environmental education may strengthen this perception by providing knowledge, skills, and practical experience, while greater perceived control can increase confidence and Behavioral Intention (Ajzen, 1991).

2.4 University Students' Pro-environmental Behavior

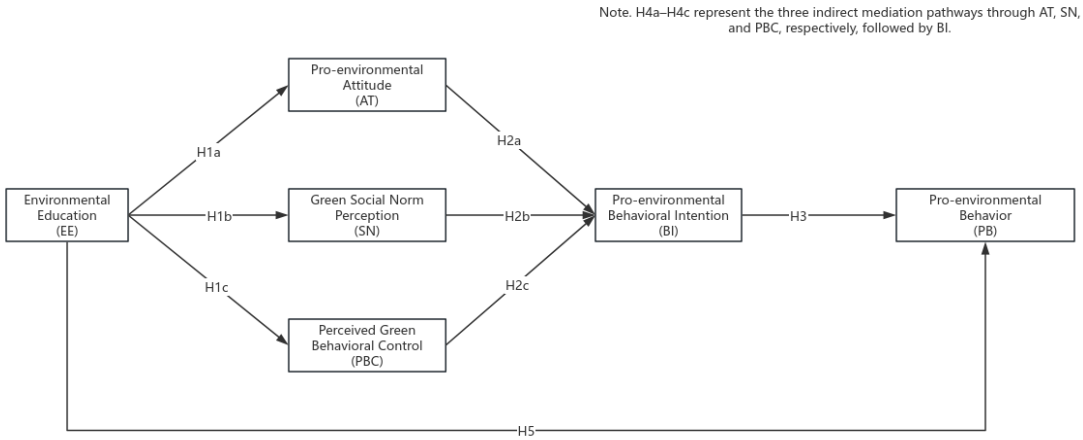
Environmental education may contribute to Pro-environmental Behavior through both direct and indirect mechanisms. In particular, its behavioral effects may operate through attitudes, social norms, perceived behavioral control, and Behavioral Intention rather than through environmental knowledge alone(Bamberg & Möser, 2007; Findler et al., 2019)

2.5 Theoretical Framework

Research on university students' pro-environmental behavior in China has expanded with growing concerns about climate change and sustainable development. However, a gap may remain between environmental awareness and actual pro-environmental behavior. Existing studies have often focused on individual psychological factors rather than integrating Environmental Education with the TPB determinants and Behavioral Intention within a single model.

Building on TPB, this study treats Environmental Education as a contextual antecedent and Pro-environmental Behavior as the outcome. Pro-environmental Attitude, Green Social Norm Perception, and Perceived Green Behavioral Control are three parallel first-stage mediators, each followed by Pro-environmental Behavioral Intention as a subsequent mediator(Ajzen, 1991; Bamberg & Möser, 2007). The proposed indirect pathways are EE → AT → BI → PB, EE → SN → BI → PB, and EE → PBC → BI → PB, as shown in Figure 1.

Figure 1 Conceptual framework of the study. Source: Developed by the authors based on Ajzen (1991), Bamberg and Möser (2007), Kaiser et al. (2007), and Steg and Vlek (2009).



2.6 Research Hypotheses

Based on the Theory of Planned Behavior (TPB) and previous research on environmental education, Environmental Education is expected to positively influence the three TPB-based psychological constructs: Pro-environmental Attitude, Green Social Norm Perception, and Perceived Green Behavioral Control. Therefore, the following hypotheses are proposed:

H1a: Environmental Education has a significant positive effect on Pro-environmental Attitude.

H1b: Environmental Education has a significant positive effect on Green Social Norm Perception.

H1c: Environmental Education has a significant positive effect on Perceived Green Behavioral Control.

According to TPB, positive attitudes, supportive social norms, and greater perceived behavioral control are expected to strengthen behavioral intention. Therefore:

H2a: Pro-environmental Attitude has a significant positive effect on Pro-environmental Behavioral Intention.

H2b: Green Social Norm Perception has a significant positive effect on Pro-environmental Behavioral Intention.

H2c: Perceived Green Behavioral Control has a significant positive effect on Pro-environmental Behavioral Intention.

Behavioral intention is regarded as an immediate predictor of actual behavior within TPB. Therefore:

H3: Pro-environmental Behavioral Intention has a significant positive effect on Pro-environmental Behavior.

Environmental Education may also influence Pro-environmental Behavior through three indirect pathways involving the TPB-based psychological constructs and Pro-environmental Behavioral Intention. Therefore:

H4a: Environmental Education indirectly and positively influences Pro-environmental Behavior through Pro-environmental Attitude and Pro-environmental Behavioral Intention.

H4b: Environmental Education indirectly and positively influences Pro-environmental Behavior through Green Social Norm Perception and Pro-environmental Behavioral Intention.

H4c: Environmental Education indirectly and positively influences Pro-environmental Behavior through Perceived Green Behavioral Control and Pro-environmental Behavioral Intention.

In addition, Environmental Education may directly influence Pro-environmental Behavior through environmental learning, sustainability practices, and opportunities provided by universities. Therefore:

H5: Environmental Education has a significant positive effect on Pro-environmental Behavior.

3. Methodology

3.1 Research Design and Data Collection

This study employed a quantitative cross-sectional design to examine the relationships among Environmental Education, Pro-environmental Attitude, Green Social Norm Perception, Perceived Green Behavioral Control, Pro-environmental Behavioral Intention, and Pro-environmental Behavior among university students in Nanchang, Jiangxi Province, China. The target population comprised undergraduate and postgraduate students enrolled in higher education institutions in Nanchang.

Data were collected from April to May 2026 using a structured questionnaire and convenience sampling. Eligible participants were students enrolled at higher education institutions in Nanchang during the survey period. The questionnaire was distributed through online platforms, course communication groups, and student communities. Respondents were mainly recruited from Nanchang University, Jiangxi Normal University, Jiangxi University of Finance and Economics, East China Jiaotong University, Nanchang Hangkong University, and Jiangxi Agricultural University because the researchers had access to student groups at these institutions. Students from other universities in Nanchang were also included. A total of 406 responses were collected. Responses completed in 20 seconds or less or showing highly repetitive answering patterns, such as selecting the same response option for every scale item, were excluded. After screening, 350 valid responses remained for analysis, representing 86.2% of the collected responses.

The questionnaire contained 30 items measuring six constructs. Part 1 collected demographic information, while Part 2 measured the research constructs using a five-point Likert scale ranging from 1 (“strongly disagree”) to 5 (“strongly agree”). The measurement items were adapted from established studies and revised for the Nanchang university context.

3.2 Data Analysis Methods

The collected data were analyzed using SPSS and AMOS. Descriptive statistics were used to summarize the demographic characteristics and research variables.Cronbach's alpha was used to assess internal consistency, while principal component analysis (PCA) with Varimax rotation and confirmatory factor analysis (CFA) were conducted to assess factor structure and construct validity.Common method bias was assessed using Harman’s single-factor test by entering all measurement items into an unrotated principal component analysis.

Spearman's rank-order correlation analysis was used to examine associations among the research variables because the data did not fully satisfy the assumption of normality. Structural equation modeling (SEM) was subsequently conducted in AMOS using maximum likelihood estimation to test the hypothesized relationships among the study variables.

Finally, Bootstrap mediation analysis with 2,000 resamples was conducted to examine the indirect effects of Environmental Education on Pro-environmental Behavior through the proposed TPB-based pathways. Mediation effects were considered statistically significant when the bias-corrected 95% Bootstrap confidence intervals did not include zero.

4. Results and Discussions

4.1 Demographic Variables

The final analytical sample consisted of 350 valid respondents from multiple universities, academic disciplines, age groups, and study levels in Nanchang.

Table 1 Demographic Characteristics of Respondents (N = 350)

Variables	Details	Frequency	Percent (%)
University	Nanchang University	46	13.1
	Jiangxi Normal University	41	11.7
	Jiangxi University of Finance and Economics	41	11.7
	East China Jiaotong University	49	14.0
	Nanchang Hangkong University	57	16.3
	Jiangxi Agricultural University	53	15.1
	Other universities	63	18.0
Gender	Male	174	49.7
	Female	176	50.3
Age Group	18–20 years	108	30.9
	21–22 years	66	18.9
	23–24 years	61	17.4
	25 years and above	115	32.9
Level of Study	Freshman	67	19.1
	Sophomore	88	25.1
	Junior	119	34.0
	Senior	55	15.7
	Postgraduate	21	6.0
Major Type	Arts / Humanities	59	16.9
	Science / Engineering	56	16.0
	Business / Economics	50	14.3
	Medicine / Health	54	15.4
	Arts & Sports	67	19.1
	Other	64	18.3
Environmental Course	Yes	194	55.4
	No	156	44.6
Environmental-related Major	Yes	79	22.6
	No	271	77.4
Environmental Club Experience	Yes	111	31.7
	No	239	68.3

Overall, the sample reflected diverse demographic and academic backgrounds.

4.2 Descriptive Statistics of Research Variables

Descriptive statistics were used to summarize the distribution of the research variables. As shown in Table 2, the item means ranged from 3.47 to 3.82, while the standard deviations ranged from 0.59 to 0.71. Overall, the results indicate generally positive perceptions of Environmental Education and pro-environmental behavior among the respondents.

Table 2 Descriptive Statistics of Research Variables

Construct	Item	Questionnaire Item	Mean	SD
Environmental Education (EE)	EE1	My courses include content related to environmental protection or sustainability.	3.81	0.70
	EE2	My university encourages students to care about environmental issues.	3.82	0.69
	EE3	Environmental education improves my understanding of environmental problems.	3.79	0.70
	EE4	Campus activities help me understand how personal behavior affects the environment.	3.77	0.71
	EE5	Environmental education strengthens my recognition of sustainable lifestyles.	3.79	0.69
	Total		3.80	0.576
Pro-environmental Attitude (AT)	AT1	Protecting the environment is valuable to me.	3.77	0.64
	AT2	Pro-environmental behavior is worthwhile.	3.71	0.66
	AT3	Pro-environmental behavior brings positive outcomes.	3.74	0.63
	AT4	I have a positive attitude toward green lifestyles.	3.75	0.64
	AT5	Making efforts to protect the environment is meaningful.	3.73	0.65
	Total		3.74	0.493
Green Social Norm Perception (SN)	SN1	My teachers and friends think I should engage in environmentally friendly behavior.	3.62	0.68
	SN2	Most of my classmates support environmentally friendly lifestyles.	3.62	0.67
	SN3	I would receive negative feedback if I did not behave in an environmentally responsible way.	3.59	0.70
	SN4	People around me generally believe that environmentally friendly behavior is important.	3.61	0.67
	SN5	Society generally supports pro-environmental behavior.	3.54	0.65
	Total		3.60	0.526
Perceived Green Behavioral Control (PBC)	PBC1	I am capable of engaging in environmentally friendly behavior.	3.59	0.67
	PBC2	I can maintain environmentally friendly behavior even when facing difficulties.	3.63	0.66
	PBC3	I have the skills needed to perform environmentally friendly behavior.	3.61	0.66
	PBC4	I can control my consumption and resource use.	3.60	0.64
	PBC5	Performing environmentally friendly	3.61	0.68

Construct	Item	Questionnaire Item	Mean	SD
		behavior is feasible for me.		
	Total		3.61	0.526
Pro-environmental Behavioral Intention (BI)	BI1	I intend to engage in more environmentally friendly behavior in the future.	3.69	0.59
	BI2	I plan to reduce my negative impact on the environment.	3.73	0.64
	BI3	I am willing to invest more time and effort in environmental protection.	3.69	0.60
	BI4	I plan to participate in environmental activities.	3.70	0.61
	BI5	I intend to maintain a green lifestyle in the long term.	3.67	0.61
	Total		3.69	0.461
Pro-environmental Behavior (PB)	PB1	I sort my waste for recycling.	3.50	0.68
	PB2	I save water and electricity in daily life.	3.52	0.65
	PB3	I choose environmentally friendly products.	3.47	0.63
	PB4	I try to reduce the use of disposable products.	3.47	0.65
	PB5	I reuse items whenever possible.	3.47	0.64
	Total		3.49	0.504

The overall mean scores were 3.80 for Environmental Education, 3.74 for Pro-environmental Attitude, 3.60 for Green Social Norm Perception, 3.61 for Perceived Green Behavioral Control, 3.69 for Pro-environmental Behavioral Intention, and 3.49 for Pro-environmental Behavior. Behavioral Intention remained higher than reported Pro-environmental Behavior, indicating an intention–behavior gap.

4.3 Reliability Analysis

Table 3 Cronbach's Alpha Reliability Results

Construct	Number of Items	Cronbach's Alpha
Environmental Education (EE)	5	0.882
Pro-environmental Attitude (AT)	5	0.821
Green Social Norm Perception (SN)	5	0.841
Perceived Green Behavioral Control (PBC)	5	0.852
Pro-environmental Behavioral Intention (BI)	5	0.811
Pro-environmental Behavior (PB)	5	0.837

Reliability analysis was conducted to assess the internal consistency of the measurement scales using Cronbach’s alpha. As shown in Table 3, the coefficients ranged from 0.811 to 0.882, exceeding the recommended threshold of 0.70. Environmental Education showed the highest reliability ($\alpha = 0.882$), while Pro-environmental Behavioral Intention showed the lowest ($\alpha = 0.811$). These results indicate satisfactory internal consistency for all six constructs.

4.4 Validity Analysis

Harman's single-factor test yielded six factors with eigenvalues greater than 1, with the first factor explaining 33.28% of the total variance, below the 50% threshold. Thus, common method bias was unlikely to pose a serious concern.

4.4.1 KMO and Bartlett's Test

The KMO value was 0.933, indicating excellent sampling adequacy, while Bartlett's Test of Sphericity was significant ($\chi^2 = 4756.608$, df = 435, $p < .001$). These results confirm that the data were suitable for factor analysis.

Table 4 KMO and Bartlett's Test

Indicator	Value
KMO	0.933
Bartlett's Chi-square	4756.608
df	435
Sig.	< 0.001

4.4.2 Principal Component Analysis

Principal component analysis (PCA) with Varimax rotation was conducted to examine the structure of the measurement items. Six components with eigenvalues greater than 1 were retained, explaining 62.134% of the total variance. The loadings ranged from 0.623 to 0.785, exceeding the recommended threshold of 0.50, with no substantial cross-loadings observed. These results supported the proposed six-component measurement structure.

4.4.3 Confirmatory Factor Analysis

Table 5 Model Fit Indices

Fit Index	Recommended	Result
χ^2/df	<3	1.109
GFI	>0.80	0.926
AGFI	>0.80	0.912
RMSEA	<0.08	0.018
RMR	<0.10	0.016
NFI	>0.80	0.912
IFI	>0.80	0.991
CFI	>0.80	0.990
TLI	>0.80	0.989
PGFI	>0.50	0.776

Confirmatory factor analysis (CFA) was conducted to evaluate the measurement model. The results indicated a satisfactory model fit, $\chi^2(390) = 432.551$, $p = .067$, $\chi^2/df = 1.109$, GFI = .926, AGFI = .912, RMSEA = .018, RMR = .016, NFI = .912, IFI = .991, TLI = .989, and CFI = .990. Overall, the measurement model demonstrated an acceptable fit to the data.

4.4.4 Convergent and Discriminant Validity

Convergent validity was assessed using Composite Reliability (CR) and Average Variance Extracted (AVE). As shown in Table 6, CR values ranged from 0.812 to 0.882, while AVE values ranged from 0.464 to 0.598. The AVE values for Pro-environmental Attitude (0.479) and Pro-environmental Behavioral Intention (0.464) were below the conventional 0.50 threshold. Both constructs were retained because their CR values exceeded 0.70; however, their convergent validity warrants caution (Fornell & Larcker, 1981; Hair et al., 2019).

Table 6 Convergent Validity (CR and AVE)

Construct	CR	AVE
EE	0.882	0.598
AT	0.821	0.479
SN	0.841	0.515
PBC	0.852	0.535
BI	0.812	0.464
PB	0.837	0.507

Note. Composite Reliability (CR) values above 0.70 indicate satisfactory internal consistency, while Average Variance Extracted (AVE) values above 0.50 indicate adequate convergent validity (Fornell & Larcker, 1981; Hair et al., 2019).

Discriminant validity was assessed using the Fornell–Larcker criterion. As shown in Table 7, the square root of the AVE for each construct exceeded its correlations with the other constructs, indicating that the six constructs were empirically distinguishable (Fornell & Larcker, 1981).

Table 7 Discriminant Validity

	EE	AT	SN	PBC	BI	PB
EE	0.774					
AT	0.662	0.692				
SN	0.597	0.380	0.717			
PBC	0.616	0.392	0.413	0.732		
BI	0.650	0.541	0.591	0.594	0.681	
PB	0.524	0.426	0.430	0.511	0.596	0.712

The off-diagonal correlations in Table 7 are latent-construct correlations derived from the CFA model, whereas Table 8 reports Spearman correlations calculated from observed composite scores; therefore, the coefficients are not expected to be identical.

4.5 Correlation Analysis

Spearman's rank-order correlation was used to examine the relationships among the research variables because the data did not fully satisfy the assumption of normality. As shown in Table 8, all variables were significantly and positively correlated ($p < .01$), with coefficients ranging from 0.296 to 0.544. The strongest correlation was observed between Environmental Education and Pro-environmental Attitude ($r = 0.544$), while the weakest was between Pro-environmental Attitude and Green Social Norm Perception ($r = 0.296$). All coefficients were below 0.80, suggesting that multicollinearity was unlikely to be a serious concern.

Table 8 Spearman Correlation Analysis

Variables	EE	AT	SN	PBC	BI	PB
EE	1.000					
AT	0.544**	1.000				
SN	0.490**	0.296**	1.000			
PBC	0.527**	0.332**	0.328**	1.000		
BI	0.543**	0.422**	0.478**	0.482**	1.000	
PB	0.431**	0.350**	0.337**	0.421**	0.467**	1.000

Note. $p < 0.01$ (2-tailed); $N = 350$.

4.6 Structural Model and Hypothesis Testing

Structural equation modeling (SEM) was conducted using AMOS to test the hypothesized relationships among the study variables. The structural model demonstrated a good fit to the data, with $\chi^2/df = 1.113$, GFI = 0.924, AGFI = 0.911, RMSEA = 0.018, RMR = 0.016, NFI = 0.910, IFI = 0.990, TLI = 0.989, CFI = 0.990, PNFI = 0.831, and PCFI = 0.904.

As shown in Table 9, all hypothesized direct relationships were positive and statistically significant, supporting H1a, H1b, H1c, H2a, H2b, H2c, H3, and H5. The largest standardized coefficient for Behavioral Intention was observed for Perceived Green Behavioral Control (β = 0.362). The model explained 57.9% of the variance in Behavioral Intention and 40.6% of the variance in Pro-environmental Behavior.

Table 9 Structural Path Results

Hypothesis	Structural Path	S.E.	C.R.	β	p
H1a	EE → AT	0.057	9.542	0.662	<0.001
H1b	EE → SN	0.058	8.704	0.602	<0.001
H1c	EE → PBC	0.059	9.282	0.624	<0.001
H2a	AT → BI	0.056	4.370	0.275	<0.001
H2b	SN → BI	0.056	5.372	0.346	<0.001
H2c	PBC → BI	0.054	5.580	0.362	<0.001
H3	BI → PB	0.101	5.222	0.456	<0.001
H5	EE → PB	0.066	3.160	0.245	0.002

Table 10 Squared Multiple Correlations (R^2)

Endogenous Construct	Predictor(s)	R^2
AT	EE	0.438
SN	EE	0.363
PBC	EE	0.390
BI	AT, SN, PBC	0.579
PB	EE, BI	0.406

Table 11 Bootstrap Mediation Results

Hypothesis	Mediation Path	Standardized Indirect Effect	Boot SE	95% Boot CI
H4a	EE → AT → BI → PB	0.083	0.024	[0.044, 0.139]
H4b	EE → SN → BI → PB	0.095	0.024	[0.055, 0.150]
H4c	EE → PBC → BI → PB	0.103	0.029	[0.056, 0.169]

Note. Bootstrap sample = 2,000; Bias-corrected 95% confidence interval.

Overall, the findings indicate that Environmental Education was associated with Pro-environmental Behavior through multiple TPB-based indirect pathways. Among the three pathways, the pathway involving Perceived Green Behavioral Control showed the largest standardized indirect effect (0.103).

Table 12 Summary of Hypothesis Testing

Hypothesis	Proposed Relationship	Result
H1a	Environmental education → Pro-environmental attitude	Supported
H1b	Environmental education → Green social norm perception	Supported
H1c	Environmental education → Perceived green behavioral control	Supported
H2a	Pro-environmental attitude → Pro-environmental behavioral intention	Supported
H2b	Green social norm perception →	Supported

	Pro-environmental behavioral intention	
H2c	Perceived green behavioral control → Pro-environmental behavioral intention	Supported
H3	Pro-environmental behavioral intention → Pro-environmental behavior	Supported
H4a	Environmental Education → Pro-environmental Attitude → Pro-environmental Behavioral Intention → Pro-environmental Behavior	Supported
H4b	Environmental Education → Green Social Norm Perception → Pro-environmental Behavioral Intention → Pro-environmental Behavior	Supported
H4c	Environmental Education → Perceived Green Behavioral Control → Pro-environmental Behavioral Intention → Pro-environmental Behavior	Supported
H5	Environmental education → Pro-environmental behavior	Supported

4.7 Discussion

The findings support the TPB framework and show that Environmental Education was positively associated with the TPB-related psychological constructs and Pro-environmental Behavior. Although Environmental Education showed its strongest bivariate correlation with Pro-environmental Attitude ($r = 0.544$), Attitude had the weakest structural relationship with Behavioral Intention among the three TPB determinants ($\beta = 0.275$). This difference is not contradictory because the correlation reflects a pairwise association, whereas the SEM coefficient represents the unique contribution of Attitude when Social Norm Perception and Perceived Behavioral Control are considered simultaneously. Perceived Green Behavioral Control showed the strongest relationship with Behavioral Intention ($\beta = 0.362$), and the mediation pathway through Perceived Green Behavioral Control and Behavioral Intention also produced the largest indirect effect (0.103). These results are consistent with TPB, which proposes that behavioral intention is jointly shaped by attitude, subjective norm, and perceived behavioral control(Ajzen, 1991; Bamberg & Möser, 2007).

The descriptive results also indicate an intention–behavior gap, with Behavioral Intention ($M = 3.69$) exceeding reported Pro-environmental Behavior ($M = 3.49$). This suggests that willingness to act may not always translate into self-reported behavior. Practical barriers such as inconvenience, limited supporting facilities, and additional time or financial costs may constrain pro-environmental action (Kollmuss & Agyeman, 2002; Steg & Vlek, 2009). As these factors were not directly measured, they should be regarded as possible explanations rather than confirmed characteristics of the Nanchang sample. Universities may help narrow this gap by reducing practical barriers and providing more accessible opportunities for students to engage in environmental activities.

5. Conclusion

This study examined the relationships among Environmental Education, the three TPB-based psychological constructs, Pro-environmental Behavioral Intention, and Pro-environmental Behavior among 350 university students in Nanchang, Jiangxi Province, using Structural Equation Modeling. The findings show that Environmental Education was positively associated with the three TPB-based psychological constructs and Pro-environmental Behavior. Attitude, Social Norm Perception, and Perceived Behavioral Control were significantly associated with Behavioral Intention, which in turn was positively related to Pro-environmental Behavior. Among the three TPB predictors, Perceived Green Behavioral Control showed the largest standardized relationship with Behavioral Intention, and its corresponding indirect pathway also showed the largest indirect effect. Overall, Environmental Education was associated with Pro-environmental Behavior through both direct and psychological pathways.

6. Limitations and Future Research

This study has several limitations. First, convenience sampling and online recruitment may have introduced self-selection bias, as students with greater interest in environmental issues may have been more likely to participate. Second, the cross-sectional design limits causal interpretation because all variables were measured at a single point in time. Third, although Harman's single-factor test did not indicate a serious common method bias, the use of self-reported data may still introduce common method variance.Fourth, the AVE values for Pro-environmental Attitude (0.479) and Pro-environmental Behavioral Intention (0.464) were slightly below the conventional 0.50 criterion and should therefore be interpreted with some caution despite satisfactory composite reliability. Future research could employ probability-based or stratified sampling, longitudinal designs, multiple data sources, and further validation of the measurement scales across different university populations.

7. Recommendations

Universities should strengthen environmental education through experiential learning and practical sustainability activities. They should also foster supportive campus norms and improve students' perceived behavioral control through accessible resources, teacher and peer support, and practical opportunities for action. In addition, universities could develop green innovation projects, sustainability challenges, mentoring, and interdisciplinary activities that encourage eco-innovation, student-led green ventures, and social-enterprise initiatives. These applications extend the practical implications of the study, although green entrepreneurial intention was not directly examined.

8. Acknowledgements

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9. Conflict of Interest

The authors declare that there is no conflict of interest regarding the publication of this article.

10. The Author's Biography

Wang Ruotong is a student with research interests in environmental education, pro-environmental behavior, and sustainability in higher education. Her academic work focuses on understanding the psychological and educational factors that influence

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