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# Will the Future Be Greener? The Environmental Behavioral Intentions of University Tourism Students

Su-Lan Pan <sup>1</sup> , Ju Chou <sup>2</sup>, Alastair M. Morrison <sup>3,\*</sup> , Wen-Shiung Huang <sup>4</sup>  and Meng-Chen Lin <sup>5</sup>

<sup>1</sup> School of Tourism & Hospitality Management and Institute for Development of Cross-strait Small and Medium Enterprises at Hubei University of Economics, Wuhan 430205, China; sandypan2015@163.com

<sup>2</sup> Graduate Institute of Environmental Education at National Taiwan Normal University, Taipei 11677, Taiwan; t73003@ntnu.edu.tw

<sup>3</sup> National Kaohsiung University of Hospitality and Tourism Management, Kaohsiung 80217, Taiwan

<sup>4</sup> Department of Tourism and Leisure Management at Ling Tung University, Taichung 40852, Taiwan; didon@mail.uma.org.tw

<sup>5</sup> School of Business Administration at Hubei University of Economics, Wuhan 430205, China; mengchen0608@gmail.com

\* Correspondence: alastair@belletourism.com

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**Abstract:** Sustainable tourism is essential for tourism sector development. Environmentally responsible behaviors and behavioral intentions are important prerequisites for sustainable tourism. This research explores the behavioral intentions of university tourism students and significant factors affecting these behavioral intentions. The questionnaire survey method was applied to university students from the tourism departments of nine universities in Taiwan. A total of 390 valid questionnaires were collected. The pro-environmental behavioral intentions of the students ranged from moderate to high. Environmental knowledge positively affected behavioral intentions and positively influenced environmental sensitivity and environmental responsibility. Furthermore, environmental sensitivity and environmental responsibility exerted a full effect in mediating the relationship between environmental knowledge and behavioral intentions. Hence, increasing students' environmental knowledge will enhance their behavioral intentions. However, by improving students' sensitivity and responsibility, their intentions to protect the environment can be more effectively elevated. Development implications and recommendations for sustainable tourism and higher education are provided.

**Keywords:** sustainable tourism; environmentally responsible behavior; behavioral intentions; environmental sensitivity; environmental responsibility; university tourism students; Taiwan

## 1. Introduction

### 1.1. Sustainable Tourism

The tourism sector will remain as one of the most substantial economic activities in the world, with above-average increases in arrivals at around 4% per year predicted for seven straight years [1]. However, the growth of tourism has not only caused environmental destruction (e.g., through pollution, land clearing, etc.) but has also subjected destinations to the threat of environmental damage, such as through local biodiversity changes, coastal erosion increases, decreases in wildlife, tourism infrastructure damage, etc. [2,3]. In 1992, the United Nations at the Earth Summit held in Rio de Janeiro proposed the concept of sustainable development. The commitment made regarding the development of tourism covers (1) promoting the sustainable development of tourism; (2) reducing the impact of recreational activities; and (3) preserving natural and cultural resources that have tourism

value. These pledges have become essential guidelines for global governments and businesses engaged in tourism development [4]. Sustainable tourism is an essential approach for the tourism sector to support sustainable development.

Sustainable tourism and ecotourism have received much academic and government attention in the past two decades [5–7]. The concepts of ecotourism and sustainable tourism overlap somewhat. Ecotourism is defined as responsible travel to natural areas that conserves the environment, sustains the well-being of local people and involves interpretation and environmental education [8]. Tourism sustainability has become a significant field of research and has its dedicated journal, the *Journal of Sustainable Tourism*. The fundamental principle of sustainable tourism is balanced environmental, economic and social development [9]. In practice, energy saving, recycling, waste reduction, and decreasing greenhouse gas emissions are good practices that some are following. However, it continues to be difficult to implement sustainable tourism on a broader scale. Most tourism enterprises remain “alarmingly unsustainable” [10]. It is challenging for tourism enterprises to promote sustainable tourism and ecotourism because irresponsible visitor behaviors are seen everywhere [11]. Handriana and Ambara indicated that ecotourism or sustainable tourism should minimize natural and cultural environment destruction through people’s environmentally responsible behaviors, and show respect for and return profits to local communities [12]. Based on previous research, tourism is often highly dependent on the natural and cultural environments of destinations. If visitors and operators do not behave responsibly, it is difficult to achieve sustainable tourism development objectives.

### 1.2. Environmentally Responsible Behaviors and Sustainable Tourism

Environmentally responsible behavior is an important indicator of sustainable tourism [13–15]. Therefore, enabling people to adopt environmentally responsible behaviors is an important prerequisite for developing sustainable tourism and ecotourism. Previous studies have mostly focused on exploring tourists’ environmental behaviors [12,16–22]. Some research has explored residents’ environmental behaviors [23,24]. However, investigations to determine the environmental behaviors of tourism employees are scarce. Imran, Alam, and Beaumont point out that the environmental attitudes and behaviors of stakeholders have an important influence on tourism sustainability [25]. Budeanu, Miller, Moscardo, and Ooi believe that sustainability depends on the power of innovation [26]. Appiah suggests it is essential to educate younger generations to become world citizens and face up to the challenges required for a sustainable future [27]. Higher education plays a crucial role in cultivating future citizens and experts with innovative capacity [28]. Hence, it is worthwhile to explore the environmental behaviors and behavioral intentions of future tourism employees (i.e., university tourism students) and significant factors affecting their environmental behaviors and behavioral intentions. If tourism workers have elevated environmental behavior intentions or well-developed pro-environmental behaviors, they are more likely to practice such actions in daily life, persuade others to do likewise, and participate in solving environmental problems. This potentially could contribute to sustainable tourism development.

There has been significant research conducted to investigate environmental behavior. In addition to the desire to learn about people’s environmentally responsible behaviors, scholars are interested in determining the factors affecting these behaviors. The influential factors are usually divided into the knowledge and affective domains. Some researchers have found that environmental knowledge directly affects environmental behaviors [29,30]. However, most studies have shown that environmental knowledge influences behavioral intentions or environmental behavior through affective factors (e.g., values, attitudes, sensitivity, responsibility) [18,31–35]. Many studies have already explored the influence of values and attitudes on behavioral intentions and environmental behavior. Thus, this research analyzes the causal relationships of environmental knowledge, environmental sensitivity, environmental responsibility and behavioral intentions among university tourism students in Taiwan. The specific research objectives are to:

1. Analyze the current environmental behavioral intentions of university tourism students in Taiwan;
2. Examine the influence of environmental knowledge on behavioral intentions;
3. Explore the influence of environmental knowledge on environmental sensitivity and environmental responsibility;
4. Investigate the mediation relationship of environmental sensitivity and environmental responsibility between environmental knowledge and behavior intentions.

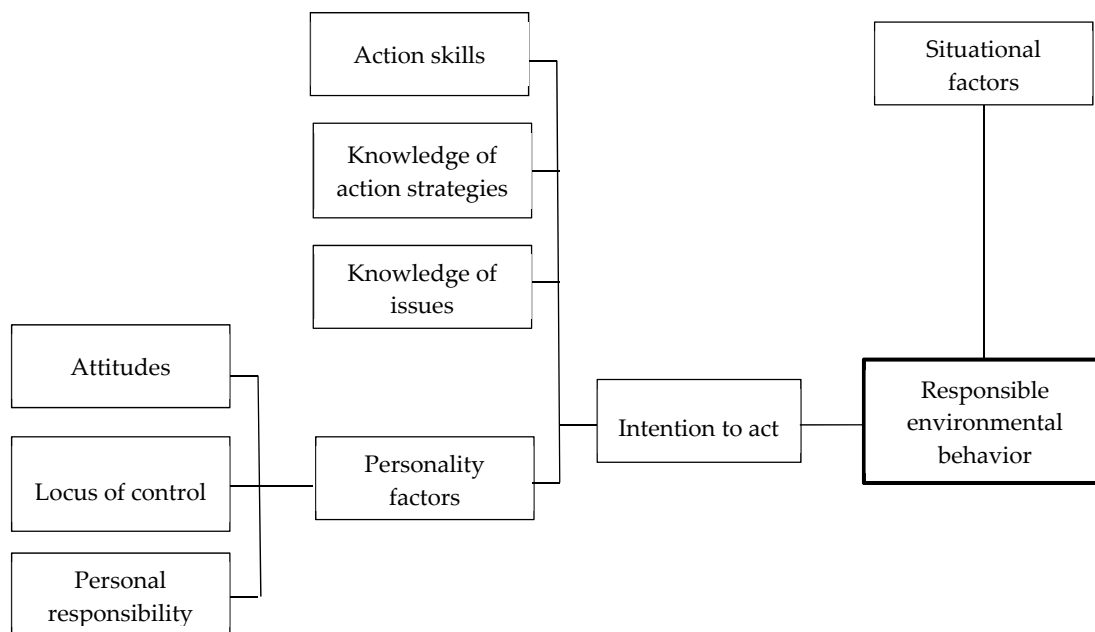
## 2. Literature Review and Research Considerations

### 2.1. Models of Environmentally Responsible Behavior

Early models of environmentally responsible behavior (i.e., before pro-environmental behavior) were based on a linear relationship of environmental knowledge leading to environmental attitudes and environmental attitudes leading to environmentally responsible behavior [36]. These models are now too simple and require further elaboration. In response, many researchers proposed alternative models to explain the relationships between various factors and environmentally responsible behavior. Ajzen introduced the *Theory of Reasoned Action* and the *Theory of Planned Behavior*. Attitudes do not directly determine behavior; instead, they influence behavioral intentions. Behavioral intentions are not only affected by attitudes but also by subjective norms and perceived behavioral control [31,37]. Furthermore, Ajzen also noted that intention is an immediate antecedent to behavior [37].

Hines, Hungerford, and Tomera developed the *Model of Environmentally Responsible Behavior*. They did a meta-analysis of 128 pro-environmental behavioral research studies and identified the variables associated with environmentally responsible behavior. In their model, environmentally responsible behavior is affected by the intention to act and situational factors. Personality, skills and knowledge influence the intention to act. Furthermore, personality factors include attitudes, the locus of control and personal responsibility [38], as shown in Figure 1. Based on this work, Kollmuss and Agyeman designed a sophisticated model of pro-environmental behavior indicating that different factors influence each other and finally, pro-environmental behavior. The influential factors are divided into two groups, external and internal. Political, social, cultural and economic factors are external factors. Environmental knowledge, values, attitudes and emotional involvement are the internal factors [39]. Oliver suggested four continuous stages of forming loyalty, including cognitive sense, affective manner, conative sense, and behavioral manner [40,41].

What shapes environmentally responsible behavior is somewhat complicated, and this shaping cannot be illustrated through a single model or diagram. However, according to these theories and models, environmentally responsible behavior appears to be influenced by affective and knowledge factors. Hence, this research explores how these affective and knowledge factors influence behavioral intentions.



**Figure 1.** The Hines et al. model of responsible environmental behavior.

Previous studies employ different variables to measure environmental behavior and actions. More commonly used are the five dimensions of environmental behavior proposed by Hungerford, Peyton, and Wilke including eco-management, consumerism, persuasion, legal, and political actions. Eco-management represents actions taken to maintain ecological systems or improve environmental defects, such as energy saving, garbage clean-up, recycling, and so on. Consumerism refers to economic threats or actions that force business or industrial behaviors to change, such as consumers jointly refusing to purchase beverages since excessive plastic cup use pollutes the environment and forcing manufacturers to recycle or change packaging materials. Persuasive actions are messages that urge people to adopt positive environmental behaviors or change people's beliefs or values through persuasion. Legal actions are taken to reinforce or amend environment-related laws or prohibit specific behaviors to solve environmental problems. Political actions include lobbying voters, public opinion representatives, or legislators to convince government administrations to address environmental issues, such as writing letters, making phone calls, or personal explanations and presentations. Citizens may also elect public opinion representatives concerned with environmental issues through voting [42]. Alternatively, the six categories of environmental behavior proposed by Smith-Sebasto and D'Costa include civic, educational, financial, legal, physical, and persuasive actions [43]. Although the environmental behavior categories of Smith-Sebasto and D'Costa and Hungerford et al. have different names, financial action is parallel to consumerism, while physical action is like eco-management. The only difference is that Smith-Sebasto and D'Costa include educational action. Since the objective of education is to prepare learners to engage in persuasive actions, eco-management, consumerism, legal and political actions that address environmental issues, educational action cannot be independently classified as a unique behavioral category. The comparison of these two categories of environmental behavior is shown in Table 1. Therefore, this research adopted the "five environmental actions" classification by Hungerford et al. (1980) to measure behavioral intentions, such as the degree of willingness to take eco-management action, to engage in consumerism, etc.

**Table 1.** The comparison of two categories of environmental behavior.

Hungerford, Peyton, and Wilke [42]	Smith-Sebasto and D'Costa [43]	Comparison
Eco-management actions	Physical actions	Similar meaning
Consumerism actions	Financial actions	Similar meaning
Persuasion actions	Persuasive actions	Same
Legal actions	Legal actions	Same
Political actions	Civic actions	Similar meaning
	Educational actions	Enhance learners to have persuasive, eco-management, consumerism, legal and political actions

## 2.2. Environmental Knowledge, Environmental Sensitivity, and Behavioral Intentions

The *Tbilisi Declaration* of 1977 identified the awareness, knowledge, attitudes, skills, and participation objectives needed in environmental education so that people acquire a basic understanding of the environment and its related issues [44]. Chawla defined environmental sensitivity as an empathetic viewpoint toward the environment and classified it as an important variable of environmental awareness as well as in the disposition to practice environmental behavior [45]. Sivek and Hungerford suggested that environmental knowledge could influence one's environmental sensitivity, and environmental knowledge and environmental sensitivity could enhance the level of environmental behavior [46]. Wurzinger and Johansson contended that tourists with more knowledge of environments have a greater concern for the environmental issues of tourism destinations [47]. Based upon these previous research findings, Hypothesis 1 is proposed.

Additionally, there is past research confirming that environmental knowledge indirectly influences environmental behavior [38,48–50]. Wang, Liu, and Qi explored the relationship between these variables with sustainable consumption behavior, including environmental knowledge, environmental responsibility, environmental sensitivity, environmental value, perceived behavioral control, and response efficacy. Their results showed that environmental knowledge positively affected behavioral intentions and impacted sustainable consumption behavior through behavioral intentions [35]. According to these study findings, Hypothesis 2 is proposed.

**Hypothesis 1 (H1).** *Environmental knowledge has positive and significant effects on environmental sensitivity.*

**Hypothesis 2 (H2).** *Environmental knowledge has positive and significant effects on behavioral intentions.*

## 2.3. Environmental Knowledge and Environmental Responsibility

Hines et al.'s model of responsible environmental behavior suggests that personal responsibility is an element of personality that influences behavioral intentions and environmentally responsible behavior [38]. Researchers are interested in knowing which factors predict individuals' responsibility toward protecting the environment. If people have knowledge and awareness of the environment, they are more likely to value environmental responsibility [51]. A measurement scale of consumers' environmental responsibility has been designed, with environmental knowledge being used to predict environmental responsibility [52]. The study sample was 1345 university students in Turkey, and the results revealed that high levels of environmental knowledge stimulated concern, attitudes and personal responsibility related to caring for the environment. Additionally, environmental knowledge was found to be an important predictor of environmental concern, attitudes, and responsibility [53]. In this research, the aim was to determine whether students with greater environmental knowledge had an elevated sense of responsibility for the environment, hence the third hypothesis:

**Hypothesis 3 (H3).** *Environmental knowledge has positive and significant effects on environmental responsibility.*

#### 2.4. Environmental Sensitivity, Environmental Responsibility, and Environmental Behavioral Intentions

Kanchanapibul, Lacka, Wang, and Chan found that younger-generation consumers with more environmental knowledge had stronger behavioral intentions to purchase green products [54]. Cheng and Wu investigated the relationships among environmental knowledge, environmental sensitivity, and environmentally responsible behavior of island tourists. Their results indicated that higher levels of environmental knowledge were related to stronger environmental sensitivity and environmentally responsible behavior. Furthermore, environmental sensitivity was found to mediate the association between environmental knowledge and environmentally responsible behavior [55].

This prior research supports the contention that environmental sensitivity is a predictor of environmental behavior [46,56,57]. Several studies confirm that intention is a predictor of environmentally responsible behavior [31,35,38,57]. Therefore, this research hypothesized that behavioral intention is a predictor of behavior and results in significant variation in environmentally responsible behavior. Therefore, Hypothesis 4 is proposed.

Some scholars have examined the relationship of environmental responsibility with behavioral intentions and environmental behavior. Meta-analyzed data revealed that individuals who feel more personal responsibility toward the environment are more likely to engage in environmentally responsible behaviors than others [38]. Hsu and Roth argued that environmental responsibility, environmental action strategies, and locus of control are the three best variables for predicting environmentally responsible behavior [58]. Kaiser and Shimoda investigated Swiss transportation association members and found that responsibility was a predictor of ecological behavior [48]. However, a person's responsibility judgment was also a predictor of ecological behavior [48,59]. Rahman indicated that attitudes and personal responsibility significantly influenced the behavior of aboriginal students, but knowledge did not contribute directly to environmental care behavior [34].

These studies suggest that enhanced responsibility perceptions significantly increase people's intention and readiness for sustainable consumption behavior. Also, the results show that behavioral intentions play the most important role in explaining behaviors [35,60]. Many researchers agree that behavioral intentions are a significant indication of behavior [31,61–63]. Hence the fifth hypothesis is proposed.

From a cognitive psychology perspective, Fishbein and Manfredo portrayed the formation of behavioral intentions as a process of cognition-affection-attitude-intention [64]. Oliver developed four stages to conceptualize loyalty, including cognitive sense, affective manner, conative sense and behavioral manner [40,41]. According to these two theories, affective factors usually have a mediating effect on the relationship between cognition and behavioral intentions (or behavior). Therefore, the sixth hypothesis is proposed.

**Hypothesis 4 (H4).** *Environmental sensitivity has positive and significant effects on behavioral intentions.*

**Hypothesis 5 (H5).** *Environmental responsibility has positive and significant effects on behavioral intentions.*

**Hypothesis 6 (H6).** *Environmental sensitivity and environmental responsibility mediate the relationship between environmental knowledge and behavioral intentions.*

### 3. Methods

#### 3.1. Sampling and Data Collection

This study targeted tourism students in nine universities in Taiwan, including those in tourism, recreation management, and leisure management departments distributed across four regions (northern, central, southern and eastern Taiwan). Most of the university tourism students had ecotourism or sustainable tourism as subjects within their curricula. Also, several of these universities



offered an environmental education curriculum within general education. Convenience sampling was employed. The authors relied on acquainted professors in these departments, who distributed the questionnaires in their classes. The sample size was based on Jackson's [65] N:q rule, which suggests a minimum sample size in terms of the ratio of cases (N) to the number of model parameters (q) that require statistical estimates. A total of 390 (N) valid responses were received and the number of model parameters (q) was 19. Hence, the subject to item ratio was 20.53:1, passing the criterion of 20:1 for sample size [65].

### 3.2. Measurement

The survey questionnaire was divided into five sections: environmental knowledge, environmental sensitivity, environmental responsibility, behavioral intention, and background information. The scales for environmental knowledge, environmental sensitivity, environmental responsibility were 5-point Likert scales ranging from 1 (minimal) to 5 (extensive). The items for behavioral intention were 5-point Likert scales from 1 (strongly disagree) to 5 (strongly agree).

The 7-item environmental knowledge scale established and revised by Hsu and Roth, Zhu was used to measure students' perceived knowledge of the environment and its related issues (subjective knowledge) [66,67]. The 4-item environmental sensitivity scale from Hsu and Roth, and Hsu was used to evaluate environmental sensitivity as an empathetic viewpoint toward the environment [66,68]. The 4-item environmental responsibility scale from the same authors measured responsibility for the environment [66,68]. The 4-item behavioral intention scale designed and revised by Hungerford et al. (1980), Hsu and Roth (1998), Erdogan, Ok and Marcinkowski (2012) was applied to evaluate willingness to engage in environmentally responsible behaviors (eco-management, consumerism, persuasion and civic actions) [42,66,69]. For the behavioral intention questions, only four of the five categories of environmental behavior were used. Political elections are often the platform for citizens to express their opinions and convince government to take actions that address environmental issues. Since only people aged over 20 in Taiwan can vote, many university students who are under 20 years old are not yet eligible. Therefore, legal and political actions were merged into civic actions, and civic action intentions were measured.

### 3.3. Data Analysis

This study used SPSS 20 for descriptive analysis of the collected data. LISREL 8.8 was employed for confirmatory factor analysis and structural equation modeling. Structural equation modeling examined the proposed hypotheses, and the research framework is shown in Figure 2.

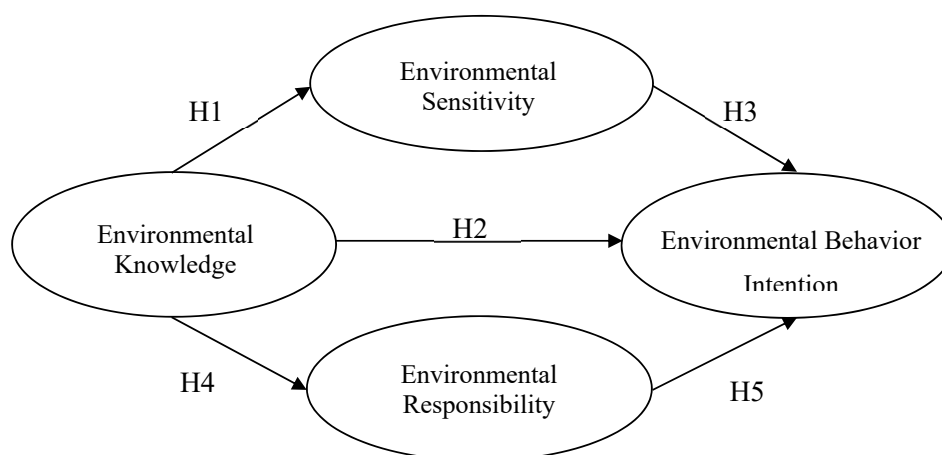


Figure 2. The research framework.

## 4. Results

### 4.1. Profile of Participants

There were more female (60.8%) than male respondents (39.2%). First-year students comprised 37.2%, second-year students 22.8%, third-year students 14.6%, and fourth-year students 24.6% of the sample. The students were mostly from urban areas (53.8%), followed by townships (33.6%). As for fathers' education levels, a senior high school (vocational high school) education was in the majority (37.8%), followed by university (19.6%), less than junior high school (19.6%), and technical college (17.7%). For mothers' education levels, a senior high school (vocational high school) education represented the majority (48.8%), followed by technical college (16.3%), university (16.0%), and less than junior high school (15.4%).

The average score for environmental knowledge was 2.93, ranging from 2.55 to 3.25, and therefore this self-reported score was between low and medium. The average level of environmental sensitivity was 3.35, ranging from 3.28 to 3.38, which was above medium. The average score for environmental responsibility was 3.38, in the range of 2.92 to 3.73, which was from medium to high. The average level of behavioral intentions was 3.72, ranging from 3.48 to 4.00, indicating the willingness to adopt environmental behaviors was medium to high, as shown in Table 2.

### 4.2. Measurement Model

Confirmatory factor analysis (CFA) was conducted to test measurement reliability and validity. CFA results indicated an acceptable model fit, including an  $\chi^2/df$  of 4.13, a root mean square error of approximation (RMSEA) of 0.090, standardized root mean square residual (SRMR) of 0.054, comparative fit index (CFI) of 0.95, and normed fit index (NFI) of 0.93 [70]. Table 2 shows the scores for all variables, and it should be noted that two were expressed as questions and two were supplied as statements. All items were significantly related to their corresponding constructs ( $p < 0.01$ ), and their standardized factor loadings ranged from 0.58 to 0.83. The average variance extracted (AVE) of these constructs was from 0.50 to 0.55. Composite reliability (CR) of all constructs ranged from 0.82 to 0.87. On the basis of these CFA results, the constructs were reliable and valid [70–72]. Table 3 shows the correlation table of the constructs. To achieve discriminant validity, the coefficient for a correlation between a pair of constructs should be lower than the square root of AVE of each construct [73]. Most constructs in the model achieved this requirement, indicating adequate discriminant validity.

**Table 2.** Results of confirmatory factor analysis.

Variable/Construct	Mean	SFL	t Value	ME	IR	CR (AVE)
<b>Environmental Knowledge</b>	<b>2.93</b>					
Population and community in ecology (e.g., dynamics of a population, succession of a biological community).	2.55	0.63	13.28 **	0.60	0.40	0.87 (0.50)
Ecosystem in ecology (e.g., energy flow, cycles of matter).	2.61	0.64	13.59 **	0.59	0.41	
Earth system science (e.g., plate tectonics, currents, and circulation in the oceans, the Earth's climate patterns).	2.88	0.67	14.26 **	0.55	0.45	
Natural resource management (e.g., renewable and non-renewable energy, declines in biological resources and minerals).	2.84	0.70	15.10 **	0.51	0.49	
Environmental pollution (e.g., marine/coastal pollution, acid rain, smog, white pollution).	3.25	0.77	17.37 **	0.41	0.59	
The environment and human health (e.g., air-borne disease, genetically modified foods).	3.17	0.73	16.17 **	0.47	0.53	
Climate change (e.g., causes and effects of climate change, etc.).	3.24	0.80	18.21 **	0.36	0.64	
<b>Environmental Sensitivity</b>	<b>3.35</b>					
What are the levels of my appreciation, passion, and concern for nature?	3.37	0.62	12.61 **	0.62	0.38	0.84 (0.52)
What is the level of my interest in nature?	3.28	0.64	13.15 **	0.59	0.41	
What is the level of my concern towards destruction of the natural environment?	3.37	0.81	18.04 **	0.34	0.66	
What is the level of my concern for the impact of air pollution and water pollution on human beings?	3.38	0.77	16.73 **	0.41	0.59	



Table 2. Cont.

Variable/Construct	Mean	SFL	t Value	ME	IR	CR (AVE)
<b>Environmental Responsibility</b>	<b>3.38</b>					
How much do I feel about “I have a responsibility to solve environmental problems”?	3.47	0.80	17.79 **	0.36	0.64	0.82 (0.54)
How much do I feel about “People have a responsibility to solve the problems of environmental destruction”?	3.73	0.76	16.47 **	0.42	0.58	
How much do I feel about “I have a responsibility to change my consumption habits to solve environmental problems (such as reducing shopping and purchasing energy-saving products)?	3.40	0.77	16.83 **	0.41	0.59	
How much do I feel about “I have a responsibility to adopt citizen actions to solve environmental problems (such as petitions or rallies)?	2.92	0.60	12.10 **	0.64	0.36	
<b>Environmental Behavior Intention</b>	<b>3.72</b>					
I am willing to adopt environmental actions in daily life to protect the environment (e.g., saving water and electricity, taking low carbon transportation producing a less detrimental effect on the environment).	4.00	0.70	14.83 **	0.51	0.49	0.83 (0.55)
I am willing to prevent environmental problems through purchases, refusal, donations, and other consumption behaviors.	3.69	0.83	18.62 **	0.31	0.69	
I am willing to encourage or persuade others to adopt behaviors that prevent or solve environmental problems.	3.71	0.82	18.33 **	0.33	0.67	
I am willing to adopt political or legal citizen actions (e.g., petitions or rallies) to prevent and solve environmental problems.	3.48	0.58	11.69 **	0.66	0.34	

Note: SFL: Standardized factor loading; ME: measurement error; IR: item reliability; CR: composite reliability; AVE: average variance extracted. \*\*  $p < 0.01$ .

Table 3. Correlation table.

Dimensions	EK	ES	ER	EBI
Environmental knowledge (EK)	0.71			
Environmental sensitivity (ES)	0.60	0.72		
Environmental responsibility (ER)	0.44	0.72	0.74	
Environmental behavior intention (EBI)	0.42	0.60	0.58	0.74

Note: The diagonal elements are the squared roots of the AVE.

### 4.3. Structural Model

Based on the CFA results, four constructs were considered in structural equation modeling. The fit indices of the estimated structural model ( $\chi^2/df = 4.13$ , RMSEA = 0.090, SRMR = 0.054, CFI = 0.95, NFI = 0.93) indicated that the model provided an acceptable fit [74]. As Figure 3 shows, environmental knowledge was positively related to environmental sensitivity ( $\beta = 0.60$ ,  $p < 0.01$ ) and environmental responsibility ( $\beta = 0.44$ ,  $p < 0.01$ ), supporting H1 and H4. Environmental sensitivity ( $\beta = 0.33$ ,  $p < 0.01$ ) and environmental responsibility ( $\beta = 0.31$ ,  $p < 0.01$ ) were positively related to environmental behavioral intention, supporting H3 and H5. However, the effect of environmental knowledge on environmental behavior intentions was not significant ( $\beta = 0.08$ ,  $p > 0.05$ ), rejecting H2. The rejection of H2 reveals an important indirect path for environmental knowledge to improve environmental behavior intention through environmental sensitivity and environmental responsibility. Table 4 summarizes the results for the proposed hypotheses.

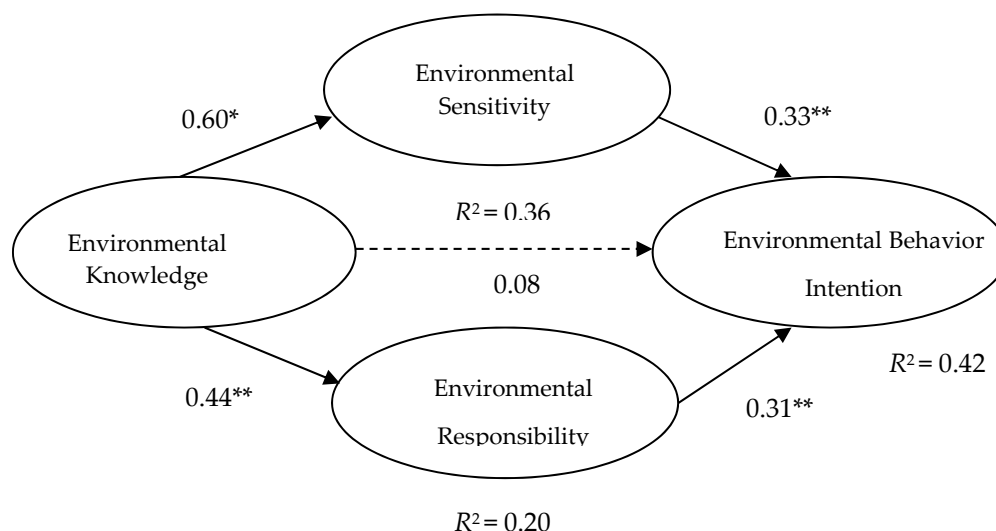


Figure 3. Structural model. Note: \*\*  $p < 0.01$ .

Table 4. Results of the hypothesized paths.

Paths	Standardized Estimate	t-Value	Hypothesis
H1 Environmental knowledge → environmental sensitivity	0.60	8.85 **	Support
H2 Environmental knowledge → environmental behavior intention	0.08	1.26	Not supported
H3 Environmental sensitivity → environmental behavior intention	0.33	3.30 **	Support
H4 Environmental knowledge → environmental responsibility	0.44	7.62 **	Support
H5 Environmental responsibility → environmental behavior intention	0.31	3.62 **	Support

Notes: \*  $p < 0.05$ ; \*\*  $p < 0.01$ .

#### 4.4. Assessment of Mediating Effects

Based on Judd and Kenny [75], this research used three steps to examine the proposed mediating effects. The results of the three-step test are shown in Table 5. With environmental behavioral intentions as the outcome variable in Step 1, environmental knowledge exerted significant positive effects ( $\beta = 0.41$ ,  $p < 0.01$ ), resulting in an  $R^2$  of 0.17. In Step 2-1, environmental knowledge was positively and significantly related to environmental sensitivity ( $\beta = 0.60$ ,  $p < 0.01$ ), causing an  $R^2$  of 0.36. In Step 2-2, environmental knowledge was positively and significantly related to environmental responsibility ( $\beta = 0.44$ ,  $p < 0.01$ ), with an  $R^2$  of 0.20. In Step 3, environmental knowledge was not significantly related to environmental behavioral intention, while both environmental sensitivity ( $\beta = 0.33$ ,  $p < 0.05$ ) and environmental responsibility ( $\beta = 0.31$ ,  $p < 0.01$ ) positively influenced environmental behavioral intention, resulting in a  $R^2$  of 0.42. Together, the effect of environmental knowledge on environmental behavioral intention was decreased when adding environmental sensitivity and environmental responsibility as mediators, demonstrating the significant mediating effects of environmental sensitivity and environmental responsibility.

**Table 5.** Mediator analysis of full model.

Steps	Variable	$\beta$	$R^2$
Step 1 Outcome	Environmental behavior intention		0.17
Predictor	Environmental knowledge	0.41 **	
Step 2-1 Mediator	Environmental sensitivity		0.36
Predictor	Environmental knowledge	0.60 **	
Step 2-2 Mediator	Environmental responsibility		0.20
Predictor	Environmental knowledge	0.44 **	
Step 3 Outcome	Environmental behavior intention		0.42
Mediator	Environmental sensitivity	0.33 **	
Mediator	Environmental responsibility	0.31 **	
Predictor	Environmental knowledge	0.08	

Notes: \*  $p < 0.05$ ; \*\*  $p < 0.01$ .

A further analysis was performed to clarify the direct and indirect effects in the proposed model for the mediating effects of environmental sensitivity and environmental responsibility. Table 6 shows that the total effect of environmental knowledge on environmental behavioral intentions was 0.42 ( $t = 6.94$  \*\*,  $p < 0.01$ ), indicating environmental knowledge improved environmental behavioral intentions. The total mediating effects of environmental sensitivity and environmental responsibility on the relationship between environmental knowledge and environmental behavioral intentions was 0.34 ( $t = 6.26$  \*\*,  $p < 0.01$ ). Together, the results clarified the mediating effects of environmental sensitivity and environmental responsibility on the relationship between environmental knowledge and environmental behavioral intentions.

**Table 6.** Direct and indirect effects in the proposed model.

Independent Variable	Dependent Variable		
	Environmental Sensitivity ( $R^2 = 0.36$ )	Environmental Responsibility ( $R^2 = 0.20$ )	Environmental Behavior Intention ( $R^2 = 0.42$ )
Environmental knowledge			
Direct effects	0.60 (8.85 **) <sup>a</sup>	0.44 (7.62 **)	0.08 (1.26)
Indirect effects	–	–	0.34 (6.26 **)
Total effects	0.60 (8.85 **)	0.44 (7.62 **)	0.42 (6.94 **)
Environmental sensitivity			
Direct effects			0.33 (3.30 **)
Indirect effects			–
Total effects			0.33 (3.30 **)
Environmental responsibility			
Direct effects			0.31 (3.62 **)
Indirect effects			–
Total effects			0.31 (3.62 **)

Notes: <sup>a</sup> parentheses is t value; \*  $p < 0.05$ ; \*\*  $p < 0.01$ .

## 5. Discussion and Conclusions

The results indicate that the environmental behavioral intentions of university tourism students range from medium to high. Relating to the first research objective, the willingness to adopt eco-management actions is the highest, followed by the willingness to engage in consumerism. The intention to perform citizen actions is the lowest.

Environmental knowledge has a significant positive effect on environmental behavioral intentions, but this effect decreases when accounting for environmental sensitivity and environmental

responsibility as mediators. Environmental knowledge indirectly influences environmental behavioral intentions, and this result was parallel to prior studies [38,48,49,76]. Most previous researchers found that environmental knowledge did not directly affect environmental behavioral intentions or environmentally responsible behavior. However, when exploring the reasons, scholars express different opinions.

Some scholars argue that traditional environmental knowledge is not a prerequisite for environmentally responsible behavior because the knowledge alone does not develop personal competence for taking actions about the environment [39,77]. Other researchers believe that environmental knowledge influences behavioral intentions and pro-environmental behaviors through environmental attitudes and other affective factors [31,39]. This relates to the second objective of this research and the overall purpose to explore other influential factors between environmental knowledge and behavioral intention, including environmental sensitivity and environmental responsibility.

The results indicate that students with more significant environmental knowledge tend to have increased environmental sensitivity. This finding coincides with the results of Cheng and Wu [17] and Sivek and Hungerford [46]. In other words, having more environmental knowledge means more concern and empathy towards the environment. The results show that environmental sensitivity positively affects behavioral intentions, a finding consistent with Marcinkowski [55,78], Chou, Pan and Wu [56] and Wang, Liu and Qi [35]. That is, those with greater empathy and sensitivity for the environment are more willing to protect the environment and adopt environmentally responsible behaviors. The students with more environmental knowledge are likely to have greater environmental responsibility. This finding coincides with the results of Stone, Barnes and Montgomery [51], Teksoz, Sahin, and Tekkaya-Oztekin [53], Taufique, Siwar, Talib and Chamhuri [52]. Additionally, environmental responsibility positively influences behavioral intentions, and this outcome is close to the results of Kaiser and Shimoda [48], Rahman [34]. It indicates that people with more environmental knowledge will have enhanced environmental responsibility, while responsibility also promotes environmental behavioral intentions. These results correspond with the third research objective.

Related to the fourth research objective, another important finding is that environmental knowledge positively affects behavioral intentions, but when environmental sensitivity and environmental responsibility coexist, the impact of environmental knowledge on behavioral intentions is much decreased. Environmental sensitivity and environmental responsibility mediate the relationship between environmental knowledge and behavioral intentions. This finding suggests that environmental knowledge must elicit people's environmental sensitivity and environmental responsibility to cultivate environmental protection intentions. This requirement produces the question: What environmental knowledge should be enhanced in people? It is only by encouraging them to connect with nature, and enhancing knowledge of natural environments and environmental issues, that elicits concern and empathy for nature and environmental issues as well as their responsibility for the environment. Previous research has pointed out that being frequently exposed to nature not only produces a pleasant mood and distinct sense of well-being but also promotes sustainable behaviors and responsible environmental behaviors [79–81].

In an era of rapid tourism development and significant environmental challenges, sustainable tourism is an important way to support sustainable development. Encouraging environmentally responsible behaviors and behavioral intentions is a significant goal of sustainable tourism development. University tourism students represent future tourism staff, and their behavioral intentions are an indicator of the potential success of sustainable tourism. How to equip tourism students with adequate environmental knowledge and responsible environmental behaviors is a significant challenge for the tourism sector and higher education.

This research shows that environmental knowledge positively affects behavioral intentions. However, strengthening students' ecological and earth science and environmental science knowledge alone is not likely to cultivate their intentions to protect the environment or pro-environmental behaviors, unless there are emotional links with the environment. This finding suggests that tourism

higher education should offer more curricular contents on sustainability, which will heighten university students' concern for the environment and sustainability issues. Previous studies mostly discuss affective factors, such as values and attitudes, but this analysis explores other affective factors, namely environmental sensitivity and environmental responsibility. The results indicate that environmental sensitivity and responsibility produce significant mediation effects between environmental knowledge and behavioral intentions. Apparently, environmental sensitivity and environmental responsibility are important factors to increase intentions to protect the environment (such as eco-management, consumerism, persuasive, and citizen action intentions). Enabling tourism students to connect with nature and real environments for them to better understand environmental issues and increase their empathy with nature and their environmental responsibility are substantial approaches for fostering greater environmental protection intentions. Cheng and Wu pointed out that if tourists engage in environmentally responsible behavior, these behaviors enhance sustainable tourism development [17]. If future tourism staff have greater concern for environmental protection, they will encourage or persuade colleagues and visitors to practice sustainable behavior. The more people that engage in pro-environmental behavior, the less will be the damage to the environment. Furthermore, these people may become advocates for establishing more protected areas and for the promotion of sustainable tourism.

As a final conclusion to this analysis, the researchers expected that the mean scores for tourism students would be higher than found. This expectation was based on tourism's great reliance on natural environments within Taiwan. However, there are no international standards available to accurately assess the scores in comparison to other groups of tourism students. Also, there is a danger that student knowledge and intentions will dissipate after graduation and it may be difficult to maintain the score levels when measured during university studies, and without the support of teachers and fellow students.

## 6. Limitations and Future Research Needs

This research has some limitations that must be acknowledged. The sample was composed of undergraduate students and no graduate students were surveyed. The attitudes and behaviors of graduate students might be significantly different. The analysis is based on students in Taiwan and thus cannot be generalized to undergraduate student populations in other countries. The research did not consider the environmental curricula at the nine universities, nor the environmental experiences offered by individual universities.

The sample size did not allow for robust comparisons across the four years of study at university. It is logical to assume that the mean scores for the four variables would increase positively with years in university and greater knowledge, but this was not tested. It also remains to be investigated if tourism students' mean scores for the variables are sustained after graduation. Presumably, their abilities to practice environmental behaviors are constrained by the policies and practices of places of employment, as well as by their managers and supervisors.

Future research should consider students in other countries and include qualitative techniques to explore their attitudes and opinions in greater depth. The analysis could be expanded to cover graduate students, teachers, and academic administrators as well. The environmental curricula and field experiences in tourism-related departments should be assessed for depth and appropriateness.

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