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A RISK PERCEPTION MODEL OF CLIMATE CHANGE FOR UNIVERSITY STUDENTS

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Abstract. *This study establishes a behavioral model for university students by utilizing the theories of planned behavior and value-belief-norm, and proposes key latent variables for risk perception toward climate change to establish a structural equation model. Partial least squares analyses and three indicators are utilized to test the reliability, validity, and goodness-of-fit of the model. This study establishes a mixed model with formative and reflective indicators, and assesses both environmental concern and personality traits as formative indicators. Using standardized path coefficients, eight out of 10 paths demonstrate statistical significance, indicating that environmental value and environmental attitudes influence environmental behavior. Three of the five included personality traits (e.g., agreeableness, extraversion, and openness) demonstrate a positive correlation with environmental behavior and environmental attributes. Individuals' risk perception positively influences their environmental value, environmental attitudes, and environmental behavior with respect to climate change.*

Keywords: *climate change, environmental behavior, partial least square, personality trait.*

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Introduction

Climate change represents a significant public risk; providing sustainability education is one important climate adaptation strategy. Basic climate literacy for all undergraduates, not limited to specific disciplines, can help the citizens of tomorrow better understand climate change impacts, climate mitigation strategies, and climate adaptation policies. Climate change causes serious damage to humans' basic living requirements, such as sanitary conditions, water, air, and foodstuffs (World Health Organization, 2008). Failure to respond to the effects of climate change is likely to result in high global costs in terms of natural resources and human health that far surpass the preventive costs (Bazerman, 2006). Recent scientific evidence has shown that, despite the unpredictability of the outcomes of climate change, the number of poor weather days, insect infestations, diseases, and wildfires have increased, as have uneven distributions of rainfall and the frequency and severity of floods and droughts (IPCC, 2001). Climate change is undoubtedly a critical public risk, which represents scientific and technical hazards and involves mental and social factors, such as personal experiences, affect and emotions, intentions, trust, values, and worldviews (Slovic, 2000).

Risk Perceptions of Climate Change

Climate change 2007, the Fourth Assessment Report (AR4) of the United Nations Intergovernmental Panel on Climate Change (IPCC), showed that over the last 100 years, the global average temperature has risen by 0.74°C (IPCC AR4 WG1, 2007), while the average temperature across Taiwan has increased by 1.3°C (TCWB, 2009). These statistics presented the frequency and severity of climate change risk in Taiwan could be higher than global average. The serious impact of climate change became clearly visible was the typhoon, Morakot in 2009, which caused serious damage to property loss and personal injury in the past 50 years over Southern Taiwan and accumulated rainfall in 3 days reached 2,854mm, and direct losses were estimated over US$3 billion (0.7% GDP) (Li, et al., 2013). Understanding risk perception, defined in this context as a response process in risk management strategies consistent with the perception of climate change risk, is likely to provide insight into the short-, mid-, and long-term resource investment planning in sustainability education in Taiwan. This includes education regarding energy

savings and carbon reduction, as well as adjustment to and transformation of the domestic industries (Djordjevic & Cotton, 2011). The current study focuses on climate change, and selects suitable latent variables to construct an environmental behavior model based on the theory of planned behavior (Ajzen, 1991). Understanding university students' perceptions of climate change risk can assist sustainability-oriented policy makers to formulate adaptation strategies, and educators to develop a robust curriculum for raising risk perceptions and knowledge of students on climate change (Cutter, 1993; Kempton et al., 1995). Local catastrophic event would influence individual risk levels on risk perception. Bord et al. (1998) suggested that prior to the severe drought of 1988, most Americans had a limited appreciation of the issues related to climate change; however, the level of awareness increased significantly afterwards (Dunlap, 1998).

Recent studies have shown, that general public often base attitudes and behaviors on incorrect interpretations of the data related to climate change (Bostrom et al., 1994; Read et al., 1994). Johnson (2012) noted that the communication and educational techniques related to climate change can be challenging for the public to comprehend, given that long-term monitoring and adjustments are required to detect its slow changes, negative signs, and influence on human activities. In terms of risk perceptions of climate change, the significance of the relationship between risk perception and environmental attitudes has been validated using demographic factors, such as family condition, educational level, and income (Davidson & Freudenburg, 1996); nevertheless, the relevance of the relationship between risk perception and environmental attitudes was shown to be statistically insignificant (Dunlap, 1998). Some scholars have also suggested that female, young, and highly educated populations perceive considerable risk associated with climate change (Alhakami & Slovic, 1994; Krosnick et al., 2006; Semenza et al., 2008). Even though this topic has received increased emphasis, public polls and academic studies have indicated that climate change issues are seen as low-priority national policies (Bord et al., 1998).

Environmental Behavior Models

Mental models can assess behaviors predicated on risk perception, as well as the importance of scientific information and knowledge in influencing learners during the formation of environmental protection concepts. Studies of mental models have indicated the possible presence of cognitive fallacies among the public regarding the causality of climate change, and found that predetermined mental models exist concerning issues related to climate change; these often lead to major misunderstandings and illogical reasoning (Bostrom et al., 1994; Read et al., 1994). Stedman (2004) employed a linear regression model to investigate risk perception variables relevant to climate change during the development of policies related to climate change in Canada; the results showed that demographic characteristics lacked a statistically significant influence on risk perception, but might affect beliefs resulting from risk perception. Ohe and Ikeda (2005) established a causal model of climate change to explore the differences between attitudes and mitigation strategies. Their results indicated that a person might agree with one aspect when considered from a public-role perspective, which in turn he disagrees with when considered from an individual-role perspective. In Europe, where most citizens exhibit stronger environmental attitudes and greater awareness of the importance of environmental protection, it can still be difficult to transform attitudes and perceptions into specific actions and environmentally friendly behaviors (TNS Opinion and Social, 2008). Gallup's *Health of the Planet* project, conducted in 24 countries, reported similar results (Dunlap et al., 1993). Gifford (2008) showed that a statistically significant difference existed between people's perceptions of climate change and their support for environmentally responsible behaviors. People can perceive the presence of climate change and be more motivated to adopt practices that prevent climate change only when major physiological and physical damage has occurred (Zaalberg et al., 2009).

According to the value-belief-norm theory (VBN) (Stern, 2000), environmental behaviors result from the interaction between environmental values, beliefs, and norms. Researchers often use this theory to assess the person's values, specific beliefs, and attitudes underlying actual behaviors; it has been extensively employed in studies on consumer behaviors toward green products (Johnson, 2012, Stern et al., 1999), acceptance level of energy policies (Steg, 2005), reduced willingness to use automobiles (Nordlund & Garvill, 2003), and ecological risk perceptions (Slimak & Dietz, 2006). The perception of environmental damages and responsibilities influences the relationship between environmental value and environmental behavior (Schultz, et al., 2005). A direct effect on individual behavior occurs only when people perceive the outcome and attribution of environmental impacts.

The belief and thought attribution associated with practicing environmental behaviors (which result from the perception of the environmental impacts of specific behaviors) may be categorized into risk perception, en-

vironmental attitudes, environmental awareness, environmental responsibility (Johnson, 2012; Steg et al., 2005; Stern, 2000), social norms (Bamberg & Moser, 2007; Thøgersen, 2008), environmental information (Togridou et al., 2006; Clark & Finley, 2007), and personality variables (Ajzen, 2005; Balderjahn, 1988; Chauvin et al., 2007). Phillips et al. (2003) emphasized that attitudes to personal responsibility affect behavioral beliefs, as do personality traits, among which extraversion, openness, and accountability are the most significant. Simmons and Widmar (1990) studied the correlation between personality traits and recycling behaviors and observed a ceiling effect when environmental education focuses on the implementation on environmental behaviors; participants showed high incentive motivation when the experiments involved feedback and rewards, but were unable to continue implementing the behaviors in their daily lives (Hovardas & Poirazidis. 2006; Moody & Hartel, 2007). Moreover, Witt (2002) suggested that people with high extraversion and accountability are more likely to make attitudinal commitments and improve their environmental behaviors. In contrast, Rhodes et al. (2002a, 2005) demonstrated that predicting behavior from personality traits was not especially accurate for individuals who displayed weak traits—only one or two personality traits significantly predicted behaviors. Wood (2012) demonstrated that sustainable behaviors are unable to pose immediate and direct influences on climate change with respect to individual characteristics.

In the theory of planned behavior (TPB) (Ajzen, 1985), three independent latent variables affect behavioral intention: attitude, subjective norms, and perceived control over behavior; these variables are useful for predicting the behaviors of people with weak behavioral control. This theory has been applied to a wide range of research topics, such as information technology adoption (Mathieson et al., 2001; Venkatesh et al., 2003; Yu & Yu, 2010), sustainable development behavior (Fielding et al., 2008; Spash et al,, 2009; Tonglet et al., 2004a; 2004b; Vermeir and Verbeke, 2008), and leisure and recreational behavior (Bamberg et al., 2003; de Groot & Steg, 2008; Rhodes et al., 2002b). Ohe and Ikeda (2002) used Ajzen's theory to establish a path relationship between risk perception and actual behavior; the study surveyed 612 Tokyo residents using the questionnaire survey method described by O'Connor et al. (1998a; 1998b) based on latent and observed variables proposed by Ajzen (1991). Regarding the data analysis of variables related to risk perceptions of climate change, Stedman (2004) conducted a factor analysis to assess the correlation between the risk perception and the phenomena of climate change, and evaluated the priority of 15 policy issues related to climate change. The results indicated that the most important influences on climate change for the general public were trade policy protection, and the increased frequency and severity of droughts. Based on the above, this study selected the theory of planned behavior as the basis for developing the approach, and operationalized the variables of the study topic. The aim of this study is analyzing perceptions of climate change risk and environmental behavior related latent variables among undergraduates to: (1) understand the cause-effect relationships between latent variables for environmental behavior towards climate change, and (2) make suggestions that might improve future green curriculums on climate change.

Methodology of Research

General Background of Research

Taiwan's Environmental Protection Administration (TEPA) implemented the Environmental Education Act in June 2011, employees of government institutions and public business organizations, and the staffs and students of elementary and junior high schools are required to attend more than four hours of environmental education courses annually. Taiwan's Ministry of Education provided subsidies to university liberal arts (general) education on climate change adaptation sustainable development in June 2012, and covered eight major domains— disasters, water resources, essential infrastructure, energy supply and industrial sector, coastal areas, agriculture and biodiversity, health and land use. The liberal arts (general) education courses are a set of academic disciplines that include the sciences and the humanities. The undergraduate students generally require a minimum of 28 credits of liberal arts courses, consisting of climate change related courses, to graduate in Taiwan. To develop appropriate environmental education and risk awareness curriculum for climate change, understanding of risk perception for undergraduate students plays a pivotal role to achieve effective learning and promote positive environmental behaviors.

Sample Selection

The typhoon Morakot, recognized as an indication of climate change, seriously hit southern Taiwan in 2009, and the Environmental Education Act implemented in June 2011, and this survey selected a university located at

southern Taiwan and occurred over March-April, 2012. Participants were college students at Southern Taiwan University of Science and Technology, which has four schools and has first largest number of students (around 20,000) for university of technology in Taiwan. The main liberal arts courses related to climate change in this university were "Energy Science, Technology and the Future,""Global Environmental Changes and Sustainable Development," "Ecology and Environmental Protection," and "Introduction to Natural Science."

Instrument and Procedures

Structural equation modeling (SEM) is a regression-based, multi-variable technique that incorporates path analysis; it is optimal for confirmatory empirical research because it can simultaneously process relationships among multiple variables. The purpose of SEM is to investigate the causal relationships among latent and measurable variables to confirm theories (MacCallum et al., 1994), and as a causal modeling technique (Igbaria et al., 1995). SEM also facilitates reliability and validity tests to determine the measurement error values of variables. Problem analysis conducted using SEM is typically a two-stage process: the measurement model analysis and the structural model analysis (Chin and Todd, 1995). Measurement models employ confirmatory factor analysis (CFA) to verify if the variables assessed in the research model accurately measure the latent variables, and to determine the presence of loadings in the measured items for the various latent variables. Structural model analysis examines the model fit between the overall research model and the observed data, as well as the causal effects between the latent variables in the model. This study estimated parameters using maximum likelihood estimation (MLE), an efficient, unbiased estimation method. The presumption of multivariate normality must be satisfied when MLE is utilized, meaning that the method is only suitable for a sample size of at least 100 (Ding et al., 1995). In addition, because MLE may lead to model oversensitivity as the sample size increases, the method is not suitable for a sample size greater than 400 (Marsh et al., 1988; Tanaka, 1987).

Analysis of the Survey Data

Table 1 presents the demographic characteristics of the sample. In total, this study issued and collected 900 survey questionnaires. Of these, 125 completed questionnaires were rejected because participants had not taken at least six hours of climate change courses, leaving 775 valid questionnaires. The majority of the respondents were 21-23 years old (51.6%) and female (62.5%). Many were in their second year of study (44.9%), majoring in schools of management (45.9%) and engineering (37.6%). Participants responded to each measurable variable on 7-point Likert scales (1 = strongly disagree, 7 = strongly agree).

Table 1. Statistics of research participants.

Variables	Type	Percentage (%)
Age	20 or less	40.1
	21-23	51.6
	24 or older	8.3
Gender	Male	37.5
	Female	62.5
Grade	Freshmen	16.4
	Sophomore	44.9
	Junior	27.0
	Senior	11.7
How many courses related to climate change	≦1	28.0
	2-3	39.4
	4-5	23.4
	6-7	5.9
	>7	2.5

Variables	Type	Percentage (%)
Schools	Management	45.9
	Engineering	37.6
	Language	4.3
	Design	12.2

Statistical analyses were undertaken using PASW Statistics 18 and SmartPLS 2. First, A χ^2 or *t*-test based on item characteristics (e.g., nominal scale or interval scale) was performed using PASW Statistics 18 to examine whether the characteristics of the returned questionnaires exhibited consistency. Second, Cronbach's α and CFA were used to evaluate the consistency between the factor constructs collected from the literature review. Nunnally and Berstein (1994) suggested that Cronbach's α should be larger than 0.6 with respect to the preliminary measurement and assessment of construct reliability and single construct validity. Further, measurement variables can be removed to increase reliability when factor constructs do not meet these reliability requirements. Finally, reliability and validity of the latent variables and the corresponding measurement variables were examined to establish a research reference model. The CFA measurement model helps to determine if differences exist in the operational measurements of the variables in each group, which were categorized according to the survey source.

Results of Research

Validation of the Research Model

In accordance with Bagozzi and Yi (1988), this study selected three indicators to assess a predictive model of reflective indicators. Environmental concerns and personality traits were considered as formative indicators; a definition of each indicator is provided as follows. Individual item reliability assesses the factor loading of the observation variables with respect to their latent variables, and examines the loading significance of every variable. In this study, all observation variable loading scores exceeded 0.5, and were significant (Table 2); the coefficient of the sample factor loading score was 0.572-0.963, which is in the range suggested by Hair et al. (2010). The composite reliability (CR) of the latent variables is the composition of the reliability of all measured variables. Its indicator is equal to Cronbach's alpha, which indicates the internal consistency of the constructive indicator. When the reliability increases, the internal consistency of the latent variables also increases. The CR analyzed in this study was 0.742-0.960, and the CRs of all the variables exceeded 0.7, which suggests a good fit based on the suggested CR of 0.6 by Fornell and Larcker (1981), and further indicates the internal consistency of the model. The average variance extracted (AVE) is a summary measurement of convergence within a set of items representing a construct: the average percentage of the variation explained among the items. A higher AVE represents better discriminant and convergent validity of the latent variables. Fornell and Larcker (1981) suggested that the average should be no less than 0.5. The AVE values of the latent variables in our study are 0.546-0.923. Partial least squares (PLS) uses CR and AVE to assess reliability and validity, respectively, in terms of structural modeling. Although most PLS analyses use CR > 0.5 as their citing criterion, a CR of 0.7 is more reliable (Chin, 1998) and CR values in this study are 0.74-0.96.

Table 2. Validation benchmarks of the research model.

	AVE	CR	R2
Risk perception	0.923	0.960	
Social identity	0.603	0.742	
Environmental value	0.665	0.856	0.191
Environmental attitude	0.546	0.828	0.147
Environmental behavior	0.698	0.874	0.256

Furthermore, under structural modeling conditions (R^2), the coefficient distribution in the current study ranged from 0.147 to 0.256. The standardized path coefficients represented the direct effects between latent variables, where eight of the 10 hypothesized paths achieved significance. The individual factor loading exceeded 0.7 in this assessment mode, producing a stable result that provided adequate fit. However, with respect to PLS analysis, it did not offer a good fit of the measures in the assessment model. To examine the overall fitness of our structural model, this study adopted the goodness-of-fit (GoF) measure by Tenenhaus et al. (2005). The GoF is based on the use of minimal partial correlation analysis; its calculation is similar to that of the maximum likelihood parameter in structural modeling analysis. Marcoulides et al. (2009) argued that the size of the standard effect (small: 0.02, medium: 0.15, and large: 0.35) by Cohen (1998) was insufficiently accurate, so they incorporated the AVE and GoF to improve it. More recently, the size of the standard effect has been changed, and new standard fit measures have been set (weak: 0.1, intermediate: 0.27, and good: 0.42). This study obtained a GoF value of 0.370 in our study: this value falls between the intermediate and good level, which suggests that the research model was acceptable.

Path Analysis of the Research Model

This study established a mixed model using both formative and reflective indicators, and tested whether environmental concerns and personality traits are formative indicators. Environmental concerns are comprised of humanistic care (0.329) and ecological concerns (0.949); the latter remains the main target of environmental concerns studied in universities. The discourse on personality traits notes that five major traits are essential to individual composition. To specify the latent variables of personality traits, this study specifically defined personality traits as formative indicators instead of reflective indicators, although these five major personality traits are typically classified as reflective indicators. Among the five major personality traits, test results for agreeableness, extraversion, and openness to experience all demonstrated statistical significance, whereas conscientiousness and emotional stability showed no significance.

Using a PLS assessment tool, we can identify the path coefficients between latent and measurable variables and present individual path values. Eight of the 10 hypothesized paths attained statistical significance in the validation research mode ($\alpha = .05$). The paths for the individual sense of value to environmental behavior were as follows: environmental risk perception → environmental value (0.148), environmental risk perception → environmental attitude (0.136), and environmental risk perception → environmental behavior (0.175). However, the paths for environmental value and environmental attitudes from environmental concerns were as follows: environmental concerns → environmental value (0.06) and environmental concerns → environmental attitudes (0.383). The environmental concerns → environmental value path relation did not receive significant support.

The two paths for the five major personality traits to environmental attitudes and behavior were as follows: personality traits → environmental attitudes (0.125) and personality traits → environmental behaviors (0.269), and these paths were statistically significant. Individually internalized environmental value and environmental attitudes reflected a positive influence on environmental behavior, and environmental value → environmental attitudes (0.109), and environmental attitudes → environmental behavior (0.203). This result indicates that people's attitudes positively influence their environmental behavior. Although environmental attitudes had a greater influence on their environmental values, the path relationship was not significant. Previous results have indicated positive relationships between environmental values and environmental attitudes regarding environmental behavior. However, it is difficult for people to act on these positive environmental commitments. Climate change agendas are mainly publicized through the media, which can induce a social identity related to climate change through coverage of affective images; media can play a significant role to promote sound environmental attitudes towards climate change. The social identity → environmental attitude (0.194) path indicates that social identity had a significantly positive correlation with environmental attitudes.

Environmental risk perception also had significantly positive effects on environmental value, but showed no significance on environmental concern. The variance (R^2) of environmental attitudes was 0.147; environmental attitudes were significantly influenced by environmental concern, environmental risk perception, social identity, and personality traits, indicating that a perception, recognition, and attitude chain can be effectively predicted. The variance (R^2) of environmental behavior was 0.256; environmental behavior was significantly affected by personality traits, environmental risk perception, and environmental value, which again supports the formation of a perception, recognition, and attitude chain. However, our results did not demonstrate significant support for the path of

environmental attitude to environmental behavior, which differs from previous studies that have emphasized a strong consistency between environmental attitudes and environmental behavior (see Figure 1).

This study also used structural equation modeling (SEM) as implemented in PLS for data analysis, and utilized the SmartPLS (a statistical package to compute partial least squares) to determine the fitness between the survey data and research model. A major reason for using PLS instead of covariance structure SEM is that PLS makes minimal demands on the sample distribution requirements, and does not require that data meet criteria for homogeneity and normality (see Table 3). Further, environmental concern and personality traits were treated as formative constructs according to the process outlined by Goodhue et al. (2012), with composites using optimized weights.

Discussion

Given the views of sustainable/green education and the perspectives provided by social theory (VBN + TPB), which center on personality traits to do with cognition, emotion, motivation and behavioral intentions, VBN theory clarified factors of personal cognition and motivation to act on global climate change, while TPB theory clarified the role of motivation, emotion, and behavioral intentions. This study integrates these two important social theories to obtain a more effective understanding of college students' thinking about global climate change in four phases (cognition, emotion, motivation, and behavioral intention), and encourages individuals to mitigate and adapt to global climate change.

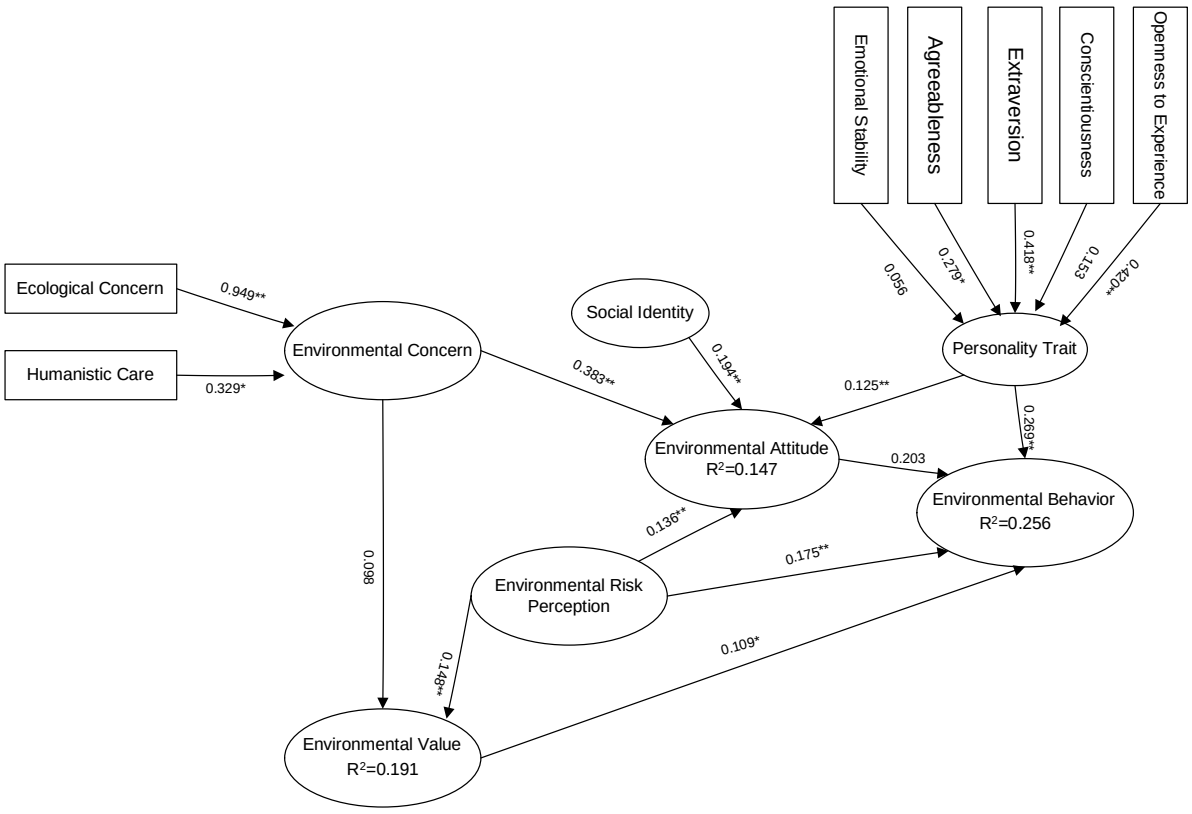

Figure 1: Path coefficients of the research model.

Table 3. Discriminant validity and correlation coefficient.

	Environmental concern	Personality trait	Environmental risk perception	Social identity	Environmental value	Environmental attitudes	Environmental behavior
Environmental concern	**1.000**						
Personality trait	0.094	**1.000**					
Environmental risk perception	0.318	0.296	**0.961**				
Social identity	0.096	0.320	0.199	**0.777**			
Environmental value	0.408	0.267	0.365	0.242	**0.815**		
Environmental attitudes	0.274	0.374	0.474	0.474	0.408	**0.739**	
Environmental behavior	0.113	0.383	0.314	0.433	0.398	0.541	**0.835**

Notes: All correlations are significant at the 0.001 level; diagonal element is the square root of AVE and should be larger than the off-diagonal correlation coefficient.

Humans' environmental concerns are a motivational variable capable of mitigating climate change. Moreover, valuing the environment is an antecedent variable to safeguarding living space for humans and animals. In this process, environmental convictions to do with global climate change could be composed of environmental consciousness, environmental attitudes, and environmental behaviors. It is worth noting that there is no significant direct relationship between the environmental concern and environmental value. However, environmental concern has an impact on environmental attitudes at the belief stage. Wang et al. (2008) noted that environmental value is a higher-order form of environmental attitudes, while Stern (2011) stated that although environmental value can induce behavioral changes, it has a greater effect on the consequences attributable to perceptions of the environment, as these influence individual environmental beliefs, and the relationships are significant. This conclusion is in line with other behavioral theory models (Jansson et al., 2011; Fielding et al., 2008; Milfont, 2012; Nigbur et al., 2010; Spence et al., 2012; Zaalberg et al., 2009).

Other research takes into account the importance of norms. Bamberg and Moser (2007) and Thøgersen (2008) believe that pressure from social norms is a kind of belief. Our study adopts the idea of the individual social identity that is formed when referring to groups of people, rather than using the definition of self-identity proposed by Mannetti et al. (2004). Thus, our study results recognize the pressure of norms formed by moral obligation and the moral sense of a personal value system as well as the collective consciousness. This pressure will ultimately form a sustainability-oriented social identity. These results correspond with those of Roeser (2012) and Shackelford (2006), who believe that group norms have a significant impact on the constancy of behaviors and attitudes toward the environment.

The study of personality traits is already mature. Based on Costa and McCrea (1992) and Goldberg (1990), the factors used in factor analysis include affinity, extroversion, openness, accountability, and emotional stability. Therefore, this study utilized a confirmatory factor analysis to verify the stability of the relevant factors that constitute environmental behaviors, and a formative model as a stable forecast variable. Past empirical researches by Fraj and Martinez (2006), and Moody and Hartel (2007) concluded that individuals associated with an attitude of high responsibility tend to buy environment-friendly goods. Moreover, Rhodes et al. (2005) carried out empirical research based on the five key personality characteristics. These studies all concluded that individual personality traits are stable. The current study collectively considered personality traits as a formative variable, while the correlations among personality traits with environmental attitudes and with environmental behavior was positive and statistically significant.

Conclusions

For sustainability education, analyzing university students' risk perceptions on climate change can facilitate greater understanding of influence on environmental behavior, and path relationships between latent variables, and alternative directions of curriculum design available to policy makers and educators. This study contributes to that understanding through the collected measurable and latent variables related to risk perceptions of climate change, leading to construction of a PLS risk perception model demonstrating university students' understanding of and beliefs about climate change. The model allows us to better assess the cause-effect relationships between various latent variables related to environmentally responsible behaviors, which can serve as a useful reference for policy makers and educators concerning sustainability education in universities. The results of the model were stable and exhibited a satisfactory fit.

Using standardized path coefficients, eight of the 10 proposed paths attained statistical significance. In addition, the path coefficients of environmental risk perception among the various constructs from personal values and perspectives to environmental behaviors were as follows: 0.148 for perceived environmental risk to environmental value, 0.136 for perceived environmental risk to environmental attitudes, and 0.175 for perceived environmental risk to environmental behavior. These results indicate that environmental value and enviornmental attitudes reflect the positive influence on environmental behaviors. However, even though the influence of environmental attitudes was stronger than that of environmental value to climate change, these path relationships did not achieve statistical significance; this result suggests that while environmental attitudes can guide personal environmental behaviors, instituting the attitudes within actual behavioral commitments is difficult.

In this study, personality trait, risk perception and environmental values positively influence environmental behavior to respondents with statistical significance, and personal trait has the highest path coefficient. Considering personality trait, extraversion and openness to experience exist the highest path coefficients. Therefore, policy makers and educators could develop the green education curriculum and adaptation strategies to meet the needs of these two personality traits and raise intention of college students to adopt pro-environmental behavior.

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