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PSYCHOLOGICAL DISTANCE AND PRO-ENVIRONMENTAL BEHAVIOR: AN APPLICATION OF BEHAVIOR MODEL TO EMERGING CONTAMINANTS IN HIGHER EDUCATION

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Abstract. *To help mitigate and educate the negative impacts of emerging contaminants (ECs), this research tried to realize the environmental attitude and environmental behavioral intention of students in the field of environmental education at higher education level. However, little is known about integration of psychological distance, environmental attitude, behavioral intention and effective teaching strategies on emerging contaminants for undergraduate students within a behavior model. This research proposed a pro-environmental behavior model, integrated with Theory of Planned Behavior (TPB), Value-Belief-Norm (VBN) model and psychological distance to realize causal relationships among latent variables that instructors concerned. In a cross-sectional survey, this research effectively surveyed 851 respondents of five universities in Taiwan through self-report questionnaires. This research utilized bootstrapping manner and Smart-PLS software to identify the crucial relationships between two formative factors (environmental attachment and psychological distance), value and beliefs and behavior intention on ECs. The level of ECs knowledge was treated as a moderator, and results indicated significant moderator effects on environmental attachment toward environmental attitude, and environmental attitude toward behavioral intention. The results provide empirical support for some previous identified barriers to pro-environmental behavioral intention and suggest guidelines for effective pro-environmental behavior on ECs issues.*

Key words: *partial least squares, behavioral intention, emerging contaminants, theory of planned behavior, value–belief–norm theory.*

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Introduction

With the emergence of novel and complex scientific technologies, emerging contaminants (ECs) such as plasticizer, nanomaterials, environmental hormones, and trace elements have become significant public risks and increased global threats. Such ECs problems have human causes and effects, and are often the result of human misuse leading to further environmental degradation. The threats of ECs to human health, food safety and environmental sustainability have been increasing over the past two decades (Noguera-Oviedo & Aga, 2016). Science education programs in most higher education institutions involve environmental education; environmental sustainability is the global concern issues, so environmental education in science education plays an increasingly essential role. The ultimate goal and most widely believed concept of environmental education for students is to establish active pro-environmental behavior (Hines, Hungerford & Tomera, 1987; Hungerford & Volk, 1990; Scoil, 1999; Vaughan, Gack, Solorazano & Ray, 2003).

This research tries to establish an environmental behavior model, analyze causal relationships among latent variables related to environmental behavioral intention on ECs, and find the views and responses of university students towards ECs. These results would facilitate the understanding of those views for environmental educators at higher education, policy makers, risk managers, and risk communicators, which then contributed towards curriculum development of environmental education and introduction of adequate strategies to meet actual requirements, thereby contributing towards effective risk management strategies. Psychological distance is involved to

understand individual's risk perception of specific topic can help decision makers to form an accurate concept of the topic, based on scientific information and knowledge. This research extends the use of construal level theory (CLT) (e.g., psychological distance), environmental behavior models (e.g., the theory of planned behavior (TPB) and value-belief-norm (VBN)), and environmental value (e.g., natural constraints, environmental attachment and conservation commitment) as equal contributors to identify relations between aforementioned latent variables and predict behavior intention of university students about ECs.

Environmental Behavior Models and Environmental Values

Most environmental educators and environmental psychologists recognized that environmental education leads a positive linkage to environmental intention (Ajzen, 1985; Hines et al., 1987; Hadjichambis, Paraskeva-Hadjichambi, Ioannou, Georgiou & Manoli, 2015). Awareness, knowledge and perceived risk for ECs in relation to health and environment involve a multidisciplinary approach in environmental education. An urgent task of sustainability education is the provision of relevant knowledge on ECs. Environmental education is an effective and lasting strategy to maintain a sustainable environment. Environmental education students in universities could apply environmental knowledge, attitude, promise, intention, and technique to solve or prevent environmental problems. At the present stage, the immediate tasks for environmental education in university are curriculum design and clarifying the degree of perceived risk of ECs. The degree of perceived risk of university students would influence fine-tuning of curriculum design. Implementing environmental education for undergraduate students, and introducing the concept of environmental sustainability could solve environmental problems to present and future human well-being (Miller, 2016).

Environmental behavior models could supply adequate predictions on environmental behaviors or behavioral intentions for students. The classical environmental behavior model (Hungerford & Volk, 1990) comprises three latent variables: knowledge, awareness or attitude, and behavior. An individual's behavior results from the interaction between environmental value, belief, and norm. This model is widely used to understand consumer behavior towards green products (Stern, Dietz, Abel, Guagnano & Kalof, 1999; Jansson, Marell & Nordlund, 2011), acceptance of energy policies (Steg, Dreijerink & Abrahamse, 2005), reducing car usage (Nordlund & Garvill, 2003), and perception of ecological risks (Slimak & Dietz, 2006).

The TPB models (Ajzen, 1985; Ajzen & Driver, 1992) advocated that individual's behavior is affected by behavioral intention, which is dependent on attitude and social norms. Tonglet, Phillips & Read (2004) used TPB to discuss the attitudes and opinions of households towards recycling, and results showed that attitude is the main factor that affects recycling behavior. do Valle, Rebelo, Reis & Menezes (2008) suggested that TPB could be used to effectively predict whether an individual would be involved in recycling activities. Klöckner & Blöbaum (2010) built a Comprehensive Action Determination Model, combined with four theories as TPB, NAM, the theoretical concept of habit (Verplanken & Wood, 2006) and the Ipsative Theory of Behavior (Frey, 1989), with normative processes, habitual processes, intentional processes, situational influences. Adam & Shauki (2014) modified TPB model with moral norm and demonstrated that attitude, social norm and moral norm of Malaysian investors had positive effect on intention and behavior towards socially responsible investment. Yazdanpanah & Forouzani (2015) utilized TPB model including moral norm and self-identity to explore students' behavioral intentions for purchasing organic food in Iran, and presented that moral norm and self-identity were important predictors of behavioral intention. Chen (2016) extended TPB model including moral obligation to explain people's intention to engage in carbon reduction behaviors in Taiwan and found moral obligation increased the explanatory power than original TPB model. Masud, Al-Amin, Junsheng, Ahmed, Yahaya, Akhtar & Banna (2016) applied TPB model to investigate cause-effect relationship for behavioral intention to adaptation strategies of climate change in Malaysia, and indicated that attitudes, social norms and perceived behavioral control had positive influence on behavioral intention.

The VBN theory (Stern, 2000) proposed a complicated causal model on pro-environmental actions with values, belief and norms. This model involved a revision of the norm–activation model (NAM) by Schwartz (1973, 1977), and combined with theory on ecological value (Li, Fahima, Beiles, Korol & Nevo, 1999). Wang, Dou & Zhou (2008) treated value as a higher form of attitude (a form that is closer to behavior), as opposed to a form of subjective external perception. Schultz, Gouveia, Cameron, Tankha, Schmuck & Franěk (2005) made use of the 56 measurable variables for environmental value, and reduced those questions to four environmental values for purpose of their multi-country study. de Groot & Steg (2008) suggested that environmental values could be

separated into self-interest and self-centeredness, altruism, and the ecological value of property. Crompton (2008) proposed that the value towards environmental change could be divided into social and ecological altruism; the former refers to the view of sustainable living for the benefit of future generations, whereas the latter refers to the preservation of natural habitats for endangered animals. Milfont (2012) suggested that environmental values would raise the individual's concern over the environment and his/her dependence on the land, thereby leading to the formation of a code of conduct. The review of the diverse literature identified a myriad of definitions of environmental value; most definitions recognize environmental value as a multi-faceted construct. Liobikienė & Juknys (2016) applied VBN theory and goal framing theory to analyze impact of self-transcendence and self-enhancement values on pro-environmental behavior, and results showed that individuals with stronger self-transcendence value would be guided by normative goals, and had a more pro-environmental behavior.

This research explored cause-effect relationships between natural constraints, environmental attachment, attitude, conservation commitment, psychological distance with pro-environmental behavior toward ECs. The natural constraint, in termed as balance of nature, was antecedent variable of environmental attachment. Bamberg & Möser (2007) also indicated that natural constraint (problem awareness) was a latent variable to pro-environmental behavior with meta-analysis. Sutton & Tobin (2011) developed a theoretical framework to investigate objective constraints (natural constraint) on cognitive and behavior al engagement with the climate change issues.

The environmental attachment is a part of environment value might also provide foundations for environmental belief about pro-environmental behaviors. Lee (2011) demonstrated that environmental attachment, recreation involvement and conservation commitment critically influence pro-environmental behavior for wetlands visitors. Cheng, Wu & Huang (2013) also showed positive relation between environmental attachment and strong pro-environmental behavior for tourists in Penghu Island. Tonge, Ryan, Moore & Beckley (2015) conducted an on-site visitor survey to examine the effect of a multi-dimensional environmental attachment on pro-environment behavioral intention at Ningaloo Marine Park, Australia. Scannell & Gifford (2010) distinguished two types of environmental attachment: civic and natural, and explored their respective influences on pro-environmental behavior and regression results revealed that natural environmental attachment had a better prediction on pro-environmental behavior than civic.

Conservation commitment was identified as an important factor to promote pro-environmental behavior (Lee, 2011; Lokhorst, Werner, Staats, van Dijk & Gale, 2011; Osbaldiston & Schott, 2011). Based on the theory of reasoned action and stakeholder theory, Marshall, Akoorie, Hamann & Sinha (2010) explored relationship between adoption of environmental practices and conservation commitment in the wine industries of New Zealand and the United States, demonstrated conservation commitment and competitive advantage are significant and most highly correlated with the implementation of all three environmental practices. Davis, Le, & Coy (2011) presented that conservation commitment had the mediated effects to predict pro-environmental behavior and had willingness to sacrifice for the environment with regression analysis. Tonge et al. (2015) demonstrated the effect increasing with the level of conservation commitment required to undertake the pro-environment behaviors for the management of natural area tourism destinations.

Psychological Distance and Pro-Environmental Behavior

Psychological distance refers to the extent that people perceive events with four theorized dimensions of distance- temporal, social, geographical, and uncertainty (Spence, Poortinga & Pidgeon, 2012). Liberman & Trope (2008) proposed CLT to describe the concrete or abstract relationship between psychological distance and specific event, and explored the effect of psychological distance on metal representations of attitudes and behaviors. It expresses psychological distance as representations that are either high and abstract, or low and concrete levels. Spence et al. (2012) used CLT and psychological distance to measure behavioral intention of the British public about differences in their energy use due to climate changes, and results showed that a low level of psychological distance made the subjects highly engaged in environmental care, energy conservation, and pro-environmental behavior. To achieve a more comprehensive understanding, Spence et al. (2012) used a mathematical combination of social, geographical, and temporal variables to measure different aspects of psychological distance levels. Short geographical, temporal, and social distances have significant impacts, of which social distance was the most prominent.

Most researches demonstrated psychological distance could be a useful indicator to evaluate environment

issues (Hartig, Kaiser & Bowler, 2001; Hartig, Kaiser & Strumse, 2007) and climate change-related events (McDonald, Chai & Newell, 2015). Skippon & Garwood (2011) utilized psychological distance to evaluate consumers' attributions on buying electric vehicles. Zhang, He, Zhu & Cheng (2014) explored the role of psychological distance in assessing degree of severity of water pollution with temporal, social, and uncertainty distances; analytical results revealed that when the three psychological distances coexisted, uncertainty distance was the only indicator that had a significant effect on severity assessment. Mir, Behrang, Isaai & Nejat (2016) evaluated impacts of psychological distance on pro-environmental intention to choose less polluted travel choices. Jones, Hine & Marks (2016) applied CLT to decide whether the communication intervention of climate change could increase public engagement by reducing the psychological distance. The concept of psychological and social factors helps the public to better understand the relevant scientific principles on basis of accurate opinions of risk events, and take preventive measures against future disasters (Newell, McDonald, Brewer & Hayes, 2014). This research therefore attempts to evaluate the pro-environmental behavior of university students to ECs with psychological distance.

Taiwan Legislative Yuan passed the Environmental Education Act as law on May 18, 2010, leading in a new era of mandatory environmental education. According to the law, all employees of government institutions, public business organizations for Taiwanese schools and organizations, are required to attend four hours or more of environmental education programs. The Taiwan Environmental Protection Administration (TEPA) amended the enforcement rules of Taiwan environmental education act in September 17, 2013. The new amendments involved theme and contents of environmental education, and this research therefore assumed knowledge levels of ECs as a dominant mediator on this research model. Most environmental education research works about ECs focused on the risk identification (Petrovic, Eljarrat, De Alda & Barceló, 2004; Sodré, Locatelli & Jardim, 2010; Thomaidi, Stasinakis, Borova & Thomaidis, 2015), evaluation manner (Mandalakis, Stephanou, Horii & Kannan, 2008), monitoring (Petrovic et al., 2004; Bueno, Gomez, Herrera, Hernando, Agüera & Fernández-Alba, 2012), analytical methods (Agüera, Bueno & Fernández-Alba, 2013), and removal techniques (Dolar, Gros, Rodriguez-Mozaz, Moreno, Comas, Rodriguez-Roda, & Barceló, 2012; Garcia-Rodríguez, Matamoros, Fontàs & Salvadó, 2014). Few research papers depicted and predicted causal relationships among latent variables of pro-environmental behavior model and the behavior intention, environmental attitude and psychological distance of students are needed before the environmental education curriculum is designed at higher education level.

The risk identification and knowledge of emerging contaminants are emerging and crucial issues in environmental education (Schahn & Holzer, 1990; Levine & Strube, 2012), and knowledge levels of ECs could be a moderator to the research model. Meinhold & Malkus (2005) explored the relationships among adolescent environmental behaviors and found that environmental knowledge was a significant moderator for the relationship between environmental attitudes and environmental behaviors. Fraj-Andrés & Martínez-Salina (2007) revealed that level of environmental knowledge moderates the significant relationship between environmental attitudes and ecological behavior. Satterfield, Kandlikar, Beaudrie, Conti & Harthorn (2009) compiled the findings from 22 studies to validate the four underlying assumptions related to nanotechnology and indicated that individuals' environmental literacy include an understanding of the knowledge, importance, and solutions of environmental issues, as well as the use of existing environmental knowledge and evidence to analyze and solve environmental problems. Aman, Harun & Hussein (2012) utilized the Theory of Reasoned Action to investigate influence of environmental knowledge on green purchase intention, and presented that environmental knowledge and environmental concern significantly influenced green purchase intention.

Methodology of Research

The current research attempts to construct a theoretical model to predict and explain students' emerging contaminants knowledge and pro-environmental behavior, as well as to test the model empirically. This research adopts a positivist research approach, contributing to the methodological pluralism that is necessary for the complete understanding of a phenomenon. Rigorous statistical testing was possible as the data collected through a structured questionnaire. A self-administered, closed-ended questionnaire with ordered choices was used to sample Taiwan's universities.

Instrument

New pro-environmental behavior is difficult to observe from an external perspective because of the nature of pro-environmental behavior in relation to practice and past habitus. In other words, self-reporting is the best way to measure changes in actual behavior intention. After confirmation of the model constructs and theory, this research considered the literature on environmental behavior, risk perception of ECs, environmental attachment, and other related latent variables. The questionnaire comprised previously published multi-item scales with favorable psychometric properties. The generation of constructs based on an extensive study of the prior literature in related fields, such as environmental attachment, natural constraints, and conversation commitment, were adapted from measurement items validated in previous empirical studies (Stern, 2000; Crompton, 2008; Osbaldiston & Schott, 2011). The new environmental paradigm (NEP) (Dunlap, Van Liere, Mertig & Jones, 2000) developed 15 scales to describe environmental attitude and extracted four latent variables as balance of nature, limits to growth and ecocrisis and exemptionalism. The scales for social norms, environmental attitude and behavioral intention were adapted from prior research (Stern et al., 1999; Klöckner & Blöbaum, 2010; Milfont, 2012; Ramkissoon et al., 2013) where possible. The constructs of psychological distance modified existing environmental psychology scales (e.g., Liberman & Trope, 2008; Spence et al., 2012) to fit the context of psychological distance for emerging contaminants impact and captured three distinct dimensions of psychological distance (social, geographical, temporal distance).

Three experts examined the each research constructs and survey items. On the basis of expert comments, we made minor adjustments to refine the questionnaire. The face and content validities of the instrument were verified based on the in-depth interviews with these professionals. Considerable effort was made to ensure that each statement in the formal survey instrument captured the intended meaning of the construct under investigation. A pretest was performed to verify that questionnaire items were clearly phrased and categorize individual items into substrata. The participants included 15 students who had undertaken general courses on environmental education (including the topic of ECs) for at least six hours in the previous semester. Two stages were conducted at this pretest, participants were allowed to complete the questionnaire on their own, but could seek clarifications from the researchers at any time during the process at the first stge. After completing questionnaires, researchers explained meaning of every question to participants and ensured no misinterpretation. After two stages, all questionnaires were carefully revised and confirmed that all items were clear and unambiguous.

A pilot study was therefore conducted before the formal test to fine-tune the wording of the questionnaire and check the psychometric properties. In the pilot test, the questionnaire was given to 45 responders who had participated in environmental education course activities. After eliminating the incomplete questionnaires, there were 39 valid questionnaires in total. Next, the following processes were adopted when preparing the questionnaire for the pilot survey. (i) The correlation coefficient matrices of all the questions were calculated. If two questions had similar words and a high degree of correlation (with a correlation coefficient greater than 0.9), one of the questions would be eliminated, or both questions would be combined. (ii) The total scores of all the samples in the pretest questionnaire were sorted in descending order, using internal consistency indicators. Scores in the top and bottom 25% were selected to form a high- and low-score group, separately. The difference between the two groups was set as the discriminant for the questions, while non-discriminant questions were eliminated. (iii) Questions with a similarity value smaller than 0.5 were eliminated, in accordance with the proposal by Hair et al. (2010).

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The above three procedures were used to examine all the survey questionnaires to ensure their reliability and validity. The questionnaire was finalized after examination of the correlation coefficient, as well as question discrimination versus similarity. All research constructs (natural constraints, environmental attachment, psychological distance, social norms, attitude, conservation commitment, behavioral intention) scale were

measured with the seven- point Likert type scale (ranging from strongly disagree to strongly agree) adapted from prior researches. The overall reliability of Cronbach's alphas for the factors of each research construct were 0.836, 0.787, 0.888, 0.909, 0.931, 0.829 and 0.865, which implied that the scales were appropriate measures of the research constructs. The survey questionnaire is composed of closed-form questions that make interpretation of respondent's answers easier.

Participants

This research population involved approximately 27,000 university studentsfrom five universities in Taiwan. The survey targeted undergraduate students taking environmental education, climate change, emerging contaminants, and introductory human-environmental rights courses. We provided eight hours of teaching materials to those lecturers who were willing to participate within this research. This way would ensure that the students have a complete understanding of the topic of ECs. Participation in the study was completely voluntary, after judgmental sampling by researchers, the questionnaires were administrated to the selected participants through various universities. To minimize the possibility of the participants reconstructing history to present a consistent and logical picture, the measurement of behavioral intention items were separated from the measurement of other constructs to test the proposed research model.

In the formal survey period lasted from March to June 2013, this research received a total of 915 responses. The Taiwan Environmental Protection Administration (TEPA) amended the enforcement rules of Taiwan environmental education act in September 17, 2013. The new amendments involved theme and contents of environmental education. The risk identification and knowledge of emerging contaminants are emerging and crucial issues in environmental education. Five reverse questions were incorporate in this questionnaire to ensure that participants answered the questions carefully. If a participant gave more than three positive answers to the reverse questions, his/her answer sheet would be invalid. After eliminating invalid answer sheets and those with more than 10% of the questions left unanswered, there were 851 valid questionnaires. The sample validation rate of the recovered questionnaires was 93.2%. The sample demographic data in Table 1 indicate a diverse cross-section of population. Of the respondents, 43.2% were males and 56.6% were females. The average age of the sample population was 21.02 years old (standard deviation was 1.57 years old). Regarding course performance (environmental education, climate change, emerging contaminants,), 180 participants ranked in the top one third among their classmates, whereas 80 ranked in the bottom one third; 54 participants declined to answer this question. When asked whether they were taking or had taken related courses, 372 participants reported 2–3 courses, 287 reported 1 other course, 114 reported 3–4 courses, 29 reported 5–6 courses, 16 reported over 7 courses, and 33 declined to answer.

Data Analysis

Partial least squares (PLS) manner is a statistical method used to explore or construct linear models. In a general linear model, there are at least two sets of variables, one independent and the other, dependent. A general regression equation can only handle one set of dependent variables, whereas PLS can handle several sets of independent variables, as well as a set of dependent variables. This research used the SmartPLS 2.0 software developed by Ringle et al. (2005) to measure the analysis model for the measurement and structural models. Petter et al. (2007) considered it more appropriate to use the PLS analysis tool for components-based models, while LISREL and AMOS are more suited for covariance-based models. Components-based models have generally replaced covariance-based ones, and can handle both measurement and structural models. Bootstrapping was a resampling technique and used to compute the standard error and *t* value of the each model parameter.

Results of Research

Reliability and Validity of Research Model

Based on the study by Bagozzi & Yi (1988), the three most commonly used indicators were selected, to evaluate the measurement model for the reflective indicators. Two latent variables, environmental attachment, psychological distance, are formative indicators in this research. Their reliability indicators of latent variables could not be calculated. The explanations of the various indicators are stated below (Table 1).

Table 1. Reliability and validity indicators of the research model.

	CR	AVE	R^2
Social norms	0.976	0.891	
Natural constraints	0.999	0.996	
Conservation commitment	0.999	0.994	0.992
Environmental attitude	0.981	0.914	0.116
Behavioral intention	0.977	0.897	0.969

a. Individual item reliability is an evaluation of the factor loading of the measurement variable to the latent variable, and tests for the statistical significance of each variable loading. With the exception of formative indicators, the loadings for the individual measurement variable were greater than 0.5, and exhibited significance. The loading coefficients of the sample factor ranged from 0.896 to 0.997, which complied with the values suggested by Hair et al. (2010).
b. Composite reliability (CR) of the latent variable is the composition of the reliabilities of all the measurement variables. The meaning of its indicator is similar to the Cronbach's alpha, and it can be used to indicate the internal consistency of the construct indicators. The higher the reliability, the greater is the internal consistency of the latent variables. The threshold value suggested by Fornell & Larcker (1981) was 0.6. The CR value of this research was between 0.976 and 0.999, whereas the CR values of all the variables were greater than 0.7(Wynne, 1998), indicating good internal consistency.
c. Average variance extracted (AVE) of the latent variable calculates the variation in the explanatory power of each measurement variable of the latent variable, and evaluates the variance of individual measurement variables, as explained by several common factors. The higher the AVE is, the better the convergent and discriminant validities of the latent variable are. The standard value suggested by Fornell & Larcker (1981) was 0.5. The AVE value of each latent variable was between 0.891 and 0.996, whereas the AVEs of all the variables in the research model were greater than 0.5.

The explanatory capacity of the structural model is R^2, with the coefficient distributed within the range of 0.116 – 0.996. The standard path coefficients represent the direct effects, with the assumptions made from all nine paths being able to reach significance. The individual factor loadings of this measurement model were greater than 0.7, which means that the measurement results were stable and valid. However, when PLS analysis was carried out, the software did not provide any fit indicator. To test the overall fit situation, the indicator goodness-of-fit (GoF) proposed by Tenenhaus, Vinzi, Chatelin, & Lauro (2005) was adopted. The GoF indicator is the calculated coefficient of the maximum likelihood estimated in the analysis of the structural model, based on the minimum partial correlation method.

Marcoulides, Chin & Saunders (2009) suggested that the standard effect sizes proposed by Cohen (1988) (small: 0.02; medium: 0.15; large: 0.35) were not sufficiently rigorous. Combining the AVE value proposed by Fornell & Larcker (1981) and the GoF indicator, they proposed the standards for a new overall fit indicator (poor: 0.1; medium: 0.27; good: 0.42). The GoF of this research was 0.855, indicating a good overall fit, and that the model was acceptable.

Path Relations of the Research Model

This research proposed and verified a pro-environmental behavior model, which combined formative and reflective indicators. To test the research hypotheses, we specified paths between constructs in order to build a structural model that matches the proposed relationships. Environmental attachment and psychological distance were set as the formative indicators and environmental attachment includes pleasure and motion that human being derived. Both aspects of environmental attachment have good predictive factors of environmental altruism, as well as modality of environmental attitudes and conservation commitments (Crompton, 2008; de Groot & Steg, 2008). There is a negative path relation between environmental attachment and behavioral intention.

From psychological distance construct, it was found that geographical, temporal and social distances are in-

dependent factors to affect individuals' opinions on environmental psychological distance. Psychological distance was set as a formative rather than reflective indicator, and explanatory capacity and abstraction capacity could be treated as latent variables. Spence & Pidgeon (2010) and Spence et al. (2012) demonstrated that psychological distance could be simplified as geographical, temporal and social distances. Based on this research of model path relations, these findings were consistent with previous researches; social distance would comprise the largest proportion, followed by time, and then geographical distances.

Figure 1 shows the results of the SEM-PLS estimation, including standardized path coefficients for each hypothesized path in the model, significance based on one-tailed t-tests, and the amount of variance explained (R^2). The nine path relations (Figure 1) of the model reached the significant level 0.05. The coefficients of path analysis for environmental attitude were natural constraints → environmental attachment (0.609), and psychological distance → environmental attachment (0.390). From the modality that environmental attachment → environmental attitude, three path relations were significantly supported by empirical data: (i) environmental attachment → environmental attitude (0.341); environmental attachment → conservation commitment (0.659); and psychological distance → conservation commitment (0.338).

If the impact of an individual's environmental attachment on his/her environmental attitude and behavioral intention was included, the following three paths were statistically significant: (i) environmental attachment → behavioral intention (-0.197); environmental attitude → behavioral intention (0.731); and conservation commitment → behavioral intention (0.179). These path relationships show that environmental attitude presents a dominant impact on behavioral intention. Milfont (2012) proposed that individuals exhibit positive attitudes towards environmental commitment and attitudes have dominant impacts on environmental behavior; however, positive attitude does not automatically lead to environmental actions. In this research, environmental attachment experienced by university students has a negative effect on their behavioral intention. The more intense the emotion of environmental attachment is, the weaker the behavioral intention to participate in pro-environmental behavior on ECs.

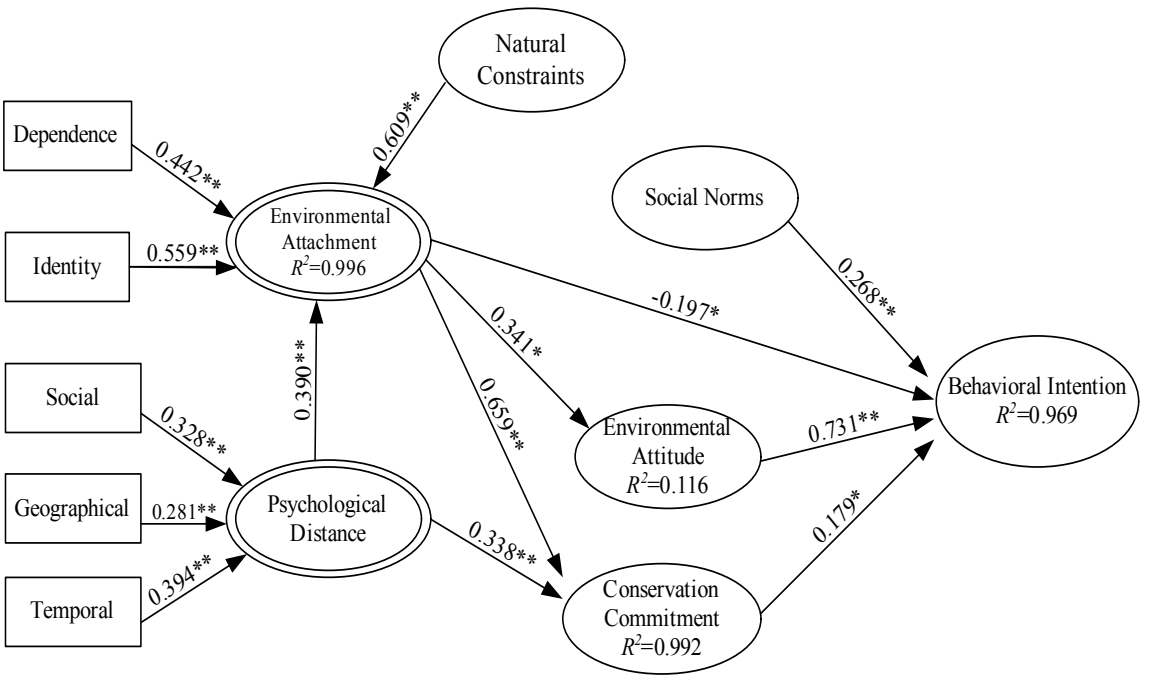

Figure 1: Path diagram of the research model.

In Taiwan, mass media usually disclosed and disseminated the existence of ECs (such as plasticizer, nanotechnology, environmental hormones, and trace elements), mass media is also primary source of individual awareness on ECs. The pro-environmental behavioral intention to deal with ECs can only arise after the public has formed a

risk perception of ECs through media dissemination and emotionally linked imagery. The significant linkage effect of the media's ability to influence individual behavioral intention would raise public awareness of the impacts of ECs, because of the path: social norms → behavioral intention (0.268). Social norms seem powerful in encouraging a growth of the desire for pro-environmental behavior intention over time.

Natural constraints and psychological distance significantly and positively affected environmental attachment, explained 99.6% of the variance in environmental attachment (R^2=0.996). Environmental attachment also significantly and positively affected environmental attitude, and sentimental value and attitude chain can be predicted effectively, and the R^2 of environmental attitude was 0.116. In addition, environmental attachment and psychological distance were significant positively affect conservation commitment, together explained 99.2% of variance associated with conservation commitment (R^2=0.992).

An individual's behavioral intention was significantly and positively affected by social norms, environmental attitude, and conservation commitment, together explained 96.9% of variance associated with behavioral intention (R^2=0.969). Empirical data supported the formation of psychological distance, attitude and behavior chain. However, the impact of environmental attachment on behavioral intention was not positive significantly supported by the statistics of the empirical data.

Moderated Test

Knowledge has also an important role both for environment values and behaviors, but usually its effect are moderate by past researches (Pe'er, Goldman & Yavetz, 2007; Zsóka, Szerényi, Széchy & Kocsis, 2013; Stevenson, Peterson, Carrier, Strnad, Bondell, Kirby-Hathaway & Moore, 2014). As such, this research used nine questions on nanotechnology as the benchmark of the knowledge assessment. Prior approaches to moderator analysis are restricted in that they only allow testing the differences in two groups' parameters. The comparison of group-specific effects entails the consideration of a categorical moderator variables, multigroup analysis is generally regarded as a special case of modeling continuous moderating effects. The 851 participants were divided into three groups, based on their knowledge scores. The table 3 shows results of the structural model evaluation. The bootstrap analyses using 5000 samples and a number of cases equal to the knowledge-specific sample size. Path relation of conservation commitment → behavioral intention changed from significant to insignificant. The path of environmental attachment → environmental attitude was significant in the data for the low-scoring group (Figure 2), but was not significant for the other two groups (medium and high-scoring groups, Figures 3-4). Higher levels of ECs knowledge increase the student's identity and dependence in attitude, but high environmental attachment does not have a significant effect on students' willingness to change attitudes. Students who have lower environmental attachment and ECs knowledge have a higher attitude toward of environmental behavior. The results also demonstrated that individuals with high ECs knowledge tended to live in subsistence contexts that with no ECs environment. However, ECs exist in much of our surface water, groundwater and drinking water. Thus, it empirically support that lack of knowledge of ECs is one of key barriers to pro-environmental behavior.

The connections to one's environmental attachment can indeed translate into attitudes for low-scoring students on ECs knowledge, but not for middle-scoring and high-scoring learners. This research concretes mental representation in cognitive tendencies and remedial behaviors and suggests raising ECs knowledge as predominant remedial actions for green higher education. The explanatory variance of environmental attitude tended to 0.00, and the path relation of social norms → behavioral intention was insignificant in the data of the low-scoring group. The changes in path relation and explanatory variance indicated that environmental knowledge on ECs affects an individual's attitude and behavioral intention. Concrete and specific representations of value-belief-behavior model may encourage individuals and increase their motivation to pro-environmental intention. According to statistical results, raised degree of ECs knowledge for university students could shape their attitude, conservation commitment and behavior intention for a pro-environmental behavior. As for students who have better environmental attitude: the lower their ECs knowledge, the higher their behavioral intention of pro-environmental behavior.

Table 3. Knowledge-specific results.

Path relationship	Low	Middle	High
natural constraints →environmental attachment	0.592**	0.583**	0.578**
psychological distance →environmental attachment	0.407**	0.416**	0.421**
environmental attachment →behavioral intention	-0.332	-0.114	-0.179
environmental attachment →environmental attitude	0.554**	0.008	0.054
environmental attachment →conservation commitment	0.564**	0.651**	0.624**
psychological distance →conservation commitment	0.434**	0.344**	0.372**
social norms →behavioral intention	0.314	0.301**	0.218**
environmental attitude →behavioral intention	0.698**	0.697**	0.449**
conservation commitment →behavioral intention	0.298	0.116	0.177
N(group sample size)	226	398	227
Endogenous latent R^2			
environmental attachment	0.997	0.993	0.995
environmental attitude	0.307	0.000	0.003
conservation commitment	0.959	0.988	0.990
behavioral intention	0.969	0.993	0.360

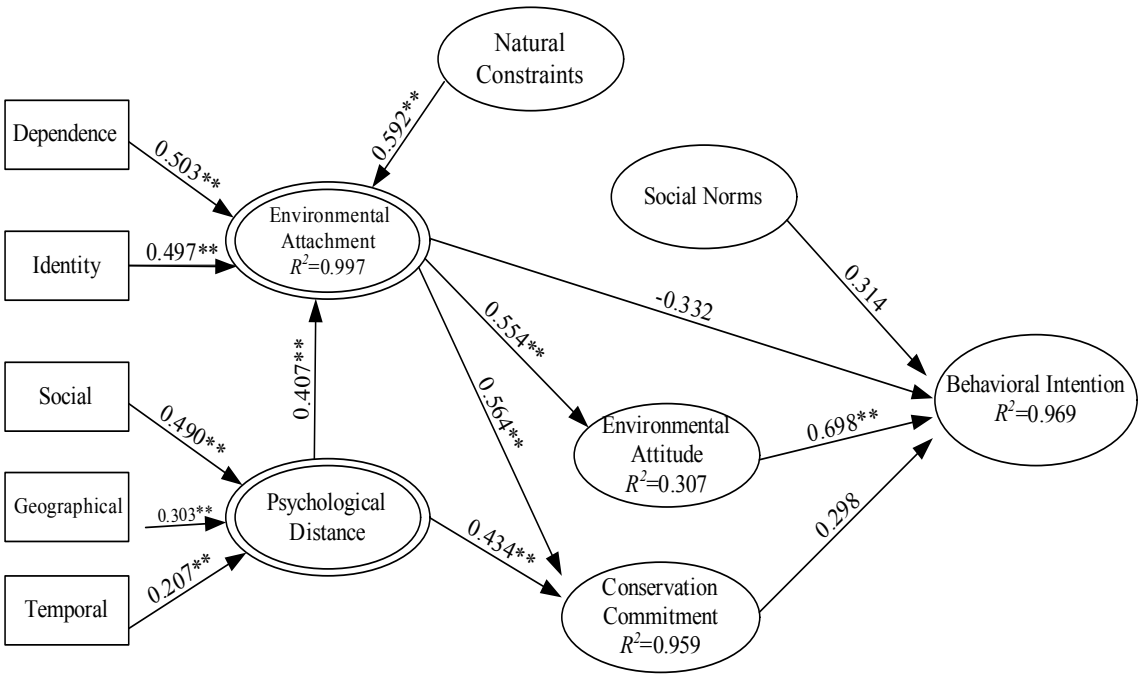

Figure 2: Pro-environmental behavior model for low-scoring learners.

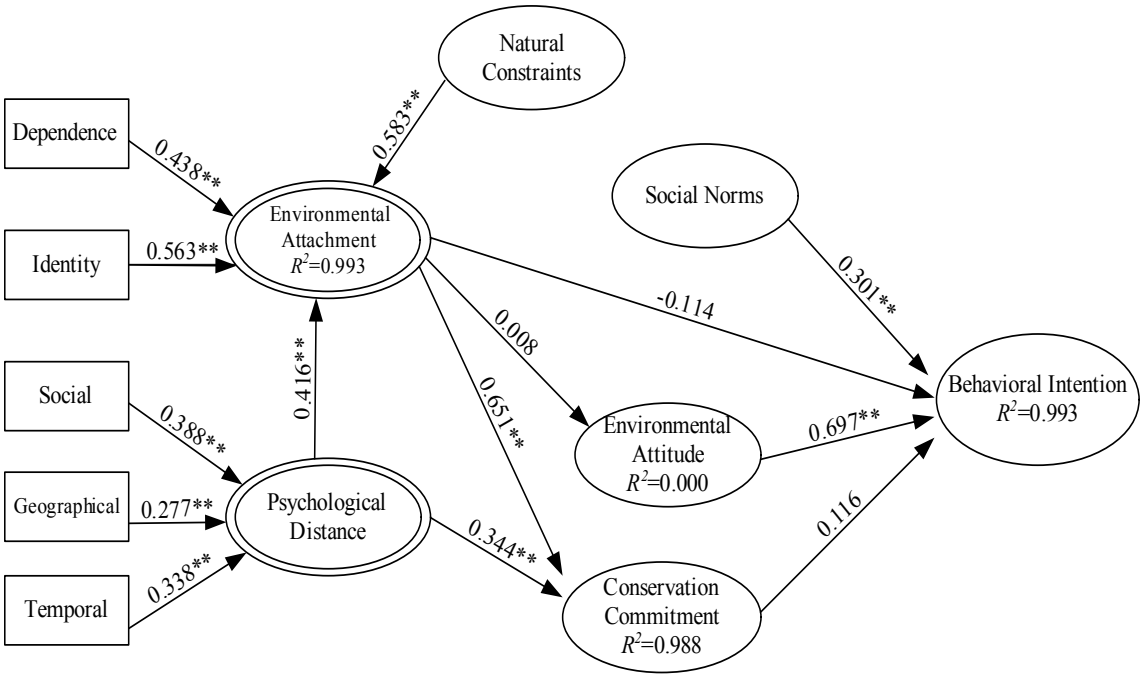

Figure 3: Pro-environmental behavior model for middle-scoring learner.

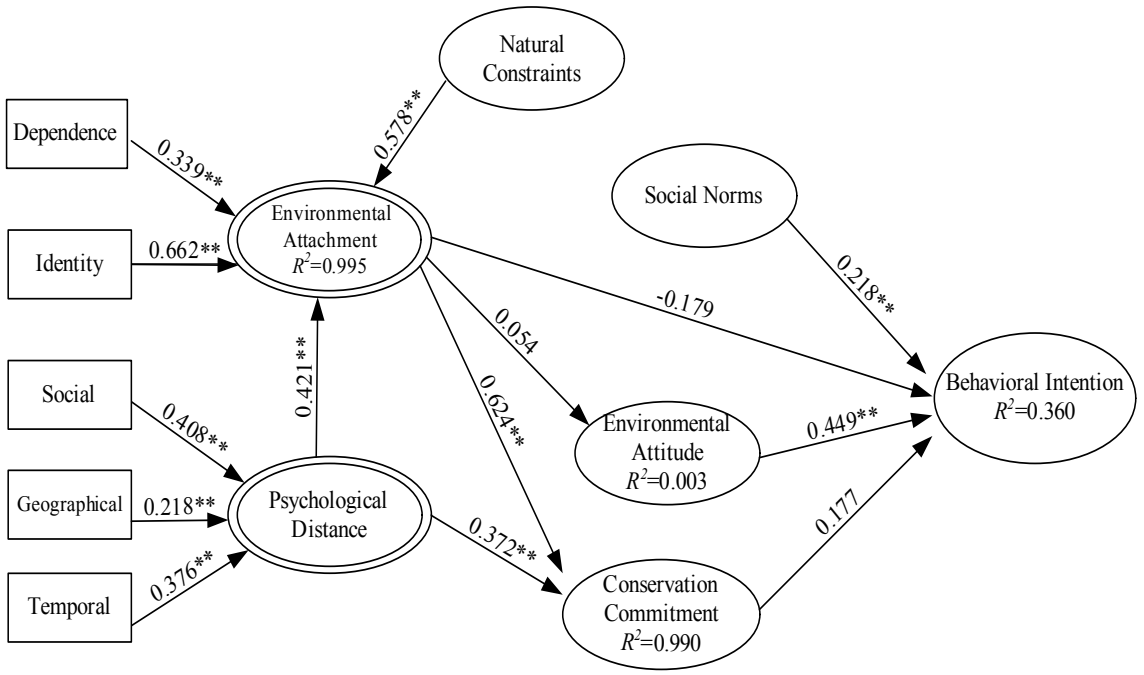

Figure 4: Pro-environmental behavior model for high-scoring learners.

Discussion

Environmental Chain of ECs

This study attempted to understand the attention that college students pay to ECs and related environmental behavior that they display. This study extends the historical literatures by identifying environmental attachment, psychological distance, and global issue (e.g., emerging contaminants) as equal contributors to concern for new pollution impacts and pro-environmental behavioral intention. This was approached from the perspective of green education, using theories of environmental behavior (TPB and VBN), as well as knowledge of ECs, and psychological distance. This study confirms asserting chain made in the previous environmental behavior model, value attitude behavior chain towards ECs, and this chain is perhaps complex and influenced by specific factors. Thus, identification of the factors that influence people's intention can be helpful to communicate the underlying risks and uncertainties embedded in decisions of pro-environmental behavior intention to ECs. The ability to analyze the determinants of pro-environmental behavior intention to ECs will provide a useful reference for policy makers in environmental education at higher education level.

This study refers to an individual's understanding of the value system, formed by the natural constraints of the environment and his/her environmental attachment to evaluate individual's exhibition of environmental value. Personal values have shown to be crucial in shaping behavior intention and thus policies must continue to elicit the message of sustainability by emphasizing that the environment is a precious resource, which everybody needs to take care of. In this study, respondents reported insignificantly negative correlation coefficients between environmental attachment versus behavioral intention, which may indicate that place identity and place dependence are difficult to change behavioral intention because of high perceived burden on existing intention. Individuals with more environmental attachment are more likely to engage in environmental attitude. Those with higher environmental attachment value are more likely to engage in conservation commitment than pro-environmental behavior intention. Wang, Dou & Zhou (2008) suggested that value is a higher form of attitude. At the same time, value is also a determining factor for attitude. Stern (2000) proposed that, although value induces behavioral intention change, it has a stronger influence on the consequences and the attitude of awareness to minimize ecological harm. Research on conservation commitment and pro-environmental behavior suggests that when people perceive a problem, a need for pro-environmental action can be activated by their environmental value, which produces feelings of nature obligation to perform or refrain from environmental behaviors (Lokhorst, et al., 2013). Our results indicate that conservation commitment leads to changes in behavior intention. Respondents in the current study explained that they making a conservation commitment could activate psychological process related to motivate the individual to change into new behavior intention. If conservation commitment had low effort to individual but high value to nature, then individual's behavior intention will be changed.

The natural constraint beliefs affect individual's willingness to engage in pro-environmental activities. The path of natural constraints environmental attachment was treated as an attribution behavior, whereas the impact of environmental attachment on an individual's attitude (environmental attitude and conservation commitment) was treated as a manifestation of the results. Individuals who believe that their own participation in attachment activity would also benefit other people in the society are more likely to engage in positive environmental attitude. It purports to compel individuals to see themselves as part of ecological community and make actions to preserve environment. This path relation was significant and consistent with previous behavioral models (Jansson, Marell & Nordlund, 2011; Milfont, 2012; Nigbur, Lyons & Uzzell, 2010; Zaalberg, Midden, Meijnders & McCalley, 2009). However, a negative path relation presented between environmental attachment and behavioral intention. This indicated that the more the participants depended on the environment, the more negative their pro-environmental behavior on ECs. Those who perceive awareness of the biophysical environment and its associated problems as the main reason for the ECs are more motivated to work toward their solution.

Gifford & Nilsson (2014) and Thøgersen (2008) proposed that the influence caused by social norms is also a type of belief. Hence, during the environmental belief stage, relevant social norms can be used as predictive variables of behavior. In this study, the influence of an individual's reference group (including the media) was used as the antecedent variable of behavioral intention. This was used in place of the pressure exerted by norms, which is formed when moral obligation and morality are influenced by collective consciousness within a value system. This was a significant distinction from the definition of operational self-identity (Mannetti, Pierro

& Livi, 2004; White & Hyde, 2012). Analytical results of this study were consistent with the research findings of Roeser (2012) and Shackelford (2006), namely, that group influence has a significant impact on environmental behavior and attitude persistence. By socially engaging with and encouraging their peers, they were able to educate others about pro-environmental issues. Social norms have been recognized as important motivations for carrying out pro-environmental behaviors (Gifford & Nilsson, 2014; Markle, 2013; Miller, 2016), furthermore, highlighting the value of social interaction. In this study, the findings reveal that individuals who hold strong moral and personal norms are likely to engage in pro-environmental behavior intention.

The contributions of these three antecedents of psychological distance were identified to be statistically significant. Regarding relevant research on psychological distance, Spence et al. (2012) suggested that geographical distance has the highest degree of influence. Temporal distance indicates that the public believes climate change will only occur after another 25 years. Social distance has the lowest degree of influence. However, when perceived intensity was the measurement variable, the ranking in terms of intensity was social distance > geographical distance > time distance. Similarly, social distance also have an approximate association immediate and near distances represent high certainty, moderate (geographical) distances less certainty, and the farthest (temporal) distances the least certainty. Rather, coping takes the form of small solutions in one's own home, to try to minimize the harmful effects of immediate near in a small way. It may lower behavioral intentions, while actually increasing such intentions for more psychological distant phenomena. The empirical data of this study showed that the social distance of ECs was consistent with that of climate change (Spence et al., 2012; Newell, et al., 2014). Spence & Pidgeon (2010) also proposed that geographical distance for climate change has the highest degree of impact. Since ECs are emergently generated, and do not draw the attention of the general public, mass communication and word of mouth would be the most efficient approaches to bring their attention to the harms of ECs.

Research Limitations

When questionnaires requiring elaboration by participants are used to measure individuals' environmental behavior, common-methods bias usually arises when one participant responds to all the questions. This research used concealing respondents' details, significance of the questions and sing reverse questions. In addition, we placed the behavioral questions at the last part of the questionnaire. The methods proposed by Harman (1976) and Sanchez, Korbin & Viscarra (1995) were adopted and, specifically, principal component factor analysis was conducted on all the research variables to check whether any single factor could explain most of the variability. The covariance matrix analysis was used to validate the relevant post-hoc model. The main limitation of this research was the impact of some covariance cannot be completely reduced. Although university students were utilized in its development, it is anticipants that the research model will be useful for a wider population. Future evaluations of the environmental behavior should include a more diverse population.

Conclusions

As increasing emerging contaminant environmental events continues to influence many countries, it is important to understand a wider range of latent variables influencing pro-environmental behavior. This research extends the literature by identifying environmental attachment, individual-level awareness (e.g., attitude, commitment), and global beliefs (e.g., natural constraints) as contributors to concern for emerging contaminant and ultimately pro-environmental behavior. It provides improvements to the measurement of emerging contaminant engagement and advances understanding of emerging contaminant mitigation by considering the role of environmental attachment and psychological distance message framing. Specifically, this research confirms assertions made in the previous literature, which indicate the relationship between environmental attachment and pro-environmental attitudes and behaviors is perhaps complex and influenced by knowledge-specific factors. The results of this research would be benefit to environmental education curriculum at higher education level. Based on the results, the target audience is middle-scoring, who showed greater receptivity to emerging contaminant issues than the other groups. Emerging contaminant knowledge-specific investigations can continue to improve our understanding of the confluence between human activities and environmental education.

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