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RESEARCH ARTICLE

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Abstract: The threat of climate change to humanity and the environment calls for urgent collective action to mitigate its effects. Previous studies have shown that experience with climate change-related events influences intention to engage in actions to mitigate climate change. Because the Philippines regularly experiences extreme weather events associated with climate change, this study examined the effects of personal experience with climate change-related events on household energy conservation behavior to help reduce climate change. A survey was conducted among college students (N = 569) about their experience of climate change-related phenomena, risk perception, and household energy conservation intention and behavior. Data were analyzed using partial least squares structural equation modeling. The results showed that personal experience of events associated with climate change had a significant indirect effect on intention to conserve energy through risk perception. Intention, in turn, directly influenced household energy conservation. The model explained 25% of the variance in energy conservation behavior in college students. Based on these findings, implications for the development and design of strategies to promote conservation behavior in students are discussed.

Keywords: climate change, experience, risk perception, intention, household energy conservation

Introduction

From 1850 to 2019, human activities have contributed to an increase of about 1.07 ^{o}C in the global surface temperature (Intergovernmental Panel on Climate Change [IPCC], 2021). This long-term trend of warming temperature across the globe is caused by increased atmospheric concentrations of greenhouse gases, particularly carbon dioxide from fossil fuel combustion (IPCC, 2018). Global warming leads to climate change, which is associated with various destructive consequences (IPCC, 2018). These include warmer temperatures; rise in sea level; more frequent or prolonged extreme weather events, such as heat waves, drought, heavy precipitation, intense tropical cyclones, flash floods; and decreased food production (Eckstein et al., 2021; Holden, 2018; IPCC, 2018, 2021). The Philippines is one of the most vulnerable countries to the impacts of climate change. Over the period 2000 to 2019, it ranked fourth among countries most affected by extreme weather events in terms of deaths and cost of damage (Eckstein et al., 2021). Because of this vulnerability, mitigating climate change is as crucial as building resilience (Crepin, 2013).

Mitigating global warming and climate change involves reducing greenhouse gas emissions (IPCC, 2018). Achieving this goal requires not only technological solutions but behavioral changes as well (Frederiks et al., 2015). For example, conserving energy is key to reducing carbon dioxide emissions (IPCC, 2018). In 2020, the household sector was responsible for 31% of the total energy consumption in the Philippines (Department of Energy [DOE], 2020). Because households use up a substantial proportion of energy, household energy conservation (HEC) should be part of any climate change mitigation strategy. Adoption of simple sustainable behaviors by individuals can have a significant impact in reducing greenhouse gas emissions (Spence & Pidgeon, 2009). For example, if all the people in the United States unplugged unused electronics and turned off unnecessary lights, the carbon dioxide-equivalent emissions would be reduced by about 70 million metric tons (Stashwick, 2010).

Engaging the youth in energy conservation is critical in the fight against climate change. They make up a major group of consumers, whose choices and actions could significantly influence the course of global warming and climate change (United Nations, 2010). Moreover, they are the ones who are most likely to be affected by the impacts of climate change (Sanson et al., 2019). To promote HEC among the youth, it is important to understand the factors that influence their behavior. Given that the Philippines is constantly exposed to the hazards of climate change, this study investigates how personal experience of climate change-related events influences HEC in college students. Specifically, the indirect effect of personal experience on the HEC behavior of college students through risk perception and intention is examined.

Household Energy Conservation

HEC behaviors may be demonstrated as efficiency behaviors or curtailment behaviors (Gardner & Stern, 2002). Efficiency behaviors involve buying energy-efficient products, while curtailment behaviors involve recurring actions that reduce the use of energy. The most common source of energy used by households in the Philippines is electricity (DOE & National Statistics Office, 2011). It is used mainly for lighting, recreation, and space cooling or air conditioning (DOE & National Statistics Office, 2011). Other uses include ironing, refrigeration, laundry, food preparation, computer activities, water heating, and water pumping (DOE & National Statistics Office, 2011). Thus, curtailment behaviors include switching off unnecessary lights, limiting the use of air conditioners and unplugging home appliances when not in use.

Household energy consumption and conservation are complex behaviors influenced by the interaction of sociodemographic (e.g., education, income), psychological (e.g., awareness, attitude, perceived risk, intention), and contextual and structural factors (e.g., policies, available technology; Frederiks et al., 2015; Steg, 2008). Two of the most commonly used frameworks for explaining pro-environmental behaviors, including energy conservation, are the theory of planned behavior (TPB; Ajzen, 1991; Fishbein & Ajzen, 2010) and the value-belief-norm (VBN) theory (Stern et al., 1999). Yet, while several frameworks have been developed to explain pro-environmental behaviors and HEC, there is no single model that comprehensively explains the behavior (Frederiks et al., 2015). Moreover, because relationships among the variables are not consistent across studies, factors relevant to the target population must be investigated if one has to devise a strategy for promoting energy conservation behavior (Frederiks et al., 2015).

Few studies have been conducted on energy conservation behavior of young people in the Philippines. While some studies found that HEC was one of the pro-environmental activities students most commonly practiced (Bernardo, 2010; Ragragio, 2003), more recent studies have indicated that students were not very actively engaged in energy conservation (Cruz & Tantengco, 2017; Ermac, 2018). These studies did not investigate the relationship of energy conservation with factors that may influence the behavior.

There are relatively more studies in the Philippines that investigated the wider field of pro-environmental behavior than HEC in particular. These studies established associations between pro-environmental behaviors and environmental awareness (dela Pena, et al., 2018; Pardo, 2012; Punzalan, 2020), attitude (Abun & Aguot, 2017; Abun et al., 2019; Garcia et al., 2015), and concern (Garcia et al., 2015). Although environmental awareness was found to be correlated with overall pro-environmental behavior, it was not associated with energy-saving behavior (dela Pena et al., 2018). The limited number of studies on HEC among young people in the Philippines calls for more investigations on other potential significant predictors of energy conservation.

Personal Experience

Personal experience of climate change-related events was shown to be a significant predictor of intention to mitigate climate change (Broomell et al., 2015; Demski et al., 2017; Osberghaus & Demski, 2019; Spence et al., 2011) and energy conservation behavior (Ung et al., 2018). However, mediation analyses revealed that experience had little or no direct effect on intention to perform actions that mitigate climate change (Demski, et al., 2017; Spence et al., 2011). Moreover, previous studies found that experience of flooding or other extreme weather events has a significant effect on perceptions of risk (Akerlof et al., 2013; Demski et al., 2017; Ngo et al., 2020; Spence et al., 2011; van der Linden, 2014a, 2015; Xie et al., 2019).

Despite the frequent occurrence of extreme weather events in the Philippines, studies on climate change-related experience and risk perception in the country are scarce. In one nationwide survey, personal experience with natural disasters and risk perception have been shown to be positively associated with preparations for disasters (Bollettino et al., 2020). Whether experience and risk perception influenced mitigation behavior such as energy conservation was not addressed in the study.

Risk Perception

Climate change risk perception refers to the perceived likelihood of negative effects of climate change to oneself and to society (O'Connor et al., 1999). Public perception of climate change risk varies across and within countries, reflecting its complex and multidimensional nature (van der Linden, 2015). A number of factors shape climate change risk perceptions. According to the climate change risk perception model, risk perception is determined by cognitive factors (knowledge of causes, consequences, and solutions to climate change), experiential processing (affective evaluations and personal experience), and sociocultural influences, which include social norms and broad value orientations (van der Linden, 2015).

In the Philippines, geographical location was found to be an important variable in influencing risk perception. People living near the coast perceived greater risks from flooding than those living farther from the shoreline (Combest-Friedman et al., 2012). It can only be surmised that those living near the coast must have experienced flooding at some time.

Several studies indicated that climate change risk perception positively influences intention or willingness to engage in mitigation and adaptation activities (Leiserowitz, 2006; Ngo et al., 2020; O'Connor et al., 1999; Spence et al., 2011; van der Linden, 2014b; Xie et al., 2019). Moreover, risk perception has been shown to be significantly related to energy conservation behavior (Lacroix & Gifford, 2018; Kwon et al., 2019). In contrast, risk perception was negatively related to adaptation to climate change and disasters in an urban poor community (Mercado, 2016).

Intention

Behavioral intentions refer to an individual's readiness to perform a behavior (Fishbein & Ajzen, 2010). Several factors influence behavioral intentions. In the TPB, intention is determined by attitude, subjective norm, and perceived behavioral control. Yet, intention may also be influenced by other factors. For example, flooding experience has been shown to indirectly influence climate change mitigation intention through risk perception (Spence et al., 2011).

Intention is a key variable in the TPB as the immediate antecedent of behavior (Ajzen, 1991; Fishbein & Ajzen, 2010). Accordingly, the stronger the intention to perform a given behavior, the more likely it is that the behavior will be performed. Indeed, intention was found to be a significant predictor of energy conservation and climate change mitigation behaviors (Ajzen et al., 2011; van der Linden, 2014b; Macovei, 2015; Zhang et al., 2020).

Research Framework and Hypotheses

The present study aimed to determine the effects of climate change experience, risk perception, and intention on students' HEC behavior. The foregoing discussion leads to the following hypotheses:

1. Climate change experience has a significant positive direct effect on risk perception.

2. Risk perception has a significant positive direct effect on intention to conserve energy.
3. Intention to conserve energy has a significant positive direct effect on HEC.
4. Climate change experience has a significant positive direct effect on intention to conserve energy.
5. Climate change experience has a significant positive indirect effect on intention through risk perception.
6. Climate change experience has a significant positive indirect effect on HEC behavior through risk perception and intention.

The model in Figure 1 shows the relationships described in the hypotheses.

Method

Data Collection and Sample

A paper-based survey was administered in March 2019 to 569 students (18–23 years, M = 18.97, SD = 1.20; 47% men, 48% women, 5% unreported) selected by convenience from a private higher education institution in Manila, Philippines. These were students enrolled in various degree programs who were taking Science, Technology and Society as part of the general education curriculum. The participants completed the survey in 20 to 30 minutes in the classroom in the presence of the researcher. Participation was voluntary, and there was no compensation or other form of incentive given to the participants. Informed consent was obtained from each participant. Data gathering and handling complied with the ethical guidelines of the institutional research committee.

The adequacy of the sample size was checked based on the estimated minimum sample size required in partial least squares structural equation modeling (PLS-SEM). The inverse square root and gamma-exponential methods were applied to estimate the minimum sample size requirement (Kock & Hadaya, 2018). Using WarpPLS 7.0 to perform the calculations, the minimum sample size required to achieve a power of .80 with .05 level of significance was estimated to be 230 and 217 based on the inverse square root and gamma-exponential methods, respectively. Thus, the sample size in the study was more than sufficient to test the model.

Research Instrument

Content Validity

To develop scales that were appropriate to the context of Filipino students, items that measured climate change experience, risk perception, intention, and HEC were constructed or adapted from previous studies (Ajzen et al., 2011; Leiserowitz, 2006; van der Linden, 2014a). Initially, each variable in the model had seven indicators, except for risk perception, which had 19.

Experts from higher education institutions in Manila, Philippines, were purposively selected and invited for content validation of the research instrument if they fulfilled any the following criteria: a graduate degree in the environmental or behavioral sciences, higher education teaching or research experience in the field of environmental or behavioral sciences. They were asked to rate the relevance of the items to the underlying constructs using a 4-point scale (Davis, 1992, as cited in Polit & Beck, 2006). Four experts rated the relevance of the

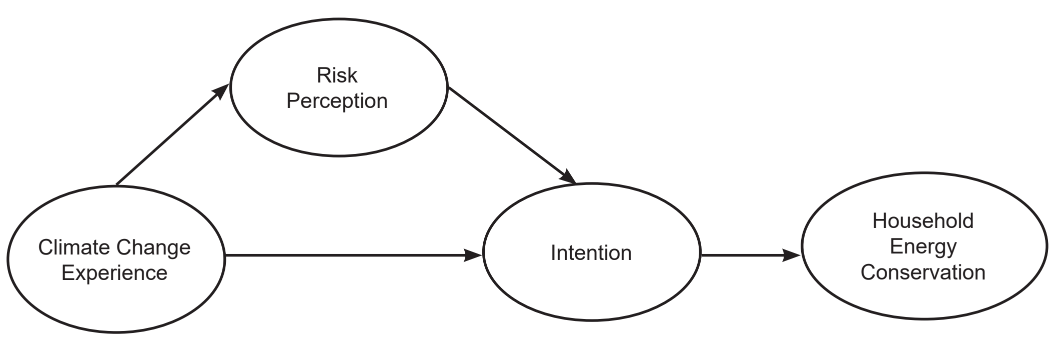


Figure 1. Model for Explaining Household Energy Conservation Behavior

items for intention, while seven rated the relevance of the measures for climate change experience, risk perception, and energy conservation behavior. Ethical guidelines of the institutional research committee were observed.

To calculate the item-level content validity index (I-CVI), the number of experts who rated the item a 3 or 4 was divided by the total number of experts (Polit & Beck, 2006). With five or fewer raters, items with an I-CVI of 1.00 were retained. If there were six or more raters, an item was retained if the I-CVI was greater than or equal to .78 (Lynn, 1986, as cited in Polit & Beck, 2006). After eliminating three and four items from risk perception and intention, respectively, that did not meet the criteria for I-CVI, the scale-level content validity index (S-CVI/Ave) was determined by calculating the average of the I-CVIs of each scale (Polit & Beck, 2006). An S-CVI/Ave of .90 was considered acceptable (Polit & Beck, 2006). The calculated values for S-CVI/Ave ranged from .92 to 1.00, which satisfied the requirement for content validity. Finally, some items were reworded based on the experts' comments.

Cognitive Pretesting

Prior to the pilot test, a pretest was conducted with 36 college students to check if there were items that were difficult to understand. The pilot questionnaire consisted of a total of 40 items. There were seven items to measure experience, 16 items to measure risk perception, three items to measure intention, and seven items to measure HEC behavior. The wording in the items that needed clarification were subsequently modified. The questionnaire was then administered to 229 students (18–24 years, M = 18.63, SD = 1.14; 36% men, 64% women) selected by convenience from a private higher education institution in Manila. Each participant signed an informed consent form.

To check for the validity and reliability of the scales, data from the pilot study were analyzed as described for the evaluation of the measurement model using the WarpPLS 7.0 software. Three more items from the risk perception scale and one from the energy conservation scale were deleted because of indicator loadings less than .50 (Hair et al., 2009; Kock, 2020). The three items on the risk perception scale that were eliminated included measures about concern for climate change ("How concerned are you about climate change?") and the severity of the threats (e.g., "How serious are the current impacts of climate change around the world?"). The item that was deleted from the energy conservation scale asked about the frequency of using hot or warm water for shower or bath. After eliminating these items, all the scales exhibited convergent validity, reliability, and discriminant validity.

Measures

Climate Change Experience. Seven items were used to evaluate climate change experience (α = .85). The scale was modified from van der Linden (2014a) by constructing a separate item for each specific climate change event. Respondents were asked how frequently they experienced a particular climate change phenomenon (e.g., "In the last five years, how frequently have you experienced the following: very strong typhoons"). Response options (*never* to *very frequently*) were indicated on 7-point rating scales. The complete items are listed in the Appendix.

Risk Perception. Climate change risk perception was measured using a scale patterned after the risk perception index of Leiserowitz (2006). Respondents were asked to indicate on 7-point rating scales how likely (*very unlikely* to *very likely*) they thought adverse events would occur in their area and around the world in the next 50 years as a result of climate change (e.g., "How likely do you think it is that each of the following will occur in the area where you live during the next 50 years due to climate change? floods"). The risk perception scale consisted of 13 items (α = .92), including four from Leiserowitz (2006). These items are presented in the Appendix.

Intention. To measure intention, items were constructed based on the guidelines for the construction of a TPB questionnaire (Francis et al., 2004). Respondents were asked to indicate on 7-point rating scales the extent to which they agreed or disagreed (*strongly disagree* to *strongly agree*) with statements about their intention to conserve energy at home (e.g., "I plan to conserve energy at home in the next four weeks"). The scale consisted of three items (α = 87), which are listed in the Appendix.

Household Energy Conservation Behavior. HEC was measured using a scale consisting of six items (α = .76). A list of five specific actions that would reduce the use of gas or electricity at home was presented. Respondents were asked how frequently (*never* to *always*) they performed each action during the past four weeks (e.g., "During the past four weeks, how frequently did you do the following? switched off lights when not in use"). The sixth question asked the respondents to rate their overall energy conservation behavior at home (Ajzen et al., 2011). Response options were indicated on 7-point rating scales. The items used to measure HEC behavior are listed in the Appendix.

Statistical Analyses

To test the proposed model, PLS-SEM was performed using WarpPLS 7.0. Because the data did not exhibit normality based on the Jarque–Bera and robust Jarque–Bera tests of normality, PLS-SEM is especially appropriate for the analysis of this study. Unlike the covariance-based structural equation modeling, which requires data to be normally distributed, PLS-SEM is a nonparametric approach and does not require data to be normally distributed (Hair et al., 2019; Kock, 2020). To control for the effects of age and gender, these variables were included as covariates in the analysis (Kock, 2011).

Evaluation of Measurement Model

Convergent validity was assessed using indicator loadings and average variance extracted (AVE). Convergent validity is established when the indicator loadings are statistically significant ($p \leq .05$) and greater than or equal to .50 (Hair et al., 2009). For the AVE, the criterion is also .50 or greater (Fornell & Larcker, 1981). Reliability was evaluated using Cronbach's alpha and composite reliability. The acceptable values for both reliability measures are greater than .70 but less than .95 (Hair et al., 2020). Discriminant validity was evaluated using the Fornell–Larcker criterion (Fornell & Larcker, 1981) and the heterotrait–monotrait ratio of correlations (HTMT; Henseler et al., 2015). According to the Fornell–Larcker criterion, discriminant validity is established when the square root of the AVE of each variable is greater than the correlation of the variable with any of the other variables. In applying HTMT, the most conservative criterion was used. This criterion specifies a maximum value of .85 to establish discriminant validity (Henseler et al., 2015).

Evaluation of Structural Model

Model fit was assessed using average path coefficient (APC), average R^2 (ARS), average adjusted R^2 (AARS), average block variance inflation factor (AVIF), average full collinearity variance inflation factor (AFVIF), and Tenenhaus goodness of fit (GoF). For APC, ARS, and AARS, the p values should be .05 or below (Kock, 2020). Because the variables in the model have more than two indicators, the recommended values for AVIF and AFVIF are those less than or equal to 3.3 (Kock, 2020). The Tenenhaus GoF describes the explanatory power of a model as small, medium, or large for values equal to or greater than .1, .25, and .36, respectively (Wetzels et al. 2009, as cited in Kock, 2020).

Results

Validity and Reliability of the Measurement Model

The convergent validity and reliability statistics of the variables are presented in Table 1. All indicator loadings were within the acceptable values of greater than or equal to .50. Except for HEC, the AVEs were also within the recommended values. Because the AVE for HEC was only very slightly less than 0.50, it was still acceptable for establishing convergent validity (Cheung & Wang, 2017). Cronbach's alpha and composite reliability values were all above .70 and below .95, indicating that the scales were reliable.

Discriminant validity was assessed using the Fornell–Larcker criterion and the HTMT method. As shown in Table 2, the square root of the AVE of each variable was greater than the correlation of the variable with any of the other variables, thus satisfying the Fornell–Larcker criterion. Likewise, discriminant validity was established based on the HTMT method. As shown in Table 3, all HTMT ratios were below the threshold of .85.

Table 1

Indicator Loadings, Average Variance Extracted, and Reliability Statistics of Variables

Variable and indicator	Indicator loading	AVE	CA	CR
Experience (EXP)		.52	.85	.88
EXP 1	.77*			
EXP 2	.81*			
EXP 3	.72*			
EXP 4	.70*			
EXP 5	.74*			
EXP 6	.64*			
EXP 7	.69*			
Risk perception (RP)		.53	.92	.94
RP 1	.60*			
RP 2	.63*			
RP 3	.67*			
RP 4	.66*			
RP 5	.69*			
RP 6	.70*			
RP 7	.75*			
RP 8	.77*			
RP 9	.79*			
RP 10	.84*			
RP 11	.77*			
RP 12	.77*			
RP 13	.79*			
Intention (INT)		.80	.87	.92
INT 1	.90*			
INT 2	.91*			
INT 3	.87*			
Household energy conservation (HEC)		.46	.76	.84
HEC 1	.66*			
HEC 2	.79*			
HEC 3	.73*			
HEC 4	.60*			
HEC 5	.50*			
HEC 6	.77*			

Note. AVE = average variance extracted, CA = Cronbach's alpha, CR = composite reliability.
*$p < .001$.

Table 2

Square Roots of Average Variance Extracted and Correlations Among Variables

	Experience	Risk perception	Intention	Household energy conservation
Experience	.72			
Risk perception	.49	.73		
Intention	.12	.19	.89	
Household energy conservation	.10	.09	.49	.68

Note. The values on the diagonal are the square roots of the average variance extracted.

Table 3

Heterotrait–Monotrait Ratios of Correlations

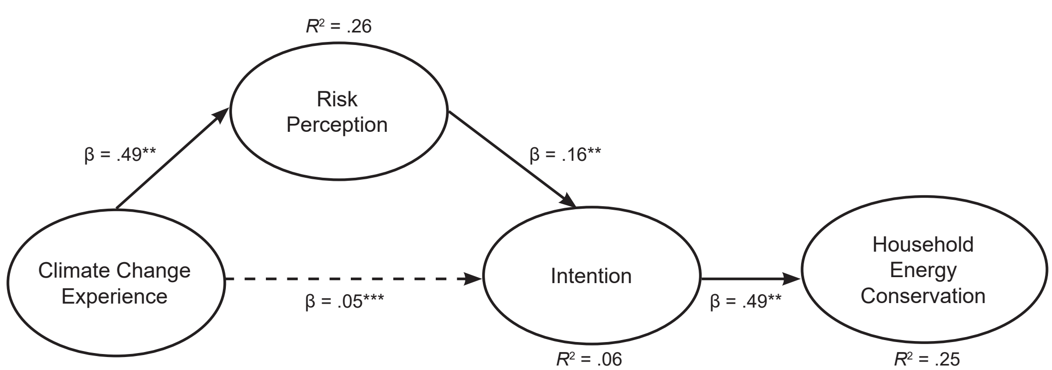
	Experience	Risk perception	Intention
Experience			
Risk perception	.56*		
Intention	.14*	.20*	
Household energy conservation	.16*	.14*	.60*

*$p < .001$.

The Structural Model

The structural model is shown in Figure 2. The model fit and quality indices indicated that the model provided an acceptable fit to the data.

As shown in Figure 2, the model explained 25% of the variance in students' HEC behavior. Climate change experience had a significant direct effect on risk perception (β = .49, *SE* = .04, p = <.01). Based on the guidelines provided by Cohen (1988), the size of this effect was medium (f^2 = .24). Risk perception also had a significant direct effect on intention (β = .16, *SE* = .04, p = <.01), but the effect size was small (f^2 = .03). Intention, in turn, had a significant direct effect on HEC (β = .49, *SE* = .04, p = <.01) with a medium effect size (f^2 = .24). These findings



Note. Model fit and quality indices: average path coefficient = .16, $p < .001$; average $R^2 = .19$, $p < .001$; average adjusted $R^2 = .13$, $p < .001$; average block variance inflation factor = 1.07; average full collinearity variance inflation factor = 1.24; Tenenhaus goodness of fit = .37.
**$p < .01$. ***$p = .14$. = not significant.

Figure 2. Structural Model of Household Energy Conservation

support Hypotheses 1, 2, and 3, respectively. In contrast, there was no direct relationship between experience of climate change-related events and intention to conserve energy ($\beta = .05$, $SE = .04$, $p = .14$, $f^2 = .00$). Thus, Hypothesis 4 is not supported. To test Hypothesis 5, the indirect effect of experience on intention through risk perception was determined by calculating the product of the path coefficients between experience and risk perception, and between risk perception and intention (Preacher & Hayes, 2004). The result indicated that experience had a significant indirect relationship with intention through risk perception, although the effect size was negligible ($\beta = .08$, $SE = .03$, $p = .003$, $f^2 = .01$). Thus, Hypothesis 5 is supported. Likewise, experience had a significant but marginal indirect effect on HEC behavior through risk perception and intention ($\beta = .04$, $SE = .02$, $p = .05$, $f^2 = .00$). This finding supports Hypothesis 6.

Discussion

This study examined factors that influence college students' HEC behavior. In particular, the research investigated how climate change-related experience, risk perception, and intention influence HEC in college students. The results show that climate change-related experience has an indirect positive effect on energy conservation behavior through risk perception and intention.

Experience with climate change-related events leads to higher risk perception. The link between climate change experience and risk perception is consistent with previous studies (Akerlof et al., 2013; Demski et al., 2017; Ngo et al., 2020; Spence et al., 2011; van der Linden, 2014a, 2015; Xie et al., 2019). Personal experience with climate change-related events reduces one's psychological distance from climate change (McDonald et al., 2015). Psychological distance refers to one's perception of when, where, to whom, and whether a phenomenon occurs (Trope & Liberman, 2010). Accordingly, people who have no direct experience with climate change-related events are psychologically distant and have an abstract view of climate change and its consequences. On the other hand, those who have direct experience are psychologically close and have a more concrete perception of climate change, its reality, and the threats it poses (Demski et al., 2017; McDonald et al., 2015; Myers et al., 2013). The decrease in the abstractness of climate change brought about by experiencing its effects heightens perceptions of risk (van der Linden, 2015). Moreover, experiencing the effects of climate change stimulates negative affective responses, which then increase risk perceptions (Keller et al., 2006; Weber, 2006). For example, people reported feelings of fear and helplessness after a flood experience (Terpstra, 2011). Awareness of their vulnerabilities may then lead people to perceive greater risks (Terpstra, 2011).

Higher risk perceptions, in turn, produce stronger intentions to conserve energy. This finding is consistent with the results of previous studies (Ngo et al., 2020; Spence et al., 2011; Xie et al., 2019). Risk perception and affect have a reciprocal and mutually reinforcing relationship (van der Linden, 2014a). As mentioned previously, climate change-related experience elicits negative affective responses that lead to greater perceptions of risk (Keller et al., 2006; Weber, 2006). Higher risk perceptions then strengthen the negative affect that was initially produced by the experience. Negative emotions such as fear motivate people to move away from danger or to modify the environment to reduce the risk (Weber, 2006). In the case of climate change, conserving energy reduces greenhouse gas emissions, which would then lower the associated risks. Indeed, negative emotions have been shown to have a significant effect on intention to mitigate climate change (Demski et al., 2017).

The protection motivation theory provides a model for understanding how fear influences protective responses (Rogers, 1983). According to the theory, cognitive appraisal processes mediate the effects of fear on protective responses. The motivation to protect oneself from danger (e.g., to mitigate climate change by conserving energy) is linearly related to their threat appraisal (perceptions of the severity of threat and their vulnerability to the threat) and coping appraisal (perceptions of their ability to perform the coping response and the effectiveness of the coping response). Protection motivation can be measured by behavioral intentions (Rogers, 1983), which, in the context of climate change, is the intention to conserve energy.

This study went further to investigate if intentions to conserve energy had a significant effect on behavior. The results show that intention has a significant influence on energy-saving behavior. The stronger is the intention to conserve energy, the more likely it is that the behavior will be performed. This finding is consistent with previous studies on energy-saving behavior (Ajzen et al., 2011; Carrus et al., 2021; Macovei, 2015; van der Linden, 2014b). In general, if an individual has volitional control over the performance of an intended behavior, it is likely that the intentions will be put into actions (Fishbein & Ajzen, 2010). Because the HEC measures do not require complex skills, time, and expensive devices, it is expected that intentions to conserve energy are followed by actual performance of the behavior.

Contrary to Hypothesis 4, this study found no direct effect of experience on intention. Previous studies reported similar results (Demski et al., 2017; Spence et al., 2011). This result highlights the importance of risk perception in influencing intention and energy conservation behavior and suggests that the experience must first generate perceptions of risks before intentions are formed. This requires that the experiences be causally attributed first to climate change (Helgeson et al., 2012; Whitmarsh, 2008). For example, a study showed that flood experience had no effect on climate change risk perception and responses (Whitmarsh, 2008). The same study found that flood victims viewed flooding as a separate issue from climate change and attributed their experience to some other factors (Whitmarsh, 2008). Indeed, many Filipinos have little or no knowledge about climate change (Bollettino et al., 2020), and this may well apply to the students in the sample.

Overall, this study shows that personal experience predicts risk perception, which in turn predicts intention. Intention, in turn, predicts conservation behavior. The model presented in this study may be useful in predicting students' energy conservation behavior as it explains 25% of the variance in the behavior. The explanatory power is similar to those of previous studies that used the TPB as a framework to explain pro-environmental behavior (de Leeuw et al., 2015) and climate change mitigation behaviors (Zhang et al., 2020).

Implications

The findings in this study have important implications for designing educational strategies to promote HEC in college students. The strong impact of experience on risk perception suggests the importance of highlighting students' experiences in discussions about climate change. One approach might be to have students recall and relate their experiences with extreme weather events to heighten risk perceptions and evoke feelings of concern (Akerlof et al., 2013; van der Linden, 2014a, 2015; Weber, 2006). Because learning from experience happens automatically and effortlessly, it is more likely to occur than learning from descriptive information, which requires analytic thinking and more effort (Myers et al., 2013). In line with this, presenting graphic elements of students' experiences might be more effective in conveying information about climate change and its risks compared to providing descriptive, statistical information (Marx et al., 2007). This should then be followed by discussions that highlight the causal relationship between their experiences and climate change (Demski et al., 2017; Helgeson et al., 2012; Spence et al., 2011).

Students who have little or no direct experience with the effects of climate change may be made to experience them vicariously by watching videos, looking at vivid images depicting the effects of climate change, or listening to the narratives of their classmates' direct experiences. Role-playing and virtual reality might also be used to increase risk perceptions and promote conservation behavior. Indeed, role-play simulation showed promise in helping communities adapt to climate change by educating them about the risks (Rumore et al., 2016). In another study, experiencing flood through immersive virtual reality increased risk perception among university students and staff (Simpson et al., 2022).

Limitations and Directions for Future Research

One limitation of this study is the use of convenience sampling in the selection of participants. Thus, the results of this study may not be generalized to the entire population of college students. To achieve generalizability of the results, it is recommended that future studies use a random sample of students from both public and private universities.

Another limitation is presented by its cross-sectional design. Conceptually, intentions are used to predict future behavior. In this study, past behavior served as the indicator of future behavior. According to Fishbein and Ajzen (2010), on average, intentions are shown to predict behavior whether the study is retrospective or prospective. Nevertheless, a longitudinal study would be ideal in future studies to confirm the relationship between intention and behavior.

The data were gathered through self-report questionnaires, which may be subject to certain biases. For example, respondents may have chosen answers that were considered socially acceptable, like switching off lights when not in use, even if those were not true. To minimize this bias, the respondents were assured that their answers would not be graded and would be kept confidential and anonymous. In future studies, additional information such as household electricity bills may be collected for a more objective measure of energy conservation.

It is worth noting that although significant, the effect of risk perception on intention is rather weak and the model accounted for only 6% of the variance in intention to save energy. This suggests that other factors may be important in forming intentions and need to be investigated in future studies. For example, knowledge of the causes of climate change was found to be a strong predictor of intention to address the problem (O’Connor et al., 1999). The students should understand that the extreme weather events that they experienced are manifestations of climate change, which in turn is caused by increased carbon dioxide emissions from energy use. Failure to recognize these connections would weaken the relationship between climate change risk perception and intention to conserve energy. It may be that the students failed to make these connections.

Furthermore, while the model explained 25% of the variance in behavior, the explanatory power of the model is weaker compared to that using the VBN framework for predicting climate change mitigation behaviors (Zhang et al., 2020). Being an altruistic behavior, climate change mitigation is expected to be significantly influenced by the constructs in the VBN framework—values, ascription of responsibility, and personal norms (Zhang et al., 2020). Future studies may improve the explanatory power of the model by including constructs in the VBN framework.

Lastly, integrating climate change-related experience and risk perception into the TPB model in future studies may provide a deeper understanding of how these factors influence HEC behavior.

To the best of my knowledge, this is the first study that investigated the influence of climate change-related experience, risk perception, and intention on energy conservation behavior of students in the Philippines. The results of this study could be used to guide the design of interventions to promote energy conservation behavior. Future research may be directed at evaluating the effectiveness of the aforementioned strategies for raising climate change risk perceptions and consequently increasing student engagement in energy conservation behaviors.

Conclusion

The present research contributes to the existing literature by presenting a model that explains and predicts HEC behavior of college students in the Philippines. The model, which explained 25% of the variance in HEC behavior in college students, indicates that experience with climate change-related events has an indirect effect on energy conservation behavior through risk perception and intention. The results of the study highlight the importance of increasing climate change risk perceptions by drawing upon personal experiences in promoting HEC among students.

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Appendix

MEASURES

Climate Change Experience Scale (EXP)

In the last five years, how frequently have you experienced the following? (*never* to *very frequently*)

EXP1	very strong typhoons
EXP2	very heavy rainfall
EXP3	extreme temperatures (severe heat or extreme cold)
EXP4	prolonged dry season
EXP5	unusual weather or rainfall pattern
EXP6	water shortage
EXP7	flooded surroundings (van der Linden, 2014a)

Climate Change Risk Perception Scale (RP)

How likely do you think it is that each of the following will occur in the area where you live during the next 50 years due to climate change? (*very unlikely* to *very likely*)

RP1	Increased cases of death, illness, harm, or injury to people (Leiserowitz, 2006)
RP2	Floods
RP3	Water shortage (Leiserowitz, 2006)
RP4	Food shortage
RP5	Extreme weather events (very heavy rainfall, drought, very strong typhoon, or extreme temperature)

How likely do you think it is that each of the following will occur worldwide during the next 50 years due to climate change? (*very unlikely* to *very likely*)

RP6	Melting ice
RP7	Rise in sea levels
RP8	Damage to houses and properties
RP9	Increased cases of death, illness, harm or injury to people (Leiserowitz, 2006)
RP10	Floods
RP11	Water shortage (Leiserowitz, 2006)
RP12	Food shortage
RP13	Extreme weather events (very heavy rainfall, drought, very strong typhoon, or extreme temperature)

Intention Scale (INT)

INT1 I plan to conserve energy at home in the next four weeks. (*strongly disagree* to *strongly agree*)
INT2 I will make an effort to conserve energy at home in the next four weeks. (*strongly disagree* to *strongly agree*)
INT3 I want to conserve energy at home in the next four weeks. (*strongly disagree* to *strongly agree*)

Household Energy Conservation Scale (HEC)

During the past four weeks, how frequently did you do the following? (*never* to *always*)

HEC1 switched off lights when not in use
HEC2 turned off appliances or electronic devices when not in use
HEC3 unplugged appliances or electronic devices when not in use
HEC4 reduced the use of gadgets for leisure
HEC5 used electric fan instead of air conditioner
HEC6 In general, do you make an effort to conserve energy at home? (*never* to *always*) (Ajzen, et al. 2011)