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Climate Risk Perception and Environmental Behavior: The Moderating Role of Education Level

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***Abstract*:** Climate change represents one of the most significant environmental and social challenges confronting contemporary societies. Although scientific evidence concerning climate change has become increasingly accessible, individuals differ substantially in how they perceive climate related risks and translate those perceptions into environmentally responsible behavior. This study examines the relationship between climate risk perception and environmental behavior and investigates whether education level moderates this relationship. The study is theoretically grounded in the Value Belief Norm theory and the Theory of Planned Behavior. The proposed framework assumes that individuals who perceive climate change as serious, immediate, personally relevant, and consequential are more likely to engage in proenvironmental behavior. Education level is proposed as a moderator because higher educational attainment may increase access to scientific information, environmental knowledge, critical thinking, awareness of consequences, and perceived behavioral efficacy. A quantitative, cross sectional research design is proposed. Primary data are assumed to be collected through a structured questionnaire using established Likert scale measures. The proposed model can be examined through Partial Least Squares Structural Equation Modeling using SmartPLS. The analytical procedure includes assessment of indicator reliability, internal consistency, convergent validity, discriminant validity, coefficient of determination, effect size, predictive relevance, direct effects, and moderation effects. For demonstration, hypothetical SmartPLS results indicate a positive and statistically significant relationship between climate risk perception and environmental behavior. The illustrative moderation analysis further indicates that education strengthens this relationship, suggesting that the behavioral consequences of climate risk perception are greater among individuals with higher educational attainment. The study contributes to environmental behavior literature by positioning education not merely as a demographic control variable but as a contextual factor capable of transforming climate risk perception into environmentally responsible action. The findings have implications for policymakers, educational institutions, environmental organizations, and climate communication practitioners.

Keywords: Climate Risk Perception, Environmental Behavior, Education Level, Climate Change, Proenvironmental Behavior, Value Belief Norm Theory, Theory Of Planned Behavior, Smartpls, Pls Sem, Environmental Education

Introduction

Climate change has evolved from a primarily scientific concern into a multidimensional social, economic, environmental, and behavioral challenge. Rising temperatures, changing precipitation patterns, extreme weather events, ecosystem degradation, water insecurity, and threats to human livelihoods have increased the importance of understanding how individuals perceive climate related risks and respond through everyday behavior. Although climate change is a global phenomenon, its consequences are experienced differently across individuals, communities, and countries. Consequently, perceptions of climate risk vary according to personal experience, knowledge, social context, values, access to information, and demographic characteristics. The Intergovernmental Panel on Climate Change emphasizes that perceptions of climate risks influence motivation and adaptation behavior and identifies education as an important predictor of climate risk awareness and action.

Climate risk perception refers to an individual's subjective assessment of the probability, seriousness, immediacy, and consequences of climate change. It includes cognitive judgments concerning the likelihood of climate related threats as well as affective evaluations concerning worry, concern, vulnerability, and perceived severity. Risk perception is important because individuals rarely respond directly to scientific information alone. Instead, behavioral responses depend substantially on how people interpret and personally evaluate environmental threats. Recent research demonstrates that climate risk perception can positively influence proenvironmental behavior. For example, research among employees in Pakistan found that climate change risk perception positively influenced proenvironmental behavior, although the strength of the relationship depended on contextual factors such as environmental values and psychological contract breach.

Environmental behavior represents individual actions intended to reduce environmental degradation or support environmental sustainability. Such behavior includes recycling, reducing household energy consumption, conserving water, using public transportation, avoiding unnecessary consumption, purchasing environmentally responsible products, participating in environmental initiatives, and supporting climate mitigation activities. The transition from environmental awareness to actual behavior is not automatic. Individuals may recognize climate change as a serious problem while failing to translate this perception into consistent behavioral action. Recent research on climate literacy similarly identifies a persistent gap between proenvironmental intentions and actual behavior, while showing that stronger climate literacy can improve the translation of intention into behavior.

Education level may help explain this behavioral gap. Education provides individuals with opportunities to acquire scientific knowledge, develop critical thinking abilities, evaluate environmental information, understand causal relationships, and recognize the consequences of individual and collective actions. The IPCC reports that education is strongly associated with climate change awareness and can support motivation for climate action. However, education should not automatically be assumed to produce environmentally responsible behavior. Higher education may increase knowledge without necessarily changing values, attitudes, social norms, perceived behavioral control, or behavioral opportunities. Therefore, examining education as a moderator is theoretically important because it focuses on whether education changes the strength of the relationship between climate risk perception and environmental behavior rather than simply assuming that education directly produces environmental behavior.

Recent empirical evidence supports the relevance of this research direction. Studies have found that climate risk perception predicts proenvironmental intentions and behaviors, while climate literacy and environmental education can improve climate related knowledge, attitudes, and behavior. Research involving higher education students has also demonstrated that risk perception, environmental values, attitudes, perceived behavioral control, and subjective norms can contribute to proenvironmental behavior. Nevertheless, comparatively limited research has directly examined education level as a moderating mechanism between climate risk perception and environmental behavior.

The present study therefore proposes an integrated model in which climate risk perception represents the independent variable, environmental behavior represents the dependent variable, and education level represents the moderating variable. The research aims to determine whether individuals with different levels of education respond differently to perceived climate risk. The study is particularly relevant for developing country contexts where climate vulnerability is high but access to environmental education and scientifically reliable information may vary substantially. The findings can assist policymakers in designing climate communication and education strategies that convert risk awareness into meaningful environmental action.

Literature Review

Climate Risk Perception

Climate risk perception is concerned with how individuals understand and evaluate threats associated with climate change. It includes perceptions of seriousness, probability, personal vulnerability, temporal proximity, societal consequences, and perceived controllability. Risk perception theories suggest that people do not evaluate environmental threats entirely through objective probability calculations. Instead, emotional responses, personal experience, social communication, trust, values, and knowledge influence how risks are interpreted.

Climate risk perception is particularly important because climate change is characterized by uncertainty, temporal distance, complexity, and uneven geographical consequences. Individuals may therefore perceive the same scientific information differently. The IPCC notes that climate risk is understood differently across members of the public, communities, professionals, scientists, and policymakers. Cognitive knowledge, emotional reactions, values, and behavioral responses interact in shaping climate related perceptions.

Personal experience can also influence risk perception. Individuals who have experienced floods, heatwaves, droughts, storms, water shortages, or other climate related events may perceive climate change as more immediate and personally relevant. Research among young people indicates that perceived climate risk is a significant predictor of willingness to engage in proclimate behavior even after accounting for other cognitive and social factors. This suggests that risk perception may constitute an important psychological mechanism connecting climate information with environmental action.

Environmental Behavior

Environmental behavior refers to actions that contribute to environmental protection or reduce environmental harm. Stern's framework distinguishes between different types of environmental behavior, including private sphere behavior, environmental activism, organizational behavior, and environmentally significant consumer behavior. The concept has subsequently been examined through numerous theoretical approaches, including the Theory of Planned Behavior, Value Belief Norm theory, Norm Activation theory, and the Knowledge Attitude Behavior framework.

The Theory of Planned Behavior proposes that attitudes, subjective norms, and perceived behavioral control influence behavioral intentions, which subsequently influence actual behavior. Environmental behavior can therefore be understood as the outcome of psychological evaluations, social expectations, and perceived ability to perform a particular action. Climate risk perception may influence attitudes and intentions because recognizing environmental threats can increase the perceived importance of environmentally responsible behavior.

The Value Belief Norm perspective provides another explanation. According to this framework, environmental values influence ecological worldview, awareness of consequences, personal norms, and ultimately environmentally responsible behavior. Climate risk perception can increase awareness of consequences by making individuals more conscious of the negative outcomes associated with environmentally harmful behavior. This can activate personal responsibility and encourage behavioral change.

Recent empirical studies support the connection between climate risk perception and environmental behavior. Latif and colleagues found that climate change risk perception positively influenced proenvironmental behavior among employees in Pakistan. Similarly, recent structural equation modeling research has shown that climate risk perception and awareness can have substantial relationships with proenvironmental behavior. Research among adolescents has also found that climate risk perception predicts proenvironmental behavior over time.

Education Level

Education represents an important social and cognitive resource. Educational attainment can influence environmental knowledge, information processing, critical thinking, scientific literacy, awareness of environmental consequences, and perceived ability to participate in environmental decision making. Education may therefore affect both the level of climate risk perception and the extent to which that perception translates into environmental action.

The relationship between education and climate perception has received increasing attention. The IPCC identifies education as a major predictor of public awareness of climate risks across countries. Education may expose individuals to scientific explanations of climate change and provide opportunities to distinguish reliable information from misinformation.

Climate change education can also influence actual environmental outcomes. A recent systematic review of climate change education interventions found that most studies reported positive effects on environmental outcomes, although relatively few studies directly examined actual behavior rather than intentions or attitudes. A recent meta analysis further reported meaningful effects of climate education on knowledge, attitudes, and behavior. These findings indicate that education has potential to support behavioral transformation.

However, education does not necessarily guarantee environmental responsibility. Highly educated individuals may possess extensive knowledge while maintaining consumption patterns that generate substantial environmental impacts. This possibility supports examining education as a moderator rather than simply as an independent predictor.

Moderating Role of Education

A moderator changes the strength or direction of the relationship between an independent and dependent variable. In this study, education level is expected to strengthen the positive relationship between climate risk perception and environmental behavior. The logic is that individuals with greater educational attainment may be more capable of interpreting climate risks, understanding their consequences, evaluating information, and identifying effective behavioral responses.

For individuals with lower education, climate risk perception may create concern without providing sufficient knowledge concerning what actions are effective or feasible. Conversely, individuals with higher education may possess greater environmental knowledge and cognitive resources that enable them to translate concern into concrete behavioral choices.

Recent research on climate literacy supports this argument. Higher climate literacy has been associated with stronger intentions and a greater capacity to translate intentions into environmental behavior. Research concerning climate change education similarly indicates that knowledge and educational interventions can improve behavioral outcomes.

The moderating argument is also consistent with the IPCC's observation that education is associated with climate awareness, motivation, and action. Nevertheless, education should be considered one contextual factor among many. Environmental values, social norms, political orientation, perceived behavioral control, institutional support, economic resources, and personal experience can also influence the conversion of risk perception into action.

Research Gap

Although previous research has established relationships among climate risk perception, environmental attitudes, climate literacy, and environmental behavior, three gaps remain. First, many studies examine education as a control variable or direct predictor rather than investigating whether it changes the strength of the climate risk perception and environmental behavior relationship. Second, substantial research focuses on students, employees, or specific demographic groups, limiting generalizability across broader populations. Third, studies using PLS SEM to explicitly test education as a moderator remain comparatively limited.

The proposed research addresses these gaps by positioning education level as a moderating variable. This approach contributes to theory by explaining not only whether climate risk perception influences environmental behavior but also under what educational conditions this influence becomes stronger.

Conceptual Model and Theoretical Framework

The proposed theoretical framework integrates the Value Belief Norm theory and the Theory of Planned Behavior.

The Value Belief Norm theory explains environmentally responsible behavior through a sequence involving values, ecological worldview, awareness of consequences, ascription of responsibility, personal norms, and behavioral action. Climate risk perception can be interpreted as an awareness of environmental consequences. When individuals perceive climate change as serious and personally relevant, they may experience stronger responsibility to reduce environmental harm.

The Theory of Planned Behavior complements this explanation by emphasizing attitudes, subjective norms, perceived behavioral control, behavioral intentions, and actual behavior. Climate risk perception may increase favorable attitudes toward environmental protection and strengthen behavioral intentions. Education can facilitate this process by increasing knowledge and perceived competence.

The conceptual model is:

Climate Risk Perception → Environmental Behavior

Education Level × Climate Risk Perception → Environmental Behavior

The independent variable is climate risk perception.

The dependent variable is environmental behavior.

The moderator is education level.

Hypotheses

H1: Climate risk perception has a positive and significant effect on environmental behavior.
H2: Education level has a positive and significant effect on environmental behavior.
H3: Education level positively moderates the relationship between climate risk perception and environmental behavior, such that the relationship is stronger among individuals with higher education levels.

Methodology

A quantitative research methodology based on a cross sectional survey design is appropriate for examining the proposed relationships. The target population consists of adult individuals capable of responding to questions concerning climate change perceptions and everyday environmental behavior. A structured questionnaire can be administered using a five point Likert scale ranging from strongly disagree to strongly agree. Climate risk perception should be measured through items assessing perceived seriousness, likelihood, personal relevance, vulnerability, and consequences of climate change. Environmental behavior should include items concerning energy conservation, waste reduction, recycling, environmentally responsible consumption, transportation choices, water conservation, and participation in environmental activities. Education level can be measured using ordered educational categories such as secondary education, intermediate education, undergraduate education, postgraduate education, and doctoral or equivalent education.

A minimum sample of approximately 300 respondents is recommended for the proposed PLS SEM model, although a larger sample would improve statistical power and subgroup analysis. A combination of purposive and convenience sampling may be used where a probability sampling frame is unavailable. Before full data collection, a pilot study involving approximately 30 to 50 respondents should be conducted to evaluate wording, reliability, and questionnaire clarity.

Data analysis should be conducted using SmartPLS. The measurement model should first be assessed through indicator loadings, Cronbach's alpha, composite reliability, average variance extracted, and discriminant validity. The structural model should subsequently be assessed through path coefficients, bootstrapping, significance values, coefficient of determination, effect size, predictive relevance, and moderation analysis. Bootstrapping with 5,000 subsamples is recommended for testing direct and interaction effects. Common method bias should be examined using appropriate statistical procedures and procedural remedies. Demographic characteristics such as age, gender, income, and employment status may be included as control variables where theoretically justified.

Measurement Model

Table 1

Construct Reliability and Convergent Validity

Construct	Cronbach Alpha	Composite Reliability	AVE	Assessment
Climate Risk Perception	0.901	0.926	0.716	Acceptable
Environmental Behavior	0.914	0.935	0.742	Acceptable
Education Level	0.887	0.918	0.691	Acceptable

Note. Values are illustrative SmartPLS results and must be replaced with actual empirical output.

Table 2
Illustrative Indicator Loadings

Construct	Indicator	Loading
Climate Risk Perception	CRP1	0.824
Climate Risk Perception	CRP2	0.871
Climate Risk Perception	CRP3	0.846
Climate Risk Perception	CRP4	0.853
Climate Risk Perception	CRP5	0.818
Environmental Behavior	EB1	0.842
Environmental Behavior	EB2	0.876
Environmental Behavior	EB3	0.859
Environmental Behavior	EB4	0.891
Environmental Behavior	EB5	0.851
Education Level	EDU1	0.801
Education Level	EDU2	0.864
Education Level	EDU3	0.842
Education Level	EDU4	0.833

Note. Values are illustrative.

Table 3
Discriminant Validity Using HTMT

Construct Pair	HTMT	Threshold	Decision
Climate Risk Perception and Environmental Behavior	0.681	< 0.850	Established
Climate Risk Perception and Education Level	0.392	< 0.850	Established
Environmental Behavior and Education Level	0.417	< 0.850	Established

Note. Values are illustrative.

Structural Model Analysis
Table 4
Direct Effects

Hypothesis	Relationship	Beta	Standard Error	t value	p value	Decision
H1	Climate Risk Perception → Environmental Behavior	0.472	0.061	7.738	< 0.001	Supported
H2	Education Level → Environmental Behavior	0.186	0.067	2.776	0.006	Supported

Note. Values are illustrative SmartPLS results.

Table 5
Moderation Effect

Hypothesis	Interaction	Beta	Standard Error	t value	p value	Decision
H3	Climate Risk Perception × Education Level → Environmental Behavior	0.164	0.052	3.154	0.002	Supported

Note. Values are illustrative SmartPLS results.

Table 6
Coefficient of Determination and Effect Size

Endogenous Variable	R^2	Interpretation	f^2 for Main Effect	Interpretation
Environmental Behavior	0.391	Moderate explanatory power	0.247	Medium effect
Environmental Behavior	0.391	Moderate explanatory power	0.041 for Education	Small effect
Environmental Behavior	0.391	Moderate explanatory power	0.038 for Interaction	Small effect

Note. Values are illustrative.

Interpretation of Table 1

The results presented in Table 1 demonstrate acceptable reliability and convergent validity for the three constructs included in the proposed model. The Cronbach alpha coefficients range from 0.887 to 0.914, exceeding the commonly accepted threshold of 0.70. This indicates that the measurement items associated with each construct demonstrate satisfactory internal consistency. The highest reliability is observed for environmental behavior, suggesting that the indicators measuring environmentally responsible actions consistently represent the same underlying construct.

Composite reliability values range from 0.918 to 0.935. These results provide additional evidence that the indicators reliably measure their respective latent variables. Composite reliability is particularly appropriate within PLS SEM because it considers the individual contribution of each indicator rather than assuming equal indicator loadings. All values substantially exceed the recommended minimum of 0.70.

The average variance extracted values are 0.716 for climate risk perception, 0.742 for environmental behavior, and 0.691 for education level. These values exceed the recommended threshold of 0.50, indicating satisfactory convergent validity. In practical terms, the results suggest that each construct explains more than half of the variance in its respective indicators.

The findings therefore indicate that the measurement model is sufficiently reliable for subsequent structural model assessment. Climate risk perception is represented consistently by indicators measuring perceptions of climate severity, likelihood, vulnerability, and consequences. Environmental behavior is represented by a range of environmentally responsible actions. Education level is represented through educational attainment indicators.

These illustrative findings are consistent with recent environmental behavior studies that employ structural equation modeling to examine relationships between climate perception and proenvironmental outcomes. Recent research has demonstrated the suitability of SEM based approaches for examining environmental awareness, risk perception, attitudes, and proenvironmental behavior.

However, reliability alone does not establish construct validity. It is necessary to examine indicator loadings and discriminant validity before interpreting the structural relationships. Therefore, Tables 2 and 3 provide additional evidence regarding the adequacy of the measurement model.

Interpretation of Table 2

Table 2 presents the illustrative outer loadings of the measurement indicators. All indicator loadings exceed 0.80, which indicates that the indicators have strong relationships with their corresponding latent constructs. In PLS SEM, outer loadings above 0.70 are generally considered acceptable because they indicate that the construct explains a substantial proportion of the indicator's variance.

The climate risk perception indicators have loadings ranging from 0.818 to 0.871. These results indicate that each indicator makes a meaningful contribution to measuring perceived climate risk. The strongest loading is associated with CRP2, suggesting that this indicator provides particularly strong representation of the climate risk perception construct.

The environmental behavior indicators have loadings ranging from 0.842 to 0.891. These values suggest strong measurement performance. EB4 has the highest loading, indicating that this particular behavior item is strongly associated with the overall environmental behavior construct.

Education indicators range from 0.801 to 0.864. Although education level is conceptually different from psychological constructs such as climate risk perception, the illustrative results demonstrate acceptable measurement consistency when education related responses are operationalized through appropriate indicators.

The strong outer loadings provide evidence that the indicators are suitable for retention. Removing indicators with strong loadings would not normally be justified unless there were theoretical or statistical reasons for doing so. The measurement results therefore support proceeding to discriminant validity assessment.

The results also reinforce the importance of using multidimensional indicators rather than relying on a single question. Climate risk perception is complex and can include perceived probability, seriousness, personal vulnerability, and consequences. Environmental behavior is similarly multidimensional because individuals may engage in some environmentally responsible activities while avoiding others. A reliable measurement instrument should therefore capture several behavioral dimensions.

Recent research similarly emphasizes the importance of using validated multidimensional measures when investigating climate perception and proenvironmental behavior through structural equation models.

Interpretation of Table 3

Table 3 presents the heterotrait monotrait ratio results for assessing discriminant validity. All HTMT values are below 0.850, indicating that the constructs demonstrate adequate empirical distinctiveness. This is important because climate risk perception and environmental behavior are theoretically related but should not represent the same construct.

The HTMT value of 0.681 between climate risk perception and environmental behavior indicates a meaningful association while remaining below the recommended threshold. This result supports the conceptual argument that individuals who perceive greater climate risks tend to engage in more environmentally responsible behavior, while confirming that risk perception and behavior remain empirically distinguishable.

The HTMT value between climate risk perception and education level is relatively low at 0.392. This indicates that education and climate risk perception represent substantially different constructs. Although education may influence how individuals understand climate risk, educational attainment itself is not equivalent to perceived environmental risk.

Similarly, the HTMT value between environmental behavior and education level is 0.417. This suggests that education is associated with environmental behavior but does not represent environmental behavior itself.

The discriminant validity findings are theoretically important because the proposed moderation model requires clear separation between the predictor, moderator, and outcome. If education level were highly correlated with climate risk perception or environmental behavior, interpretation of the moderation effect could become problematic. The reported values suggest that multicollinearity between the main constructs is unlikely to threaten construct distinctiveness.

Overall, the measurement model provides evidence that the three constructs can be meaningfully distinguished. This supports subsequent evaluation of the structural model and hypothesis testing.

Interpretation of Table 4

Table 4 presents the illustrative direct effects of climate risk perception and education level on environmental behavior. The results support H1 because climate risk perception has a positive and statistically significant effect on environmental behavior, with a path coefficient of 0.472 and a p value below 0.001. This indicates that higher perceived climate risk is associated with stronger environmentally responsible behavior.

The magnitude of the coefficient suggests that climate risk perception represents an important predictor of environmental behavior. Substantively, individuals who perceive climate change as serious, probable, immediate, and personally consequential may be more willing to conserve resources, reduce environmentally harmful consumption, recycle, use sustainable transportation, and participate in environmental activities.

This finding is consistent with recent research showing that climate risk perception can positively predict proenvironmental behavior. Latif and colleagues reported a positive relationship between climate change risk perception and employee proenvironmental behavior in Pakistan. Research among young people has similarly found perceived climate risk to be a significant predictor of proclimate behavioral intentions.

H2 is also supported. Education level has a positive coefficient of 0.186 and a p value of 0.006. This suggests that higher educational attainment is independently associated with stronger environmental behavior. The effect is smaller than that of climate risk perception, indicating that education may provide supportive cognitive resources but may not be sufficient on its own to generate substantial environmental action.

The finding is theoretically consistent with evidence that education contributes to climate awareness, knowledge, and motivation. The IPCC identifies education as an important predictor of public awareness of climate risk. Recent research also indicates that climate education produces meaningful improvements in environmental knowledge, attitudes, and behavior.

Nevertheless, the results should not be interpreted as evidence that education automatically causes environmental behavior. The relationship may reflect broader factors associated with education, including access to information, socioeconomic conditions, environmental knowledge, and social networks. A longitudinal design would be required to establish stronger causal conclusions.

Interpretation of Table 5

Table 5 provides the central finding of the proposed research by examining the moderating role of education level. The interaction between climate risk perception and education level produces a positive coefficient of 0.164 with a t value of 3.154 and a p value of 0.002. Since the p value is below 0.05, H3 is supported.

The positive interaction means that education strengthens the relationship between climate risk perception and environmental behavior. In other words, individuals with higher education are expected to translate their perception of climate risk into environmentally responsible behavior more strongly than individuals with lower educational attainment.

This finding provides an important extension to existing research. Previous studies have established that climate risk perception can predict proenvironmental behavior, while other research has demonstrated the importance of education and climate literacy. The present model combines these insights by proposing that education changes the strength of the relationship between perception and behavior.

Theoretically, the moderation effect can be explained through cognitive capacity and environmental literacy. Higher educational attainment may provide individuals with greater ability to understand scientific information, evaluate competing claims, recognize environmental consequences, and identify appropriate behavioral responses. Consequently, when highly educated individuals perceive climate change as risky, they may be more capable of converting concern into concrete actions.

The finding also explains why awareness campaigns do not always produce uniform behavioral outcomes. Two individuals may receive identical climate information and perceive climate change as equally serious, but their subsequent behavior may differ because their educational resources and ability to process information differ.

The moderation effect should ideally be visualized through a simple slope analysis in SmartPLS. The expected pattern would show a relatively steep positive relationship between climate risk perception and environmental behavior among individuals with higher education and a weaker positive relationship among individuals with lower education.

The finding has practical implications. Policymakers should not rely exclusively on general climate awareness campaigns. Climate communication should be accompanied by educational programs that provide practical knowledge concerning how individuals can respond to climate risks. Such programs may be particularly important for groups with lower educational attainment.

Interpretation of Table 6

Table 6 reports the illustrative coefficient of determination and effect size results. The R squared value for environmental behavior is 0.391, meaning that approximately 39.1 percent of the variance in environmental behavior is explained by the predictors included in the proposed model. In behavioral research, this represents meaningful explanatory power, although substantial unexplained variance remains.

The R squared value demonstrates that climate risk perception and education level, together with their interaction, contribute considerably to explaining environmental behavior. However, environmental behavior is a complex outcome affected by many psychological, social, economic, institutional, and contextual factors. Therefore, a value below 50 percent should not be interpreted as a weakness of the model. Instead, it indicates that additional variables could be incorporated in future research.

The effect size of climate risk perception is 0.247, indicating a medium practical effect. This reinforces the path coefficient result and suggests that climate risk perception is not merely statistically significant but also substantively important.

The effect size of education is 0.041, indicating a small effect. This suggests that education independently contributes to environmental behavior but is less influential than climate risk perception.

The interaction effect size is 0.038, which is also relatively small. Moderation effects in behavioral research are frequently smaller than direct effects because they explain changes in the strength of relationships rather than representing independent causal relationships.

The results therefore suggest a nuanced model. Climate risk perception is the primary behavioral driver, education has an additional direct contribution, and education further strengthens the translation of climate risk perception into environmental behavior.

The findings correspond with recent literature emphasizing that climate risk perception, climate literacy, environmental values, social factors, and education jointly influence environmental behavior.

Conclusion and Discussion

The purpose of this study was to examine the relationship between climate risk perception and environmental behavior and to determine whether education level moderates this relationship. The proposed framework was developed using the Value Belief Norm theory and Theory of Planned Behavior. The model suggests that individuals who perceive climate change as serious, likely, personally relevant, and consequential are more likely to engage in environmentally responsible behavior. Education was positioned as a moderator because educational attainment can provide knowledge, cognitive resources, scientific literacy, and greater capacity to interpret environmental information.

The illustrative SmartPLS results support all three proposed hypotheses. Climate risk perception demonstrates a positive and significant relationship with environmental behavior. This finding is consistent with contemporary research showing that perceived climate risk can encourage environmental action. Education also demonstrates a positive direct relationship with environmental behavior. More importantly, the interaction between climate risk perception and education is positive and significant, suggesting that education strengthens the conversion of climate risk perception into environmental behavior.

The moderation finding represents the principal theoretical contribution of the study. Climate risk perception alone may not always be sufficient to produce environmentally responsible behavior. Individuals need the cognitive resources and knowledge necessary to understand what actions are effective. Education may therefore function as an enabling condition that helps individuals translate environmental concern into practical action. This interpretation is consistent with recent evidence concerning climate literacy and climate education.

The study also contributes to environmental behavior research by demonstrating the value of integrating psychological perceptions with socioeconomic characteristics. Instead of treating education merely as a demographic control variable, the proposed framework recognizes education as a contextual factor that can alter behavioral processes.

From a practical perspective, governments, universities, schools, environmental organizations, and media organizations should design climate communication programs that combine risk information with practical environmental education. Communicating that climate change is dangerous may increase concern, but individuals should also be shown what they can realistically do to reduce environmental impacts. Educational interventions should therefore include practical activities involving energy conservation, waste management, sustainable transportation, water conservation, and responsible consumption.

Future studies should employ longitudinal and experimental designs to establish causal relationships. Researchers should also examine climate literacy rather than relying exclusively on formal education level. Other potential moderators and mediators, including environmental values, environmental knowledge, perceived behavioral control, social norms, climate anxiety, personal experience, and environmental identity, should be incorporated into future models. Cross cultural research would also determine whether the moderating effect of education is consistent across countries and socioeconomic contexts.

Future Recommendations

Future research should extend the proposed framework in several directions. First, researchers should collect longitudinal data to determine whether changes in climate risk perception lead to sustained changes in environmental behavior. Cross sectional surveys provide useful associations but cannot adequately establish temporal causality.

Second, future studies should distinguish between formal education and climate specific literacy. Educational attainment may indicate years of schooling but does not necessarily measure knowledge about climate science. A person with a university degree may have limited climate knowledge, while someone with lower formal education may possess extensive environmental experience.

Third, future research should compare different educational groups through multigroup analysis in SmartPLS. Respondents could be divided into lower, medium, and higher education groups, allowing researchers to determine whether path coefficients differ significantly across groups.

Fourth, future models should incorporate environmental knowledge, environmental values, personal norms, perceived behavioral control, social norms, climate anxiety, and environmental identity. Recent research demonstrates that risk perception interacts with environmental values and other psychological factors in shaping proenvironmental behavior.

Fifth, future researchers should examine actual environmental behavior rather than relying entirely on self reported responses. Self reported behavior may be affected by social desirability bias. Behavioral records, energy consumption data, recycling participation, transportation choices, or experimental behavioral tasks could provide stronger evidence.

Finally, climate education programs should emphasize action oriented learning. Recent evidence suggests that education can improve climate knowledge and attitudes, but the translation into actual behavior remains an important challenge. Therefore, educational institutions should combine scientific knowledge with practical activities, behavioral planning, community participation, and opportunities for students and citizens to practice sustainable behavior.

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