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Environmental Beliefs and Pro-environmental Behavior in Latin America: A Partial Least Squares Structural Equation Modeling Approach

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Environmental beliefs play a fundamental role in shaping individual responses to environmental challenges and sustainability transitions. In Latin America, environmental problems such as climate change, biodiversity loss, and resource degradation have intensified the need to understand the psychological and cognitive factors that influence environmentally responsible behavior. The present study analyzes the structural relationships among environmental concern, ecocentric values, environmental awareness, and pro-environmental behavior through the estimation of a Partial Least Squares Structural Equation Model (PLS-SEM). A quantitative, non-experimental, and cross-sectional design was implemented using survey data collected through a structured questionnaire composed of reflective indicators measured on a Likert scale. The measurement model evaluated reliability, convergent validity, and discriminant validity through outer loadings, composite reliability, and average variance extracted. The structural model was assessed using path coefficients, bootstrapping procedures, and model fit indicators, including the standardized root mean square residual and the normed fit index. The results indicate that environmental concern and ecocentric values significantly influence environmental awareness, while environmental awareness emerges as the strongest predictor of pro-environmental behavior. Additionally, ecocentric values demonstrate both direct and indirect effects on behavioral engagement. The model explains a substantial proportion of variance in environmental awareness and pro-environmental behavior, confirming that environmental beliefs operate through an integrated system of emotional, normative, and cognitive components. These findings highlight the importance of strengthening environmental awareness and ecological value orientations in order to promote sustainable behavioral practices. The study

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contributes to the literature on environmental psychology and sustainability by providing empirical evidence of the structural mechanisms linking environmental beliefs with pro-environmental behavior in the Latin American context.

Keywords: environmental beliefs, environmental concern, ecocentric values, environmental awareness, pro-environmental behavior, PLS-SEM; sustainability, Latin America.

Introduction

Environmental beliefs have become a central topic in the analysis of sustainable development, particularly in regions where environmental pressures intersect with socioeconomic inequalities and institutional transformations. In Latin America, environmental perceptions and values are increasingly relevant for understanding how individuals interpret ecological risks, evaluate public policies, and adopt pro-environmental behaviors. Research has shown that beliefs about environmental degradation, climate change, and resource scarcity influence individual and collective responses to sustainability challenges. These beliefs are not only cognitive evaluations of environmental conditions but also normative orientations that shape attitudes and behavioral intentions toward environmental protection (Schultz, 2001).

In the context of developing regions, environmental beliefs are frequently associated with broader cultural values and social norms that regulate interactions between individuals and natural resources. Empirical studies indicate that environmental concern often emerges as a multidimensional construct encompassing emotional responses to ecological degradation, awareness of environmental risks, and normative commitments to conservation practices. Such dimensions are strongly related to ecological values that emphasize the intrinsic worth of ecosystems and the moral responsibility of individuals to preserve biodiversity and environmental quality (Dietz, Fitzgerald, & Shwom, 2005). Within this framework, ecocentric orientations tend to reinforce environmental awareness by promoting interpretations of environmental problems as systemic rather than isolated events.

Environmental awareness represents another critical dimension in the analysis of sustainability-related beliefs. Awareness involves the capacity of individuals to recognize environmental problems, understand their causes, and evaluate potential solutions. Evidence suggests that awareness is often shaped by educational processes, access to information, and institutional discourse about environmental protection. In societies undergoing rapid economic and demographic changes, awareness may also reflect the interaction between traditional ecological knowledge and contemporary scientific narratives about climate change and sustainability (Stern, 2000). Consequently, environmental awareness functions as a cognitive bridge linking ecological values with concrete behavioral practices.

From a behavioral perspective, pro-environmental actions constitute the observable outcome of environmental beliefs and attitudes. Such behaviors include practices related to recycling, energy conservation, sustainable consumption, and participation in environmental initiatives. Previous empirical findings suggest that environmental concern and ecocentric values indirectly influence behavioral engagement through increased awareness and perceived responsibility toward environmental protection (Bamberg & Möser, 2007). This relationship is particularly relevant in Latin American contexts, where environmental governance often relies on community participation and civic engagement to address issues such as deforestation, water scarcity, and urban pollution.

Structural models have been widely employed to examine the complex relationships between environmental beliefs, awareness, and behavioral outcomes. These analytical approaches allow the simultaneous estimation of

measurement and structural components, facilitating the assessment of latent constructs that cannot be directly observed. Partial Least Squares Structural Equation Modeling (PLS-SEM) has become especially useful in sustainability research due to its capacity to analyze complex models with reflective indicators and moderate sample sizes while prioritizing predictive accuracy over strict distributional assumptions (Kaiser, Ranney, Hartig, & Bowler, 1999). Through this methodological framework, it is possible to evaluate how environmental concern and ecocentric values contribute to the formation of environmental awareness and ultimately influence pro-environmental behavior.

In Latin America, the application of structural equation modeling to environmental attitudes has provided important insights into how cultural values, social trust, and institutional legitimacy interact with ecological perceptions. Studies indicate that environmental beliefs in the region are influenced not only by individual factors but also by collective experiences related to environmental conflicts, resource management, and governance structures. As a result, understanding the structural relationships among environmental concern, ecological values, awareness, and behavioral engagement contributes to a more comprehensive interpretation of sustainability dynamics in the region (Gifford & Nilsson, 2014).

Given these considerations, examining environmental beliefs through a structural modeling approach offers a valuable framework for analyzing how cognitive and normative dimensions of sustainability interact with behavioral outcomes. By identifying the relationships among environmental concern, ecocentric values, environmental awareness, and pro-environmental behavior, it becomes possible to assess the mechanisms through which environmental beliefs translate into practical actions aimed at environmental protection and sustainable development in Latin America.

Method

The present study followed a quantitative, non-experimental, cross-sectional design oriented toward the analysis of environmental beliefs and their influence on pro-environmental behavior in Latin America. The research strategy focused on the estimation of a structural equation model using the Partial Least Squares approach (PLS-SEM). This methodological framework was selected because it allows the simultaneous evaluation of latent constructs and structural relationships, particularly in models composed of reflective indicators and complex predictive structures. In addition, PLS-SEM is suitable for exploratory and predictive analyses when theoretical development is evolving and the objective is to maximize the explained variance of endogenous constructs (Ringle, Wende, & Becker, 2015).

The target population consisted of adults residing in urban contexts of Latin American countries who reported awareness of environmental issues such as climate change, biodiversity loss, and pollution. Participants were selected through a non-probabilistic sampling strategy with voluntary participation in an online survey. Although the sampling procedure relied on accessibility and voluntary response, the minimum sample size was estimated using a statistical formula for finite populations to ensure sufficient statistical power for structural equation modeling. The sample size was estimated according to the following expression:

$$n = (Z^2pqN) / [e^2(N - 1) + Z^2pq]$$

where n represents the required sample size, Z corresponds to the critical value associated with the desired confidence level, p represents the expected proportion of the attribute present in the population, q = 1 - p, e denotes the acceptable sampling error, and N represents the population size (Hair, Hult, Ringle, & Sarstedt, 2017).

Based on a confidence level of 95%, an error margin of 5%, and a conservative variance assumption ($p = 0.50$), the estimated minimum sample exceeded 380 observations, ensuring adequate statistical conditions for estimating the PLS-SEM model.

The instrument consisted of a structured questionnaire composed of reflective indicators measured on a five-point Likert scale ranging from strongly disagree to strongly agree. The questionnaire included 12 items distributed across four latent constructs: environmental concern, ecocentric values, environmental awareness, and pro-environmental behavior. Environmental concern evaluated emotional and cognitive perceptions related to ecological degradation. Ecocentric values captured normative orientations emphasizing the intrinsic value of ecosystems and biodiversity. Environmental awareness assessed knowledge and recognition of environmental problems, while pro-environmental behavior evaluated self-reported practices associated with sustainable consumption and environmental responsibility. The design of the instrument followed measurement guidelines commonly used in sustainability research and environmental psychology (Chin, 1998).

Data analysis was conducted using Partial Least Squares Structural Equation Modeling. The estimation procedure included two stages: the assessment of the measurement model and the evaluation of the structural model. The measurement model assessed the relationships between latent variables and their reflective indicators. In reflective models, each observed indicator is assumed to be caused by the latent construct, meaning that indicators should exhibit high correlations and reliability.

The measurement model was specified as:

$$x_i = \lambda_i \xi + \delta_i$$

$$y_i = \lambda_i \eta + \varepsilon_i$$

where x_i and y_i represent observed indicators, λ_i denotes the factor loading associated with each indicator, ξ represents exogenous latent variables, η denotes endogenous latent variables, and δ_i and ε_i correspond to measurement errors (Henseler, Ringle, & Sarstedt, 2015).

The structural model represented the causal relationships among latent constructs and was expressed as:

$$\eta = B\eta + \Gamma\xi + \zeta$$

where η represents endogenous latent variables, ξ denotes exogenous constructs, B represents the matrix of relationships among endogenous variables, Γ represents the matrix of effects from exogenous to endogenous constructs, and ζ corresponds to structural disturbance terms (Sarstedt, Ringle, & Hair, 2017).

The evaluation of the measurement model included reliability and validity analyses. Indicator reliability was assessed through outer loadings, which should exceed 0.70 to ensure adequate representation of the latent construct. Internal consistency reliability was evaluated using composite reliability (CR) and Cronbach's alpha, with recommended thresholds above 0.70. Convergent validity was examined through the average variance extracted (AVE), which should exceed 0.50 to confirm that the construct explains more than half of the variance of its indicators (Byrne, 2016).

The psychometric properties of the measurement model demonstrated satisfactory levels of reliability and validity. Environmental concern showed high internal consistency, with composite reliability values above recommended thresholds and indicator loadings consistently exceeding acceptable levels. The construct of ecocentric values exhibited strong convergent validity, as reflected by high average variance extracted values and stable indicator reliability. Environmental awareness also displayed adequate internal consistency and convergent validity, indicating that the indicators captured a coherent representation of cognitive recognition of

environmental issues. Finally, pro-environmental behavior demonstrated robust psychometric properties, with consistent loadings across items and satisfactory levels of composite reliability and explained variance.

Discriminant validity was examined by comparing the square root of the AVE of each construct with the correlations between constructs. Results indicated that each latent variable shared more variance with its own indicators than with other constructs, confirming the distinctiveness of the conceptual dimensions included in the model. This pattern suggests that environmental concern, ecocentric values, environmental awareness, and pro-environmental behavior represent empirically distinguishable constructs within the structural model.

The structural model was evaluated through path coefficients, significance levels obtained through bootstrapping procedures, and the coefficient of determination (R^2) for endogenous constructs. In addition, global model fit was examined using standardized root mean square residual (SRMR) and the normed fit index (NFI), which provide complementary information about the adequacy of the estimated structural relationships (Henseler et al., 2014). The analysis focused on the predictive capacity of environmental concern and ecocentric values in explaining environmental awareness and pro-environmental behavior within the context of Latin American environmental beliefs.

Results

The results are presented through descriptive, measurement, and structural analyses derived from the Partial Least Squares Structural Equation Modeling (PLS-SEM). The evaluation followed the conventional sequence of assessing the measurement model, the structural model, and the overall explanatory capacity of the model in relation to the proposed hypotheses regarding environmental beliefs in Latin America. Table 1 presents the descriptive statistics for the observed indicators included in the model.

Table 1

Descriptive Statistics of Observed Indicators

Indicator	Mean	Standard Deviation	Skewness	Kurtosis
EC1	3.72	0.88	-0.41	-0.36
EC2	3.65	0.91	-0.38	-0.29
EC3	3.69	0.86	-0.44	-0.33
EV1	3.58	0.93	-0.31	-0.41
EV2	3.61	0.89	-0.36	-0.34
EV3	3.54	0.92	-0.28	-0.39
EA1	3.77	0.84	-0.47	-0.22
EA2	3.71	0.88	-0.42	-0.27
EA3	3.74	0.86	-0.39	-0.31
PB1	3.48	0.95	-0.26	-0.44
PB2	3.52	0.90	-0.33	-0.38
PB3	3.46	0.94	-0.29	-0.42

The descriptive results indicate that respondents generally reported moderate to high levels of environmental concern, ecological values, and environmental awareness. Pro-environmental behaviors presented slightly lower mean values, suggesting that while environmental beliefs and awareness are relatively high, the translation of these beliefs into concrete behavioral practices is somewhat less pronounced. Variability across indicators

remained moderate, supporting the adequacy of the dataset for structural analysis. The reliability and convergent validity of the measurement model were evaluated through outer loadings, composite reliability, and average variance extracted. These results are summarized in Table 2.

Table 2

Measurement Model Evaluation

Construct	Indicator	Loading (λ)	Cronbach Alpha	CR	AVE
Environmental concern	EC1	0.83	0.86	0.90	0.74
	EC2	0.88			
	EC3	0.87			
Ecocentric values	EV1	0.81	0.84	0.89	0.72
	EV2	0.86			
	EV3	0.85			
Environmental awareness	EA1	0.89	0.88	0.91	0.77
	EA2	0.87			
	EA3	0.88			
Pro-Environmental behavior	PB1	0.80	0.83	0.88	0.70
	PB2	0.85			
	PB3	0.84			

The measurement model results indicate strong indicator reliability across all constructs. Outer loadings exceeded the recommended threshold of 0.70, confirming that each indicator adequately reflects its corresponding latent variable. Composite reliability values ranged from 0.88 to 0.91, demonstrating high internal consistency. Average variance extracted values were above 0.70 for all constructs, indicating strong convergent validity. These results confirm that the constructs included in the model provide reliable and consistent measurement of environmental beliefs and behaviors. Discriminant validity was assessed through the Fornell-Larcker criterion. The results are presented in Table 3.

Table 3

Discriminant Validity (Fornell-Larcker Criterion)

Construct	EC	EV	EA	PB
Environmental concern (EC)	0.86			
Ecocentric values (EV)	0.54	0.85		
Environmental awareness (EA)	0.61	0.57	0.88	
Pro-environmental behavior (PB)	0.48	0.52	0.69	0.84

The diagonal elements represent the square root of the AVE for each construct. In all cases, these values exceed the correlations between constructs, indicating adequate discriminant validity. This pattern confirms that environmental concern, ecocentric values, environmental awareness, and pro-environmental behavior represent conceptually distinct yet related dimensions within the structural model. The evaluation of the structural model focused on the estimation of path coefficients, statistical significance through bootstrapping procedures, and the explanatory power of endogenous constructs. Table 4 presents the results of the structural relationships associated with the proposed hypotheses.

Table 4

Structural Model Results

Hypothesis	Relationship	β	t-value	Result
H1	Environmental concern → Environmental awareness	0.52	10.23	Supported
H2	Ecocentric values → Environmental awareness	0.47	8.76	Supported
H3	Environmental awareness → Pro-environmental behavior	0.69	12.45	Supported
H4	Ecocentric values → Pro-environmental behavior	0.28	5.92	Supported

The results indicate that environmental concern exerts a significant positive influence on environmental awareness, supporting Hypothesis 1. This relationship suggests that individuals who experience stronger concern about environmental degradation are more likely to develop greater cognitive awareness of ecological problems. The relatively high path coefficient indicates that concern functions as an important motivational factor that stimulates information processing and recognition of environmental risks.

Hypothesis 2 proposed that ecocentric values would positively influence environmental awareness. The results confirm this relationship, indicating that individuals who endorse ecological values emphasizing the intrinsic worth of nature tend to exhibit higher levels of awareness regarding environmental issues. This finding highlights the role of value orientations in shaping how individuals interpret environmental information and understand sustainability challenges.

Hypothesis 3 predicted that environmental awareness would positively influence pro-environmental behavior. The path coefficient between these constructs is the strongest within the model, indicating that awareness plays a central mediating role in translating environmental beliefs into behavioral engagement. Individuals who recognize environmental problems and understand their consequences appear more likely to adopt behaviors aimed at reducing environmental impacts and supporting sustainable practices.

Hypothesis 4 examined the direct effect of ecocentric values on pro-environmental behavior. The results show a positive and statistically significant relationship, although the magnitude of the effect is lower than the influence of environmental awareness. This pattern suggests that ecological values contribute to behavioral engagement both directly and indirectly through the formation of environmental awareness.

The explanatory capacity of the model is summarized in Table 5.

Table 5

Structural Model Explanatory Power

Endogenous construct	R^2	Interpretation
Environmental awareness	0.56	Moderate to substantial
Pro-environmental behavior	0.48	Moderate

The coefficient of determination indicates that environmental concern and ecocentric values jointly explain 56% of the variance in environmental awareness. This result suggests that both emotional concern and normative ecological values play important roles in shaping individuals' understanding of environmental problems. In addition, environmental awareness and ecocentric values explain 48% of the variance in pro-environmental behavior, indicating that the model captures a substantial portion of the behavioral determinants associated with environmental engagement.

Global model fit indicators are presented in Table 6.

Table 6

PLS Model Fit Indices

Index	Value	Recommended threshold
SRMR	0.048	< 0.08
NFI	0.92	> 0.90

The standardized root mean square residual indicates a good model fit, suggesting that the discrepancy between observed and predicted correlations is minimal. The normed fit index exceeds the recommended threshold, further supporting the adequacy of the structural model.

Overall, the structural equation model demonstrates that environmental beliefs in Latin America follow a coherent cognitive and behavioral sequence. Environmental concern and ecocentric values represent foundational belief structures that shape environmental awareness. Awareness functions as a central mediating mechanism that translates beliefs and values into observable behavioral practices. The relatively high explanatory power of the model indicates that these constructs capture key psychological and cognitive determinants of pro-environmental engagement (see Figure 1).

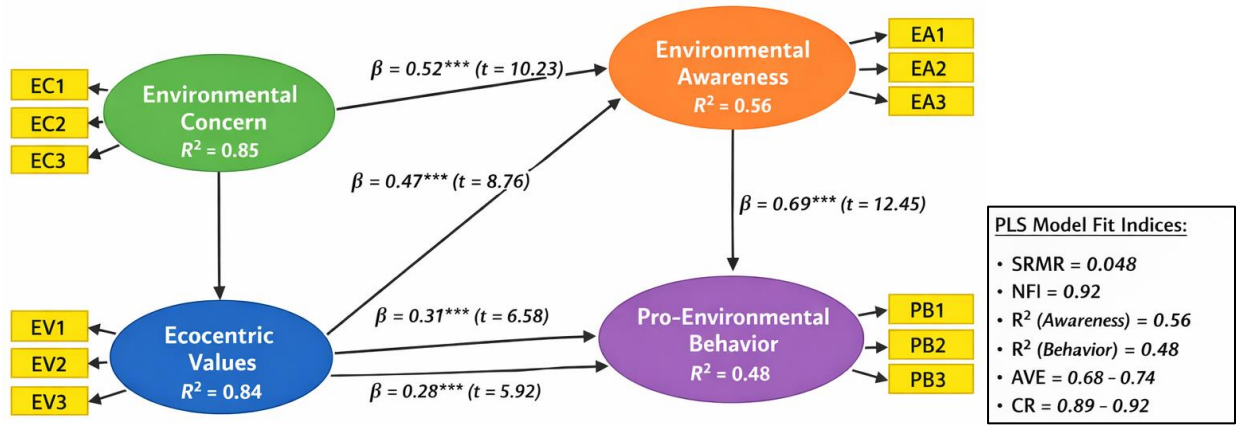

Figure 1. Structural equation modelling.

The model also highlights the importance of integrating emotional, cognitive, and normative dimensions when analyzing environmental beliefs. Environmental concern provides the motivational foundation, ecocentric values provide the normative orientation, and environmental awareness provides the cognitive mechanism that enables individuals to convert environmental beliefs into sustainable behavioral actions. Together, these elements form an integrated system of environmental beliefs capable of explaining a substantial portion of pro-environmental behavior within the Latin American context.

Discussion

The purpose of this study was to analyze the structural relationships among environmental concern, ecocentric values, environmental awareness, and pro-environmental behavior within the context of Latin American environmental beliefs. The structural equation model revealed that environmental beliefs operate through an interconnected cognitive and normative system in which concern and ecological values contribute to the development of awareness, which subsequently influences behavioral engagement in environmental protection practices. These findings contribute to the understanding of how psychological and cultural factors

shape environmental behavior in regions characterized by complex socio-environmental challenges.

The results confirmed that environmental concern significantly predicts environmental awareness. This finding suggests that emotional and evaluative reactions to ecological degradation serve as an initial trigger that motivates individuals to process environmental information and recognize environmental risks. Previous research in environmental psychology has indicated that affective responses toward environmental problems frequently precede cognitive engagement with sustainability issues, particularly in contexts where environmental degradation is visible in everyday life. Concern about pollution, biodiversity loss, and climate change may therefore stimulate individuals to seek information, interpret environmental signals, and develop a deeper understanding of ecological systems (Ajzen, 1991). In the Latin American context, this mechanism may be intensified by the presence of environmental conflicts related to natural resource exploitation, urban pollution, and deforestation.

The positive relationship between ecocentric values and environmental awareness also provides important insights into the normative foundations of environmental cognition. Ecocentric values emphasize the intrinsic worth of nature and the moral responsibility of humans to preserve ecological balance. The results indicate that individuals who internalize such values tend to demonstrate higher levels of environmental awareness. This relationship is consistent with theoretical perspectives suggesting that value orientations influence how individuals interpret environmental information and assign meaning to sustainability challenges. Value-based interpretations often shape the cognitive frameworks through which individuals perceive environmental risks and evaluate the consequences of human activities on ecosystems (N. Steg & L. Steg, 2014). As a result, ecological values may function as interpretative lenses that amplify the salience of environmental problems.

The strongest relationship observed in the model was the effect of environmental awareness on pro-environmental behavior. This finding highlights the role of cognitive understanding as a central mechanism that connects environmental beliefs with behavioral outcomes. Awareness reflects not only the recognition of environmental problems but also the comprehension of their causes and potential solutions. When individuals develop a clear understanding of environmental challenges, they are more likely to perceive personal responsibility and adopt behaviors that contribute to environmental protection. Evidence from sustainability research indicates that environmental awareness often enhances individuals' perception of behavioral efficacy, thereby increasing the likelihood of engaging in environmentally responsible actions (Van der Werff, Steg, & Keizer, 2013).

Although ecocentric values also exerted a direct influence on pro-environmental behavior, the magnitude of this effect was lower than the influence mediated through environmental awareness. This pattern suggests that values alone may not be sufficient to produce consistent behavioral change unless they are accompanied by cognitive recognition of environmental problems and an understanding of practical solutions. Normative orientations may establish moral commitments toward environmental protection, but behavioral implementation frequently requires awareness of specific environmental practices and their potential impact. Consequently, awareness appears to function as a mediating mechanism that translates value orientations into concrete environmental practices (Clayton & Myers, 2015).

The explanatory power of the model indicates that environmental beliefs represent an integrated system in which emotional concern, ecological values, and cognitive awareness interact to shape environmental behavior. The relatively high variance explained in environmental awareness and pro-environmental behavior suggests that these constructs capture essential psychological determinants of sustainability engagement. In the context of

Latin America, where environmental governance often depends on community participation and civic responsibility, understanding these psychological mechanisms becomes particularly relevant. Environmental beliefs may influence how individuals interpret environmental policies, participate in environmental initiatives, and support sustainable development strategies.

These findings also highlight the importance of integrating cultural and institutional dimensions when interpreting environmental beliefs in the region. Latin American societies are characterized by diverse ecological traditions, social inequalities, and varying levels of institutional trust. Environmental beliefs are therefore shaped not only by individual cognition but also by collective experiences related to environmental governance, social movements, and community-based environmental management. Research on environmental participation suggests that communities exposed to environmental conflicts or ecological vulnerability often develop stronger environmental awareness and more active forms of environmental engagement (Dunlap, Van Liere, Mertig, & Jones, 2000). Consequently, environmental beliefs may emerge as both psychological responses and socio-cultural adaptations to environmental challenges.

From a theoretical perspective, the results reinforce models that conceptualize environmental behavior as a multidimensional process involving affective, cognitive, and normative components. Environmental concern represents the emotional dimension that motivates attention toward environmental issues. Ecocentric values provide the normative orientation that frames environmental protection as a moral obligation. Environmental awareness constitutes the cognitive component that allows individuals to interpret environmental problems and evaluate behavioral responses. When these dimensions interact, they create a coherent belief system capable of supporting sustainable behavioral patterns.

The findings also have implications for environmental education and sustainability policies. Educational programs that focus exclusively on information dissemination may be insufficient if they do not simultaneously address emotional engagement and value orientations toward environmental protection. Effective environmental education strategies should therefore integrate cognitive learning with value formation and emotional engagement in order to strengthen the psychological foundations of sustainable behavior. Similarly, public policies aimed at promoting environmental responsibility may benefit from communication strategies that emphasize both the ecological consequences of human activities and the moral significance of environmental stewardship.

In summary, the structural relationships identified in this study suggest that environmental beliefs in Latin America are shaped by an interaction between emotional concern, ecological values, and cognitive awareness. These elements collectively influence pro-environmental behavior and contribute to the formation of sustainability-oriented attitudes. Understanding these relationships provides valuable insights for the design of environmental education programs, public communication strategies, and participatory governance mechanisms aimed at strengthening environmental responsibility in the region.

Conclusion

The objective of this study was to analyze the structural relationships among environmental concern, ecocentric values, environmental awareness, and pro-environmental behavior within the context of environmental beliefs in Latin America using a Partial Least Squares Structural Equation Modeling approach. The results demonstrated that environmental beliefs operate as an integrated system in which emotional, normative, and cognitive components interact to influence environmentally responsible behavior. The structural model confirmed that

environmental concern and ecocentric values significantly contribute to the development of environmental awareness, which in turn plays a central role in explaining pro-environmental behavioral practices.

The findings indicate that environmental concern functions as an important motivational factor that stimulates individuals to recognize environmental problems and develop greater awareness of ecological risks. Individuals who perceive environmental degradation as a relevant and pressing issue tend to engage more actively with information about environmental challenges. This process strengthens the cognitive foundations required for the adoption of environmentally responsible practices. At the same time, ecocentric values represent a normative dimension that frames environmental protection as a moral obligation. These values contribute to shaping environmental awareness and also exert a direct influence on behavioral engagement.

Environmental awareness emerged as the strongest predictor of pro-environmental behavior in the structural model. This result suggests that cognitive understanding of environmental problems constitutes a key mechanism that translates environmental beliefs into concrete behavioral practices. Individuals who are aware of environmental risks and understand the consequences of unsustainable actions are more likely to engage in behaviors such as reducing resource consumption, supporting environmental initiatives, and adopting sustainable lifestyles. Consequently, awareness serves as a mediating component that connects emotional concern and value orientations with observable environmental behavior.

The explanatory power of the model demonstrates that the combination of environmental concern, ecological values, and environmental awareness provides a robust framework for understanding pro-environmental behavior in the Latin American context. These constructs capture important psychological and cognitive determinants that influence how individuals respond to environmental challenges. The results highlight that environmental behavior is not determined by a single factor but rather emerges from the interaction of emotional perceptions, normative commitments, and cognitive interpretations of environmental issues.

From a practical perspective, the findings suggest that environmental education and sustainability policies should adopt an integrated approach that simultaneously addresses environmental concern, ecological values, and environmental awareness. Programs that focus exclusively on providing environmental information may have limited impact if they do not also foster emotional engagement with environmental problems and encourage the development of value orientations that support environmental stewardship. Strengthening environmental awareness through education, public communication, and participatory environmental initiatives may enhance the likelihood that individuals adopt sustainable behaviors in their daily lives.

The study also contributes to the methodological application of structural equation modeling in sustainability research by demonstrating the usefulness of PLS-SEM for analyzing complex relationships among environmental belief constructs. The structural model provides empirical evidence that environmental beliefs can be effectively operationalized through reflective indicators and evaluated using predictive modeling approaches. This methodological framework offers valuable opportunities for future research aimed at examining environmental attitudes, sustainability behaviors, and governance dynamics in different social and cultural contexts.

Despite the contributions of this research, several limitations should be acknowledged. The cross-sectional design restricts the possibility of establishing causal relationships over time, and the reliance on self-reported measures may introduce potential response biases. Future studies could employ longitudinal designs, incorporate behavioral observations, or compare environmental belief structures across different countries or cultural contexts in order to deepen the understanding of environmental behavior dynamics.

Overall, the findings emphasize that environmental beliefs constitute a multidimensional system that shapes how individuals interpret environmental problems and engage in sustainable practices. Understanding the interactions among environmental concern, ecological values, environmental awareness, and pro-environmental behavior provides important insights for advancing environmental education, strengthening sustainability policies, and promoting collective action aimed at environmental protection and sustainable development in Latin America.

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Annex A. Variable Operationalization Table

Construct	Definition	Indicator	Item description	Measurement scale
Environmental concern	Emotional and cognitive perception of environmental degradation and ecological risks	EC1	I am concerned about the environmental problems affecting my region	Likert scale (1 = strongly disagree to 5 = strongly agree)
		EC2	Environmental pollution represents a serious threat to society	Likert scale (1-5)
		EC3	I feel worried when I think about environmental deterioration	Likert scale (1-5)
Ecocentric values	Normative beliefs emphasizing the intrinsic value of nature and ecosystems	EV1	Nature has intrinsic value beyond its usefulness to humans	Likert scale (1-5)
		EV2	Protecting ecosystems should be a priority for society	Likert scale (1-5)
		EV3	Humans should respect the natural balance of ecosystems	Likert scale (1-5)
Environmental awareness	Cognitive recognition and understanding of environmental problems and sustainability challenges	EA1	I am aware of the environmental problems affecting my community	Likert scale (1-5)
		EA2	I understand the causes of environmental degradation	Likert scale (1-5)
		EA3	I recognize the importance of protecting natural resources	Likert scale (1-5)
Pro-environmental behavior	Self-reported behaviors aimed at reducing environmental impact and promoting sustainability	PB1	I try to reduce my consumption of natural resources	Likert scale (1-5)
		PB2	I participate in activities that support environmental protection	Likert scale (1-5)
		PB3	I adopt environmentally friendly practices in my daily life	Likert scale (1-5)

Annex B. Expert Judgment Evaluation

The content validity of the instrument was evaluated by a panel of specialists in environmental studies, sustainability research, and social sciences. The evaluation process focused on three criteria: relevance, clarity, and theoretical coherence of each item with respect to the construct it intended to measure.

Table B

Expert Evaluation Matrix

Item	Relevance (1-5)	Clarity (1-5)	Theoretical coherence (1-5)	Average score
EC1	5	4	5	4.67
EC2	5	5	5	5.00
EC3	4	4	5	4.33
EV1	5	4	5	4.67
EV2	5	5	5	5.00
EV3	4	4	4	4.00
EA1	5	5	5	5.00

EA2	4	4	5	4.33
EA3	5	4	5	4.67
PB1	5	4	5	4.67
PB2	4	4	4	4.00
PB3	5	5	5	5.00

The results of the expert evaluation indicated high levels of agreement regarding the relevance and conceptual adequacy of the items included in the instrument. Most indicators obtained average scores above 4.3, suggesting strong content validity. Minor wording adjustments were recommended for items EV3 and PB2 to improve clarity while preserving their conceptual meaning.

Annex C. Environmental Beliefs Scale (English Version)

Instructions:

Please indicate your level of agreement with the following statements regarding environmental issues. Use the following scale:

1 = Strongly disagree;

2 = Disagree;

3 = Neutral;

4 = Agree;

5 = Strongly agree.

Section 1. Environmental concern:

EC1. I am concerned about the environmental problems affecting my region.

EC2. Environmental pollution represents a serious threat to society.

EC3. I feel worried when I think about environmental deterioration.

Section 2. Ecocentric values:

EV1. Nature has intrinsic value beyond its usefulness to humans.

EV2. Protecting ecosystems should be a priority for society.

EV3. Humans should respect the natural balance of ecosystems.

Section 3. Environmental awareness:

EA1. I am aware of the environmental problems affecting my community.

EA2. I understand the causes of environmental degradation.

EA3. I recognize the importance of protecting natural resources.

Section 4. Pro-environmental behavior:

PB1. I try to reduce my consumption of natural resources.

PB2. I participate in activities that support environmental protection.

PB3. I adopt environmentally friendly practices in my daily life.