EVALUATION OF ENVIRONMENTAL EDUCATION POLICY IN VIETNAM FROM 2005 TO PRESENT

Le Thi Luan[1], Vu Thi Huong Giang[2], Nong Thi Thu Trang[3], Do Thi Nhu Quynh[4]

[1]*Center for Child and Development, Vietnam Institute of Educational Sciences*

[2]*Faculty of Primary and Early Childhood Education, Hai Phong University*

[3]*Center for Child and Human Development Research, Vietnam National Institute of Education Sciences*

[4] *University of Education, Vietnam National University, Hanoi, Vietnam*

ABSTRACT

In the context of Vietnam's implementation of the National Strategy for Sustainable Development and its fulfillment of international commitments to Education for Sustainable Development (ESD), this study assesses the impact of five environmental education policy factors—level of detail and clarity, resource commitment, stakeholder participation, communication and dissemination, and monitoring and evaluation—on both implementation effectiveness and societal awareness. The sample comprises XXX education administrators, teachers, and other stakeholders, stratified across three geographical regions; data were collected through a structured questionnaire and analyzed using MANOVA and multivariate regression. Findings indicate that all policy factors exert a positive and statistically significant influence on at least one dependent variable. Resource commitment and monitoring–evaluation exert the strongest influence on implementation effectiveness; communication–dissemination and stakeholder participation play a pivotal role in enhancing societal awareness. Professional roles and work experience generate pronounced differences, while institutional type exerts minimal impact, though regional disparities persist. The study affirms that the current policy structure is relatively well-developed, yet highlights the necessity of stratifying objectives, tailoring interventions to target groups and regions, and reinforcing monitoring–feedback mechanisms to enhance both effectiveness and sustainability.

1. Introduction

In the context of globalization and the increasingly severe impacts of climate change, environmental education has emerged as one of the critical pillars in promoting global sustainable development. The United Nations Educational, Scientific and Cultural Organization (UNESCO) emphasizes that environmental education not only imparts knowledge but also cultivates the skills, values, and attitudes necessary for individuals to proactively protect and improve their living environment (UNESCO, 2019). Accordingly, environmental education contributes to establishing a solid foundation for addressing pressing challenges such as climate change, biodiversity loss, and environmental pollution. Across the globe, nations have promptly integrated environmental education into their national education systems, recognizing it as an essential mandate within both educational development and environmental protection policies.

Vietnam, with its distinctive geographical position and developing economy, faces multiple severe environmental challenges, including air, water, and soil pollution, alongside a significant decline in biodiversity. According to the World Bank (2018), air pollution in Vietnam has become one of the primary causes of illness and premature death. Against this backdrop, environmental education is not merely about the transmission of knowledge but also serves as a process of shaping awareness and fostering environmentally responsible behaviors within the community, particularly among younger generations. Research by Pham (2023) demonstrates that environmental education plays a pivotal role in enhancing public consciousness and motivating environmental protection actions.

In Vietnam, aligned with global trends, environmental education has increasingly been prioritized within national development strategies and policies. Since 2005, when the Law on Environmental Protection officially came into effect, environmental education has been more explicitly regulated, assigning responsibilities to all levels of education for integrating environmental protection content into official curricula (National Assembly of the Socialist Republic of Vietnam, 2005). Subsequent key policy instruments, such as Decree No. 19/2007/NĐ-CP, environmental education programs issued by the Ministry of Education and Training, the National Strategy on Green Growth, and the National Action Programs on Environmental Education (2012–2013), have contributed to establishing a progressively comprehensive policy framework (Ministry of Education and Training, 2010; Government of Vietnam, 2013). These efforts aim not only to raise awareness but also to transform community and youth behaviors towards environmental protection, thereby contributing to the fulfillment of Vietnam's international commitments to sustainable development.

In 2011, the Ministry of Education and Training (MOET) approved the Action Plan for Climate Change Adaptation in the Education Sector for the period 2011–2015, with the objective of enhancing the awareness and capacity of administrators, teachers, and students regarding climate change and related environmental issues. Furthermore, Party resolutions—such as Resolution No. 41-NQ/TW of 2004 on environmental protection in the period of industrialization and modernization—have also underscored the role of education in raising public environmental awareness.
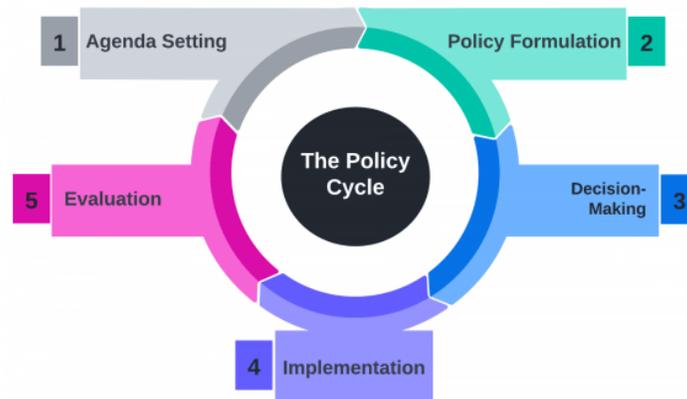
Despite significant efforts in developing and implementing environmental education policies, evidence shows persistent gaps in evaluating their effectiveness and impact. Pham Tien's (2023) research points out that while environmental education policies have been promulgated, their implementation and assessment remain limited. Current studies primarily focus on describing policies, with insufficient in-depth analysis of their actual impacts on communities and the environment.

Therefore, there is an urgent need for more comprehensive and scientifically rigorous evaluations of the effectiveness of environmental education policies in Vietnam.

2. Theoretical basis
2.1. Policy Cycle Theory

According to the Policy Cycle Theory, the formulation and implementation of policy constitute a sequence of tightly interconnected stages, including problem identification, formulation, implementation, monitoring, and evaluation (Howlett & Ramesh, 2003). In the context of environmental education, the initiation stage often stems from an urgent awareness of environmental challenges and the necessity to integrate sustainable development education into the national education system.

Figure 1. The public policy cycle

The transition from the policy formulation phase to implementation requires coordination across multiple levels of governance to ensure that strategic objectives are translated into programs and activities tailored to the specific context. At the same time, monitoring and evaluation mechanisms play a central role in adjusting, sustaining, and enhancing policy effectiveness, reflecting the dynamic and adaptive nature of the policy cycle.

This approach allows environmental education policy to be analyzed as a complex process in which institutional factors, contextual conditions, and practical implementation continuously interact to shape and sustain social impact.

2.2. Transformative Learning Theory

According to Transformative Learning Theory, education possesses the capacity to foster profound changes in an individual's cognitive frameworks and frames of reference, thereby leading to sustainable adjustments in attitudes and behaviors (Mezirow, 1997). This process is often triggered by experiences or information that challenge existing perceptions, compelling learners to re-examine their underlying assumptions and to reconstruct their understanding of the world.
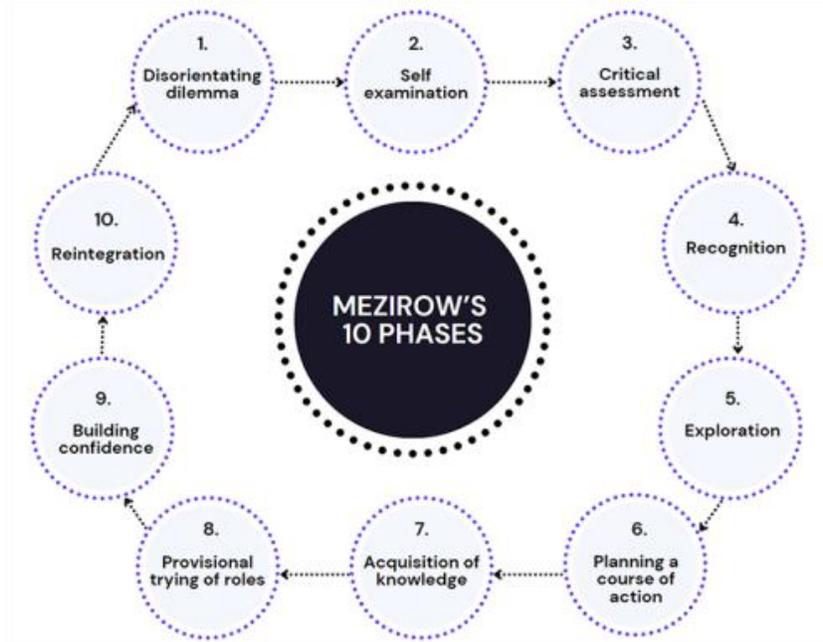
Figure 2. Cognitive transformation cycle

In the field of environmental education, this theory provides a foundation for explaining how educational activities and policies can cultivate critical thinking skills, awaken self-awareness, and promote long-term commitment to sustainable development goals. Such transformation does not occur instantaneously but emerges as the cumulative outcome of experiences, dialogue, and reflection, through which new courses of action aligned with environmental values are formed.

2.3. Policy Evaluation Theory

According to Policy Evaluation Theory, the examination and analysis of a policy extends beyond merely measuring its outputs; it also encompasses the assessment of the appropriateness of its objectives, the feasibility of its implementation, and the sustainability of its impacts within a specific socio-economic context (Patton, 2008). This process requires the integration of both quantitative and qualitative data, employing scientific criteria to ensure objectivity while faithfully reflecting the relationship between policy design and the outcomes achieved.
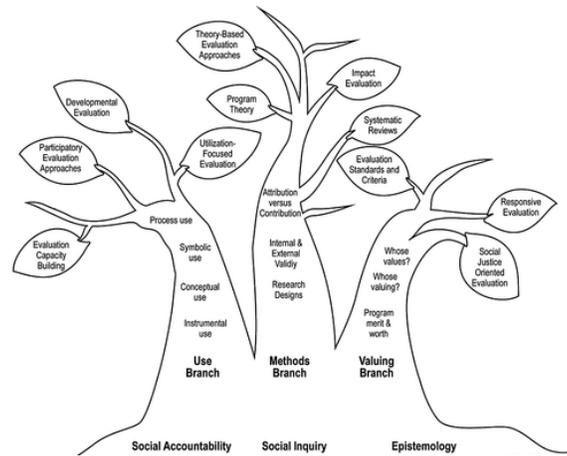
Figure 3. Evaluation tree in policy analysis

In the field of environmental education, this theoretical framework provides a foundation for comprehensively analysing the extent to which a policy has met strategic goals related to raising awareness, changing behaviours, and promoting community engagement. Furthermore, the evaluation process helps identify gaps between policy intentions and implementation realities, thereby establishing a scientific basis for policy adjustment and restructuring. This not only ensures the continuity of environmental education programmes but also enhances their capacity to adapt to fluctuations in natural, economic, and social conditions.

2.4. Vietnam Enviromental Education Policy Framework

Since the concept of "environmental education" was recognised as an essential component in the trajectory towards sustainable development, countries — including Vietnam — have gradually developed and refined multi-tiered policy systems to integrate this content into the formal education system. In the initial stage (2005–2007), the 2005 Law on Environmental Protection laid the legal foundation, reflecting an awareness of the importance of environmental education. Subsequently, Government Decree No. 19/2007/NĐ-CP served as a key legal instrument, expanding the operational framework and enabling intersectoral coordination in environmental protection communication and education (Government of Vietnam, 2007).

In the developmental stage (2012–2020), policy thinking shifted towards a more strategic orientation: Decision No. 432/QĐ-TTg of 2012 approved the "Sustainable Development Strategy for the 2011–2020 Period," in which environmental education was identified as a cornerstone of a comprehensive education strategy (Prime Minister of Vietnam, 2012). Notably, the 2020 Law on Environmental Protection (Articles 5 and 6) reaffirmed the central role of education and communication in promoting environmental protection across society (National Assembly of the Socialist Republic of Vietnam, 2020).

The current policy structure is organised in a multi-tier model: the legal tier (Laws, Decrees) defines the mandatory framework; the strategic tier (Decisions, Strategies) sets objectives, targets, and intersectoral mechanisms; and the implementation tier (guidelines, materials, activities) operationalises these through educational programmes, teacher training, and extracurricular activities at the local level. Regular monitoring and evaluation constitute an essential component to ensure that policies remain aligned with the rapidly changing socio-environmental realities.

The progression from an initial legal concept to today's multi-tiered policy system reflects Vietnam's process of adaptation and refinement. These legal documents not only demonstrate the nation's commitment to advancing environmental education but also establish a solid foundation for evaluating policy effectiveness within the context of international integration and global transformation.

3. Research methodology

3.1. Conceptual framework of research

The conceptual framework of this study is constructed through the integration of multiple theoretical perspectives, including the Policy Cycle Theory, Transformative Learning Theory, and Policy Evaluation Theory. The interplay among these theories enables a comprehensive understanding of the formulation, implementation, and feedback processes of environmental education policy, while simultaneously illuminating how policy influences societal awareness, attitudes, and behaviours.

Figure 4. Research model

From the perspective of the Policy Cycle Theory, environmental education policy is shaped through several stages — from the inception of ideas, content formulation, and resource mobilisation, to implementation and outcome evaluation. In each stage, the policy structure is reflected in the clarity of its directions and objectives; the adequacy of material and human resources; the extent of stakeholder participation; and the effectiveness of communication in disseminating key messages. Although these elements operate differently across contexts, they collectively determine the quality and effectiveness of policy implementation.

In parallel, from the standpoint of Transformative Learning Theory, environmental

education policy is not merely about transmitting information but also plays a role in fostering profound shifts in awareness and attitudes, aiming to shape sustainable values and behaviours. This is closely linked to the policy's capacity to influence the educational community, learners, and other societal groups through the integration of relevant content, methods, and activities.

Policy Evaluation Theory offers a foundation for examining the extent to which intended objectives are achieved — from enhancing public awareness to ensuring effective practical implementation. In this context, policy outcomes may be observed through improvements in environmental understanding,

behavioural change, and the degree to which environmental education activities are present in schools and communities.

In the analysis, factors such as geographical characteristics, target groups, and stages of implementation are treated as control variables, serving to adjust for contextual influences and ensure comparability and reliability of research results. The conceptual framework thus reflects a coherent structure, while maintaining the flexibility needed to adapt to the specificities of Vietnam's environmental education context.

3.2. Research sample

This study employs a quantitative approach with a cross-sectional survey design to analyze the influence of policy components and implementation processes on the effectiveness of environmental education policy in Vietnam. Data were collected through a structured questionnaire using a five-point Likert scale to measure respondents' levels of agreement with pre-designed statements. This design enables the identification of relationships between policy structure, implementation mechanisms, and outcomes in the field of environmental education.

The research targets three main groups: (1) Primary and lower secondary school teachers (400 participants), (2) Educational administrators at various levels, including district and provincial education departments and school principals (400 participants), and (3) Students majoring in Education and Environmental Studies at selected key universities (400 participants). These groups have either direct or indirect involvement in the implementation of environmental education policy and collectively represent perspectives from multiple positions within the education system.

To ensure representativeness and diversity of the dataset, the study adopts a stratified sampling method based on four main criteria:

(1) Geographical region: North – Central – South, to reflect regional characteristics and differences in natural, economic, and social conditions.

(2) Respondent category: Teachers – Educational administrators – Students, to ensure a multi-dimensional perspective from practitioners, policymakers, and the next generation of educators.

(3) Type of educational institution: Public – Non-public, to examine differences in policy implementation across institutional types.

(4) Professional experience: Less than 5 years – More than 15 years, to analyze differences in perception and evaluation based on professional tenure.

A total of 1,200 questionnaires were distributed and successfully collected in full accordance with the predetermined stratification structure. All participants were guaranteed confidentiality of personal information and voluntary participation in the survey.

3.3. Scale structure and reliability

The data were collected using a structured questionnaire comprising five groups of independent variables and two dependent variables (Table 1), along with control factors. All primary measurement items in the questionnaire were assessed using a five-point Likert scale (1 = strongly disagree, 5 = strongly agree), except for questions on demographic information and background factors. Prior to official implementation, the questionnaire was reviewed by experts and pilot-tested to ensure clarity and validity.

Table 1. Description of data collection tools

Factor	Encryption	N^*
Independent variable		
1 Level of detail and clarity of policy	IV_DC	10
2 Level of resource commitment	IV_RC	10

3	Stakeholder engagement	IV_SE	10
4	Communication and policy dissemination	IV_CD	10
5	Monitoring and evaluation mechanisms	IV_ME	10
Dependent variable			
6	Effective policy implementation	DV_IE	8
7	Level of awareness and understanding of environmental education in society	DV_AU	8

N^* - *Number of Observed Variables*

The analysis results showed that all measurement scales achieved high reliability, with Cronbach's Alpha values ranging from 0.915 to 0.965, exceeding the acceptable threshold of 0.7. The item–total correlation coefficients for all items were above 0.6, confirming the internal consistency and stability of the scales, thus meeting the conditions for further analyses.

Table 2. Result of scale reliability assessment

Factor	Variable – Total Correlation	Cronbach's Alpha if item deleted	Cronbach's Alpha
Independent variable			
IV_DC	0.736 – 0.763	0.929 – 0.931	0.937
IV_RC	0.734 – 0.757	0.928 – 0.929	0.936
IV_SE	0.732 – 0.753	0.929 – 0.930	0.936
IV_CD	0.654 – 0.706	0.905 – 0.908	0.915
IV_ME	0.698 – 0.746	0.926 – 0.928	0.933
Dependent variable			
DV_IE	0.774 – 0.899	0.954 – 0.961	0.962
DV_AU	0.787 – 0.896	0.958 – 0.964	0.965

The data collection process adhered to research ethics principles. Participants were clearly informed of the research objectives, signed informed consent forms, and retained the right to withdraw at any time without any penalties or interventions. All responses were anonymized, with no personally identifiable information collected. The study complied with the ethical regulations stipulated in Circular No. 23/2014/TT-BGDĐT on research ethics in Vietnam.

4. Research result

4.1. Confirmatory factor analysis (CFA)

The results of the CFA analysis indicate that the research model achieved a very high level of fit with the collected data. The χ^2 value was 1195.537, with df = 1165 and p = 0.261 (> 0.05), suggesting no statistically significant difference between the observed covariance matrix and the covariance matrix predicted by the model. This finding reflects that the proposed theoretical model aligns well with the empirical data (Jöreskog & Sörbom, 1993).

Figure 5. Factor structure analysis model

The χ^2/df ratio was 1.026, within the ideal threshold ($<$ 2), demonstrating an optimal balance between model fit and complexity (Kline, 2016). Other fit indices also met or exceeded internationally recommended standards: GFI = 0.962, TLI = 0.999, CFI = 0.999 (Bentler, 1990; Hu & Bentler, 1999). The RMSEA value of 0.005 ($<$ 0.06), along with PCLOSE = 1.000, confirmed an almost zero approximation error, reflecting an exceptionally high degree of model fit (MacCallum, Browne, & Sugawara, 1996).

Table 3. Model fit analysis results (CFA)

Index	Value
CMIN	1195.537
DF	1165
P	0.261
CMIN/DF	1.026
GFI	0.962
TLI	0.999
CFI	0.999
RMSEA	0.005
PCLOSE	1.000
Modification Indices – Covariances	4.003 – 13.521

Regarding adjustment indices, the Modification Indices (MI) ranged from 4.003 to 13.521, below the threshold of 15 — a level considered acceptable and indicative of no substantial need for model adjustments (Byrne, 2010). Along with the consistently high fit indices, this supports the conclusion that the current model is stable and does not require the addition of theoretically ungrounded relationships, thereby avoiding the risk of overfitting (MacCallum et al., 1992).

Following the evaluation of model fit, validity analysis revealed that the model met both convergent validity and discriminant validity

requirements, further supported by the HTMT (Heterotrait–Monotrait Ratio) test.

First, regarding convergent validity, all latent variables demonstrated composite reliability (CR) ranging from 0.915 to 0.937, far exceeding the minimum threshold of 0.70 (Hair, Hult, Ringle, & Sarstedt, 2022), indicating very high internal consistency among measurement indicators. The Average Variance Extracted (AVE) ranged from 0.519 to 0.598, above the recommended threshold of 0.50 (Fornell & Larcker, 1981), indicating that the latent variables explained more than half of the variance in the observed variables. Additionally, MaxR(H) values were in the same range (0.915–0.937), reinforcing the reliability and stability of the measurement scales.

	CR	AVE	MSV	MaxR(H)	IV_DC	IV_SE	IV_RC	IV_ME	IV_CD
IV_DC	0,937	0,598	0,001	0,937	**0,773**				
IV_SE	0,936	0,596	0,002	0,937	-0,020	**0,772**			
IV_RC	0,936	0,593	0,003	0,936	0,000	-0,008	**0,770**		
IV_ME	0,933	0,582	0,003	0,933	0,038	-0,040	0,056†	**0,763**	
IV_CD	0,915	0,519	0,002	0,915	0,008	-0,031	-0,048	0,031	**0,720**

Figure 6. Validity analysis results

Second, in terms of discriminant validity, the Maximum Shared Variance (MSV) values ranged from only 0.001 to 0.003, substantially lower than the AVE values, indicating no conceptual overlap between constructs (Fornell & Larcker, 1981).

Examination of the covariance matrix showed that the correlation coefficients between latent variable pairs were small and did not exceed the square root of their respective AVEs, satisfying the discriminant validity criterion.

	IV_DC	IV_SE	IV_RC	IV_ME	IV_CD
IV_DC					
IV_SE	0,020				
IV_RC	0,000	0,008			
IV_ME	0,038	0,040	0,055		
IV_CD	0,008	0,030	0,049	0,031	

Figure 7. HTMT analysis results

Third, the HTMT test results ranged from 0.000 to 0.055, far below the 0.85 threshold (Henseler, Ringle, & Sarstedt, 2015), confirming no substantial overlap between research constructs. The absence of warnings in the HTMT analysis indicated that the model was free from serious common method variance issues.

Combining these findings with the previously reported CFA fit indices (CMIN/DF = 1.026, GFI = 0.962, TLI = 0.999, CFI = 0.999, RMSEA = 0.005, PCLOSE = 1.000), it can be concluded that the current measurement model not only demonstrates a high statistical fit but also ensures the reliability and validity of the latent constructs. There is no evidence suggesting the

need for model adjustments, particularly given that all Modification Indices are < 15, within the acceptable limit (Byrne, 2010). Therefore, the model is ready for direct application in subsequent structural equation modeling (SEM) analyses.

4.2. Linear structural equadeling model analysis (SEM)

The results of the Structural Equation Modeling (SEM) analysis reveal that the initial model—prior to any modifications—had already achieved an excellent level of model fit, satisfying the majority of benchmark criteria

recommended in contemporary quantitative research (Byrne, 2010; Kline, 2016). This indicates that the proposed theoretical structure is capable of accurately capturing the latent relationships between observed and unobserved variables within the collected dataset. Nevertheless, to further optimize the congruence between the model and the empirical data, the research team examined the Modification Indices (M.I)—a crucial diagnostic tool in SEM for detecting potential relationships not yet specified in the model but which, if incorporated, could enhance model fit (MacCallum et al., 1992).
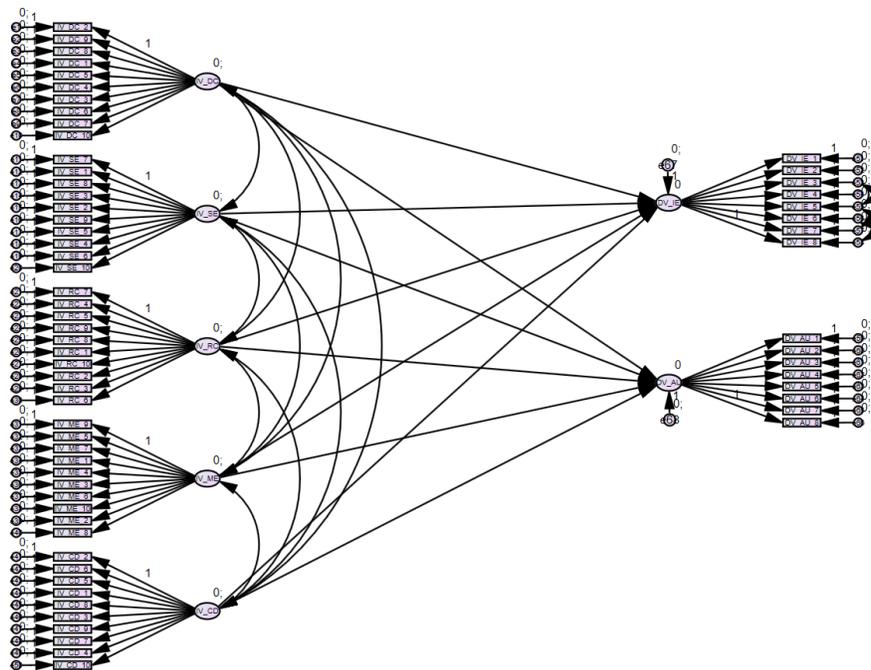
Figure 8. Linear structural model

The M.I analysis identified several prominent error covariance pairs with exceptionally high M.I values, including: e57 ⟺ e56 (M.I = 375.457), e58 ⟺ e53 (M.I = 193.453), e55 ⟺ e53 (M.I = 188.415), and e58 ⟺ e55 (M.I = 167.090). All of these pairs correspond to observed variables belonging to the same latent construct or measuring conceptually similar content, thereby providing a sound theoretical

rationale for the inclusion of their covariances (Byrne, 2010). More importantly, the adjustments were carried out selectively, ensuring that all remaining pairs met the threshold criterion of M.I < 15. This precaution prevented overfitting—a phenomenon that can undermine the generalizability of the model (MacCallum et al., 1992).

Table 4. Results of the error – correlation intervention with oversized covariance

Covariances	M.I	Par Change

e58 ⬌ e55	167.090	0.025
e55 ⬌ e53	188.415	0.030
e58 ⬌ e53	193.453	0.031
e57 ⬌ e56	375.457	0.046

After implementing the specified error covariances, all model fit indices reached optimal values. Specifically, CMIN/DF = 1.419 (< 2.0) reflected a strong balance between model complexity and fit; TLI = 0.985 and CFI = 0.985 both exceeded the 0.95 benchmark, indicating high explanatory power and stability; RMSEA = 0.019 (< 0.05) and PCLOSE = 1.000 demonstrated minimal approximation error and near-perfect alignment with the observed data. These results not only preserved but also reinforced the reliability, convergent validity, and discriminant validity established during prior CFA procedures, confirming that the adjusted SEM can be regarded as a finalized model, well-suited for subsequent hypothesis testing and advanced analysis.

Table 5. Model fit analysis results (SEM)

Chỉ báo	Giá trị
CMIN	2915.664
DF	2055
P	0.000
CMIN/DF	1.419
TLI	0.985
CFI	0.985
RMSEA	0.019
PCLOSE	1.000

The SEM analysis further revealed that all five independent variables—IV_DC (Policy Detail and Clarity), IV_RC (Resource Commitment), IV_SE (Stakeholder Engagement), IV_CD (Policy Communication and Dissemination), and IV_ME (Monitoring and Evaluation Mechanism)—exerted positive and highly significant effects ($p < 0.001$). This underscores that enhancing the quality of any policy dimension simultaneously improves implementation effectiveness and fosters societal awareness.

Table 6. Results of causal relationship analysis (unstandardized)

Factor	Estimate		Std. Estimate		C.R		p-value	
	DV_IE	DV_AU	DV_IE	DV_AU	DV_IE	DV_AU	DV_IE	DV_AU
IV_DC	0.200	0.245	0.019	0.021	10.788	11.938	0.000	0.000
IV_SE	0.191	0.233	0.017	0.019	11.317	12.468	0.000	0.000
IV_RC	0.184	0.214	0.016	0.017	11.658	12.313	0.000	0.000
IV_ME	0.201	0.196	0.017	0.019	11.592	10.403	0.000	0.000
IV_CD	0.170	0.218	0.015	0.017	11.214	12.813	0.000	0.000

The unstandardized regression results showed that all relationships between the independent variables (IV_DC, IV_SE, IV_RC, IV_ME, IV_CD) and the two dependent variables (DV_IE, DV_AU) were statistically significant at p < 0.001, with Critical Ratio (C.R) values exceeding 10, indicating stable and reliable effects. For DV_IE, the strongest predictor was IV_ME (Estimate = 0.201), followed by IV_DC (0.200), IV_SE (0.191), IV_RC (0.184), and IV_CD (0.170). Conversely, for DV_AU, IV_DC ranked highest (Estimate = 0.245), followed by IV_SE (0.233), IV_CD (0.218), IV_RC (0.214), and IV_ME (0.196). These coefficients represent the absolute change in the dependent variable for a one-unit change in the independent variable, illustrating that all five factors exert positive effects, though their magnitudes vary depending on the dependent variable in question.

Table 7. Results of causal relationship analysis (standardized)

Relationship	Estimate
DV_IE ← IV_DC	0.275
DV_IE ← IV_SE	0.291
DV_IE ← IV_RC	0.301
DV_IE ← IV_ME	0.301
DV_IE ← IV_CD	0.295
DV_AU ← IV_DC	0.295
DV_AU ← IV_SE	0.311
DV_AU ← IV_RC	0.307
DV_AU ← IV_ME	0.256
DV_AU ← IV_CD	0.329

In terms of standardized regression coefficients, which allow for direct comparison of influence magnitude by eliminating measurement units, the findings show that for DV_IE, the strongest effects were observed for IV_RC and IV_ME (Estimate = 0.301), followed by IV_CD (0.295), IV_SE (0.291), and IV_DC (0.275). This suggests that, when the primary objective is to enhance policy implementation effectiveness, priority should be given to resource commitment and monitoring–evaluation mechanisms. In contrast, for DV_AU, IV_CD achieved the highest standardized coefficient (0.329), highlighting the pivotal role of policy communication and dissemination in raising societal awareness; this was followed by IV_SE (0.311), IV_RC (0.307), IV_DC (0.295), and IV_ME (0.256).

These findings not only reinforce the statistical significance of the observed effects but also provide a clear strategic prioritization for different objectives of environmental education policy. They demonstrate that policy-related factors exert both direct effects on implementation performance and indirect influences on societal awareness. If the priority is to improve implementation effectiveness, emphasis should be placed on IV_SE and IV_ME; if the goal is to expand public awareness, IV_CD and IV_RC should be given precedence. This serves as critical empirical evidence to guide the optimization and sustainable development of environmental education policy.

4.3. Evaluating environmental education policies among target groups

In this study, MANOVA was employed to simultaneously examine the differences in the two dependent variables — DV_IE and DV_AU — across demographic groups, including Area, Type_Unit, Role, and Exp. The sample distribution was as follows: Area comprised three groups — North (n = 488), Central (n = 381), and South (n = 331); Type_Unit comprised Public (n = 847) and Non-Public (n = 353); Role comprised six groups — primary school teachers (n = 215), lower secondary school teachers (n = 185), education administrators at the Department/District level (n = 313), principals/vice principals (n = 87), pre-service teacher education students (n = 245), and environmental science students (n = 155); Exp comprised four categories — less than 5 years (n = 477), 5–10 years (n = 341), 11–15 years (n = 221), and more than 15 years (n = 161).

Table 8. Results of MANOVA test between groups

Interact	MANOVA (Pillai's Trace)	F (df1, df2)	p	ηp^2
Area	0.269	91.87 (4.2364)	0.000	0.135
Type_Unit	0.017	10.11 (2.1181)	0.000	0.017
Role	0.434	65.57 (10.2364)	0.000	0.217
Exp	0.392	95.97 (6.2364)	0.000	0.196
Area × Exp	0.022	6.55 (4.2364)	0.000	0.011
Other Interactions	___	___	> 0.05	___

Assumption testing indicated a violation of homogeneity of covariance matrices across groups, as shown by Box's M = 1429.615, F = 32.819, p < .001. In such cases, Pillai's Trace was preferred due to its robustness and greater resistance to assumption violations compared to other multivariate statistics (Warne, 2014; Ateş et al., 2019). Additionally, Levene's test for both DV_IE and DV_AU returned p < .001 across all variants, indicating heterogeneity of variances between groups; therefore, in interpreting ANOVA results, effect size (ηp^2) was emphasized alongside the p-value.

The MANOVA results revealed that all demographic factors had statistically significant multivariate effects. Specifically, Area: Pillai = .269, F(4, 2364) = 91.87, p < .001, ηp^2 = .135 (medium – large); Type_Unit: Pillai = .017, F(2, 1181) = 10.11, p < .001, ηp^2 = .017 (small); Role: Pillai = .434, F(10, 2364) = 65.57, p < .001, ηp^2 = .217 (largest among all factors); Exp: Pillai = .392, F(6, 2364) = 95.97, p < .001, ηp^2 = .196 (large). Among interaction terms, only Area × Exp reached statistical significance (Pillai = .022, F(4, 2364) = 6.55, p < .001, ηp^2 = .011 — small), while all others were either nonsignificant or could not be estimated.

Table 9. Results of ANOVA test between groups

Interact	ANOVA DV_IE			ANOVA DV_AU		
	F	p	ηp^2	F	p	ηp^2
Area	121.482	0.000	0.171	33.839	0.000	0.054
Type_Unit	14.481	0.000	0.012	5.414	0.020	0.005
Role	8.140	0.000	0.033	12.780	0.000	0.051
Exp	9.403	0.000	0.023	85.756	0.000	0.179
Area × Exp	___	0.000	0.012	___	0.061	0.005

Other Interactions	___	> 0.1	___	___	___	___

When univariate ANOVA was conducted for each dependent variable, for DV_IE, the largest differences were observed across Area (F = 121.48, p < .001, ηp^2 = .171 — large), followed by Role (ηp^2 = .033) and Exp (ηp^2 = .023), both in the small–medium range, while Type_Unit exerted a small effect (ηp^2 = .012). Conversely, for DV_AU, the most prominent factor was Exp (F = 85.76, p < .001, ηp^2 = .179 — large), followed by Area (ηp^2 = .054) and Role (ηp^2 = .051), both moderate in effect, with Type_Unit having a very small impact (ηp^2 = .005). Certain isolated interactions were statistically significant, such as Type_Unit × Role for DV_AU (F = 7.16, p = .001, ηp^2 = .012 — small) and Area × Exp for DV_IE (p = .001, ηp^2 = .012 — small), indicating slight dependency relationships between these factors.

Overall, the findings suggest that Role and Exp were the most decisive factors in creating differences in both DV_IE and DV_AU, with Exp exerting the strongest influence on DV_AU, and Area exerting the strongest influence on DV_IE. Type_Unit had minimal effect. Interactions among factors were generally weak, occurring only in a few pairs with small effect sizes. Given the heterogeneity of variances, appropriate post-hoc methods (e.g., Games–Howell) should be applied to ensure the accuracy of statistical inferences.

5. Finding and discussion

The research findings indicate that Vietnam's environmental education policy, from 2005 to the present, has achieved a relatively high level of completeness in both structure and feasibility. The five core factors—policy detail and clarity (IV_DC), resource commitment (IV_RC), stakeholder engagement (IV_SE), communication and dissemination (IV_CD), and monitoring and evaluation mechanisms (IV_ME)—all exert positive and statistically significant effects on both implementation effectiveness (DV_IE) and public awareness (DV_AU).

Notably, the strategic priority among these factors is not homogeneous across different policy objectives. When the goal is to enhance implementation effectiveness, resource commitment and monitoring–evaluation emerge as the primary pillars; whereas, for expanding public awareness, communication–dissemination and stakeholder engagement play decisive roles. This implies a need for a stratified policy management approach: a "one-size-fits-all" formula is unsuitable, and intervention priorities should be adjusted according to the intended objectives.

This finding aligns with Mezirow's (1997) Transformative Learning Theory, which emphasizes that the impact of environmental education lies not merely in the provision of information, but in fostering profound shifts in attitudes and behaviors. Similarly, in the study by Pham Tien (2023), communication and community interaction were identified as critical levers for raising awareness and sparking pro-environmental action. However, the present research clarifies the relative magnitude of these factors, thereby suggesting an optimal allocation of resources—a dimension seldom quantified in prior studies.

Another important finding comes from the analysis of demographic differences: Role and Experience are the two variables that create the most substantial differences in both implementation effectiveness and awareness. This suggests that occupational context and practical experience profoundly shape how individuals approach and respond to policy. Compared to Patton's (2008) research on policy evaluation, the results here reinforce the

argument that policy effectiveness is heavily contingent on the characteristics of the beneficiary groups—factors that policymakers must account for when designing interventions.

Conversely, the type of educational institution (Type_Unit) exerts only a minimal impact, implying that the effectiveness of environmental education policies in Vietnam is currently little influenced by whether institutions are public or non-public. This is a positive signal, partly reflecting the inclusiveness and universality of policy documents—an aspect that many countries still struggle with (UNESCO, 2019). However, significant geographic differences (Area), especially in implementation effectiveness, call for flexible adjustments tailored to the socio-economic conditions and natural environments of each region, rather than applying a uniform nationwide approach.

When compared with the international context, the finding on the importance of monitoring–evaluation is consistent with the recommendations of UNESCO (2019) and Vietnam's Sustainable Development Strategy (Decision No. 432/QD-TTg, 2012), both of which regard it as a mechanism to ensure policy feedback loops, enabling timely adjustments and maintaining long-term effectiveness. However,

unlike many international reports that place greater emphasis on legal frameworks and national commitments, the present results indicate that implementation capacity plays the most direct role in determining on-the-ground success.

In summary, this study contributes three key propositions:

(1) The structure of Vietnam's environmental education policy is sufficiently strong to simultaneously influence both implementation effectiveness and public awareness; however, the prioritization among factors should be adjusted depending on the specific objectives.

(2) Personal characteristics and occupational context (Role, Exp) significantly influence policy outcomes, while institutional type makes little difference.

(3) Regional flexibility and monitoring–evaluation mechanisms are two critical levers for enhancing policy adaptability and sustainability.

These findings not only reinforce the conclusions of previous research but also add quantitative evidence and strategic prioritization analysis, providing a scientific basis for proposing policy solutions in the next phase.

6. Policy Recommendations

The findings of this research not only provide empirical evidence on the multidimensional impacts of the components of environmental education policy but also highlight varying strategic priorities depending on the objectives and implementation context. This forms a critical foundation for formulating feasible recommendations aimed at optimizing policy execution, expanding societal impact, and enhancing the sustainability of environmental education programs in Vietnam. On this basis, the study proposes three managerial implications and policy recommendations:

First, it is essential to stratify objectives and strategic priorities in policy implementation.

Each policy component—detail and clarity, resource commitment, stakeholder participation, communication and dissemination, and monitoring–evaluation—exerts varying levels of influence depending on the specific goal. Authorities should clearly determine the primary focus before implementation. If the primary goal is to improve implementation effectiveness, priority should be given to strengthening resource commitment and refining monitoring–evaluation mechanisms. Conversely, if the goal is to expand public awareness, efforts

should concentrate on enhancing communication effectiveness and encouraging stakeholder participation. This stratified approach enables more efficient resource allocation, avoids fragmentation, and improves policy feasibility.

Second, strengthen policy personalization and adaptation to target group characteristics and regional contexts.

Demographic analysis shows that occupational role and work experience are the most significant variables influencing both implementation effectiveness and social awareness, while regional differences also play a meaningful role in implementation outcomes. This necessitates designing training, capacity-building, and communication activities tailored to each audience. For example, specialized training programs could be developed for managers and teachers with shorter tenure, or instructional materials could be created to integrate environmental features specific to each region. Policies adapted to both group and regional characteristics will increase engagement and reduce the gap between policy design and practical implementation.

Third, reinforce and expand the policy monitoring–feedback mechanism toward an intersectoral and multilevel approach.

Monitoring and evaluation are not merely tools for measuring results but serve as a "feedback loop" to adjust policies promptly in response to changes in natural, social, and economic conditions. This factor has a powerful impact on implementation effectiveness, yet it is still predominantly conducted through a one-way administrative process. Therefore, an intersectoral monitoring system should be developed, with the participation of social organizations, educational institutions, local authorities, and communities. Additionally, digital technology should be applied to collect real-time data, analyze trends, and publish reports publicly—thereby improving transparency, accountability, and the adaptive capacity of environmental education policy.

Limitations of the study

This study presents certain structural and methodological limitations. First, the generalizability of the findings is constrained by the dynamic nature of the environmental education policy context, which is influenced by shifts in national strategic directions and international commitments. Second, the measurement model may not fully capture the depth and interactive dynamics of policy factors, particularly for complex constructs such as stakeholder participation. Third, the use of MANOVA and linear regression does not allow for the exploration of non-linear causal relationships, indirect effects, or moderating effects among variables. Fourth, regional comparison data are currently limited to geographical classification (North, Central, South) without incorporating region-specific socio-economic and environmental indicators. These limitations reflect the inherent complexity of policy research and highlight the need to expand the theoretical model, refine measurement instruments, and adopt multidimensional analytical approaches in future studies.

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