

# Fostering Pro-Environmental Behaviors Through Climate Change Education: An Empirical Study on Primary School Students

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## Abstract

Climate change poses an existential threat to global sustainability, demanding immediate pedagogical interventions to nurture environmentally responsible citizens from an early age. This study investigates the empirical impact of a structured Climate Change Education (CCE) program on the pro-environmental behaviors (PEB) of primary school students in Vietnam. Utilizing a quasi-experimental pre-test/post-test design with a control group ( $N = 240$ , aged 10–11), the research evaluated changes in students' environmental knowledge, climate change awareness, and self-reported PEB over an 8-week intervention period. The experimental group participated in an experiential CCE curriculum emphasizing active learning, inquiry-based outdoor activities, and collaborative problem-solving, while the control group followed the standard national curriculum. Quantitative data analyzed via Analysis of Covariance (ANCOVA) revealed statistically significant improvements in environmental knowledge ( $p < .001$ ) and pro-environmental behaviors ( $p < .001$ ) within the experimental group compared to the control group. Furthermore, qualitative insights gained from semi-structured teacher interviews corroborated the quantitative findings, demonstrating heightened student initiative in waste reduction and energy conservation within the school environment. The study underscores the critical necessity of integrating experiential climate pedagogy into elementary curricula to drive meaningful behavioral transformations.

**Keywords:** Climate change education; Pro-environmental behavior; Primary school students; Quasi-experimental study; Experiential pedagogy.

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## I. INTRODUCTION

The escalation of global anthropogenic climate change presents unprecedented environmental, economic, and social challenges. Mitigating these multi-faceted crises necessitates not only technological innovation and policy reform but also a fundamental shift in societal values and individual behaviors. Educators and policymakers increasingly recognize that fostering pro-environmental behaviors (PEB)—actions taken by individuals to intentionally minimize their negative footprint on the natural and built world—is a foundational pillar of sustainable development.

Early childhood and pre-adolescence represent critical developmental windows for forming long-lasting attitudes, environmental values, and behavioral habits. Primary school students, particularly those in upper elementary levels (ages 10–11), possess the cognitive maturity to comprehend basic ecological interdependencies while remaining highly receptive to behavioral modeling. However, traditional environmental education in many developing contexts, including Vietnam, remains predominantly theoretical, relying heavily on rote memorization from textbook materials rather than active, behavior-oriented engagement.

Despite a growing body of literature on Climate Change Education (CCE), limited empirical research systematically isolates the direct causal linkages between experiential educational interventions and actual behavioral shifts among primary school demographics in Southeast Asia. This study addresses this scholarly gap by executing a rigorous empirical evaluation of a dedicated CCE program designed for Vietnamese primary schools. The core objective is to evaluate whether an experiential, inquiry-based CCE curriculum significantly enhances students' environmental knowledge and catalyzes observable pro-environmental behaviors compared to conventional teaching methods.

## II. LITERATURE REVIEW AND HYPOTHESES

### 2.1 Climate Change Education (CCE) and Behavioral Change

Early models of environmental behavior assumed a linear progression: increasing knowledge would inherently foster environmental awareness, which in turn would alter behavior. Contemporary behavioral psychology, however, challenges this simplistic information-deficit paradigm. Theories such as the Value-Belief-Norm (VBN) theory and the Theory of Planned Behavior (TPB) assert that behavioral intention is a complex construct driven by personal norms, attitudes, subjective norms, and perceived behavioral control. CCE must therefore transcend passive information dissemination. Experiential learning theory suggests that when students engage directly with environmental phenomena—through experiments, local environmental auditing, and outdoor observation—they develop higher ecological affinity and self-efficacy, converting abstract knowledge into internalized moral obligations to act.

### 2.2 Hypotheses Development

Based on the theoretical frameworks of experiential learning and planned behavior, we argue that a structured, interactive climate curriculum will yield superior educational and behavioral outcomes. Consequently, the following hypotheses are formulated for empirical validation:

**Hypothesis 1 (H1):** Students exposed to the experiential CCE curriculum will demonstrate significantly higher levels of post-intervention environmental knowledge than students in the traditional curriculum control group.

**Hypothesis 2 (H2):** Students exposed to the experiential CCE curriculum will exhibit a significantly greater increase in self-reported and observed pro-environmental behaviors compared to the control group.

## III. METHODOLOGY

### 3.1 Research Design and Participants

This study employed a quantitative-dominant, quasi-experimental pre-test/post-test control group design, supplemented by qualitative interview data. The research was conducted across two demographically matched public primary schools in Hanoi, Vietnam, over an 8-week period during the academic year. A total of four Grade 5 classes participated, yielding a sample size of  $N = 240$  students (Experimental group:  $n = 120$  distributed across two classes; Control group:  $n = 120$  distributed across two classes). Ethical clearance was secured from institutional boards and school administrations, and informed written consent was attained from all participating students' parents or legal guardians.

### 3.2 The Educational Intervention

The control group received standard national science instruction focusing on generic ecological topics utilizing traditional lecture-and-textbook modalities. Conversely, the experimental group was subjected to a specialized CCE curriculum titled "Young Climate Guardians." This program comprised eight distinct 90-minute weekly modules structured around four core pillars: (1) The Science of Climate Change, (2) Local Impacts and Adaptation, (3) Carbon Footprint Mitigation, and (4) Eco-citizenship Action. Crucially, instruction prioritized experiential learning loops, including carbon footprint tracking, school recycling audits, tree-planting workshops, and interactive group simulations of climate adaptation strategies.

### 3.3 Measures and Instrumentation

Data were gathered using a structured questionnaire administered immediately before (Pre-test) and one week after (Post-test) the 8-week intervention. The instrument was pre-validated through expert panel reviews and a pilot study ( $n = 45$ ) to ensure age-appropriate readability and robust psychometric properties.

*Environmental Knowledge (EK):* Evaluated using a 15-item multiple-choice test covering greenhouse gases, climate impacts, and conservation strategies. Each correct response scored 1, and incorrect responses scored 0 (Range: 0–15; Cronbach's  $\alpha = .78$ ).

*Pro-Environmental Behavior (PEB):* Measured via a 12-item scale adapted from the Children's Environmental Attitudes and Knowledge Scale (CHEAKS). Responses were recorded on a 5-point Likert scale ranging from 1 (Never) to 5 (Always), capturing actionable behaviors across waste separation, energy conservation, water saving, and eco-advocacy (Cronbach's  $\alpha = .84$ ).

## IV. RESULTS AND DISCUSSION

### 4.1 Quantitative Analysis

To isolate the treatment effect of the CCE curriculum while controlling for baseline variances, an Analysis of Covariance (ANCOVA) was executed, specifying pre-test scores as covariates and the educational intervention

group as the fixed factor. Descriptive data and ANCOV A outputs are comprehensively outlined in Table 1.

**Table 1. Descriptive statistics and ANCOV A results for experimental and control groups.**

Variable	Experimental Group (n=120)		Control Group (n=120)		F-statistic	p-value	Partial $\eta^2$
	Pre-test	Post-test	Pre-test	Post-test			
	(SD)	(SD)	(SD)	(SD)			
Environmental Knowledge	8.32 (1.45)	12.85 (1.12)	8.41 (1.38)	9.12 (1.26)	148.64	<.001	0.385
Pro-Environmental Behavior	2.94 (0.52)	4.15 (0.44)	2.91 (0.49)	3.08 (0.51)	212.18	<.001	0.471

The statistical analyses strongly substantiate both research hypotheses. For Environmental Knowledge, the post-test mean score of the experimental group rose markedly to 12.85, whereas the control group exhibited a negligible adjustment to 9.12. The ANCOV A model revealed a significant main effect of the intervention group,  $F(1,237) =$

$148.64, p < .001$ , with a substantial partial eta-squared ( $\eta^2 = 0.385$ ), fully validating **H1**.

Crucially, regarding the core variable of interest—Pro-Environmental Behavior—the experimental group demonstrated an extraordinary post-test mean increase to 4.15 on the 5-point scale, contrasting sharply with the static profile of the control group (3.08). The resulting ANCOV A was highly significant,  $F(1,237) = 212.18, p <$

$.001$ , explaining 47.1% of the post-test variance ( $\eta^2 = 0.471$ ), thereby firmly supporting **H2**.

#### 4.2 Qualitative Discussion

Post-intervention focus group evaluations conducted with elementary teachers validated these data matrices. Educators reported that experimental group participants actively organized student-led green monitoring groups, systematically reduced single-use plastics in school lunches, and autonomously enforced classroom electricity-saving protocols. These findings empirically validate the position that moving away from abstract, textbook-centered science models toward localized, participatory environmental projects bridges the traditional gap between knowledge and behavioral execution.

### V. CONCLUSION AND RECOMMENDATIONS

This research provides robust empirical evidence that structured, experiential Climate Change Education effectively drives pro-environmental behaviors in primary school cohorts. By leveraging hands-on modules that build both cognitive comprehension and emotional connection, the CCE intervention empowered young learners to implement concrete, day-to-day sustainability practices.

The pedagogical implications are profound. Ministries of Education and regional primary school administrations should reorient environmental curricula away from passive informational frameworks toward experiential modules. Integrating localized environmental problem-solving, campus sustainability tracking, and outdoor inquiry into standard primary education plans is paramount. Future research should prioritize longitudinal investigations to measure the structural persistence of these behavioral gains as students transition into secondary education.

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