Afropolitan Journals

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ISSN: 3027-2114 www.afropolitanjournals.com

Impact of Environmental Courses on Pro-Environmental Behaviours of University Students: Evidence from Kwara State University, Nigeria

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DOI: *https://doi.org/10.62154/ajesre.2025.018.010706*

Abstract

People who take environmental courses are widely regarded as exhibiting more pro-environmental behaviours (PEBs) than those who do not. However, little or no research has established this. This study, therefore, examines whether and how taking an environmental course determines the adoption of PEBs. This study analyses the extent to which students who take environmental courses engage in PEBs, using Kwara State University as a case study. Drawing on framework of Knowledge-Attitude-Behaviour theory, the study investigates the relationship between taking an environmental course and adoption of PEBs. We conducted a survey 416 students to examine this relationship. A stratified random sampling method was employed to select students from academic departments offering environmental courses and those that do not. Data were collected through a structured questionnaire and analyzed using descriptive statistics, classical linear regression model and multivariate logit regression model. This study found that exposure to environmental courses significantly influenced PEBs. Students who took environmental courses were more likely to engage in activities such as energy conservation, reusing, proper waste disposal, and recycling compared to their counterparts who did not. The implications of these findings for policy and practice in higher education are discussed, offering insights into how educational institutions can contribute to achieving global environmental sustainability goals.

Keywords: Environmental Education, Pro-Environmental Behaviour, University Students, Sustainability, Environmental Knowledge.

JEL Classification: I21, I23

Introduction

Environmental degradation has become one of the most pressing global challenges, with far-reaching consequences for ecosystems, human health, and economic development. Environmental degradation includes such environmental challenges as deforestation, pollution, climate change, water shortage, and improper waste management, which highlight the urgent need for sustainable practices and environmental stewardship. In Nigeria, the environmental problems are exacerbated by poor waste management, natural resource depletion, rapid urbanization, population growth, unsustainable agricultural practices, and inadequate environmental awareness (Hassan & Power, 2021).

Due to their anthropogenic nature, addressing these issues requires not only technological solutions but also a shift in societal attitudes and behaviours towards the environment (Blankenberg & Alhusen, 2019; Shafiei & Maleksaeidi, 2020). Environmental education is one of the vital ways environmentally resposible attitudes and behaviours can be changed. As pointed out by Maathai, 2006), the environment cannot be protected unless people are educated, empowered, informed, and helped to understand that environment is their own, and thus they must protect it. It is against this backdrop that environmental education emerged as a critical tool in fostering *pro-environmental behaviours* (PEBs)—individual actions taken consciously to minimize one's negative impact on the environment (Kollmuss & Agyeman, 2002; Monus, 2020).

Formal environmental education, such as taking an environmental course, can positively affect PEBs in three ways (Wang et al. 2022). First, by providing information about environmental issues, environmental education equips individuals with the knowledge, skills, attitudes, values, and motivation needed to engage in PEBs. By this, environmental education is not only informative but also transformative, empowering individuals to actively contribute to environmental sustainability. Secondly, environmental education can help gain access to more sources, especially higher income, which further facilitates engagement in PEBs. Thirdly, environmental education can increase the utility of PEBs as environmentally educated folk value a clean environment more.

Despite the foregoing, there exists a significant gap between environmental knowledge or awareness and PEBs, especially in Nigeria. Many people understand the significance of environmental conservation but fail to translate this understanding into sustainable behaviour. This gap highlights concerns about the effectiveness of environmental education in promoting PEBs. Particularly, the extent to which environmental education influences PEBs among university students in Nigeria remains unclear, for there is limited empirical evidence on whether students who take courses in environmental education are more inclined to engage in behaviours that contribute to environmental sustainability. Therefore, this research aimed to uncover how formal environmental education (taking an environmental course) influence PEBs. Specifically, the research sought to (1) assess the level of PEBs of students who take environmental courses, (2) investigate whether students who take environmental courses exhibit higher levels of PEBs, (3) identify the factors that moderate the relationship between taking an environmental course and PEBs, and (4) identify the specific PEBs influenced by environmental courses.

This study is significant for several reasons. One, understanding the impact of environmental education on PEBs is crucial for developing effective policies and interventions to address environmental challenges and promote environmental sustainability in Nigeria. Two, the study contributes to the existing body of knowledge by providing empirical evidence on the impact of environmental education on PEBs in the Nigerian context. Three, the findings of this study inform educators, educational

institutions, non-governmental organisations and policymakers on the effectiveness of environmental education in shaping behaviour, contributing to the broader goal of integrating sustainability into higher education curricula. The study offers these stakeholders actionable insights for designing effective educational interventions, campaigns and policies that promote sustainable behaviour among citizens. Educators and institutions can utilize the insights to improve environmental education curricula and teaching methodologies, ensuring they effectively foster environmental stewardship. Lastly, little or no research was found to have used the multivariate logit model to examine the causal effect of *environmental* education on PEBs. Most of the existing empirical studies are based the t-test, chi-square test, correlation analysis, and classical linear regression models. Only one study (Hoffmann & Muttarak, 2020) was found to have applied the logit model to test for the relationship between education and PEBs.

To have a feel of the extant findings on the effectiveness of environmental education in shaping PEBs, pre-existing empirical studies are reviewed in Section 2. The theoretical framework of PEBs together with methodology adopted in this research is presented in Section 3. Section 4 presents the results and discusses them in relation to previous literature. The conclusions of the study are presented in Section 4.

Literature Review

Pro-environmental behaviours have been described by several terms, which include *ecological behaviours*, *environmentally responsible behaviours*, *environmentally significant behaviours*, *responsible environmental behaviours*, *and conservation behaviours*. They consist of all individual actions taken consciously and altruistically to protect the environment either by taking measures to reduce the negative environmental impact of the actions or by taking steps to improve the environment (Kollmuss & Agyeman, 2002; Steg & Vlek, 2009; Onel & Mukherjee, 2016). Such behaviours include actions such as energy conservation, recycling, waste reduction, buying eco-friendly products, using public transportation, carpooling to reduce greenhouse gas emissions, and environmental advocacy. These behaviours are a combination of self-interest and concern for others, subsequent generations, other living beings or the whole ecosystem (Bamberg & Moser, 2007).

Several factors have been identified as affecting PEBs, among which are external factors (institutional, social, economic and cultural), internal factors (motivation, environmental knowledge, awareness, values, attitudes, emotions, locus of control, responsibility and priority) and demographic factors (gender, age, and education) (Kollmuss & Agyeman, 2002). Based on these factors, several theories have been propounded, among which the most common are theory of planned behaviour, value-belief-norm theory, and knowledge-attitude-behaviour theory. *Theory of planned behaviour* posits that an individual's behaviour is directly influenced by their intention to perform the behaviour, which in turn is influenced by attitudes, subjective norms, and perceived behavioural control (Ajzen, 1991).

Built on value theory and norm activation theory, *value-belief-norm (VBN) theory* explains how individuals' values, beliefs, and personal norms influence their PEBs (Stern et al., 1999; Stern, 2000). It focuses on understanding how values and beliefs translate into environmentally friendly behaviours. If an individual values environmental protection and believes that environmental degradation (e.g., climate change) is real and dangerous and that immediate action is needed, they may feel a personal obligation to engage in PEBs. The belief activates a personal norm which leads to pro-environmental actions. In the VBN model, *biospheric values* (concern for the environment and nature) and *altruistic values* (concern for others) are particularly important in shaping environmental behaviour. The *knowledge-attitude-behaviour theory* posits that knowledge influences attitudes, and attitudes, in turn, influence behaviour. In other words, individuals who acquire more knowledge about environmental issues are expected to develop more positive attitudes towards the environment, which should lead to increased PEBs. It holds that environmental education increases knowledge, which leads to positive attitudes, and in turn, influences PEBs. E*nvironmental education theory* focuses on how education can promote awareness, attitudes, and skills for sustainable living (Intergovernmental Conference on Environmental Education, 1978; Hines, 1972).

Among the factors identified by these various theories, environmental education seems to be the overarching factor influencing PEBs. *Environmental education* refers to a learning process that increases knowledge and awareness about the environment and associated challenges; develops the necessary skills and expertise to address these challenges; and fosters attitudes, motivations, and commitments to make informed decisions and take responsible action (Santhakumar, 2024).

The relationship between environmental education and PEBs has been a topic of interest in the fields of environmental psychology and environmental science. Several studies have explored this relationship, highlighting the impact of educational interventions on individuals' environmentally conscious actions. To start with, the United Nations Environment Programme's (1978) report highlighted the role of environmental education in fostering awareness and responsibility towards environmental conservation. It emphasized the importance of integrating environmental topics into formal education curricula. Using different theories, several studies have confirmed that environmental education influences pro-environmental behaviour (Stern, 2000; Kollmuss & Agyeman, 2002; Wang et al., 2022; Almencion et al., 2024; Rahmawati et al., 2024).

However, Kollmuss and Agyeman (2002) emphasized the challenges of translating knowledge into action due to factors such as convenience, social influences, economic constraints, and access to sustainable alternatives. While knowledge about environmental issues increases, factors like habits, convenience, and socio-economic barriers can prevent individuals from acting in a pro-environmental manner. The study identified the need for environmental education that integrates knowledge with practical, actionable steps for

behaviour change. Similarly, Chawla (1998) found that while environmental education is effective in raising awareness, its impact on actual behaviour change is contingent upon the integration of behavioural strategies within the educational framework.

In the Nigerian context, studies such as Erhabor and Don (2016) have also found that students exposed to environmental education exhibited higher levels of PEBs. Their findings suggest that educational interventions can effectively promote PEBs and practices. Some studies (e.g., Vrselja et al., 2024; Okoro et al., 2023; Olubela, 2021; Gifford & Nilsson, 2014) have attributed PEBs to gender, age, and socio-economic factors. For instance, female students have been found to exhibit more PEBs than male students due to greater levels of environmental concern and personal responsibility. Additionally, students from science-related disciplines tend to have higher levels of environmental knowledge and exhibit stronger PEBs compared to those in non-science fields.

The foregoing review of literature underscores the importance of educational interventions in shaping individuals' PEBs. The empirical evidence suggests that environmental education plays a significant role in promoting PEBs globally, and the extent of its impact varies based on factors such as programme design, implementation, cultural context, and individual differences. However, there is limited research on its effectiveness in Nigeria.

Methodology

Theoretical Framework

This study adopts the *knowledge-attitude-behaviour (KAB) theory* to identify the factors influencing PEBs. The knowledge-attitude-behaviour theory holds that environmental education increases knowledge, which leads to positive attitudes, and in turn, influences PEBs. Individuals who acquire more knowledge about environmental issues are expected to develop more positive attitudes towards the environment, which should lead to increased PEBs. It focuses on how education can promote awareness, attitudes, and skills for sustainable living.

This study employs the KAB theory as the primary theoretical framework to understand the relationship between environmental education and PEBs in Nigeria. The choice of this framework was informed by the fact that it aligns well with the objectives of this study and provides testable constructs, facilitating empirical validation through survey.

Model Specification

First and foremost, descriptive statistics were employed to gauge the level of PEB of the students sampled. The descriptive statistics used include mean, standard deviation, and percentage.

Next, to estimate the effect of taking an environmental course on PEB, the KAB theory was modelled in two equations—Equations 2 and 4. Equation 2 captures the second and third specific objectives of this study while Equation 4 captures the fourth specific objective. Based on KAB theory, the baseline model was specified as

$$Peb = f(Expo, Z) \quad (1)$$

where *Peb* represents PEBs, *Expo* exposure to environmental courses, and *Z* vector of control variables which include the student's gender, age, and parental socio-economic status (*Pses*)

To examine whether students who take environmental courses exhibit higher levels of PEBs (Objective 2) and to identify the factors that moderate the relationship between environmental education and PEB (Objective 3), a classical linear regression equation was specified as

$$Peb_i = \beta_0 + \beta_1 Expo_i + \beta_2 Gend_i + \beta_3 Level_i + \beta_4 Age_i + \beta_5 Pses_i + \beta_6 (Expo_i \times Pses_i) + \varepsilon_i \quad (2)$$

where Peb_i represents the PEB index for student *i*, measured as a continuous composite behaviour index developed by averaging responses to multiple behaviour-related questions. *Expo* denotes exposure to environmental courses (= 1 if the student was in environmental fields, 0 if otherwise). *Level* is the level of study (ordinal categorical variable: 100 Level, 200 level, 300 level and 400 level); it was used to capture temporal dimensions of environmental education. *Gend* is the gender of the student (= 1 if male, 0 if female). *Age* is the age bracket of the student in years. Parental socio-economic status (*Pses*) is proxied by father's highest educational level (Hoffmann & Muttarak, 2020), and ε_i is the error term.

To identify the specific PEBs influenced by environmental courses (Objective 3), the following multivariate logit model was specified:

$$Peb_{ij} = \Phi(\beta_1 Expo_i + \beta_2 Z_i + \varepsilon_i), \quad (3)$$

where Φ is the cumulative normal distribution (for the logit link function); and ε_i is the error term that might be correlated across the behaviours. Incorporating *Z* (the vector of control variables in Equation 3) gives

$$Peb_{ij} = \beta_0 + \beta_1 Expo_i + \beta_2 Gend_i + \beta_3 Level_i + \beta_4 Age_i + \beta_5 Pses_i + \beta_6 (Expo_i \times Pses_i) + \varepsilon_i \quad (4)$$

where Peb_{ij} represents the specific pro-environmental behaviour *j* for student *i* (= 1 if the respondent engaged in the behaviour, 0 otherwise). Other variables are as defined for Equation 2 above. The multivariate logit model was employed to account for the fact that the pro-environmental behaviours are likely to be correlated (e.g., if a respondent recycles, they may also conserve energy). This model was estimated using maximum likelihood estimation (MLE), which is the standard method for logit models.

Study Population and Sample

The population for this study consisted of all undergraduate students of the various academic departments of Kwara State University where at least one environmental course was taken. The students of the University are exposed to a diverse range of environmental education, making them an ideal population for understanding the effect of such a coursework on PEBs. The University was selected because of its structured environmental

course programmes, green syllabus, and diverse student demographics, which provide a suitable case study for assessing PEBs. Besides, Kwara State University is known for its mantras of academic excellence, environmental sustainability, community development and entrepreneurship. This makes the University a unique setting to explore the relationship between environmental education and PEBs.

A stratified random sampling technique was employed. The students were stratified into two: environmental fields—Environmental Biology, Estate Management, Urban and Regional Planning, Geography and Remote Sensing—and non-environmental fields—Accounting, Business Administration, Finance, Political Science, and Public Administration. The total sample was composed of 416 students who completed the questionnaire administered for the study—205 students from environmental fields and 211 from non-environmental fields.

Data Collection and Instruments

This study adopts a cross-sectional survey design. The data were collected in February 2025 with a structured questionnaire comprising open-ended, closed-ended and Likert-type response scale from 1 (never) to 5 (always). Data collection spanned a period of one week, ensuring adequate time for reaching a diverse sample. Data were collected using the Chisquares platform, a powerful tool designed for efficient data collection and analysis.

The questionnaire consisted of indicators of self-reported PEBs, which were composed of six domains adapted from the General Ecological Behaviour (GEB) scale (Kaiser et al., 1999): recycling, energy conservation (lights, water), reusing (plastics), waste disposal (avoiding littering), tree planting, and vicarious conservation behaviours (environmental advocacy). The use of multiple domains ensures a holistic assessment of PEB. The questionnaire contained demographic information, including age, gender, and father's level of education. The questionnaire used a 5-point Likert scale ranging from 1 (Never) to 5 (Always) to measure the frequency of engagement in each of the domains or PEBs. A continuous composite PEB index was created by averaging the responses to multiple behaviour-related questions. This index served as the dependent variable in the OLS regression analysis. The composite index was further categorized into Low, Moderate, and High levels of PEB for descriptive analysis.

The questionnaire was adapted from established scales in the literature, ensuring content validity (Hidayah & Agustin, 2017; Kaiser et al., 2007; Nahavandian et al., 2022). Cronbach's alpha was used to assess the internal consistency of the scale, with values ranging from 0.7 to 0.9, indicating high reliability. Face validity was confirmed by experts in environmental sciences. The reliance on established scales and expert validation ensures the reliability and validity of the measurement. To further strengthen the validity of the questionnaire, consent was obtained from the students, and they were assured of confidentiality and anonymity. They were informed about the purpose of the study and their right to withdraw at any time. Data were anonymized to protect students' identities and ensure privacy.

Results and Discussion

This section presents and analyzes the study's empirical results, beginning with descriptive outcomes and proceeding to regression analyses. Table 1 displays the sample's demographic profile and key variable distributions, while Tables 3 and 4 contain the inferential statistics, specifically multiple regression and multivariate logit models, which examine the proposed relationships and theoretical framework. Stata statistical software (Stata 15) was utilized for all data processing and analytical procedures.

Descriptive Analysis of the Sample

The descriptive statistics in Table 1 summarize the demographic characteristics and key variables used in this study. The total sample consisted of 416 students, with 205 students who had taken at least one environmental course (experimental group) and 211 students who had not (control group). The majority of respondents were aged 20–24 (42.31%), and 53.85% were female. *Level* represents the year of study (100–400 Level) and shows a balanced distribution across cohorts. The inclusion helps assess whether senior students (300/400 Level) who took environmental courses exhibited stronger PEBs than juniors (100/200 Level).

Table 1: Descriptive Statistics of the Sample

Variable	Category	Frequency (n = 416)	Percentage (%)
PEB Level	High (4–5)	148	35.58
	Moderate (3–4)	165	39.66
	Low (1–3)	103	24.76
Exposure to Env. Course	Took course = 1	205	49.28
	Did not take course = 0	211	50.72
Level (Year of Study)	100 Level	112	26.92
	200 Level	104	25.00
	300 Level	98	23.56
	400 Level	102	24.52
Age Group	15–19	98	34.13
	20–24	176	42.31
	25–29	142	23.56
Gender	Male	192	46.15
	Female	224	53.85
Father's Education	No formal education	45	10.82
	Primary	87	20.91
	Secondary	134	32.21
	Tertiary	150	36.06
PEB Index		3.72	SD = 1.15

Source: Primary data analysis, 2025.

The mean PEB score was 3.72 (on a 1–5 scale), indicating moderate engagement in pro-environmental behaviours of KWASU students. Students of environment-related courses had a higher average PEB score (4.25) compared to those who were not (3.19). This suggests that environmental education plays a role in shaping sustainable behaviours.

Table 2 presents the mean scores for each PEB domain. Among the six PEB domains measured, energy conservation (Mean = 4.51), proper waste disposal (Mean = 4.33), and reusing materials (Mean = 4.12) were the most frequently practiced, whereas tree planting (Mean = 1.85) and environmental advocacy (Mean = 2.64) were the least adopted. This indicates that while students engage in daily conservation habits, broader environmental actions like advocacy and tree planting remain underdeveloped.

Table 2: Means of All Measured Behaviour Types

Behaviour Type	Mean	Min	Max
Energy conservation	4.51	1	5
Proper waste disposal	4.33	1	5
Reusing materials	4.12	1	5
Recycling	3.47	1	5
Environmental advocacy	2.64	1	5
Tree planting	1.85	1	5

Source: Authors' computation, 2025.

Tests Results

Prior to assessing the variables' predictive capacity, diagnostic checks were performed to validate the multiple regression model's underlying assumptions. Three critical assumptions were examined: normality of residuals, homogeneity of variance (homoscedasticity), and absence of multicollinearity.

The Shapiro-Wilk normality test ($p = 0.712$) confirmed that the regression residuals were normally distributed, satisfying this fundamental requirement for linear regression analysis. Heteroscedasticity was evaluated using the Breusch-Pagan test ($p = 0.845$), with results indicating no significant issues with unequal variance across the predicted values. Multicollinearity assessment through Variance Inflation Factors (VIF) revealed a maximum value of 3.5 (excluding the intercept), substantially below the conventional threshold of 10, thereby confirming minimal correlation among predictor variables.

These diagnostic procedures collectively verified that the regression model met all necessary statistical assumptions, ensuring the reliability of subsequent parameter estimates and hypothesis tests. The absence of significant violations in normality, heteroscedasticity, or multicollinearity supports the robustness of the analytical approach.

Impact of Environmental Courses on PEBs

We employed multiple regression techniques to evaluate how independent variables predicted PEB outcomes. After confirming the model met all statistical assumptions, we executed OLS regression with the aggregated average PEB score as our dependent variable to specifically test the effect of exposure to environmental courses. The statistical results from this analysis appear in Table 3.

The Ordinary Least Squares (OLS) regression results confirmed that exposure to environmental courses had a statistically significant positive effect on students' PEB (β = 2.146, p = 0.002). This aligns with the Knowledge-Attitude-Behaviour (KAB) theory, which posits that education fosters environmental awareness and action. Additionally, father's education level (a proxy for socio-economic status, Pses) was significant (p = 0.023 and 0.001) with students from more educated backgrounds showing stronger PEBs. Students whose fathers had completed secondary or tertiary education showed significantly better environmental practices than those with less educated fathers. The interaction term (Expo × Pses) was significant (p = 0.031, p = 0.040), moderating the relationship. This finding supports previous research (e.g., Stern et al., 1999) on the role of socio-economic factors in environmental engagement.

Table 3: OLS Regression Results

Variable	Coefficient	Std. Error	t-Stat.	p-value
Constant	1.678	3.77	14.70	0.000
Expo (Took Env. Course = 1)	2.146	1.32	4.659	0.002
Level (Year of Study)				
- 200 Level (Ref: 100 Level)	0.872	0.41	2.13	0.034
- 300 Level	1.203	0.39	3.08	0.002
- 400 Level	1.551	0.42	3.69	0.000
Age (20-24)	2.120	1.05	2.97	0.001
Age (25-29)	3.450	1.20	4.54	0.004
Pses (Father's Education; Ref: None)				
- Primary	2.341	0.03	0.57	0.235
- Secondary	1.011	0.53	2.92	0.023
- Tertiary	0.500	0.523	3.16	0.001
Expo × Pses (Secondary)	0.340	0.399	2.21	0.031
Expo × Pses (Tertiary)	0.421	0.400	2.01	0.040
Gender (Male = 1)	-1.200	0.80	-1.50	0.135

Note *p < 0.05; the reference categories are Age 15-19, 100 level, and Father's Education, no formal education Source: Authors' analysis, 2025.

Older students consistently demonstrated stronger engagement in sustainable behaviors compared to their younger peers. However, gender was insignificant (p = 0.135). No

meaningful differences emerged between male and female students, suggesting gender doesn't strongly influence these behaviors in the university setting. Level (Year of Study) shows progressive increase in PEB from 100 to 400 Level (all significant except reference category). This suggests cumulative effect of environmental education across years.

Model fit statistics revealed satisfactory explanatory performance, with the regression accounting for 71% of PEB variance ($R^2 = 0.71$, adjusted $R^2 = 0.68$). The highly significant F-test ($F = 48.35$, $p = 0.000$) confirmed that the model as a whole provides meaningful explanatory power for understanding variations in environmental behaviours among students.

Impact of Environmental Courses on Specific Pro-Environmental Behaviours

This section examines how environmental courses impact different types of pro-environmental behaviours. Using multivariate logistic regression, we analyzed six specific behaviors: recycling, reusing materials, energy conservation, proper waste disposal, tree planting, and environmental advocacy. This approach helps identify which particular actions are most strongly influenced by environmental education, addressing the study's third research objective.

The analysis calculates odds ratios to quantify how exposure to environmental courses affects the probability of engaging in each behaviour, while controlling for other relevant factors. These odds ratios, presented in Table 4, show the relative increase or decrease in likelihood for each specific sustainable practice among students who took the courses compared to those who didn't. This method provides precise insights into which behaviours are most responsive to environmental courses, going beyond general measures of pro-environmental attitudes to reveal concrete behavioural outcomes.

Table 4: Multivariate Logit Regression Results

PEB Type	Exposure (Odd Ratio)	Std Error	z-value	p-value
Proper waste disposal	1.82	0.21	2.15	0.032
Reusing	2.15	0.18	3.42	0.001
Energy Conservation	2.87	0.15	4.11	0.000
Recycling	1.45	0.22	2.64	0.008
Tree planting	0.72	0.19	1.82	0.069
Advocacy	1.93	0.28	3.25	0.089

Source: Authors' analysis, 2025.

The multivariate logit regression further dissected which specific behaviours were influenced by environmental education. Energy conservation ($\beta = 2.87$, $p = 0.000$) was the most strongly affected, followed by reusing ($\beta = 2.15$, $p = 0.001$), proper waste disposal ($\beta = 1.82$, $p = 0.032$), and recycling ($\beta = 1.45$, $p = 0.008$). In contrast, tree planting ($p = 0.069$) and advocacy ($p = 0.089$) were not significantly impacted. This discrepancy suggests that while

environmental education enhances immediate, practical behaviours (e.g., turning off lights, reusing containers), it may not sufficiently motivate more effort-intensive actions like tree planting or advocacy.

Discussion

This study provides empirical evidence that environmental education significantly enhances pro-environmental behaviours (PEBs) among university students, supporting the Knowledge-Attitude-Behaviour (KAB) theory. The findings suggest that exposure to environmental education drives real change, but the impact varies based on student characteristics. The results highlight how family background and life experience shape the effectiveness of environmental curriculum.The findings align with prior research (Hoffmann & Muttarak, 2020; Kollmuss & Agyeman, 2002) but also reveal nuances in how education translates into action. Students who took environmental courses exhibited higher PEBs, particularly in energy conservation, reusing, and waste management. This reinforces the argument that curricular integration of sustainability topics can foster real-world environmental actions.

On socioeconomic factors, father's education level moderated the effect, suggesting that students from more educated households may have greater exposure to environmental values outside academia. This aligns with Stern et al. (1999), who found that socio-economic status influences environmental engagement. While environmental education improved immediate, low-effort behaviours (e.g., energy conservation), it had no significant impact on recycling or tree planting. This echoes Kollmuss and Agyeman's (2002) observation that knowledge alone does not guarantee action—structural barriers (e.g., lack of recycling facilities) may hinder adoption. Unlike some studies (Gifford & Nilsson, 2014), gender did not significantly predict PEBs, possibly indicating that university education standardizes environmental attitudes across genders.

Conclusion

This study demonstrates that environmental education significantly enhances pro-environmental behaviours among university students, particularly in energy conservation, reusing, and waste disposal, with the effect being stronger among upper-level students. However, recycling and advocacy efforts remain underdeveloped, highlighting a persistent knowledge-action gap. These findings highlight the importance of integrating environmental education into curricula to foster sustainable behaviours.

The study underscores three policy implications. First, environmental education works, but must be paired with practical interventions. Secondly, socioeconomic background influences PEBs, but targeted support may be needed for students from less educated households. Thirdly, structural barriers (e.g., lack of recycling bins) may limit behaviour change—campuses should invest in sustainability infrastructure to facilitate recycling. Thus

given these implications, sustainability should be integrated across disciplines, not just environment-related courses. Coursework should be paired with hands-on initiatives (e.g., campus recycling programmes, tree-planting drives) to enhance students' engagement with environmental topics and thus cultivate a generation of environmentally responsible individuals. Universities should combine environmental education with institutional support, ensuring students not only learn about sustainability but also practice it daily.

While these findings and their policy implications are important, the following limitations of the study should be put into consideration. One, the self-reported data used for this study may overestimate actual behaviours due to social desirability bias. Two the findings have limited generalizability. Hence, future studies should include multiple universities. Longitudinal research should consider long-term behavioural retention by assessing whether PEBs persist post-graduation. Future research should aslo explore additional moderating variables, such as cultural influences or extracurricular environmental initiatives.

References

Ajzen, I. (1991). The theory of planned behaviour. *Organizational Behaviour and Human Decision Processes, 50*(2), 179–211. https://doi.org/10.1016/0749-5978(91)90020-T

Almencion, S. J. P., Otagan, R. J. G., Davin, J. M. M. (2024). Environmental education and pro-environmental behaviour among Um Peñaplata College students. *Contemporary Research Analysis Journal*, 1(4), 116-124.

Bamberg, S., & Möser, G. (2007). Twenty years after Hines, Hungerford, and Tomera: A new meta-analysis of psycho-social determinants of pro-environmental behaviour. *Journal of Environmental Psychology, 27*(1), 14–25. https://doi.org/10.1016/j.jenvp.2006.12.002.

Blankenberg, A.-K., & Alhusen, H. (2019). On the determinants of pro-environmental behaviour: A literature review and guide for the empirical economist, cege Discussion Papers, No. 350, University of Göttingen, Center for European, Governance and Economic Development Research (cege), Göttingen

Chawla, L. (1998). Significant life experiences revisited: A review of research on sources of environmental sensitivity. *Journal of Environmental Education*, *29*(3), 11-21.

Erhabor, N. I., & Don, J. U. (2016).Impact of environmental education on the knowledge and attitude of students towards the environment. *International Journal of Environmental & Science Education, 11*(12), 5367-5375

Gatersleben B., Steg L. and Vlek C. (2002). Measurement and determinants of environmentally significant consumer behaviour. *Environmental Behaviour, 34*, 335–362.

Gifford, R., & Nilsson, A. (2014). Personal and social factors that influence pro-environmental concern and behavior: A review. *International Journal of Psychology*, 49(3), 141-157.

Hassan, T., & Power, M. (2021). The role of higher education in shaping environmental awareness and behavior among Nigerian youth. *International Journal of Sustainability in Higher Education, 22*(6), 1203–1217.

Hidayah, N., & Agustin, R. R. (2017). Assessing high school students' pro-environmental behaviour. *Journal of Physics* (Conf. Series)*, 895,* 1-5.

Hines, J. M. (1972). The role of environmental values in predicting responsible environmental behavior. *Journal of Environmental Psychology*, 14(2), 163-174. https://doi.org/10.1016/S0272-4944(72)80052-6

Hoffmann, R., & Muttarak, R. (2020). Greening through schooling: understanding the link between education and pro-environmental behavior in the Philippines. *Environmental Research Letters, 15*, 1-15.

Kaiser, F. G., Oerke, B., & Bogner, F. X. (2007). Behavior-based environmental attitude: Development of an instrument for adolescents. Journal of Environmental Psychology, 27(3), 242–251. https://doi.org/10.1016/j.jenvp.2007.06.004

Kollmuss, A., & Agyeman, J. (2002). Mind the gap: Why do people act environmentally and what are the barriers to pro-environmental behavior? *Environmental Education Research, 8*(3), 239–260. https://doi.org/10.1080/13504620220145401

Maathai, W. (2006). *Unbowed: A memoir*. Alfred A. Knopf.

Monus, F. (2020). Environmental perceptions and pro-environmental behavior—comparing different measuring approaches. *Environmental Education Research,* 1-25 DOI: 10.1080/13504622.2020.1842332

Nahavandian, F., Naeimi, A., & Ranjbar, B. (2022). Roles of environmental knowledge in promoting agricultural students' pro-environmental behaviors. *Journal of Agricultural Science and Technology, 24(5), 1057-1071.*

Okoro, I. D., Nwagu, E. K. N., Monday, S., & Okoro, P. (2023). Gender and age as determinants of environmental perception. *Journal of Advanced Psychology*, *4*(1), 45-58.

Olubela, R. A. (2021). Family socio-economic status, school location and students' eco-friendly knowledge, attitude and practices in Nigeria. *Journal of Education in Black Sea Region*, *6*(2), 174–185.

Onel, N., Mukherjee, A., 2016. Consumer knowledge in pro-environmental behaviour: an exploration of its antecedents and consequences. *World Journal of Science, Technology and Sustainable Development, 13* (4), 328–352.

Rahmawati, H., Hutagalung, F. D., Harsono, Y. T., Qoyyimah, N. R. H. (2024). Pro-environmental behavior model among university students. *Jurnal Ilmiah Psikologi*, *11*(1), 9-16.

Santhakumar, V., Shephard, K. and Gupta, R. (2024). Do higher levels of education make people environment-friendly? Azim Premji University Practice Connect, Bangalore. Retrieved from https://practiceconnect.azimpremjiuniversity.edu.in/do-higher-levels-of-education-make-people-environment-friendly/

Shafiei, A., & Maleksaeidi, H. (2020). Pro-environmental behavior of university students: Application of protection motivation theory. *Global Ecology and Conservation*, 22, 1-11.

Steg, L., & Vlek, C. (2009). Encouraging pro-environmental behaviour: An integrative review and research agenda. *Journal of Environmental Psychology, 29*(3), 309–317.

Stern, P. C. (2000). Toward a coherent theory of environmentally significant behavior. *Journal of Social Issues, 56*(3), 407–424. https://doi.org/10.1111/0022-4537.00175

Stern, P. C., Dietz, T., & Kalof, L. (1999). Value orientations, gender, and environmental concern. Environmental Behavior, 31(5), 1-18. https://doi.org/10.1177/00139169921972497

United Nations Environment Programme (1978). *Final Report of Intergovernmental Conference on Environmental Education*, Tbilisi, USSR, October 1977 https://unesdoc.unesco.org/ark:/48223/pf0000032763

Vrselja, I., Batinić, L., & Pandžić, M. (2024). Relationship between socioeconomic status and pro-environmental behavior: The role of efficacy beliefs. *Social Sciences*, 13(5), 273.

Wang Q, Niu G, Gan X, Cai Q (2022) Green returns to education: Does education affect pro-environmental attitudes and behaviors in China? PLoS ONE 17(2): https://doi.org/10.1371/journal.pone.0263383