PEGEM EĞİTİM ve ÖĞRETİM DERGİSİ
PEGEM JOURNAL OF EDUCATION and INSTRUCTION
ISSN: 2146-0655

Pegem Journal of Education and Instruction, Vol. 16, No. 2 , 2026 (pp. 236-253)

Utilizing Structural Equation Modelling (SEM) to examine Students' Attitudes (SA), Environmental Knowledge (EK), and Sustainable Behaviour (SB) at the University of Calabar in Nigeria.

Offiong, Agnes Edet Asuquo, Miebaka Nabiebu Ph.D, FICMC, Itang Ede Egbung, Etim, Raphael-Effiong Okon, Anthony Godwin Bullem, Obeten, Okoi Okorn, Brown Isokon, Peter Kutjon, Undie Peter Angiagieye, Acha, Joseph Odama, Kujoh Jude Ubuh,

Environmental Education Department, University of Calabar, Calabar, Cross River State, Nigeria.
Department of Jurisprudence and International Law, University of Calabar, Calabar, Cross River State, Nigeria.
English and Literary Studies Department, University of Calabar, Calabar, Nigeria
Environmental Education Department, University of Calabar, Calabar, Cross River State, Nigeria.
Continuing Education and Development Studies Department, University of Calabar, Calabar, Cross River State, Nigeria.
Educational Management Department, University of Calabar, Calabar, Cross River State, Nigeria
Social Work Department, University of Calabar, Calabar, Nigeria, Cross River State, Nigeria
Curriculum and Teaching Department, University of Calabar, Calabar, Cross River State, Nigeria.
Department Of Guidance and Counselling, University of Calabar, Calabar. Cross River State, Nigeria
Continuing Education and Development Studies Department, University of Calabar, Calabar, Cross River State, Nigeria.
Environmental Education Department, University of Calabar, Calabar, Cross River State, Nigeria.

agnesoffiong04@gmail.com
nmiebaka@yahoo.com,
itangede@yahoo.com
theprincere@gmail.com,
anthonygbullem@gmail.com
okoi123obeten@unical.edu.ng
brownisokon76@gmail.com.
kutjonpeter@gmail.com
peterundie@unical.edu.ng
achajoseph5@gmail.com
judekujoh123@gmail.com

Offiong, Agnes Edet Asuquo
Environmental Education Department
University of Calabar, Calabar.
agnesoffiong04@gmail.com
(Corresponding Author)

PEGEM EĞİTİM ve ÖĞRETİM DERGİSİ
PEGEM JOURNAL OF EDUCATION and INSTRUCTION
ISSN: 2146-0655

Pegem Journal of Education and Instruction, Vol. 16, No. 2 , 2026 (pp. 236-253)

Abstract

In this research, Students at the University of Calabar, Nigeria, had their Attitudes, Sustainable Behavior (SB), and Environmental Knowledge (EK) examined using the Structural Equation Modeling (SEM) method. The study specific objectives were to evaluate the covariance structures of the variables, confirm that the model fit the data, and ascertain the multifaceted and relative effects of environmental knowledge on attitude and sustainable behaviors. Using the correlational survey design and stratified random sampling technique, a representative sample size of 380 was selected from the study population, which consisted of 7,284 final-year students. A standardized questionnaire was used by the researchers to collect data. Additionally, AMOS SEM was used to test the statistics. The tool was validated by two specialists from the University of Calabar's Department of Educational Measurement and Evaluation. The internal consistency reliability analysis of the research instrument yielded Cronbach Alpha results of.80,.80,.81, and.80. With a correlation of r = 0.39, the study's results indicate a favorable relationship between attitude and knowledge. The attitude and sustainable behavior have a weak and negative association, as indicated by the correlation coefficient of r = -0.24. Additionally, a weak and negative association between knowledge and sustainable behavior is indicated by the correlation coefficient (r = -0.31). The model's fit indices were within reasonable bounds. The range of the factor loads was 0.60 to 0.88. The study concluded that becoming environmentally conscious requires more than just having a good outlook; institutional support, action-oriented learning, and reinforcement strategies are essential to the necessary behavioral practice.

Keywords: Environmental knowledge, Environmental attitude, Sustainable behaviour, Structural Equation Modelling, University of Calabar.

PEGEM EĞİTİM ve ÖĞRETİM DERGİSİ
PEGEM JOURNAL OF EDUCATION and INSTRUCTION
ISSN: 2146-0655
Pegem Journal of Education and Instruction, Vol. 16, No. 2 , 2026 (pp. 236-253)

Introduction

Over the last few decades, environment destruction, climate change and unsustainable consumption have emerged as global challenges which threaten human and ecological survival. Environmental knowledge refers to how well an individual understands various concepts related to environments, including issues like pollution, depletion of resources, and climate change (Kollmuss & Agyeman, 2022). It includes the knowledge of causes and effects of environmental issues and what we could do to solve it. Studies show that the more someone knows about the environment, the more positive their thoughts will be. The presence of knowledge does not guarantee sustainable behaviour implying that other psychological and contextual factors mediate the knowledge behaviour relationship (Kaiser et al, 2019).

Environmental attitudes represent the extent to which a person is concerned about the environment and believes that he or she can do something to protect it. These include feelings and thoughts about the environment and one's work to preserve it (Milfont & Duckitt, 2020). People with a positive attitude towards the environment are likely to conserve energy, recycle, and reduce waste (Bamberg & Möser, 2020).

The concept of sustainable behaviour is defined as a deliberate action which contributes to the protection of the environment, and the conservation of resources for present and future generations (Steg & Vlek, 2019) Many of these behaviours promote reducing waste and using recyclables or renewable materials. The Knowledge-Attitude-Behaviour model states that knowledge generates attitude and attitude generates behaviour. However, empirical studies have produced mixed results across different cultures and institutions (Ajzen, 1991; Lee, 2015).

In Nigeria, Nwosu (2023) and Eneh & Eze (2021) have found that many students display moderate environmental knowledge but low levels of sustainable behaviour. It seems like what people know and what they do in reality is different. This could be due to poor environmental education. In addition, it might also be due to the lack of support of institutions and socio-economic constraints.

As institutions of knowledge creation and dissemination, universities are increasingly being recognized as strategic partners for sustainability in research, teaching, and building responsible citizens (Okonkwo & Nwankwo, 2021). The knowledge, attitudes and behaviours of students regarding their environment are key determinants in an effective transition to sustainability in society. By understanding these variables and the interplay between them, it will lead to the effective formulation of environmental education as well as sustainability policies in higher education institutions (Bamberg & Möser, 2020).

In Nigeria, environmental challenges like deforestation, flooding, waste mismanagement and pollution have become major problems especially at Urban Centres mostly Calabar. Despite the incorporation of environment-related curriculum and campaigns by the Nigerian government and educational institutions, there is uncertainty as to whether the knowledge acquired by students will translate into "environmentally-friendly" attitudes and sustainable behaviours (Eze, 2020).

Throughout the world, we have become more aware of global environmental issues. Also, Nigeria is committed to achieving Sustainable Development Goal 13 (Climate Action). However, students of tertiary institutions still engage in unsustainable behaviours. At the University of Calabar, the existence of habits of poor waste disposal, waste of energy and low involvement in environmental activities indicates a poor sustainability culture. As stated by Kaiser and Fuhrer (2015) that a weak direct path from environmental attitude to behaviour, and also Chen and Tsai (2021), that the mediation of behavioural intention. The awareness and attitude may be institutional motivation that must result in measurable sustainable outcomes (Mishra et al., 2020).

PEGEM EĞİTİM ve ÖĞRETİM DERGİSİ
PEGEM JOURNAL OF EDUCATION and INSTRUCTION
ISSN: 2146-0655
Pegem Journal of Education and Instruction, Vol. 16, No. 2 , 2026 (pp. 236-253)

Even though students may know a bit about the environment, this does not mean they have positive pro-environment attitude or will live sustainably (Eze, 2020). Previous studies have shown that environmental knowledge and attitudes are important in shaping behaviour (Kaiser & Fuhrer, 2015; Lee, 2015). However, the nature and strength of this relationship vary by context. Few studies in Nigeria.
Bamberg and Möser (2020) investigated the factors that influence pro-environmental behavior by conducting a meta-analysis of 56 papers. According to their analysis, intentions to engage in pro-environmental behaviors like recycling and energy conservation are significantly predicted by environmental knowledge and attitudes. The information and the behavior are mediated by the optimistic attitude. Similarly, Vicente-Molina, Fernández-Sainz, and Izagirre-Olaizola (2015) investigated how behavior is influenced by environmental information. According to the results, increased environmental knowledge generally results in more pro-environmental attitudes and behaviors.

Chen and Tsai (2021) and Mishra et al. (2020) stated that students with greater environmental literacy have a stronger pro-environmental attitude. Accodring to Ajzen, (1991), in the Theory of Planned Behaviour (TPB), knowledge and beliefs of individuals largely determine attitude and behavioural intention.
According to Tikka, Kuitunen, and Tynys (2020), environmental knowledge is not sufficient for pro-environmental action across the board in the absence of appropriate environmental concern, enabling conditions, and reinforcement mechanisms. Moreover, it appears that students are knowledgeable about the current environmental issues; however, knowledge alone cannot overcome habits or convenience.
A study conducted in Nigeria by Ihuoma and Udofia in 2020, examined the environmental awareness and sustainable practices of university students. It found that there was high level of awareness, however, they could only translate it into sustainable behaviour at a moderate level. They also observed that students faced infrastructural and motivational challenges in Nigeria. According to Yusoff and Samah (2018), use of SEM method in Malaysia to see the relationship between knowledge attitude and behaviour among students showed that attitude significantly mediates relationship between knowledge and behaviour. Okorie and Adetayo (2022) reported that students of Nigerian tertiary institutions adopt green practices as a result of Environmental Education programmes.

Based on these empirical evidences, it is observed that environmental knowledge, attitude and sustainable behaviour are interrelated variables and their relationship can further be analysed through Structural Equation Modelling (SEM). Using SEM, the researcher test both direct and indirect effects, thus, allowing for an all-encompassing understanding of the structures among the postgraduate students of the University of Calabar. So, the study practically analysed the links between environmental knowledge, attitudes, and sustainable behaviour of the students of University of Calabar, Nigeria using advanced multivariate techniques such as Structural Equation Modelling (SEM), which allows for analysis of direct and indirect effects among variables. The aim was to see if environmental knowledge is significant in predicting attitudes and in turn attitudes towards sustainable behaviours.

Purpose of the Study

The primary purpose of this study is to utilize a Structural Equation Modelling (SEM) to examine Students' Attitudes (SA), Environmental Knowledge (EK), and Sustainable Behaviour (SB) at the University of Calabar in Nigeria.
The study specifically aimed to:
1. Assess the degree of environmental knowledge among University of Calabar students.
2. Evaluate the attitudes of the students about the environment.
3. Assess the degree of sustainable environmentally conscious behavior exhibited by students.

PEGEM EĞİTİM ve ÖĞRETİM DERGİSİ
PEGEM JOURNAL OF EDUCATION and INSTRUCTION
ISSN: 2146-0655
Pegem Journal of Education and Instruction, Vol. 16, No. 2 , 2026 (pp. 236-253)

Research questions

The following research questions served as a guide for the study in order to accomplish these goals:

1. To what extent do University of Calabar students have knowledge about the environment?
2. What attitudes do students have about the environment?
3. How much do students practice environmentally sustainable behaviors?

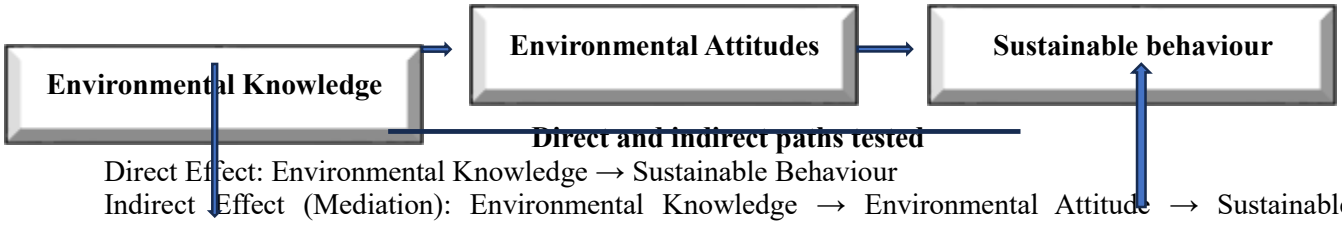
Hypotheses for Research

To direct the investigation, the following null hypotheses were developed:

H_1: Students' sustainable behavior is significantly impacted by their environmental knowledge and attitudes, both partially and compositely.

H_0: Students' sustainable behavior is not significantly impacted by their environmental knowledge or attitudes, either partially and compositely.

Conceptual framework



Direct Effect: Environmental Knowledge → Sustainable Behaviour

Indirect Effect (Mediation): Environmental Knowledge → Environmental Attitude → Sustainable Behaviour. This model allowed the researcher to test the strength and significance of these paths simultaneously.

Theoretical framework

This study rests on the shoulders of the Theory of Planned Behaviour (TPB) by Ajzen (1991). According to Ajzen (1991), human behaviour is guided by three core determinants:

- Attitude toward the behaviour (the degree to which a person has a favourable or unfavourable evaluation of a behaviour),
- Subjective norms (social pressure or expectations from others regarding that behaviour), and
- Perceived behavioural control is the perceived ease or difficulty of performing the behaviour, which reflects past experience and anticipated barriers.

The theory explains that these three factors together create one's behavioural intention which then predicts actual behaviour. According to the research, knowledge impacts the attitude of people. Students who understand environmental issues are more likely to develop a positive cognition towards it. Also, attitudes influence Sustainable Behaviour. A student who values the environment is likely to recycle more often, be more energy efficient, and engage in green behaviours. Perceived behavioural control is students' ability and opportunity to behave sustainably in the university setting (for example, accessing recycling bins, environmental clubs, or clean environments). The TPB links knowledge, attitude and behaviour in a way that is structurally similar to the relationships examined in this paper through Structural Equation Modelling (SEM).

PEGEM EĞİTİM ve ÖĞRETİM DERGİSİ
PEGEM JOURNAL OF EDUCATION and INSTRUCTION
ISSN: 2146-0655
Pegem Journal of Education and Instruction, Vol. 16, No. 2 , 2026 (pp. 236-253)

METHODOLOGY

Research design

The correlational survey study design was used by the researchers. Since it enables the researcher to ascertain the correlations between variables, specifically, Environmental Knowledge, Environmental Attitudes, and Sustainable Behavior without changing any of the variables, the design is considered acceptable. Correlational investigations are useful for determining the direction and strength of correlations between dimensions in real-world contexts (Creswell & Creswell, 20185).

The study uses structural equation modeling, or SEM, as an analytical method to assess the variables' direct and indirect correlations. SEM was chosen because it is a powerful method for assessing the proposed structural links among the study's latent dimensions because it integrates factor analysis and multiple regression (Byrne, 2016).

Participants

In this research, final-year University of Calabar students for the 2024–2025 academic year make up the study's target population. The Academic Planning Unit (2025) of the institution reports that 7,284 final-year students are enrolled in several faculties. These students were deemed appropriate because of their extensive university education, which increased their likelihood of exposure to environmental education initiatives and, as a result, their likelihood of offering well-informed answers to the study's variables. Using Taro Yamane's (1973) technique for calculating sample size from a finite population, 380 students were chosen as a sample from the 7,284 total population:

$$n = \frac{N}{1 + N\,(e)^2}$$

Where:

n= sample size

N= population size (7,284)

e= margin of error (0.05)

$$n = \frac{7284}{1 + 7284(0.05)^2} = \frac{7284}{19.21} = 379.2 \approx 380$$

As a result, the study included 380 respondents as the sample size. The stratified random sampling technique was adopted. The university was stratified by faculty, and proportional allocation was used for fair representation. To participate in the study, from each faculty participants were randomly selected from class lists.

Variables of the Study

The study consisted of three main variables.

1. Environmental Knowledge which means a student understanding of environment concepts, problems and solutions.
2. The Environmental Attitude has to do with the students' feelings about the environment.
3. The term Sustainable Behaviour is the dependent variable which refers to student's acts and practices.

The Structural Equation Modelling (SEM) was used to assess the relationship among the variable and its direct and indirect (mediating) effect.

Instrumentation

A questionnaire entitled: Environmental Knowledge; Attitude and Sustainable Behaviour Questionnaire (EKASBQ) was the data collection instrument. The instrument consisted of four sections (A–D). In Section

A: Demographic profile (Gender, faculty, level). Some items in Section B fall under Environmental Knowledge, which is adapted from Kaiser and Fuhrer (2003). The items were measured on a four-point Likert scale that ranged from (5) strongly agree to (1) strongly disagree.

The items in section C were taken from Environmental Attitude Inventory developed by Milfont and Duckitt (2010). It consists of eight (8) statements that were rated on the same 4-point scale. Section D, meanwhile, contains items measuring Sustainable Behaviour. These are adapted from Kaiser, Wölfing, and Fuhrer (1999). It contains nine (9) items as well that captured recycling, energy conservation, and waste management behaviours. The questionnaire contained a total of 26 items that were designed to measure the students' self-reported knowledge, attitudes, and behaviours towards environmental sustainability.

To verify the instrument's content validity, two experts in educational measurement and evaluation from the University of Calabar reviewed the instrument's draft. These professionals verified that the questionnaire's items were unambiguous and free of double-barrelled or ambiguous language. Items that were dysfunctional or did not fit the criteria for clarity, unambiguity, vagueness, etc. were changed or removed in order to provide improvement. To evaluate the construct validity of the instrument using preliminary data, the researchers conducted Exploratory Factor Analysis (EFA) on a sample of respondents. The purpose of the analysis was to determine the items' factor structure and to reject or identify items that did not suit the different sub-scales. A Confirmatory Factor Analysis was conducted by the researchers. This was done in order to verify the EFA's findings. Additionally, the models used in this study were compared to other models. These models are predicated on acceptance standards. The Cronbach Alpha approach was used to estimate the instrument's internal consistency and dependability. The instrument's overall dependability coefficients as well as those of its many sub-scales are displayed in Table 1.

Method of Data Collection

The researcher and two trained research assistants asked the questions directly to collect the data. The heads of departments were granted permission, and respondents were assured of anonymity and voluntary nature of participation. Only those who were willing to participate in the study filled out the survey. The completed questionnaires were retrieved straight after filling to have high response rates.

Ethical Considerations

The researchers sought and obtained approval from the research and ethics committee of the University of Calabar, to execute the study. Those who responded to the feedback, were told about the aims of the study. They were reassured that participation was voluntary. Moreover, it was also mentioned that their answers would remain confidential. All participated in the study willingly. Participants could leave the study at any point for free. No identifying information was collected during the study.

Method of Data Analysis

To evaluate the data, find answers to the questions, and test the null hypotheses, the researchers employed structural equation modeling and descriptive statistics. Version 23 of the Amos graphics program was used to create the structural equation model, and SPSS software was used for the study's analysis.

RESULTS

Exploratory Factor Analysis (EFA)

Before carrying out the Exploratory Factor Analysis (EFA), researchers must determine whether the sample of data that was gathered is sufficiently large to be subjected to factor analysis. The KMO met sample adequacy criteria for this. Our use of factor analysis on our sample was justified by the high KMO score

PEGEM EĞİTİM ve ÖĞRETİM DERGİSİ
PEGEM JOURNAL OF EDUCATION and INSTRUCTION
ISSN: 2146-0655
Pegem Journal of Education and Instruction, Vol. 16, No. 2 , 2026 (pp. 236-253)

of.85. With a Chi-square value of 328.45, the Bartlett's test of sphericity was significant at 167 degrees of freedom. It indicates that there is no redundancy among the variables and that the observed correlation matrix differs from the identity matrix, which qualifies it for use with the data reduction approach (PAF). It was demonstrated that there was no multicollinearity among the variables since the correlation matrix's determinant (.001) was higher than the criteria value (0.00002).

After determining that the dataset satisfied the necessary presumptions for factor analysis, the Exploratory Factor Analysis (EFA) was carried out using Promax rotation to examine the correlation matrix based on Eigenvalues greater than 1 and Principal Axis Factoring (PAF) as the extraction method.
Following 25 iterations of this study, it was found that four components together accounted for 51.11% of the variation, which is less than the allowed requirement of 60%. Nevertheless, after looking at the pattern and structure matrices, it was found that eight (8) of the 26 items—designated as items 3, 7, 11, 12, 17, 22, and 23—did not load to any of the factors. As a result, they were removed from the analysis. Three factors with Eigenvalues greater than one were found after the items were removed and reanalyzed. Their total variance explained was 65.11%, which is higher than the allowed lower bound of 60%. In particular, the variation was explained by Factor 1 (24.01%) with an Eigenvalue of 3.64, Factor 2 (2.33%) with an Eigenvalue of 3.67, and Factor 3 (21.04%) with an Eigenvalue of 3.30. Apart from these three, the Eigenvalues of the other factors from factor 4 and lower did not meet the cut-off of more than 1 (see the scree plot in Figure 1).

PEGEM EĞİTİM ve ÖĞRETİM DERGİSİ
PEGEM JOURNAL OF EDUCATION and INSTRUCTION
ISSN: 2146-0655
Pegem Journal of Education and Instruction, Vol. 16, No. 2 , 2026 (pp. 236-253)

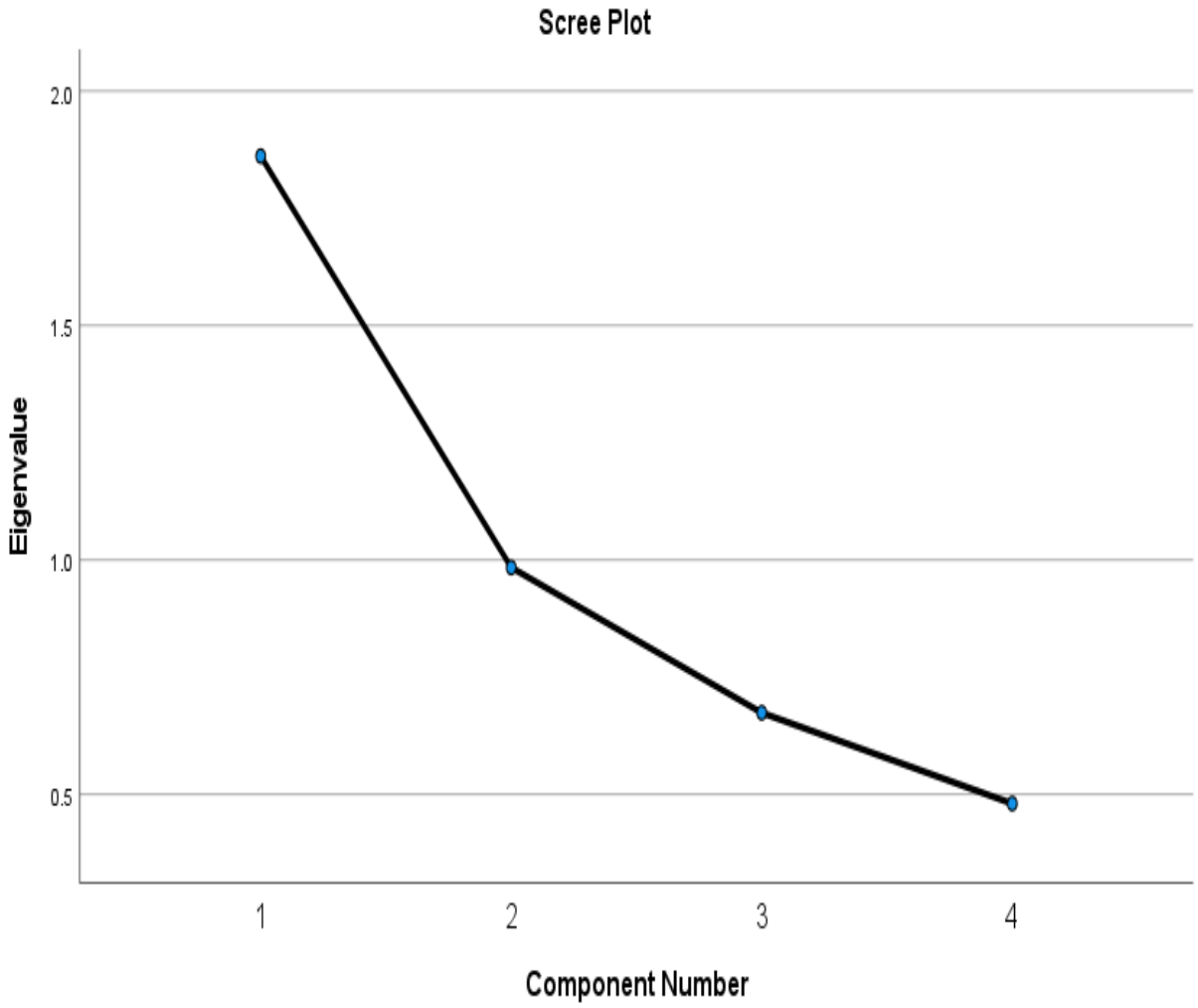


FIG 1: Scree plot showing the number of factors and their Eigenvalues

Following the retention of three factors, each variable's loading on the relevant factors was examined for loadings below the allowed minimum of.40. All of the variable loadings were high (more than.40) to their respective factors, according to the analysis. The top elements in each cluster were examined in order to identify the clusters. The first criteria was thus called "Environmental Knowledge." Likewise, "Environmental attitude" was the label given to the second factor. Similarly, "Sustainable behavior" was the label given to the third factor. See above Table 1. The Cronbach Alpha measure of internal consistency was then used by the researchers to assess the scales' and the instrument's overall dependability. All of the components, including the instrument's overall coefficient, had reliability coefficients of.80,.80,.81, and.80 (see Table 1).

Table 1:

Factor	Items	$\bar{X}$	SD	Factor loadings	α	% of explained S^2
1					.80	18.09
	Item1	1.78	.99	.78		
	Item2	1.01	.98	.67		

PEGEM EĞİTİM ve ÖĞRETİM DERGİSİ
PEGEM JOURNAL OF EDUCATION and INSTRUCTION
ISSN: 2146-0655
Pegem Journal of Education and Instruction, Vol. 16, No. 2 , 2026 (pp. 236-253)

	Item4	2.01	1.11	.89		
	Item5	2.56	.79	.66		
	Item6	1.89	.88	.78		
	Item8	1.88	.76	.69		
	Item9	2.01	1.00	.88		
2					.80	20.06
	Item 10	2.22	1.19	.67		
	Item 13	2.29	.99	.67		
	Item 14	1.88	.99	.69		
	Item 15	1.04	1.01	.77		
	Item 16	1.90	.89	.73		
3					.81	22.22
	Item 18	1.18	1.11	.61		
	Item 19	2.22	1.11	.69		
	Item 20	2.56	1.01	.66		
	Item 21	2.76	.79	.71		
	Item 24	2.75	.68	.65		
	Item 25	2.77	1.00	.63		
	Item 26	2.89	.96	.72		
	Kaiser-Meyer-Olkin (KMO)				.80	60.15
	Bartlett's Test of Sphericity				11129.54	
	Df				167	

Extraction Method: Principal Axis Factoring.
Rotation Method: Promax with Kaiser Normalization.
a. Rotation converged in 4 iterations.
b.

Confirmatory Factor Analysis (CFA)

The purpose of the CFA was to evaluate the variables' ability to measure the corresponding factors (constructs). Hypothesized models were based on theoretical models in order to evaluate their viability. The correlations between observable (indicator) variables and their assumed constructs that were proposed by EFA were verified using the CFA. The study's CFA measuring model is displayed to us in Figure 2. The CFA factor loadings are identical or almost identical to those obtained from the EFA, as seen in Figure 2. In order to assess the acceptability of the CFA model, a number of fit indices were used.

Since the fit indices offer comparable advantages and disadvantages, the study's model was evaluated using a variety of fit indices. At 167 degrees of freedom, the chi-square index of 328.45 was significant, which generally indicates that the fitted correlation matrix and the sample do not match. However, given the huge sample size of the study, the model's outcome is not surprising because the Chi-square is sensitive to sample sizes. The model takes into consideration the population covariance of.93 with GFI and.96 with AGFI. According to the Normed Fit Index (NFI), Relative Fit Index (RFI), Incremental Fit Index (IFI), and Tucker Lewis Index, the corresponding values were.93,.96,.95, and.95. This indicates that the excess fit of the theoretical model is improved by 95% as a result of the model portion of this study. This study also uses the Root Mean Square Error of Approximation (RMSEA) as a key metric to evaluate the model. This indicator is used to determine the sample model's distance from a theoretical or population model. The

PEGEM EĞİTİM ve ÖĞRETİM DERGİSİ
PEGEM JOURNAL OF EDUCATION and INSTRUCTION
ISSN: 2146-0655
Pegem Journal of Education and Instruction, Vol. 16, No. 2 , 2026 (pp. 236-253)

study's model is fairly good, as evidenced by the.039 that was produced inside the study design. As a result, the model for these proof structures was approved for use in this investigation.

The model demonstrates that human activity significantly contributes to climate change (item 1 [β =.79, t = 51.03, p <.000]), that it is important to conserve natural resources, such as water and energy (item 2 [β =.76, t = 51.66, p <.01]), that uncleaning trash contributes to environmental pollution (item 4 [β =.41, t = 55.32, p <.01]), that understanding sustainable development is important, and that excessive use of plastic affects the safety of the environment. In response to the sixth question, who thinks that understanding how renewable energy sources help lessen environmental issues? The term "forest degradation" describes the deterioration of the physical and biological features of forests and forest lands, which may render them unfit for their intended forest activities. In contrast to deforestation, it is sometimes known as "forest degradation."

Furthermore, everyone of us has a personal obligation to safeguard the environment (item 10 [β =.61, t = 48.90, p <.01]). When people litter and pollute the environment, we become concerned (item 13 [β =.73, t = 52.09, p <.01]). Every university program should include environmental education (item 14 [β =.65, t = 55.48, p <.01]). We agree with the laws and regulations put in place by the government to safeguard the environment. Based on the results, it is evident that engaging in environmentally friendly activities (item 15 [β =.59, t = 46.87, p <.01]), feeling inspired to engage in environmentally friendly activities (item 16 [β =.65, t = 57.02, p <.01]), and having positive environmental attitudes are all possible.

In addition, it was also proven that shutting off electrical objects while not in use (item 18 [β = .67, t = 57.78, p < .01]), appropriately sorting and disposing of solid wastes materials on campus. Reusable items (such as bottles and bags) should be used instead of disposable ones, according to item 19 (where β =.59, t = 48.89, and p <.01).
The researchers observe that important components of environmental behavior include taking part in campus events that support environmental cleanliness (item 21 [β =.54, t = 41.09, p <.01]), conserving water whenever possible in my daily routine (item 24 [β =.54, t = 34.34, p <.01]), choosing to purchase environmentally friendly products (item 25 [β =.65, t = 43.98, p <.01]), and choosing to purchase environmentally recyclable products (item 26 [β =.65, t = 40.87, p <.01]). However, the extent to which University of Calabar students have adapted to these environmental factors is still unknown. Better insights will be obtained by attempting to address the research questions and test the previously developed null hypotheses.

Environmental Knowledge
The mean rating and standard deviation of respondents' perceptions of environmental knowledge were evaluated in order to look into the degree of environmental knowledge held by University of Calabar students. Overall, students' environmental knowledge is graded with a mean score of 2.14, which is lower than the projected average extent of 2.50, according to the results in Table 2. To put it another way, University of Calabar students had very little environmental understanding.

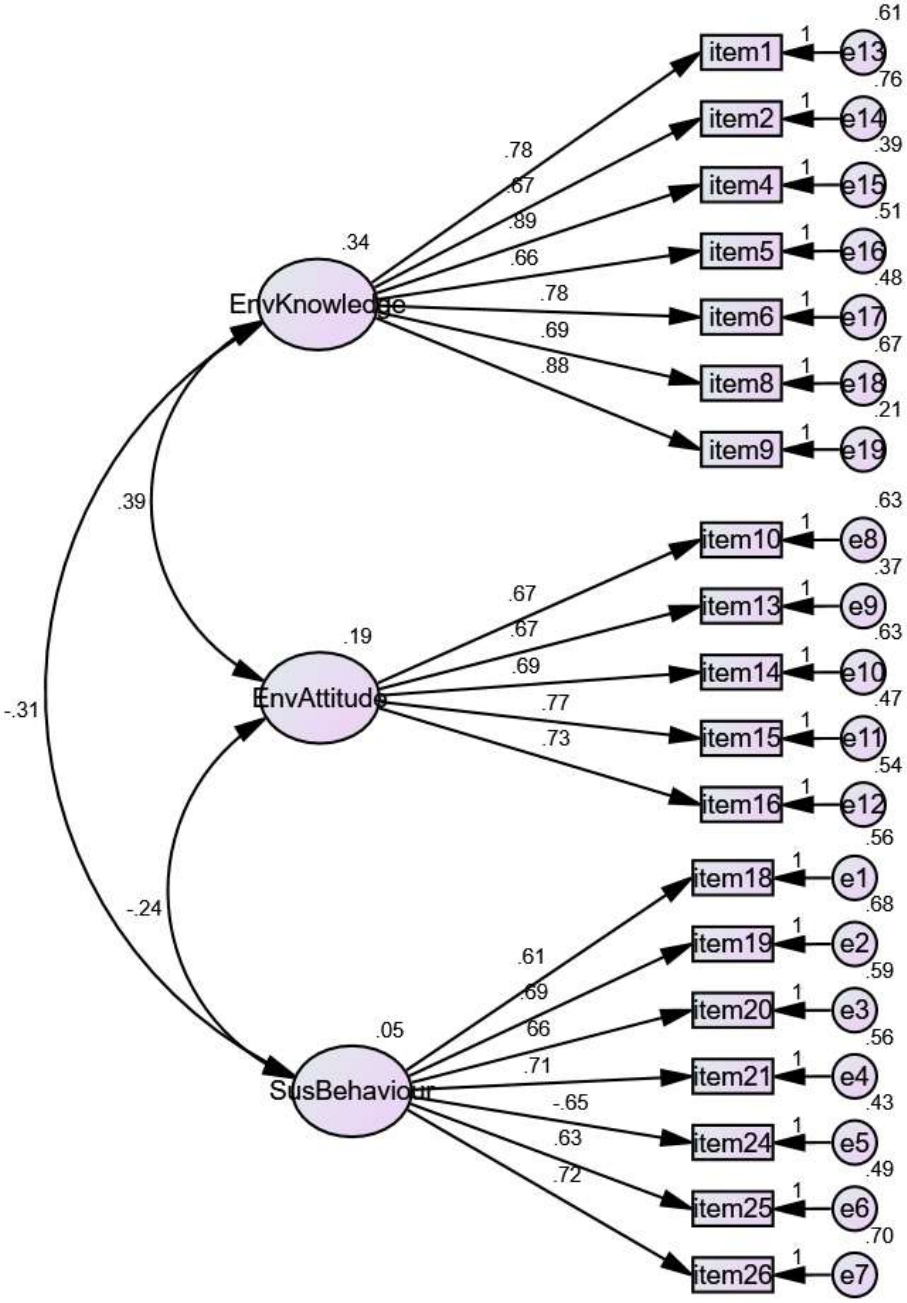
Table 2: Mean rating and standard deviation showing the environmental knowledge of students in the university of Calabar

Items	Sum	Mean	SD	Variance	Skewness	Kurtosis
1	5321	2.68	1.19	1.28	0.07	-1.43
2	5546	2.43	1.16	1.34	0.04	-1.31
4	5232	2.55	1.06	1.52	0.01	-1.56

PEGEM EĞİTİM ve ÖĞRETİM DERGİSİ
PEGEM JOURNAL OF EDUCATION and INSTRUCTION
ISSN: 2146-0655
Pegem Journal of Education and Instruction, Vol. 16, No. 2 , 2026 (pp. 236-253)

5	5517	3.09	1.07	1.76	0.01	-1.33
6	5534	3.34	1.09	1.64	0.65	-1.34
8	5589	2.54	1.18	1.98	0.71	-1.33
9	5185	2.61	1.15	1.69	0.45	-1.32
Average	**4213.8**	**2.14**	**0.88**	**1.25**	**0.22**	**1.07**

PEGEM EĞİTİM ve ÖĞRETİM DERGİSİ
PEGEM JOURNAL OF EDUCATION and INSTRUCTION
ISSN: 2146-0655
Pegem Journal of Education and Instruction, Vol. 16, No. 2 , 2026 (pp. 236-253)



PEGEM EĞİTİM ve ÖĞRETİM DERGİSİ
PEGEM JOURNAL OF EDUCATION and INSTRUCTION
ISSN: 2146-0655
Pegem Journal of Education and Instruction, Vol. 16, No. 2 , 2026 (pp. 236-253)

Figure 2. Measurement model of Environmental Knowledge → Environmental Attitude → Sustainable Behaviour.

Environmental attitude

To find out the level of environmental attitude of University of Calabar students, the mean rating and standard deviation of the perception of respondents on environmental attitude was checked. Table 3 shows that on the average, the respondents' level of environmental attitude was rated 3.25 which is moderately influential, therefore above the expected average extent of 2.50. Environmental attitude among students of the University of Calabar was significantly high and positive.

Table 3: Mean rating and standard deviation showing the environmental attitudes of students in the university of calabar

Items	Sum	Mean	SD	Variance	Skewness	Kurtosis
10	5223	2.89	1.11	1.18	0.34	-1.33
13	5332	3.97	.98	1.23	0.47	-1.32
14	5339	3.97	1.54	1.26	-0.56	-1.32
15	5212	3.01	.76	1.28	0.79	-1.34
16	5343	2.41	1.31	1.38	-0.69	-1.32
Average	**5289.8**	**3.25**	**1.14**	**1.27**	**0.57**	**1.33**

PEGEM EĞİTİM ve ÖĞRETİM DERGİSİ
PEGEM JOURNAL OF EDUCATION and INSTRUCTION
ISSN: 2146-0655
Pegem Journal of Education and Instruction, Vol. 16, No. 2 , 2026 (pp. 236-253)

In order to ascertain the extent to which students at the University of Calabar engage in sustainable environmental behaviors, the study evaluated the mean rating and standard deviation of respondents' perceptions of sustainable behavior. According to the results in Table 4, students' average rating of their involvement in sustainable environmental behaviors is 3.34, which is higher than the projected average extent of 2.50. This indicates that pupils exhibit a high degree of sustainable environmental behavior.

Table 4: Mean rating and standard deviation showing the sustainable behaviour of students in the university of Calabar

Test of hypothesis

The alternative hypothesis proposes that students' environmental knowledge and attitudes significantly affect their environmentally-friendly behaviours, while the null hypothesis asserts that these variables have no meaningful impact on such behaviours among students.

The regression weights (0.34, 0.19, 0.05) indicate how much variance in each latent construct we are able to explain and how much not. For example, Environmental Knowledge ($R^2 = 0.34$) accounts for 34% of its variance, Environmental Attitude accounts for 19%, while Sustainable Behaviour only accounts for 5%.

Items	Sum	Mean	SD	Variance	Skewness	Kurtosis
18	5221	3.56	1.21	1.32	0.03	-1.35
19	5532	2.19	1.16	1.11	-0.24	-1.34
20	5342	3.88	1.32	1.34	-0.32	-1.33
21	5544	3.92	.99	1.32	0.34	-1.33
24	5312	2.19	1.81	1.34	0.34	-1.35
25	5232	3.75	1.18	1.34	0.31	-1.35
26	5324	3.89	1.65	1.35	-0.31	-1.32
Average	**5358**	**3.34**	**1.33**	**1.30**	**0.27**	**1.15**

The results indicate that while the model captures a significant amount of the variance for knowledge, it captures much less for behaviour. This suggests that some outside force (e.g., institutional policy, peer behaviour, access to sustainable resources, etc.) may help explain sustainable behaviour.

The results of SEM findings show that Environmental Knowledge has a strong prediction towards Environmental Attitude but weak prediction towards Sustainable Behaviour. Environmental attitude is related to Sustainable Behaviour at a very low level. This shows that knowledge and positive attitude do not always change behaviour. The results reveal a mismatch between poor environmental practices and high statements concerning their behavior and willingness to engage in sustainable actions. They urge the need for effective environmental education programmes. The model backs the theory that environmental knowledge and attitude are linked, but they don't necessarily contribute to sustainable behaviour.

Discussion of the findings

Influence of Environmental Knowledge on Environmental Attitude

The results showed that the environmental knowledge of students is positively and moderately correlated with their environmental attitude ($r = 0.39$). The chances are that students with higher knowledge regarding environment issues develop a better attitude towards environmental sustainability. The findings are consistent with the position of Ajzen, (1991), in the Theory of Planned Behaviour (TPB) that the knowledge and beliefs of individuals largely determine attitude and behavioural intention. This also supports Chen and Tsai (2021) and Mishra et al. (2020) who find that students with greater environmental literacy have a stronger pro-environmental attitude.

PEGEM EĞİTİM ve ÖĞRETİM DERGİSİ
PEGEM JOURNAL OF EDUCATION and INSTRUCTION
ISSN: 2146-0655
Pegem Journal of Education and Instruction, Vol. 16, No. 2 , 2026 (pp. 236-253)

This study may have conditioned students' understanding of ecological problems such as pollution, waste disposal, and climate change in favour of environmental protection. Nevertheless, the strong association between knowledge and attitudes suggests that knowledge is not the only driver of attitudes, in that cultural, social and institutional factors are also responsible for change.

Relationship between Environmental Attitude and Sustainable Behaviour

Negative environmental knowledge had a weak negative correlation with sustainable behaviour (r = -0.31). More environmental knowledge does not translate into more eco-friendly behaviour among the students. The result corroborates with Tikka, Kuitunen, and Tynys (2020), who remark that environmental knowledge is not sufficient for pro-environmental action across the board in the absence of appropriate environmental concern, enabling conditions, and reinforcement mechanisms. Moreover, it appears that students are knowledgeable about the current environmental issues; however, knowledge alone cannot overcome habits or convenience.

In terms of University of Calabar, this parallax could be a reflection of the institutional framework of driving sustainability. For example, students may learn about waste segregation, but if there are no waste bins or campaigns no real change will take place.

Overall Model Fit and Construct Validity

All indicator factor loadings marked beyond 0.60 in value, confirm the construct reliability and convergent validity (Hair et al. 2021). The model showed acceptable relationships between constructs and validated its theory. But, the low explained variance shown for sustainable behaviour (R2 = 0.05) indicates that perceived behavioural control, peer influence, institutional policy or other may have a significant prediction towards sustainable behaviour of the students. This supports the extended Theory of Planned Behaviour (Ajzen, 1991), which specifies perceived behavioural control as a mediating variable related to the transformation of attitude and knowledge into action.

The findings of the present study corroborate those of Kaiser and Fuhrer (2015), who found a weak direct path from environmental attitude to behaviour, and Chen and Tsai (2021), who pointed out the mediation of behavioural intention. The awareness and attitude may be institutional motivation that must result in measurable sustainable outcomes (Mishra et al., 2020). The present research advances the evidence base that promoting environmental knowledge and attitude alone is insufficient. What is needed is an environment and behavioural reinforcement systems that make sustainable choices easy and rewarding.

Conclusion

The study indicates that having environmental knowledge, especially in environmental education, gives rise to environmentally responsible behaviour in students. The results are a clear attitude–behaviour gap. In particular, awareness and concern must be supported by institutional rules, peer influence and opportunities for physical involvement. Sustainability will remain an academic theory unless universities put it into practice. They can do this by using learning by doing, environmental incentives, and environmental programs. The findings highlight the potential of integrating cognitive, affective, and contextual elements to create a generation of environmentally responsible graduates to promote the United Nations' Sustainable Development Goals in both academic and non-academic settings.

Limitations of the study

The outcome of the research were useful and valuable, however, there were limitations of the study that need to be highlighted. The research had a cross-sectional survey design which collects data at one point in time. Environmental knowledge or attitudes do not delineate the causes sustainable behaviour, and vice versa. Longitudinal studies would be required for studying changes in these constructs over time.

PEGEM EĞİTİM ve ÖĞRETİM DERGİSİ
PEGEM JOURNAL OF EDUCATION and INSTRUCTION
ISSN: 2146-0655
Pegem Journal of Education and Instruction, Vol. 16, No. 2 , 2026 (pp. 236-253)

Researchers obtained data via questionnaires that rely on the respondents' truthfulness/accuracy. It is possible that some students may have overstated their environmental attitudes or behaviours. Thus, social desirability bias might have been introduced. The samples of final year students in all faculties of University of Calabar who responded to the study. As a result, students in other Nigerian universities may not truly represent the study because of their exposure to the environment, curricula and other socio-economic features.

The researchers used perceived indicators instead of actual indicators to measure variables environment knowledge, attitude, and sustainable behaviour. The measurement of actual practices may have lacked precision. The SEM contained only three latent variables. If not for other confounding factors, it may have been easier to arrive at a conclusion. These confounding factors include institutional culture, access to environmental education resources, and others.

The study took place in a university in Southern Nigeria, where, compared with other places, there could be differences in policies, environmental infrastructure and awareness campaign. Thus, cultural and policy differences can cause behaviour to change from context to context. The limitations show that the study reveals certain aspects of environmental knowledge, environmental attitude, and sustainable behaviour. Further research needs to be more mixed-methods in design involving longitudinal operations with wider and more comprehensive samples from several universities.

Implications of the study

Sustainability education should be a part of all levels of the university curriculum. Integrating experiential learning, institution-wide green policies and incentives for eco-friendly actions shall be promoted. We engage in a diversity of things often because of the nature of things. Establishing recycling initiatives, saving-electro projects and environmental clubs would convert the attitudes of the students into habits.

The weak direct relationships found suggest that further research is needed on mediating and moderating variables, including perceived behavioural control, environmental concern, social norms, and institutional factors. Future models may also assess multi-group SEM comparisons for gender, discipline or age.

Recommendation

This study laid down some recommendations that;

1. The University of Calabar and the other institutions of higher learning should incorporate environmental education into all the courses offered for the establishment of culture.
2. Students should be involved in environmental activities such as clean-up campaigns, tree planting, recycling projects, and community-based sustainability initiatives to reinforce pro-environmental behaviour.
3. University authorities should develop and enforce campus-wide policies that encourage sustainable practices such as waste sorting, reduced plastic use, and energy conservation.
4. Sustainability awards, peer-led campaigns, and incentives should be used to encourage students to act in environmentally responsible ways.
5. Universities should monitor and evaluate students' environmental behaviour periodically to track progress and inform continuous improvement of environmental programs.

References

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

Bamberg, S., & Möser, G. (2020). Twenty years after Hines, Hungerford, and Tomera: A new meta-analysis of psycho-social determinants of pro-environmental behavior. *Journal of Environmental Psychology, 27*(1), 14–25.

PEGEM EĞİTİM ve ÖĞRETİM DERGİSİ
PEGEM JOURNAL OF EDUCATION and INSTRUCTION
ISSN: 2146-0655
Pegem Journal of Education and Instruction, Vol. 16, No. 2 , 2026 (pp. 236-253)

Chen, X., & Tsai, C. (2021). Environmental literacy and pro-environmental behaviours among university students: The mediating role of environmental attitudes. *Environmental Education Research*, 27(4), 565–580.

Eneh, A., & Eze, C. (2021). Environmental awareness and sustainability practices among Nigerian university students. *African Journal of Education and Development Studies*, *18*(3), 64–78.

Eze, C. (2020). Environmental knowledge and students' attitudes towards waste management in universities of South-South Nigeria. *Nigerian Journal of Environmental Education*, *11*(2), 44–58.

Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2021). *Multivariate Data Analysis* (8th ed.). Cengage Learning.

Ihuoma, C. & Udofia, I. (2020). Environmental awareness and sustainable practices among undergraduates in Nigerian universities. *Nigerian Journal of Educational Research and Development, 15*(1), 85–98.

Kaiser, F. G., & Fuhrer, U. (2015). Ecological behavior's dependency on different forms of knowledge. *Applied Psychology, 52*(4), 598–613.

Kollmuss, A., & Agyeman, J. (2022). Mind the gap: Why do people act environmentally and what are the barriers to pro-environmental behavior? *Environmental Education Research, 8*(3), 239–260.

Lee, K. (2014). The green purchase behavior of Hong Kong young consumers: The role of peer influence, local environmental involvement, and environmental knowledge. *Journal of International Consumer Marketing*, *23*(1), 21–44.

Milfont, T. L., & Duckitt, J. (2020). The environmental attitudes inventory: A valid and reliable measure to assess the structure of environmental attitudes. *Journal of Environmental Psychology, 30*(1), 80–94.

Mishra, S., Akman, I., & Mishra, P. (2020). Understanding green behavior among university students: A structural equation modeling approach. *Sustainability*, 12(11), 4474.

Nwosu, O. (2023). Environmental education and students' sustainable behavior in Nigerian universities: Challenges and prospects. *International Journal of Environmental Research and Public Health*, *20*(2), 1123–1137.

Okonkwo, I., & Nwankwo, C. (2021). University students' environmental attitudes and behaviors: Implications for environmental sustainability in Nigeria. *Journal of Educational Research and Development*, *16*(1), 55–68.

Okorie, T., & Adetayo, M. (2022). Environmental education and green behavioral intentions among Nigerian university students. *African Journal of Sustainable Development, 9*(2), 44–58.

Steg, L., & Vlek, C. (2019). Encouraging pro-environmental behavior: An integrative review and research agenda. *Journal of Environmental Psychology, 29*(3), 309–317.

Tikka, P. M., Kuitunen, M. T., & Tynys, S. M. (2020). Effects of educational background on students' attitudes, activity levels, and knowledge concerning the environment. *Journal of Environmental Education*, 31(3), 12–19.

Vicente-Molina, M. A., Fernández-Sainz, A., & Izagirre-Olaizola, J. (2015). Environmental knowledge and other variables affecting pro-environmental behavior: Comparison of university students from emerging and advanced countries. *Journal of Cleaner Production, 61*, 130–138.

Yusoff, N., & Samah, B. (2018). Examining the mediating role of attitude in the relationship between environmental knowledge and sustainable behavior among university students. *International Journal of Sustainability in Higher Education, 19*(4), 772–785.