INTEGRATING INDIGENOUS ECOLOGICAL KNOWLEDGE (IEK) IN ENVIRONMENTAL ACCOUNTING EDUCATION: EFFECTS ON SUSTAINABILITY COMPETENCIES AND SDG 4 & SDG 13 AWARENESS AMONG NIGERIAN UNDERGRADUATES

Olugbenga Solomon Agboola
College of Accounting Sciences
University of South Africa
agbooos@unisa.ac.za

Moses Thabang Hlongoane
College of Accounting Sciences
University of South Africa
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Abstract
This study examines the effect of integrating Indigenous Ecological Knowledge (IEK) into environmental accounting education on sustainability competencies and awareness of SDG 4 and SDG 13 among Nigerian undergraduates, addressing the need for culturally contextualised sustainability education. Building on the literature on sustainability education, the study explores how embedding indigenous perspectives within accounting curricula advances sustainability-oriented learning and competency development. A quantitative cross-sectional survey was administered to 534 undergraduate students across Nigerian universities. Data were analysed using descriptive statistics, reliability tests, simple linear regression, and Hayes' PROCESS Macro Model 4 for mediation analysis. The results show that IEK integration is positively related to sustainability competencies ($\beta = .994$, $B = .981$, $SE = .005$, $p < .001$), SDG 4 awareness ($\beta = .991$, $B = .970$, $SE = .006$, $p < .001$), and SDG 13 awareness ($\beta = .982$, $B = .979$, $SE = .009$, $p < .001$). Mediation analyses demonstrate that sustainability competencies partially mediate the relationship between IEK integration and SDG 4 awareness (indirect effect = .1100, BootSE = .0520, 95% BootCI; direct effect = .8604, $p < .001$), while an inconsistent mediation pattern emerges for SDG 13 awareness (indirect effect = 1.4503, BootSE = .0600, 95% BootCI; direct effect = −.4712, $p < .001$). The findings provide actionable insights for university administrators, educators, and curriculum developers seeking to enhance culturally relevant sustainability education and advance the SDGs in higher education. This study contributes original empirical evidence from a developing-country context, demonstrating how indigenous ecological perspectives directly and indirectly strengthen student competencies and awareness of global sustainability goals within environmental accounting education.

Keywords: Accounting education, climate action, quality education, sustainability competencies.

JEL Classification: I21, M41, Q01 and Q56

1.0 Introduction

Integrating Indigenous Ecological Knowledge into environmental accounting education has emerged as a vital pathway for addressing pressing environmental challenges while aligning accounting practices with sustainable development goals. There is an increasing global urgency regarding environmental degradation and climate change, which has led to an intensified call for a holistic and transformative change in global educational systems capable of fostering sustainabilityoriented knowledge, skills and values into the scheme of learning. As human and industrial activities globally mount continuous pressure on natural ecosystems, the resulting degradation and alteration of the natural order have prompted higher education institutions to assume a pivotal role in advancing the Sustainable Development Goals (SDGs), particularly SDG 4 (Quality Education) and SDG 13 (Climate Action) (Meena&Jha, 2023; Muluneh, 2021). Within this context, environmental accounting education (EAE) serves as a specialized, interdisciplinary

branch of accounting that incorporates environmental considerations into financial reporting and management decisions, thereby reflecting the evolving role of corporate stewardship and sustainable policy development (Agbede*et al*., 2025; Cho & Costa, 2024; D'Amore *et al*., 2025; Sundarasen*et al*., 2024; UNEP, 2019). Although frameworks exist to account for the ecological costs of human and business activities (Gray *et al*., 2014), EAE in many African countries including Nigeriaremains heavily grounded in Western epistemologies that often neglect local knowledge structures.

Indigenous Ecological Knowledge (IEK), frequently termed Traditional Ecological Knowledge (TEK), represents the totality of aboriginal knowledge, practices and beliefs through which local communities manage their relationships with natural ecosystems over generations (Berkes *et al*., 2000; Kumar *et al*., 2025; Wonglangka *et al*., 2025). Unlike reductionist Western paradigms, IEK provides a holistic framework integrating ecological insights with social institutions, cultural values and spiritual worldviews, thereby offering a contextually grounded approach to managing climate variability (Dei *et al*., 2025; Lushombo, 2025). Embedding IEK into higher education aligns with culturally responsive pedagogy, which incorporates learners lived experiences to improve engagement, critical thinking and problemsolving abilities (Ajani, 2025; Ramli *et al*., 2025). By linking indigenous practices with modern accounting frameworks, students develop a pragmatic understanding of environmental cost management, ethical decisionmaking and normative sustainability competenciessuch as futures thinking, strategic action and interpersonal collaboration (Lele, 2023).

Despite the theoretical relevance of IEK in sustainability education as reported on a global scale by Druker-Ibáñez & Cáceres-Jensen (2022); Hay (2025); Shabalala (2025); Tom *et al*., (2019) and within Nigeria (Ebele, 2024; Ibrahim, 2017), a critical challenge persists: a pronounced disconnect between globally driven sustainability models and locally relevant knowledge systems. Current EAE curricula in Nigerian universities rely predominantly on Western models of Environmental Management Accounting (EMA), which fail to reflect local sociocultural and ecological realities (Babalola & Olawuyi, 2021). Consequently, students often acquire theoretical concepts lacking practical applicability to their immediate environment, resulting in superficial awareness of SDG 4 and SDG 13 and limited sustainability competencies. Without structured frameworks and teaching strategies to integrate IEK, educational institutions risk producing graduates who are illequipped to address local ecological crises.

To address this gap, this study quantitatively investigates the intersection of IEK, environmental accounting education and sustainability outcomes among Nigerian undergraduates. Adopting a quantitative research design, the study measures key constructs including the level of IEK integration, students' sustainability competencies and awareness of SDG 4 and SDG 13, while evaluating the mediating role of sustainability competencies in these relationships. Specifically, the research addresses five central questions:

i. To what extent is Indigenous Ecological Knowledge integrated into environmental accounting education in Nigerian universities?
ii. What effect does IEK integration have on students' sustainability competencies?
iii. How does IEK integration influence students' awareness of SDG 4 (Quality Education)?
iv. How does IEK integration influence students' awareness of SDG 13 (Climate Action)?
v. Do sustainability competencies mediate the relationship between IEK integration and SDG awareness among Nigerian undergraduates?

By evaluating these dimensions, the study demonstrates how incorporating indigenous perspectives into environmental accounting serves as a strategic platform for interdisciplinary innovation, bridging traditional ecological wisdom and modern accounting frameworks to advance culturally relevant sustainability education.

Research Hypothesis and Analytical Procedure

H_1: Indigenous Ecological Knowledge is not integrated into environmental accounting education in Nigerian universities.

Analytical Procedure: Simple Linear Regression (B, β, t-statistic, R^2, 95% CI) and Descriptive Statistics

H_2: IEK integration does not have effect on students' sustainability competencies

Analytical Procedure: Simple Linear Regression (B, β, t-statistic, R^2, 95% CI).

H_3: IEK integration does not influence students' awareness of SDG 4 (Quality Education)

Analytical Procedure: Simple Linear Regression (B, β, t-statistic, R^2, 95% CI).

H_4: IEK integration does not influence students' awareness of SDG 13 (Climate Action)

Analytical Procedure: Simple Linear Regression (B, β, t-statistic, R^2, 95% CI)

H_5: Sustainability competencies does not mediate the relationship between IEK integration and SDG awareness among Nigerian undergraduates

Analytical Procedure: Hayes' PROCESS Macro Model 4 using 5,000 bootstrap resamples to estimate direct (c'), indirect (a*b), and total (c) path coefficients, standard errors, and 95% bias-corrected bootstrap confidence intervals.

2.0 Literature Review

Experiential Learning Theory (ELT)

David Kolb in 1984 developed the Experiential Learning Theory which posits that knowledge is created through the transformation of experience. It is comprised of a four staged relationship having concrete experience, reflective observation, abstract conceptualization and active experimentation. The theory provides the pedagogical foundation for the study. IEK, is built on evaluating learners in line with their previous experiences, it is rooted in lived experiences and practical engagement with the environment. It is a strong instrument for bringing about positive modifications in academic education which allow learners to apply what they have learned in school to real world problems (Nesterova, 2020; Hohenthal & Veintie, 2022). Therefore, integrating IEK into environmental accounting education enables students to learn through realworld environmental practices, thereby enhancing understanding and retention.

Constructivist Learning Theory (CLT)

Constructivist theory is a classical educational theory that dwells on the dominant position in the classroom. It posits that people construct their own understanding and knowledge of the world through experiencing things and by reflecting on those experiences Thissuggests that learners actively construct knowledge based on their experiences and interactions with their environment in same manner. It explains the cognitive mechanism through which experiences become meaningful (Chand, 2023). The theory requires teachers to explore ways that appeal to the students so that they can actively participate, explore, and construct knowledge independently, ultimately leading to the achievement of course objectives. IEK provides a contextual foundation for learning, allowing students to build new knowledge by connecting theoretical concepts with realworld environmental practices.

Sustainability Competency Theory (SCT)

There is need for change agents who are educated in sustainability and sustainable development to drive the needed transformation by addressing the persistent sustainability challenges such as climate change, biodiversity loss, and socio-economic injustices facing societies worldwide. Sustainability Competency Theory (Wiek *et al*., 2011; Evans, 2019; Redman & Wiek, 2021) provides a framework for understanding the skills required to address sustainability these challenges. It identifies key competencies such as systems thinking, anticipatory competence, and strategic competence, which are essential for achieving sustainable development. This theory underpins the mediating role of sustainability competencies in the study.

Synthesis of Empirical Literature and Hypotheses Development

A critical synthesis of recent empirical literature reveals both growing support for indigenous knowledge in education and significant empirical contradictions that necessitate systematic investigation. Theoretical and qualitative contributions by Druker-Ibáñez & Cáceres-Jensen (2022), Nesterova (2020), and Shabalala (2025) demonstrate that incorporating indigenous ways knowledge acquisition brings about some socio-environmental consciousness and decolonizes rigid academic structures. In the African context, studies by Ebele (2024) and Omilani & Bada (2024) highlight that Yoruba and broader Nigerian indigenous knowledge systems contain sophisticated conservation ethics and sustainable resource governance mechanisms. Furthermore, empirical work in general environmental education (e.g., Lele, 2023; Morakinyo *et al*., 2025) indicates that place-based learning increases environmental awareness among university students.

However, existing empirical evidence remains conflicting regarding the precise mechanisms connecting localized knowledge to global sustainability goals. While some scholars argue that indigenous perspectives directly cultivate global climate awareness (Demssie *et al*., 2020), others suggest that exposure to local cultural practices does not automatically translate into an understanding of formalized global frameworks like the UN SDGs unless mediated by structured critical competencies (Cho & Costa, 2024; Sundarasen *et al.,* 2024). Furthermore, virtually no empirical studies have evaluated these relationships within the quantitative rigor of accounting education, where technical financial reporting often overshadows qualitative socio-ecological knowledge.

To resolve these empirical tensions and test our integrated framework, we derive the following explicit, theoretically reasoned hypotheses:

H_1: Indigenous Ecological Knowledge is not integrated into environmental accounting education in Nigerian universities.

Rationale: Grounded in ELT and CLT, embedding culturally familiar ecological management concepts into accounting instruction allows students to actively construct complex systems-thinking and normative competencies by linking theoretical environmental costs to concrete local practices.

H_2: IEK integration does not have effect on students' sustainability competencies.

Rationale: IEK integration enhances educational quality awareness directly through curriculum relevance and indirectly by equipping students with the sustainability competencies needed to appreciate inclusive education

H_3: Indigenous Ecological Knowledge (IEK) integration does not influence student awareness of SDG 4 (Quality Education).

Rationale: Aligned with Culturally Responsive Pedagogy, integrating IEK enhances educational relevance and inclusivity, directly increasing student perception and awareness of high-quality, transformative learning (SDG 4).

H_4: Indigenous Ecological Knowledge (IEK) integration does not influence student awareness of SDG 13 (Climate Action).

Rationale: Place-based learning principles suggest that understanding community-level ecological adaptation and traditional climate mitigation strategies increases student awareness of global climate action mandates (SDG 13).

H_5: Student Sustainability Competencies does not influence awareness of SDG 13 (Climate Action).

Rationale: Advanced systems-thinking and anticipatory competencies allow students to comprehend complex climate feedback loops and evaluate corporate climate action obligations.

3.0 Methodology

This study adopts a quantitative research approach to examine the effects of integrating Indigenous Ecological Knowledge (IEK) into environmental accounting education on students' sustainability competencies and their awareness of Sustainable Development Goals (SDG 4 and SDG 13) in Nigeria. A cross sectional survey design was employed, as it enables the collection of data from a large population at a single point in time and facilitates the testing of relationships among variables (Marks, 2020; Taha & Nawaiseh, 2023; Morakinyo, *et al.*, 2025). The study is grounded in a positivist research paradigm, which assumes that relationships among variables can be objectively measured and analyzed using statistical techniques. This approach is appropriate given the study's objective to test the relationships between IEK integration (independent variable), sustainability competencies (mediating variable), and SDG awareness (dependent variables).

The study utilized the Statistical Package for the Social Sciences (SPSS) Version 27 for data analysis. Inferential analyses were conducted using simple linear regression to examine the direct effects among the study variables. Specifically, regression analysis was used to test the effects of Indigenous Ecological Knowledge integration on Sustainability Competencies, SDG 4 awareness, and SDG 13 awareness, as well as the effects of Sustainability Competencies on SDG awareness outcomes.Furthermore, mediation analysis was conducted using Hayes' PROCESS Macro Version 4.2 (Model 4) with 5,000 bootstrap samples to examine the mediating role of Sustainability Competencies in the relationship between Indigenous Ecological Knowledge integration and SDG awareness. The bootstrapping approach was adopted because it provides more robust estimates of indirect effects and confidence intervals in mediation analysis (Jollineau & Bowen, 2022; Hayes, 2022). Statistical significance was determined at the 0.05 level.

Population and Sampling

The target population for this study comprises undergraduate students enrolled in Nigerian universities where environmental accounting concepts are taught, particularly those studying accounting, economics, agricultural science and environmental science. These students are considered appropriate participants due to their exposure to sustainabilityrelated coursework and their potential role as future professionals in environmental and financial decisionmaking. A multi-

stage sampling technique was employed. First, selected universities offering environmental accounting or sustainability related courses were purposively identified. Subsequently, a stratified sampling method was used to ensure representation across different levels of study (e.g., 100 to 400 levels). Finally, respondents were selected using a convenience sampling approach within each stratum.

A sample size 534 respondents was received. This sample size exceeds the minimum threshold required for detecting medium effect sizes and enhances the robustness and generalizability of the findings. Participation in the study was voluntary, and ethical considerations were strictly adhered to. Respondents were informed of the purpose of the study, assured of anonymity and confidentiality and provided with the option to withdraw at any stage without penalty.

Mediation Analysis

The mediating role of sustainability competencies was tested using bootstrapping procedures, following recommended guidelines for indirect effect analysis. The significance of indirect paths was examined to determine whether sustainability competencies mediate the relationship between IEK integration and SDG awareness.

4.0 Result

Response Rate and Demographic Characteristics

Questionnaire was administered via the Google form using emails and WhatsApp groups of undergraduate students in selected Nigerian universities as a means of communication. A total of 534 responses were received after seven (7) days. After data screening, 424 questionnaires were found suitable for analysis.

Table 1:
Screening Criteria

Screening stage	Number excluded	Remaining responses
Responses received	—	534
Incomplete responses	17	517
Duplicate submissions	62	455
Ineligible participants	31	424
Total	110	424

Source: Author's Computation, 2025.

Gender Distribution of Respondents

The Figure 1 indicate that out of the total of 424 respondents, 208 participants, representing 49.06%, were male, while 216 respondents, representing 50.94%, were female. This suggests a relatively balanced gender representation among the participants, with female respondents slightly dominating the sample. This enhances the representativeness of the study and reduces the likelihood of gender bias in the analysis. This balance also strengthens the reliability of the findings, as perspectives from both genders are adequately captured in examining the integration of Indigenous Ecological Knowledge in environmental accounting education and its effects on sustainability competencies and SDG awareness.

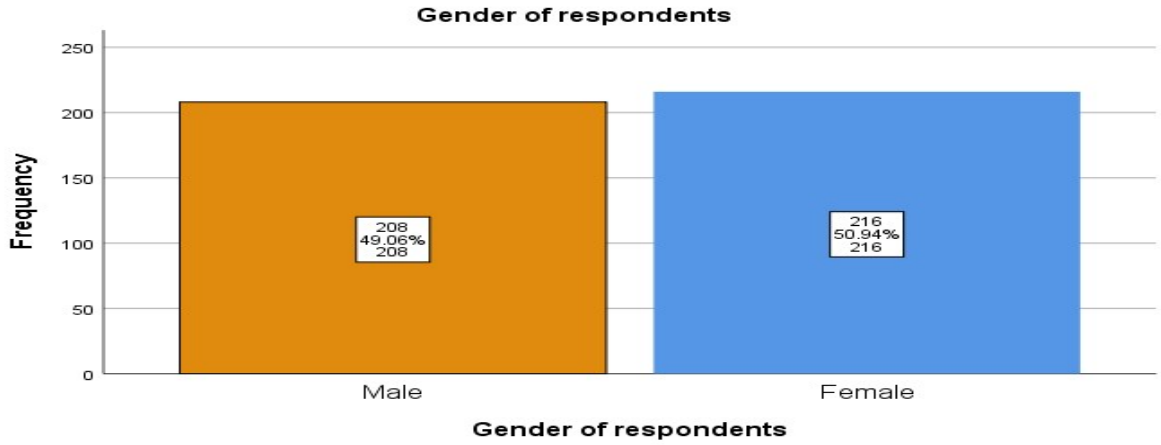

Figure 1: Gender of Respondents

Age of Respondents

The age distribution of the respondents is presented in Figure 2. The findings indicate that the majority of the respondents were within the age bracket of 21–25 years, representing 54.95% (n=233) of the total sample. Respondents aged 26–30 years accounted for 21.70% (n=92), while those within the 16–20 years' category constituted 12.50% (n=53). Additionally, respondents aged 31 years and above represented 10.85% (n=46) of the participants.

The dominance of respondents within the 21–25 years' age category suggests that the study largely captured the perspectives of young adults who constitute the active undergraduate population in Nigerian universities. This age distribution is appropriate for the study, as individuals within this demographic are more likely to be actively engaged in sustainability related learning and environmental accounting education.

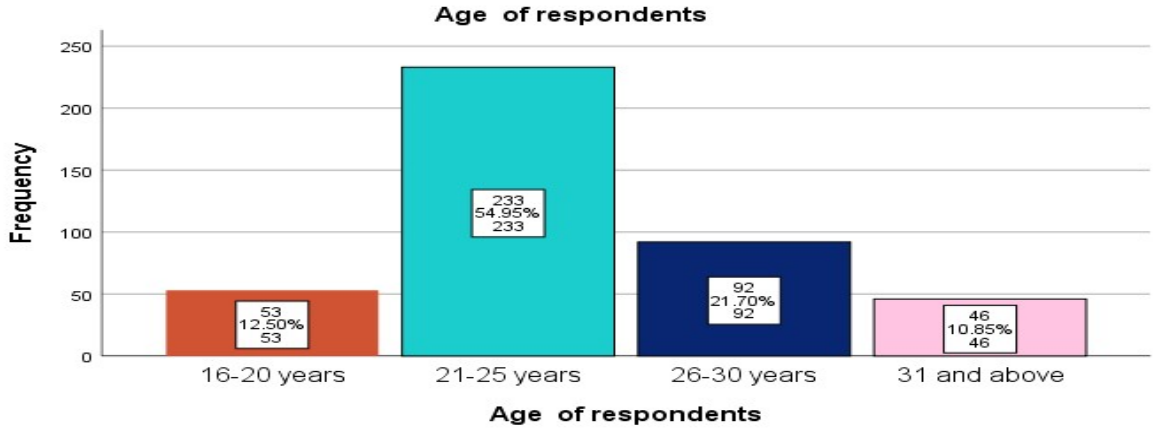

Figure 2: Age of Respondents

Level of Study

The findings as evident in Figure 4 reveals that the majority of the respondents were in 400 level, accounting for 41.27% (n = 175) of the total participants. This was followed by respondents in 300 level, who constituted 28.30% (n = 120). Respondents in 100 level represented 19.34% (n = 82), while those in 200 level accounted for the smallest proportion of the sample at 11.08% (n = 47).

The dominance of respondents in the higher levels of study suggests that a substantial proportion of the participants had considerable academic exposure and experience within the university system. This is particularly important for the present study, as students in advanced levels are more likely to have encountered sustainability related concepts, environmental accounting topics, and discussions surrounding Indigenous Ecological Knowledge in their academic coursework.

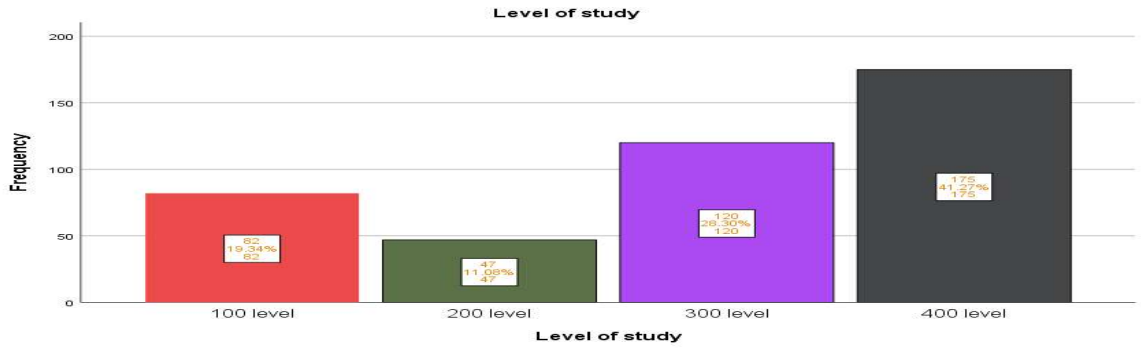

Figure 3: Level of Study of Respondents

Course of Study

Figure 4 depicts the distribution of respondents based on their course of study. The findings indicate that the majority of the respondents were students of Accounting, representing 78.30% (n = 332) of the total sample. Respondents from related fields accounted for 10.38% (n = 44), while students from Agricultural Science constituted 9.43% (n = 40). Environmental Science students represented the smallest proportion of the respondents, accounting for 1.89% (n = 8). The dominance of accounting students in the sample is consistent with the focus of the study on environmental accounting education. This suggests that the findings are largely reflective of the perspectives of students directly exposed to accounting based sustainability concepts. The inclusion of respondents from Environmental Science, Agricultural Science, and related disciplines also enhances the interdisciplinary nature of the study by incorporating diverse academic perspectives on Indigenous Ecological Knowledge and sustainability education

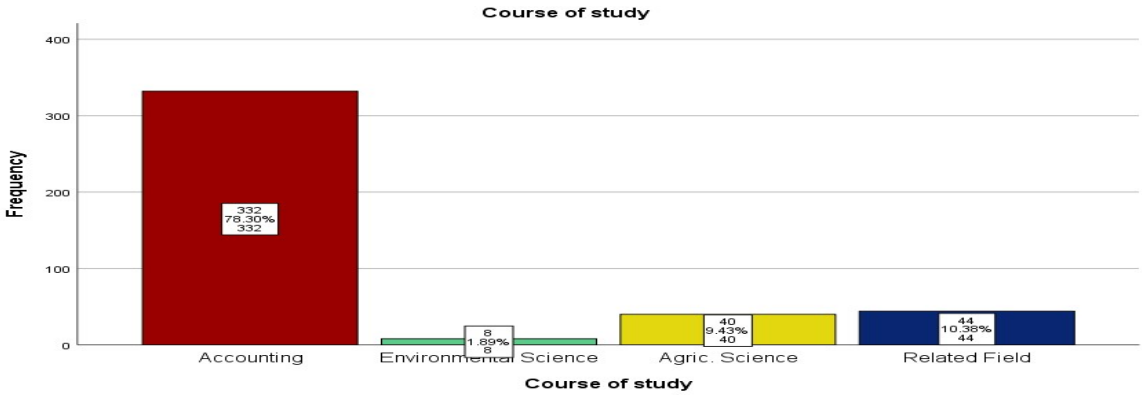

Figure 4: Course of Study

Descriptive Statistical Findings

Descriptive statistics were conducted to examine the central tendency, dispersion and distribution of the variables adopted for the study. These are Indigenous Ecological Knowledge (IEK)

integration, Sustainability Competencies (SC), SDG 4 awareness, and SDG 13 awareness. The results are thus presented in Table 2.

The finding reveals that Indigenous Ecological Knowledge (IEK) integration recorded a mean score of 3.58 with Standard Deviation (SD) of 1.36, indicating a moderately high perception of the integration of indigenous ecological knowledge into environmental accounting education among the respondents. Sustainability Competencies (SC) had a mean score of 3.48 (SD=1.34), suggesting that respondents generally possessed moderate sustainability related competencies. Additionally, SDG 4 awareness recorded the highest mean score of 3.62 and SD of 1.33, implying that respondents demonstrated relatively high awareness of issues relating to quality education and sustainability learning. SDG 13 awareness also recorded a moderate mean score (M=3.39, SD=1.35), indicating that respondents possessed a reasonable level of awareness regarding climate action and environmental sustainability issues.

Furthermore, the skewness and kurtosis statistics were examined to assess the normality of the data distribution. The skewness values ranged from −0.739 to −0.456, while kurtosis values ranged from −0.961 to −0.631. Since all values fell within the acceptable threshold of ±2, the data can be considered approximately normally distributed (Hair, *et al*., 2022). This suggests that the dataset is suitable for further parametric statistical analyses such as correlation and regression analysis.

Table 2:
Descriptive Statistics of Study Variables

Variable	N	Mean	S.D	Skewness	Kurtosis
IEK Integration	424	3.58	1.36	-0.677	-0.762
Sustainability Competencies	424	3.48	1.34	-0.600	-0.794
SDG 4 Awareness	424	3.62	1.33	-0.739	-0.631
SDG 13 Awareness	424	3.39	1.35	-0.456	-0.961

Source: Author's Computation, 2025.

Reliability Tests

Reliability analysis was conducted to assess the internal consistency of the measurement items used in the study. Cronbach's Alpha coefficient was employed to determine the reliability of the scale measuring the constructs with a value above or equal to 0.70 being satisfactory internal consistency (Hair, *et al*. 2022).

IEK Integration

The results of the reliability test conducted for IEK integration are presented in Table 3. The case processing summary indicates that out of the total 534 cases, 424 responses, representing 79.4%, were valid and included in the analysis, while 110 cases (20.6%) were excluded due to missing values based on listwise deletion. The reliability statistics show that the instrument recorded a Cronbach's Alpha coefficient of 0.996 across the seven measurement items. According to Hair, *et al*. (2022), a Cronbach's Alpha value above 0.70 indicates satisfactory internal consistency, while values above 0.90 suggest excellent reliability. Therefore, the obtained alpha value of 0.996

demonstrates a very high level of internal consistency among the questionnaire items, indicating that the instrument is highly reliable for measuring the constructs of the study.

Table 3:
IEK Integration

Measure	Value
Valid Cases	424
Excluded Cases	110
Total Cases	534
Cronbach's Alpha	0.996
Number of Items	7

Source: Author's Computation, 2025.

Sustainability Competencies
Table 4 shows the Sustainability Competencies scale which recorded a Cronbach's Alpha coefficient of 0.997, indicating excellent internal consistency and reliability. A total of 424 valid cases were included in the analysis, while 110 cases were excluded due to missing values.

Table 4:
Sustainability Competencies

Measure	Value
Valid Cases	424
Excluded Cases	110
Total Cases	534
Cronbach's Alpha	0.997
Number of Items	10

Source: Author's Computation, 2025.

SDG 4 Awareness
The Case Processing Summary as obtainable on Table 5 revealed that a total of 534 responses were obtained for the study. Out of these, 424 cases representing 79.4% were valid and used for the analysis, while 110 cases representing 20.6% were excluded due to missing values through listwise deletion procedure. The obtained Cronbach's Alpha value of 0.992 indicates that the instrument possesses a very high level of reliability and internal consistency.

Table 5:
SDG 4 Awareness

Measure	Value
Valid Cases	424
Excluded Cases	110
Total Cases	534

Number of Items	5
Cronbach's Alpha	0.992

Source: Author's Computation, 2025.

SDG 13 Awareness

Table 6 presents the reliability statistics of the case processing summary which indicates that out of the total 534 questionnaires administered, 423 responses representing 79.2% were valid and used for the analysis, while 111 responses representing 20.8% were excluded due to missing data through the listwise deletion procedure.The reliability analysis further revealed a Cronbach's Alpha coefficient of 0.993 for the five measurement items used in the study. The obtained Cronbach's Alpha value of 0.993 demonstrates that the instrument possesses a very high level of reliability and internal consistency. This implies that the items used in measuring the construct are highly stable, dependable, and suitable for further statistical analyses. Consequently, the research instrument is considered reliable for achieving the objectives of the study.

Table 6:
SDG 13 Awareness

Measure	Value
Valid Cases	423
Excluded Cases	111
Total Cases	534
Number of Items	5
Cronbach's Alpha	0.993

Source: Author's Computation, 2025.

Correlation Analysis

The result of the Pearson Correlation analysis (Table 7) showing the relationship among the variables; Indigenous Ecological Knowledge (IEK), Sustainability Competencies (SC), Sustainable Development Goal 4 (SDG4), and Sustainable Development Goal 13 (SDG13) revealed that IEK has a very strong positive and significant relationship with SC ($r = 0.994$, $p < 0.01$), SDG4 ($r = 0.991$, $p < 0.01$) and SDG 13 ($r = 0.982$, $p < 0.01$). This implies that increases in Indigenous Ecological Knowledge are associated with corresponding increases in sustainability competencies, quality education and climate action initiatives.

Similarly, Sustainability Competencies (SC) exhibited a very strong positive and significant relationship with SDG 4 ($r = 0.986$, $p < 0.01$) and SDG 13 ($r = 0.994$, $p < 0.01$). This indicates that stronger Sustainability Competencies contributes positively to educational sustainability and climate action performance. In addition, the relationship between SDG4 and SDG13 was also found to be positive and statistically significant ($r = 0.978$, $p < 0.01$), suggesting that improvements in quality education are associated with enhanced climate action outcomes.

Overall, the findings indicate extremely strong positive associations among all the variables examined in the study. The significance values ($p = 0.000$) further confirm that the observed relationships are statistically significant at the 1% level.

Table 7:
Pearson Correlation Matrix of the Study Variables

Variables	IEK	SC	SDG4	SDG13
IEK	1			
SC	.994**	1		
SDG4	.991**	.986**	1	
SDG13	.982**	.994**	.978**	1

N = 424 ***p < .001
Source: Author's Computation, 2025.

Regression Results
Hypothesis One
H1: Indigenous Ecological Knowledge (IEK) integration significantly influences Sustainability Competencies (SC). A simple linear regression analysis was conducted to examine the effect of IEK integration on Sustainability Competencies (SC) among Nigerian undergraduates. The results of the regression analysis are presented in Tables 8-10. The model summary indicates a very strong positive relationship between IEK integration and sustainability competencies (R = .994). The coefficient of determination (R^2 = .988) shows that IEK integration explains approximately 98.8% of the variance in sustainability competencies. The adjusted R^2 value of .988 further confirms the robustness of the model. Additionally, the standard error of the estimate was .14589, indicating a low prediction error.

The ANOVA results reveal that the regression model is statistically significant, $F(1, 422) = 35249.224$, $p < .001$. This indicates that the regression model provides a significantly better prediction of sustainability competencies than a model without the predictor variable. Furthermore, the coefficients table shows that IEK integration has a significant positive effect on sustainability competencies ($\beta = .994$, $t = 187.748$, $p < .001$). This implies that an increase in the integration of Indigenous Ecological Knowledge significantly enhances sustainability competencies among students. Therefore, based on these findings, Hypothesis One (H1) is accepted.

Table 8:
Model Summary for the Effect of IEK Integration on Sustainability Competencies

Model	R	R^2	Adjusted R^2	Std. Error of Estimate
1	.994	.988	.988	.14589

Predictor: IEK
Dependent Variable: Sustainability Competencies
Source: Author's Computation, 2025.

Table 9a:
ANOVA Results for the Regression Model

Model	Sum of Squares	df	Mean Square	F
Regression	750.249	1	750.249	35249.224
Residual	8.982	422	.021	
Total	759.231	423		

Source: Author's Computation, 2025.

Table 9b:
Regression Coefficients

Predictor	B	Std. Error	β	t	Sig.
Constant	-.026	.020		-1.298	.195
IEK	.981	.005	.994	187.748	.000

Source: Author's Computation, 2025.

Hypothesis Two

H2: Indigenous Ecological Knowledge (IEK) integration significantly influences SDG 4 Awareness. The result of the linear regression analysis conducted (presented in Table 11-12) to examine the effect of Indigenous Ecological Knowledge (IEK) integration on SDG 4 awareness among Nigerian undergraduates indicates a very strong positive relationship between IEK integration and SDG 4 awareness ($R = .991$). The coefficient of determination ($R^2 = .982$) reveals that IEK integration accounts for approximately 98.2% of the variance in SDG 4 awareness. The adjusted R^2 value of .982 further confirms the explanatory strength and stability of the model. In addition, the standard error of the estimate was .17928, indicating a relatively low level of prediction error. Furthermore, the result of the ANOVA test shows that the regression model is statistically significant, $F = 22864.503$, $p < .001$. This implies that the model significantly predicts SDG 4 awareness among the respondents.

The coefficients table indicates that IEK integration exerts a significant positive influence on SDG 4 awareness ($\beta = .991$, $t = 151.210$, $p < .001$). This suggests that increased integration of Indigenous Ecological Knowledge into environmental accounting education significantly enhances students' awareness of SDG 4 (Quality Education).Therefore, Hypothesis Two (H2) is accepted.

Table 10:
Model Summary for the Effect of IEK Integration on SDG 4 Awareness

Model	R	R^2	Adjusted R^2	Std. Error of Estimate
1	.991	.982	.982	.17928

Predictor: IEK
Dependent Variable: SDG 4 Awareness
Source: Author's Computation, 2025.

Table 11:
ANOVA Results for the Regression Model

Model	Sum of Squares	df	Mean Square	F
Regression	734.878	1	734.878	22864.503
Residual	13.563	422	.032	
Total	748.441	423		

Source: Author's Computation, 2025.

Table 12:
Regression Coefficients

Predictor	B	Std. Error	β	t
Constant	.146	.025		5.925
IEK	.970	.006	.991	151.210

Source: Author's Computation, 2025.

Hypothesis Three

H3: Indigenous Ecological Knowledge (IEK) integration significantly influences SDG 13 Awareness.

Table 13 to 15 shows the results of the linear regression analysis conducted to examine the effect of Indigenous Ecological Knowledge (IEK) integration on SDG 13 awareness among Nigerian undergraduates. The model summary indicates a very strong positive relationship between IEK integration and SDG 13 awareness ($R = .982$). The coefficient of determination ($R^2 = .965$) shows that IEK integration explains approximately 96.5% of the variance in SDG 13 awareness. The adjusted R^2 value of .965 further confirms the explanatory strength and predictive stability of the model. The standard error of the estimate was .25503, indicating a relatively low level of prediction error.

The ANOVA results reveal that the regression model is statistically significant, $F(1, 422) = 11499.987$, $p < .001$. This implies that the regression model significantly predicts SDG 13 awareness among the respondents. Also, the coefficients table indicates that IEK integration has a significant positive effect on SDG 13 awareness ($\beta = .982$, $t = 107.238$, $p < .001$). This finding suggests that greater integration of IEK into environmental accounting education significantly enhances students' awareness of SDG 13 (Climate Action). The hypothesis three is therefore accepted.

Table 13:
Model Summary for the Effect of IEK Integration on SDG 13 Awareness

Model	R	R^2	Adjusted R^2	Std. Error of Estimate
1	.982	.965	.965	.25503

Predictor: IEK
Dependent Variable: SDG 13 Awareness
Source: Author's Computation, 2025.

Table 14:
ANOVA Results for the Regression Model

Model	Sum of Squares	df	Mean Square	F
Regression	747.974	1	747.974	11499.987
Residual	27.447	422	.065	
Total	775.422	423		

Source: Author's Computation, 2025.

Table 15:
Regression Coefficients

Predictor	B	Std. Error	β	t	Sig.
Constant	-.111	.035		-3.182	.002
IEK	.979	.009	.982	107.238	

Source: Author's Computation, 2025.

Hypothesis Four
H4: Sustainability Competencies (SC) significantly influence SDG 4 Awareness.
A simple linear regression analysis was conducted to examine the effect of Sustainability Competencies (SC) on SDG 4 awareness among Nigerian undergraduates. The result is thus presented in the Tables 16–18. The model summary indicates a very strong positive relationship between Sustainability Competencies and SDG 4 awareness (R = .986). The coefficient of determination (R^2 = .973) reveals that Sustainability Competencies explain approximately 97.3% of the variance in SDG 4 awareness. The adjusted R^2 value of .973 further confirms the explanatory strength and predictive reliability of the regression model. Additionally, the standard error of the estimate was .21924, indicating a low level of prediction error.

The ANOVA results reveal that the regression model is statistically significant, $F(1, 422) = 15148.464$, $p < .001$. This indicates that Sustainability Competencies significantly predict SDG 4 awareness among the respondents. The coefficients table shows that Sustainability Competencies have a significant positive effect on SDG 4 awareness ($\beta = .986$, $t = 123.079$, $p < .001$). This finding implies that higher levels of sustainability competencies significantly enhance students' awareness of DG 4. Hypothesis 4 is therefore accepted.

Table 16:
Model Summary for the Effect of Sustainability Competencies on SDG 4

Model	R	R^2	Adjusted R^2	Std. Error of Estimate
1	.986	.973	.973	.21924

Source: Author's Computation, 2025.

Table 17:
ANOVA Results for the Regression Model

Model	Sum of Squares	df	Mean Square	F
Regression	728.157	1	728.157	15148.464
Residual	20.285	422	.048	
Total	748.441	423		

Source: Author's Computation, 2025.

Table 18:
Regression Coefficients

Predictor	B	Std. Error	β	t
Constant	.207	.030		6.985
Sustainability Competencies	.979	.008	.986	123.079

Source: Author's Computation, 2025.

Hypothesis Five

H5: Sustainability Competencies (SC) significantly influence SDG 13 Awareness.

To examine the effect of Sustainability Competencies (SC) on SDG 13 awareness among undergraduate students in Nigeria, the study carried out a linear regression analysis. Table 19 depicts the model summary which indicates a very strong positive relationship between SC and SDG 13 awareness with R = .994. The coefficient of determination (R^2 = .987) shows that Sustainability Competencies explain approximately 98.7% of the variance in SDG 13 awareness. The adjusted R^2 value of .987 further confirms the robustness and predictive strength of the regression model. In addition, the standard error of the estimate was .15277, indicating a low level of prediction error.

The result of the ANOVA test (Table 20) reveal that the regression model is statistically significant at F = 32802.216, $p < .001$. This indicates that Sustainability Competencies significantly predict SDG 13 awareness among the respondents. While the coefficients table (Table 20) indicates that SC have a significant positive effect on SDG 13 awareness ($\beta = .994$, $t = 181.114$, $p < .001$). This finding implies that increased sustainability competencies significantly enhance students' awareness of DG 13. Therefore, Hypothesis Five (H5) is accepted.

Table 19:
Model Summary for the Effect of Sustainability Competencies on SDG 13

Model	R	R^2	Adjusted R^2	Std. Error of Estimate
1	.994	.987	.987	.15277

Predictor: Sustainability Competencies
Dependent Variable: SDG 13 Awareness
Source: Author's Computation, 2025.

Table 20a:
ANOVA Results for the Regression Model

Model	Sum of Squares	df	Mean Square	F
Regression	765.572	1	765.572	32802.216
Residual	9.849	422	.023	
Total	775.422	423		

Source: Author's Computation, 2025.

Table 20b:
Regression Coefficients

Predictor	B	Std. Error	β	t
Constant	-.105	.021		-5.078
Sustainability Competencies	1.004	.006	.994	181.114

Source: Author's Computation, 2025.

Mediation Analysis

Mediation analysis was further conducted using Hayes' PROCESS Macro Model 4 with 5,000 bootstrap samples to test for the mediating role of Sustainability Competencies in the relationship between IEK integration and awareness of SDGs 4 and 13 among undergraduate students in Nigeria (Table 21). The first stage of the mediation analysis examined the effect of IEK integration on Sustainability Competencies. The results revealed that IEK integration significantly predicts Sustainability Competencies ($\beta = .981$, $t = 187.748$, $p < .001$), explaining approximately 98.8% of the variance in Sustainability Competencies ($R^2 = .988$). This finding indicates that increased integration of Indigenous Ecological Knowledge substantially enhances students' sustainabilityrelated competencies.

Whereas, the second stage of the analysis assessed the mediating role of SC in the relationship between IEK integration and SDG awareness outcomes. For SDG 13 awareness, the indirect effect of IEK integration through SC was statistically significant (Effect = 1.4503, BootSE = .0600, 95% CI at 1.3443, 1.5811). The direct effect of IEK integration on SDG 13 awareness became negative after the inclusion of SC ($\beta = -.4712$, $p < .001$), indicating an inconsistent mediation effect. This suggests that the influence of IEK on climate action awareness occurs primarily through the development of sustainability competencies. Similarly, the indirect effect of IEK integration on SDG 4 awareness through Sustainability Competencies was also statistically significant (Effect = .1100, BootSE = .0520, 95% CI at .0044, .2092). However, the direct effect of IEK integration on SDG 4 awareness remained positive and significant ($\beta = .8604$, $p < .001$), indicating a partial mediation effect. This implies that IEK integration enhances awareness of quality education both directly and indirectly through sustainability competencies.

Overall, the mediation results demonstrate that SCconstitutes an important mechanism through which IEK integration enhances students' sustainability awareness. However, the nature of the mediation differs across SDG outcomes. While SDG 4 awareness is influenced both directly and

indirectly by IEK integration, SDG 13 awareness is influenced predominantly through sustainability competencies. These findings highlight the differentiated pathways through which Indigenous Ecological Knowledge contributes to SDG attainment.

Table 21:
Summary of Mediation Analysis Results

Outcome Variable	Direct Effect	Indirect Effect	BootSE	BootLLCI	BootULCI	Mediation Type
SDG 4 Awareness	.8604***	.1100	.0520	.0044	.2092	Partial Mediation
SDG 13 Awareness	-.4712***	1.4503	.0600	1.3443	1.5811	Inconsistent Mediation

***p < .001
Source: Author's Computation, 2025.

Discussion of Findings
This study examined the associations between Indigenous Ecological Knowledge (IEK) integration in environmental accounting education, student sustainability competencies and awareness of SDG 4 and SDG 13 among Nigerian undergraduates. The findings contribute both theoretical and practical insights to sustainability education literature in emerging economies.

Theoretical Integration and Empirical Synthesis
The positive association between IEK integration and Sustainability Competencies strongly supports Experiential Learning Theory (Henríquez *et al.*, 2025) and Constructivist Learning Theory (Chand, 2023). By grounding abstract environmental management accounting principles (e.g., natural capital degradation, ecological liabilities) in locally familiar indigenous practices, educators enable students to form meaningful insights. This finding aligns with Culturally Responsive Pedagogy (Ajani, 2025; D'AndreaMartínez*et al.*, 2023), confirming that culturally resonant curricula enhance student engagement.

Furthermore, the direct associations observed between IEK integration and SDG awareness reinforces prior work by Druker-Ibáñez & Cáceres-Jensen (2022), Ebele (2024), and Omilani & Bada (2024), who argued that localized environmental wisdom increases overall environmental consciousness. Similarly, the strong predicting role of Sustainability Competencies on SDG 4 and SDG 13 awareness validates Sustainability Competency Theory (Redman &Wiek, 2021; Wiek *et al.*, 2011), demonstrating that students with higher systems-thinking and normative capabilities are better equipped to comprehend global sustainability frameworks.

Unpacking the Inconsistent Mediation Mechanisms
A major theoretical contribution of this study lies in revealing the contrasting mediation mechanisms across SDG outcomes. While SDG 4 awareness (Quality Education) is influenced both directly by curriculum relevance and indirectly through competence building (partial mediation), SDG 13 awareness (Climate Action) exhibits an inconsistent mediation structure.
This inconsistent mediation profile (c' = -.4712 vs. a*b = 1.4503) provides a crucial matrix which suggests that raw, uncontextualized traditional knowledge does not automatically translate into understanding complex. In fact, without formal sustainability competencies (such as carbon

accounting, climate modeling, and systems analysis), exposure to localized traditional ecological practices can create a disconnect or confusion regarding globalized, technical climate policy. Sustainability competencies act as an essential cognitive bridge that translates localized traditional ecological wisdom into actionable, macro-level climate awareness.

5.0 Conclusion

This study examined the effect of integrating Indigenous Ecological Knowledge (IEK) into environmental accounting education on sustainability competencies and awareness of SDG 4 (Quality Education) and SDG 13 (Climate Action) among Nigerian undergraduates. The findings revealed that Indigenous Ecological Knowledge integration significantly enhances sustainability competencies and positively influences students' awareness of sustainable development goals.

The study further established that sustainability competencies significantly predict both SDG 4 and SDG 13 awareness, indicating the importance of competency based sustainability education in higher institutions. In addition, the mediation analysis demonstrated that sustainability competencies play an important role in explaining how Indigenous Ecological Knowledge contributes to sustainability awareness outcomes. While sustainability competencies partially mediated the relationship between IEK integration and SDG 4 awareness, they exhibited an inconsistent mediation effect in the relationship between IEK integration and SDG 13 awareness.

The findings therefore suggest that Indigenous Ecological Knowledge represents an important educational resource capable of strengthening sustainability oriented learning within environmental accounting education. By integrating indigenous ecological perspectives into formal curricula, universities can enhance students' sustainability competencies, environmental consciousness, and understanding of global sustainability goals. The study contributes to sustainability education literature by providing empirical evidence that culturally contextualized and competencydriven educational approaches can improve sustainability learning outcomes and support the achievement of sustainable development goals in developing countries such as Nigeria.

Limitation f The Study

Harman's Single Factor Test was conducted to assess the potential presence of common method bias. The unrotated exploratory factor analysis revealed that the first factor accounted for 96.47% of the total variance, exceeding the recommended threshold of 50% suggested by Podsakoff,*et al*. (2003). This indicates the possible presence of common method variance within the dataset. The high variance explained by a single factor may be attributable to the conceptual closeness of the constructs examined, the use of self-reported measures, and the perceptual nature of the study variables. Nevertheless, procedural remedies such as respondent anonymity, voluntary participation, and scale separation were adopted during data collection to minimize response bias.

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Ethical Considerations

The authors have adhered strictly to established ethical standards for research involving human participants in the course of this study. Participation in the study was entirely voluntary and informed consent was obtained from all respondents prior to data collection. Participants were adequately informed about the purpose of the study, the nature of their involvement, and their right to withdraw from the study at any stage without penalty. To ensure confidentiality and anonymity, no personally identifiable information such as names, registration numbers or contact details was collected from the respondents. The data obtained were used strictly for academic and research purposes and were reported in aggregate form to prevent the identification of individual participants. The study further ensured that respondents were not exposed to any physical, psychological, or social harm during the data collection process. All information obtained from participants was securely handled and used solely for the purpose of this study.

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