Innovations

Transforming Basic Education and Innovative Curriculum Structures for Sustainable Development in Nigeria

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Abstract: *Transforming basic education in Nigeria through innovative curricula is critical for fostering sustainable development. This study investigated the transformation of basic education and innovative curriculum structures for sustainable development in Nigeria. Five research questions and five hypotheses were raised and tested at the 0.05 level of significance. This study was a descriptive design of the correlation type, and the population of the study comprised 480 school heads. The sample size consisted of 217 respondents. A structured questionnaire titled "Transforming Basic Education and Innovative Curriculum Structure for Sustainable Development in Nigeria Questionnaire" (TBEICSSDQ) with a Cronbach's alpha reliability coefficient of 0.81 was used to collect the data for the study. The data collected were analyzed using mean, median, and standard deviation to answer research questions, while partial least squares structural equation modelling (PLS-SEM) was used to test the hypotheses. The study revealed that there was a strong positive relationship between curriculum innovation and sustainability. The model explained a strong and positive link between curriculum innovation and sustainable development, reinforcing the idea that integrating modern teaching methods and sustainability-focused content into education can yield impactful results. The study concluded that innovative curriculum structures and adequate facilities are crucial for sustainable development in Nigerian basic schools. Based on these results, it is recommended that the national curriculum should be comprehensively revised to embed sustainability across disciplines. School leaders and policymakers should prioritize investment in science laboratories. Additionally, teachers and students should be actively encouraged to use library resources. Future studies can be conducted to examine innovative curriculum designs as well as innovative teaching methods in Nigerian basic schools.*

Keywords: *Classroom Buildings, Food Shortage, Laboratories, Libraries, Staffrooms*

Introduction

Nigeria's basic education system stands at a critical juncture. With a population exceeding 200 million, the nation faces mounting difficulties in delivering quality education that equips young learners with the tools they need to thrive in the 21st century. The structure and content of the current basic education curriculum have come under heavy scrutiny for being outdated, inflexible, and ill-suited to the pressing realities of modern Nigeria. Consequently, many students leave school without the vital knowledge, skills, and competencies necessary to navigate an increasingly complex, globalized world or to cope with economic instability. The physical and organizational structures supporting education in many schools are also substandard, further compounding the challenges. Addressing these issues is essential if basic education is to play a meaningful role in sustainable development.

A transformative approach to basic education is urgently needed to overcome the systemic shortcomings that continue to plague the sector. For years, the Nigerian education system has struggled with poor infrastructure, undertrained teachers, and a curriculum that fails to reflect current societal and technological shifts. As the country works toward achieving the United Nations Sustainable Development Goals, particularly Goal 4, on inclusive and quality education, there is a growing need for an educational framework that embraces innovation. A curriculum cannot be truly effective unless it aligns with the learning environment in which it is delivered. Thus, the push for innovation must extend beyond textbooks and syllabuses to encompass the physical spaces where learning occurs. As Igbokwe (2020) suggested, reforms such as the Revised 9-Year Basic Education Curriculum are essential for making learning more engaging, relevant, and skill-oriented.

An innovative curriculum structure extends beyond the content taught. It also encompasses the physical and pedagogical environment needed to support modern education. In other words, lasting progress in education relies not only on what is taught but also on how and where it is taught. Structural innovation, be it in classrooms, laboratories, libraries, or school facilities, is vital to achieving meaningful outcomes. Okebukola (2015) emphasized that education must be reimagined to integrate new technologies and teaching strategies that respond to both national and global needs. Introducing subjects such as digital literacy, robotics, and computer programming can prepare students for emerging career paths and future societal demands. Similarly, Oduolowu (2011) stressed the importance of embedding creative and critical thinking into the curriculum to nurture innovation and effective problem-solving in learners. When students are encouraged to think critically and apply knowledge practically, they are more likely to become proactive contributors to their communities and broader sustainable development efforts.

Dike (2014) rightly noted that crafting a new curriculum is only a first step; what matters more is ensuring that it is effectively implemented in classrooms through appropriate support and monitoring systems. Physical learning spaces must also

reflect the values of sustainability. Classrooms, laboratories, and school libraries need to be redesigned with sustainability in mind, not only to provide a conducive learning environment but also to model the practices they aim to instil. Education for Sustainable Development (ESD), as defined by Tilbury (2011), integrates the principles of sustainability into all aspects of teaching and learning. It seeks to develop students who can address the multifaceted challenges of modern life, from environmental degradation to social inequality and economic hardship. Incorporating ESD into Nigeria's curriculum could raise awareness of these issues and inspire action among students, such as promoting environmental stewardship and social responsibility.

Integrating sustainability concepts with modern teaching methods can significantly bolster the effectiveness of education. Researchers like Sterling (2011) and Wals & Corcoran (2023) argue that a sustainability-oriented curriculum leads to more environmentally conscious and ethically responsible students. This underscores the need for continual curriculum reform that reflects evolving societal needs and prepares students for future challenges.

The quality of physical learning environments has also been shown to influence student performance directly. Barrett et al. (2015) and Earthman (2017) observed that well-designed educational spaces that support sustainable practices can significantly enhance learning outcomes. Laboratories, for instance, allow for hands-on experimentation and inquiry, which are crucial for helping students understand and tackle real-world sustainability issues. Improving these facilities with updated tools, materials, and technologies can be a strategic step toward better education and sustainability outcomes. In addition, Lozano et al. (2017) and De Haan (2018) emphasized the importance of experiential learning in helping students engage with complex global issues. Libraries stocked with materials focused on sustainability themes, as advocated by Agyeman (2019) and Jukes (2021), can further enrich students' understanding and foster deeper engagement with their communities and environment.

Despite numerous reforms and efforts to improve the system, Nigeria's basic education sector continues to face significant hurdles in adequately preparing students for contemporary challenges and achieving the nation's sustainable development goals. A shift toward more innovative, inclusive, and sustainability-oriented educational practices, both in curriculum and infrastructure, is essential for building a brighter, more resilient future.

The Purpose of the Study

The primary purpose of this study is to examine the relationship between transforming basic education and innovative curriculum structure for sustainable development in Nigeria. Specifically, the study sought to find out the state of:

i. Sustainable development in Nigerian basic schools.
ii. Class room buildings available in basic Nigerian schools.
iii. Staffrooms are available in basic Nigerian schools.

iv. Laboratories are available in Nigerian basic schools, and
v. Libraries are available in Nigerian basic schools.

Research Questions

The following research questions guided the study.

i. Is there sustainable development in Nigerian Basic Schools?
ii. What is the condition of classroom buildings available in Nigerian Basic Schools?
iii. What is the condition of the staffrooms available in Nigerian Basic Schools?
iv. What is the condition of laboratories available in Nigerian Basic Schools?
v. What is the condition of the library available in Nigerian Basic Schools?

Research Hypotheses

One leading hypothesis and four hypotheses were formulated and tested at a significance level of 0.05.

Ho: There is no significant relationship between innovative curriculum structure and sustainable development in Nigerian Basic Schools, with the other four hypotheses

Methodology

The study adopted a descriptive survey of a co relational type. The study's population consisted of 480 school heads, of which 217 were sampled using Research Advisor 2006 to determine the sample size. The instrument was an adapted questionnaire titled 'Innovative Curriculum Structure and Sustainable Development Questionnaire' (ICSSDQ). The face and content validity of the instrument were ascertained. The reliability was carried out using Cronbach's alpha, and the coefficient was 0.78. The researchers administered the instrument to the respondents. Descriptive statistics of mean, median, and standard deviation were used to answer research questions, while partial least squares structural equation modelling (PLS-SEM) was used to test the hypotheses.

Hypothetical Models /Results and Interpretation

Descriptive statistics were calculated for the items in the sustainable development variable and sub-factors of innovative curricula variables, including classrooms, staffrooms, laboratories, and libraries, using the median, as the dataset is ordinal. The analysis was based on a four-point Likert scale, ranging from strongly disagree (1) to agree (4). It is essential to use methods specific to ordinal data to preserve statistical power (Agresti, 2010; Ayanwale, 2023). Calculating the mean or standard deviation for ordinal data would be inappropriate, so the preferred measures are the median, mode, or quartiles (Agresti, 2010). Medians were computed for each item, specifically for classrooms, staffrooms, laboratories,

libraries, and sustainable development, as shown in Figures 1 to 5. To aid interpretation, Likert responses were categorized as low (1-2.49) or high (2.5–4.0).

Research Questions

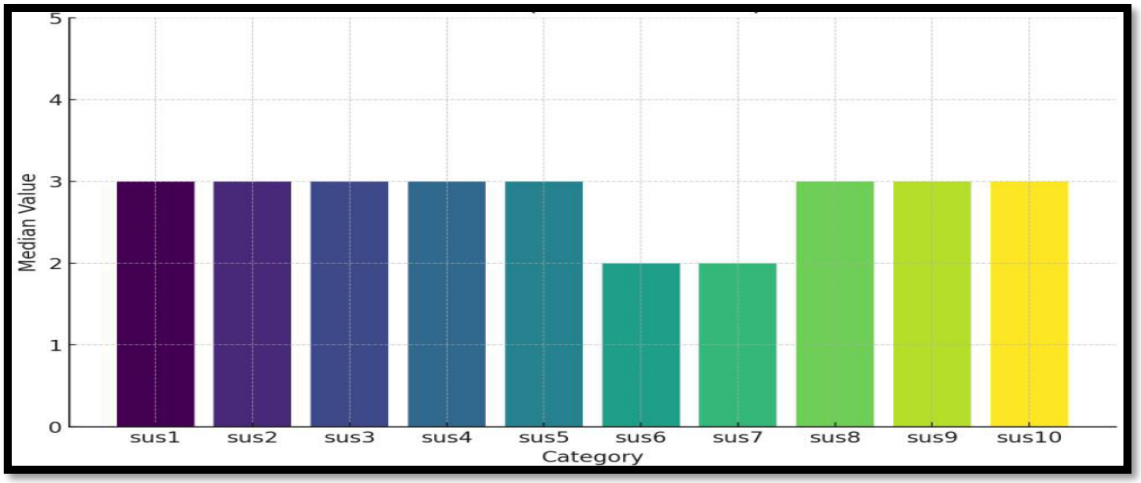

Figure 1. Bar chart showing the level of sustainable development

Figure 1 presents the level of sustainable development across the schools, which presents a varied picture. Items 1 to 5 and 8 to 9 are classified as high, with median scores of 3.0, respectively. These scores indicate satisfactory levels of sustainable development, suggesting that these areas are generally well-maintained and meet the required standards. However, items 6 and 7, each with a median score of 2.0, fall into the low category. These scores highlight areas that need significant improvement. The low scores suggest deficiencies in these aspects of sustainable development, which may impact the overall effectiveness and sustainability of the schools.

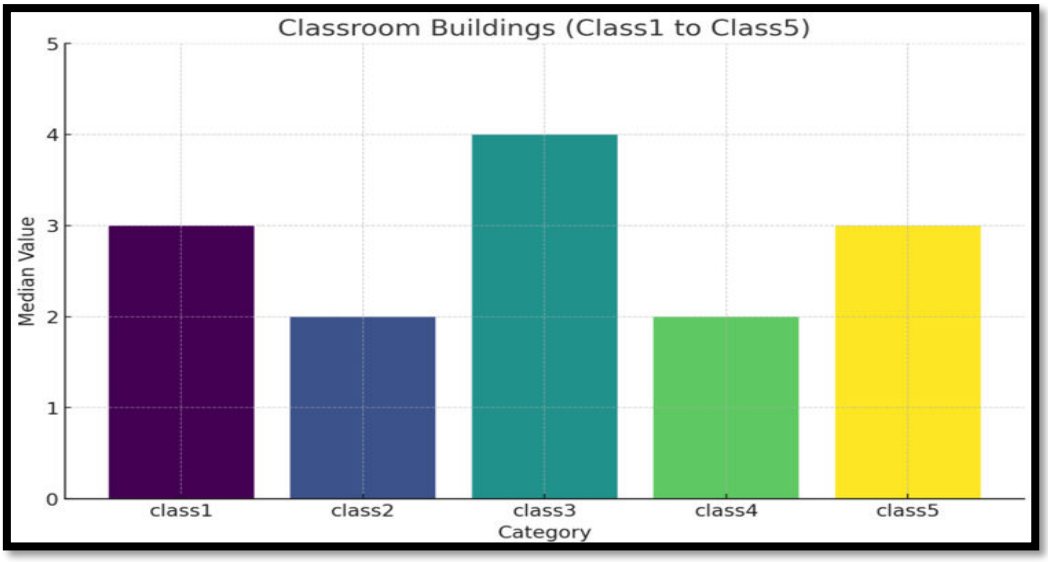

Figure 2: Bar chart showing the state of classroom buildings

Figure 2 presents the condition of classroom buildings in Nigeria's basic schools, revealing a mix of high and low conditions. Classes 1, 3, and 5 all have median

values classified as high, with scores of 3.0, 4.0, and 3.0, respectively. This indicates that these items generally show that the buildings are in good condition. However, Classes 2 and 4, with a median score of 2.0, fall into the low category, suggesting that these buildings may require attention and improvement to meet the desired standards.

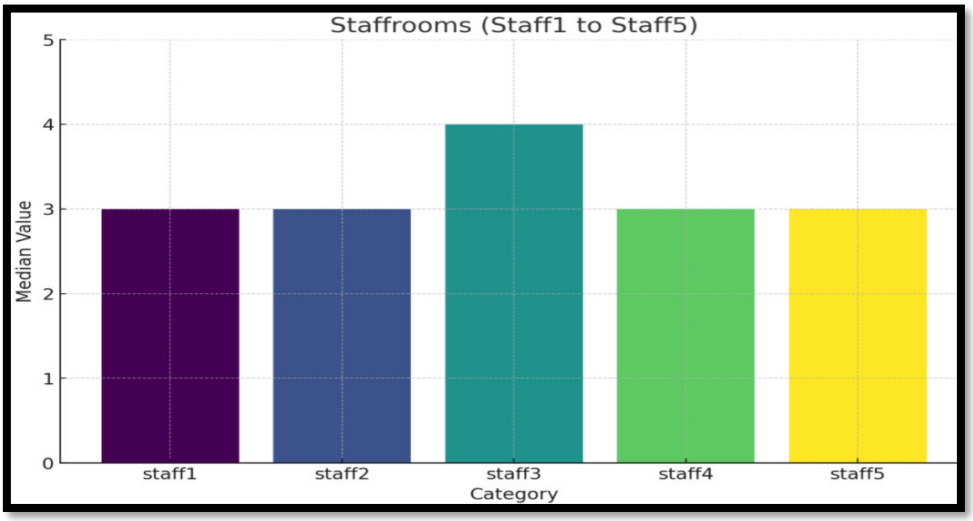

Figure 3: Bar chart showing the state of staffrooms

Figure 3 illustrates the condition of staffrooms in Kwara State basic schools, indicating that most items are in satisfactory condition. Specifically, the staffrooms labelled Staff 1 to Staff 5 have high median scores of 3.0, 3.0, 4.0, and 3.0, respectively. This suggests that the overall state of these staffrooms is relatively good, with the majority meeting expected standards. The satisfactory condition of the staffrooms implies a conducive work environment for teachers, which is essential for job satisfaction and performance. A well-maintained staffroom can significantly impact teachers' productivity and, consequently, student outcomes. The high scores reflect the effective utilization of resources allocated for maintaining and improving staffrooms, showcasing good administrative and management practices within the school.

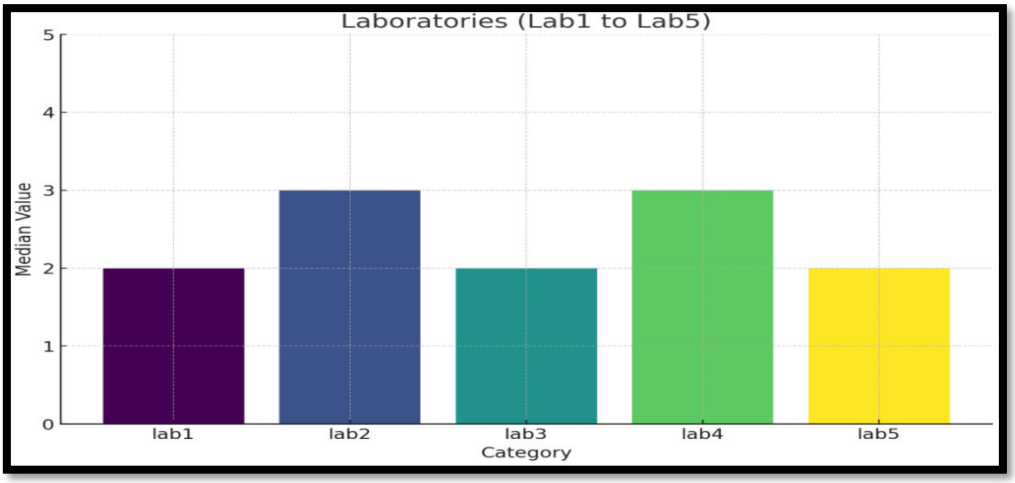

Figure 4: Bar chart showing laboratories

Figure 4 presents the condition of the laboratories in the basic schools, which are generally in a favourable state, with items 2 and 4 achieving high median scores of 3.0. Nevertheless, Items 1, 3, and 5, both scoring 2.0, fall into the low category, indicating the necessity for improvements to ensure that all laboratories are up to standard and can adequately support the educational needs of learners.

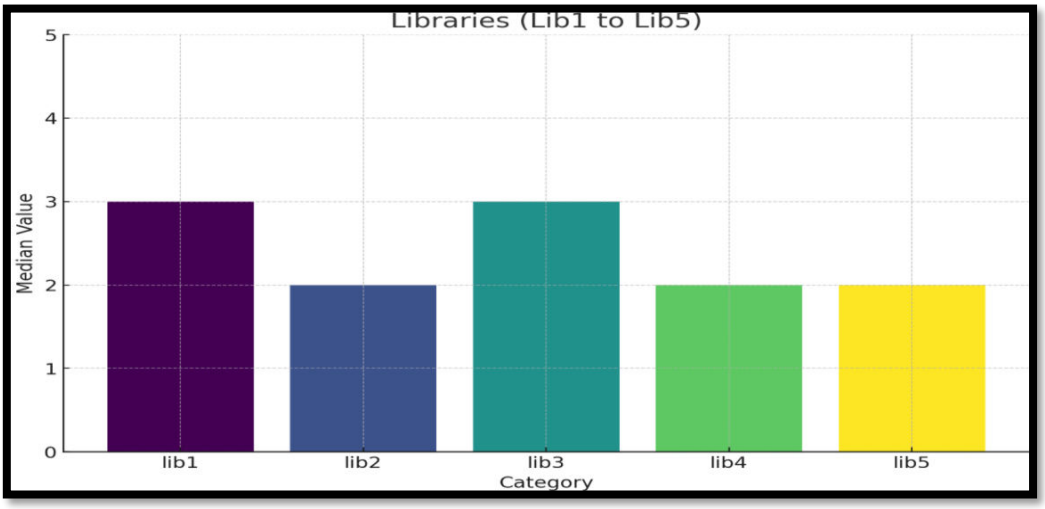

Figure 5: Bar chart showing the state of libraries

Figure 5 presents the condition of the libraries in the schools, which shows a similar pattern, with items 1 and 3 classified as high, scoring medians of 3.0. This reflects well-maintained and adequate library facilities. On the other hand, items 2, 4, and 5, each with a median score of 2.0, are categorized as low, suggesting that these libraries may need significant enhancements to provide better resources and environments for learning. Overall, these results indicate that while many facilities in Kwara State basic schools are in good condition, significant areas require attention. Classrooms, staffrooms, laboratories, libraries, and sustainable development all have evidence of low scores that suggest a need for targeted improvements. Ensuring all facilities are brought up to a high standard is crucial for providing a conducive learning environment and supporting the educational development of learners.

Measurement Model Assessment

The measurement model illustrates the connections between constructs and their corresponding indicator variables (see Figure 6). During the evaluation of the measurement model, indicators with factor loadings below 0.60 were excluded, following the guidelines of Sarstedt et al. (2021). Consequently, ten items,namely class1, class3, lib4, staff3, sus1, sus2, sus6, sus8, sus9, and sus10,were removed from the analysis due to low factor loadings. The first aspect of the measurement model assessment is reliability analysis, which includes composite reliability (CR). According to Ayanwale et al. (2024), Molefi et al. (2024) and Ringle et al. (2020), the standard threshold for composite reliability is 0.70, although 0.60 is acceptable. As a result, all the variables in the model exhibit composite reliability

(see Table 1). The second aspect is convergent validity, assessed using the Average Variance Extracted (AVE). The cutoff value for AVE is 0.50, as specified by Ayanwale et al. (2022) and Ringle et al. (2020). Therefore, the constructs demonstrate convergent validity (see Table 1).

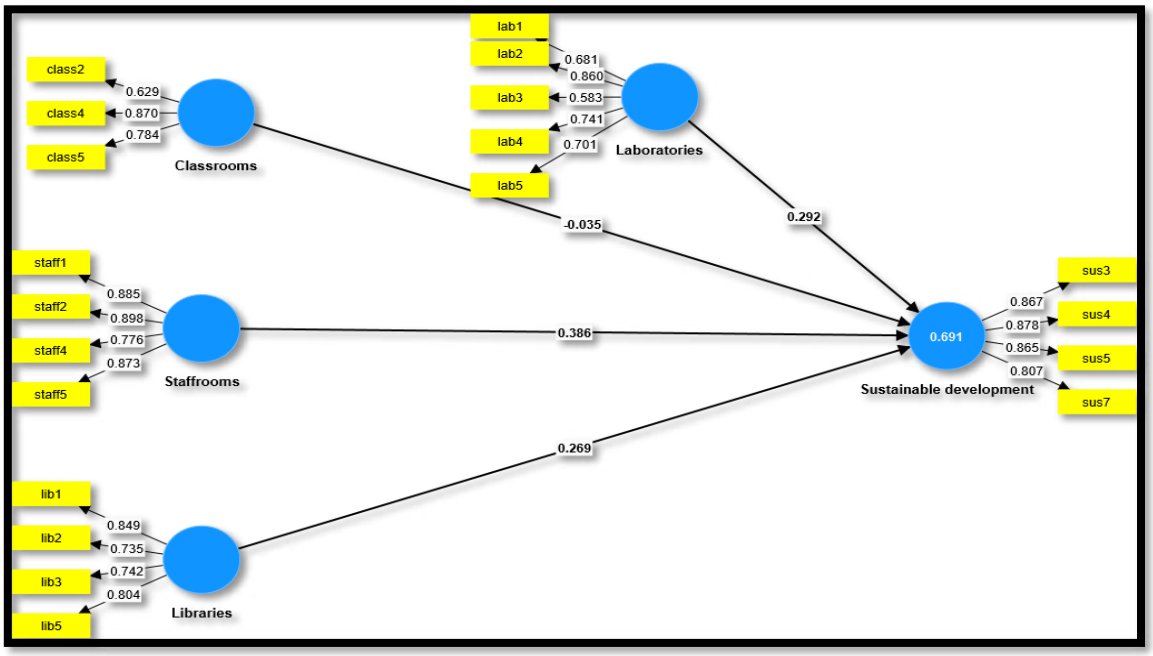

Figure 6: Validated measurement model

Table 1 Summary of reliability and validity assessment of the variables

Variable	Indicator	Item loadings	Composite reliability (rho_c)	Average variance extracted (AVE)	VIF
Classrooms	class2	0.629	0.809	0.589	1.172
	class4	0.870			1.543
	class5	0.784			1.387
Laboratories	lab1	0.681	0.840	0.517	1.380
	lab2	0.860			2.136
	lab3	0.583			1.261
	lab4	0.741			1.477
	lab5	0.701			1.632
Libraries	lib1	0.849	0.864	0.614	1.749
	lib2	0.735			1.576
	lib3	0.742			1.570
	lib5	0.804			1.574
Staffrooms	staff1	0.885	0.918	0.738	2.977
	staff2	0.898			3.317
	staff4	0.776			1.690
	staff5	0.873			2.202

Sustainable development	sus3	0.867	0.915	0.731	2.303
	sus4	0.878			2.560
	sus5	0.865			2.385
	sus7	0.807			1.783
Second-order variable					
Innovative curriculum	Classrooms	0.884	0.940	0.796	2.986
	Laboratories	0.906			3.116
	Libraries	0.865			2.409
	Staffrooms	0.913			3.480

Additionally, Table 1 includes the variance inflation factor (VIF) to examine collinearity within the model. Hair et al. (2011) recommend that VIF values should be below 3.0, and this criterion is met in the study. Discriminant validity is assessed using the Heterotrait-Monotrait (HTMT) ratio procedure. Henseler et al. (2015) suggest a conservative threshold for HTMT of 0.90 or less. In this study, all HTMT values are below this threshold, thus confirming discriminant validity (see Table 2). Importantly, the second-order variable, namely the innovative curriculum, was validated through the measurement model assessment (refer to Table 1). The model met the recommended cutoffs for item loadings, composite reliability, VIF, and average variance extracted. Additionally, the HTMT values were all below the threshold of 0.90 (refer to Table 2), further confirming the robustness of the model.

Table 2 Discriminant validity - Heterotrait-Monotrait Ratio Correlation

Variables	**Classrooms**	**Laboratories**	**Libraries**	**Staffrooms**	**Sustainable development**
Classrooms					
Laboratories	0.028				
Libraries	0.730	0.814			
Staffrooms	0.038	0.802	0.820		
Sustainable development	0.819	0.803	0.833	0.864	
Second-order variable					
Variable	Innovative curriculum	Sustainable development			
Innovative curriculum					
Sustainable development	0.854				

These findings suggest that the validation process lays a solid groundwork for examining the connections between various constructs. It also supports the development of more robust and reliable theoretical models. For professionals in

the field, especially those involved in educational management and policymaking, this level of validation ensures that the constructs being measured are both trustworthy and meaningful. As a result, decisions and policies guided by the model's outcomes are more likely to be well-informed and practical.

Assessment of the Structural Model

Evaluating the structural model requires applying standard criteria, as outlined by Hegner-Kakar et al. (2018). In the context of Partial Least Squares Structural Equation Modeling (PLS-SEM), two primary indicators are crucial for understanding the model's performance: the coefficient of determination (R^2) and the statistical significance of the path coefficients. The R^2 value reflects how much of the variation in the dependent variable is explained by the independent variables. It ranges from 0 (indicating no explanatory capacity) to 1 (indicating complete explanation). Higher R^2 values suggest that the model has strong predictive accuracy, while lower values imply limited explanatory strength.

Additionally, the significance of path coefficients reveals the strength and direction of the relationships among variables. In PLS-SEM, this significance is typically tested using the bootstrap method, with a 95% bias-corrected and accelerated (BCa) confidence interval. In this study, however, the significance was assessed using bootstrap-generated p-values, providing an alternative yet practical approach to evaluate the robustness of the model's relationships.

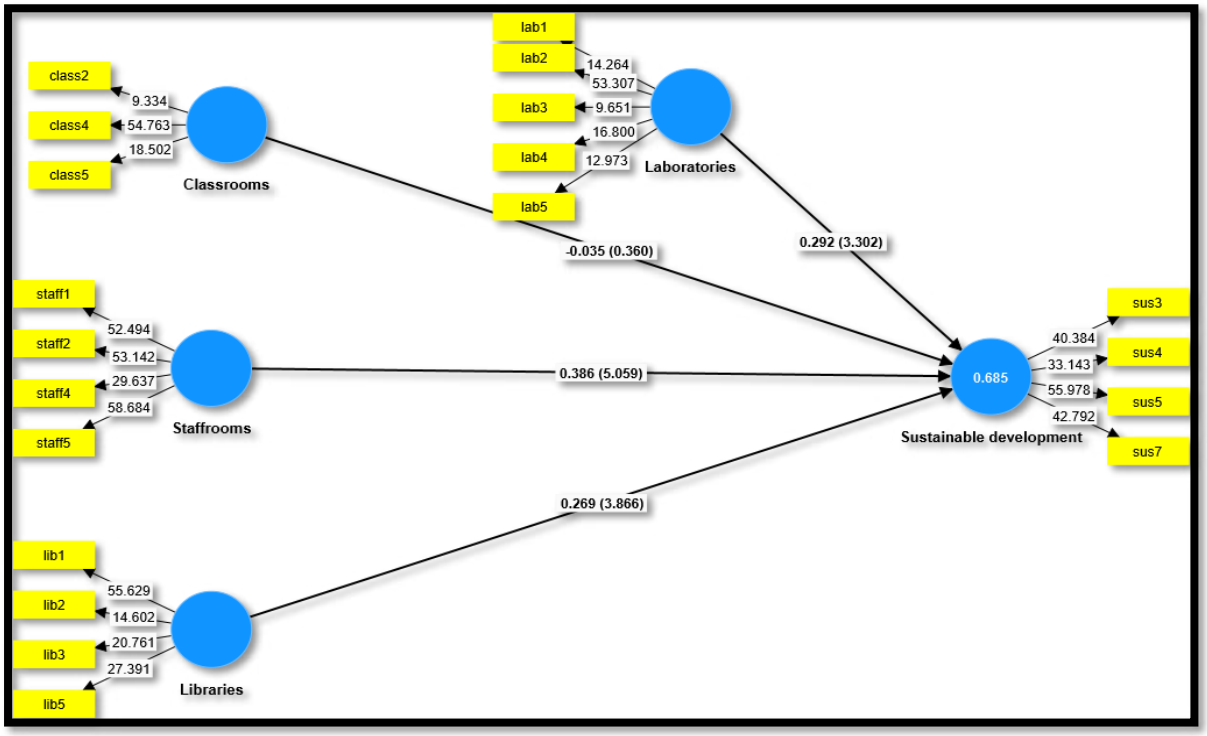

Figure 7: a Structural model estimate for the first-order variable

Figures 7a and 7b illustrate the hypothesized model based on latent scores from the first stage of the two-stage approach. Table 3 presents the path coefficients for

the hypotheses tested. These metrics provide a comprehensive understanding of the model's explanatory power and the validity of the hypothesized relationships.

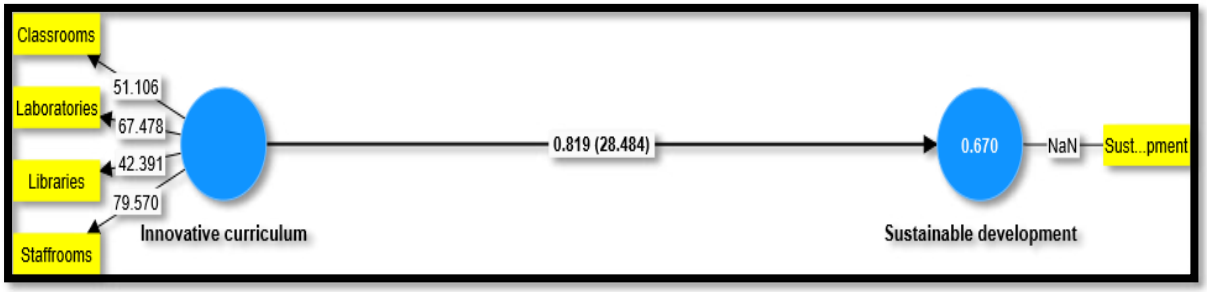

Figure 7: b Structural model estimate for the second-order variable

Table 3 Summary of structural relationships between the study variables

Hypotheses	Paths	Beta	Std. Dev.	R-Value	T statistics	P values	2.5%
Ho1	Innovative curriculum -> Sustainable development	0.819	0.029	0.670	28.484	0.000	0.756
Ho2	Classrooms -> Sustainable development	-0.035	0.098		0.360	0.719	-0.231
Ho3	Laboratories -> Sustainable development	0.292	0.089		3.302	0.001	0.115
Ho4	Libraries -> Sustainable development	0.269	0.070		3.866	0.000	0.140
Ho5	Staffrooms -> Sustainable development	0.386	0.076		5.059	0.000	0.235
R-Adjusted							
	Sustainable development	0.685					

* t > 1.96; p < 0.05; Sig. – Significant

Table 3 presents the analysis of the structural model, offering a detailed view of how various constructs relate to sustainable development in the educational context. The data show that curriculum innovation significantly and positively impacts sustainable development (Hypothesis 1), with a beta value of 0.819 ($p < 0.05$) and a large effect size ($f^2 = 2.040$). This finding strongly supports the importance of incorporating innovative approaches into curriculum design to promote sustainability.

On the other hand, the link between classroom conditions and sustainable development (Hypothesis 2) appears to be weak and statistically insignificant. The beta value is -0.035 ($p = 0.719$), the T statistic is 0.360, and the effect size is minimal ($f^2 = 0.001$). This suggests that, within the context of this model, classroom environments alone may not have a meaningful influence on sustainability outcomes. Further exploration is needed to identify which elements of classroom design or use might better support sustainability.

In contrast, a significant relationship was observed between laboratory facilities and sustainable development (Hypothesis 3), with a beta coefficient of 0.292 ($p = 0.001$), a T statistic of 3.302, and a moderate effect size ($f^2 = 0.089$). This indicates that access to well-equipped, functional laboratories plays a valuable role in promoting sustainability education. Investing in and upgrading laboratory infrastructure could be a strategic move to enhance student engagement and support sustainable practices.

Likewise, libraries were shown to have a meaningful impact on sustainable development (Hypothesis 4), with a beta value of 0.269 ($p < 0.05$) and a moderate effect size ($f^2 = 0.097$). These results underscore the essential role libraries play as hubs of knowledge, especially when they provide materials focused on sustainability themes.

Discussion

The findings confirm a strong and positive link between curriculum innovation and sustainable development, reinforcing the idea that integrating modern teaching methods and sustainability-focused content into education can yield impactful results. This aligns with the arguments made by Sterling (2011) and Wals & Corcoran (2023), who emphasized that sustainability-centered curricula lead to more environmentally conscious and socially responsible students. Their perspectives highlight the ongoing need for educational reform that embraces sustainability as a central theme.

Interestingly, the study also found that classroom conditions, when considered in isolation, do not significantly affect sustainable development outcomes. While a conducive learning environment is essential, its influence may depend more on how sustainably the space is used rather than its mere physical state. This supports the views of Barrett et al. (2015) and Earthman (2017), who suggested that integrating sustainable features and practices into learning spaces is what truly makes the difference.

The evidence also strongly supports the idea that laboratories are key contributors to sustainability education. Practical, hands-on experiences in science labs foster inquiry and problem-solving skills critical for tackling sustainability challenges. Research by Lozano et al. (2017) and De Haan (2018) similarly concluded that experiential learning environments are essential for meaningful engagement with sustainability.

Furthermore, the significant role of libraries in promoting sustainable development cannot be overstated. Libraries provide access to essential resources that foster reading, research, and critical thinking. As Agyeman (2019) and Jukes (2021) observed, when libraries are well-resourced and tailored to sustainability topics, they can significantly enhance students' awareness and participation in sustainable practices.

Conclusion

Transforming Nigeria's basic education through innovative curriculum structures is a complex but necessary endeavour. This study concludes that fostering sustainability in schools goes beyond textbook reforms. It requires appropriate physical infrastructure and the integration of sustainability principles across all areas of learning. By prioritizing curriculum innovation and improving educational facilities, Nigeria can build a more resilient and future-ready education system.

Recommendations

Based on the insights from this study, the researchers proposed the following recommendations:

- The national curriculum should be comprehensively revised to embed sustainability across disciplines. Topics such as environmental protection, social justice, and economic responsibility should be systematically included to equip students for future challenges.
- School leaders and policymakers should prioritize investment in science laboratories. This includes modernizing lab equipment and ensuring that labs are safe, well-maintained, and accessible, enabling students to explore sustainability issues through practical learning.
- Teachers and students should be actively encouraged to use library resources. Initiatives like sustainability-focused reading clubs, workshops, and student seminars can promote engagement and deepen understanding of sustainability themes.
- Although classroom conditions did not significantly impact sustainability outcomes in this study, school administrators should still strive to enhance the physical learning environment by ensuring classrooms are well-lit, ventilated, and ergonomically designed to support learning.

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