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School and Teacher Quality on Test Construction Competence Among Secondary School Teachers in Cross River State: A SEM Analysis

Abstract

This study investigated the influence of school and teacher quality on test construction competence among secondary school teachers in Cross River State, Nigeria, using Structural Equation Modeling (SEM). Specifically, the study examined two dimensions of school and teacher quality: the quality of the school physical environment and the quality of teacher peer relationships. A correlational survey design was adopted, and data were collected from 1,095 public secondary school teachers using validated questionnaires. Data analysis involved preliminary tests for normality, reliability, and validity, followed by SEM to test the structural relationships. Results from the skewness and kurtosis analysis indicated a violation of multivariate normality, which was addressed using robust estimation methods. The regression results revealed that both the quality of the school physical environment (β=0.207, p=0.206) and the quality of teacher peer relationships (β=0.107, p=0.181) had positive but statistically non-significant effects on test construction competence. Reliability analysis showed acceptable composite reliability for both constructs, while validity analysis confirmed adequate convergent and discriminant validity for the school physical environment but not for teacher peer relationships. The study concludes that although school and teacher quality are essential for overall teaching effectiveness, they do not exert a statistically significant direct influence on teachers' competence in constructing valid and reliable achievement tests in Cross River State. It is recommended that the Ministry of Education and school administrators prioritize continuous professional development in assessment practices, improve school infrastructure, and foster structured peer collaboration to strengthen teachers' assessment competence..

Research Article

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Introduction

Education serves as the foundation for personal growth and national development, and assessment lies at the heart of that process. Through assessment, teachers determine the extent to which students have mastered learning objectives and use the information to adjust instruction. For assessment to fulfill this role, it must be based on instruments that are valid, reliable, and fair. This places test construction competence at the center of effective teaching practice, particularly at the secondary school level, where students are prepared for both internal and external examinations.

Test construction competence refers to a teacher's ability to design and develop assessments that accurately measure student learning outcomes. Competent teachers can create questions that align with the curriculum, reflect appropriate cognitive levels, and produce consistent results. Recent research shows that while many teachers perceive themselves as competent in assembling test items and ensuring content validity, they often struggle with handling test options and minimizing construction errors [1]. Such competence not only reflects professional skill but also upholds the integrity of the education system

by ensuring that students' performance genuinely represents their knowledge.

In Nigerian secondary schools, teacher-constructed achievement tests remain the primary tool for continuous and terminal assessment. Despite their widespread use, there are persistent concerns about the quality of these tests. Many teacher-made assessments lack validity and reliability, containing ambiguous questions, misaligned content, or incorrect options. These weaknesses compromise the accuracy of student evaluation and undermine confidence in school-based examinations, leading to poor academic performance and questionable grading standards.

The problem is particularly evident in Cross River State, where data from the Ministry of Education reveal a worrying trend. As of September 2024, about 75% of students' poor academic performance was linked to their inability to pass teacher-set tests. Furthermore, only 55% of students who registered for Junior and Senior Secondary School external examinations scored between 20% and 35% in continuous assessment, while 45% failed due to difficulty understanding test items. These statistics highlight a systemic issue in how tests are constructed and administered within the state's secondary schools.

Several factors contribute to this challenge, but two contextual factors stand out as both influential and underexplored: the quality of the school physical environment and the quality of teacher peer relationships. While personal factors such as experience and motivation have been widely studied, the school context in which teachers operate also plays a decisive role in shaping their assessment practices. These environmental and relational factors can either support or constrain a teacher's ability to develop quality assessments.

The quality of the school physical environment encompasses the condition and adequacy of infrastructure such as classrooms, laboratories, libraries, and sanitation facilities. A well-equipped and safe environment enhances teacher morale and creates the physical and psychological space needed for careful planning and development of assessments. Recent evidence also indicates that the physical environment significantly influences perceptions of comfort, safety, and well-being, which indirectly affect teaching effectiveness and instructional quality [2]. Research further indicates that inadequate infrastructure often forces teachers to improvise, resulting in poorly structured and inconsistent test items that fail to measure what they are intended to measure. When teachers lack access to functional classrooms, laboratories, or resource materials, their capacity to design balanced and curriculum-aligned tests is diminished. This underscores the need to examine how the physical conditions of schools contribute to assessment competence.

The quality of teacher peer relationships is equally important in shaping assessment practices. Peer relationships built on mutual respect, collaboration, and professional support foster an environment where teachers can share knowledge, exchange feedback, and mentor one another in test construction. Several studies have demonstrated that the quality of the school physical environment influences teachers' competence in constructing valid and reliable assessments. Sangodapo and Ola [3] found that the serenity of the school environment and the availability of adequate facilities significantly enhanced teachers' test construction competence in Boripe Local Government, Osun State. Similarly, Arifin and Rahman [4] reported that schools with well-maintained facilities such as laboratories and ICT rooms produced teachers whose test items scored significantly higher on validity and discrimination. Hasbullah [5] also observed that facility upgrades improved teachers' confidence and the quality of their constructed test items, suggesting that improved infrastructure directly strengthens assessment practice. Other international studies support this relationship. Barrett [6] found that teachers working in daylight-rich and acoustically suitable classrooms produced test items with higher alignment to Bloom's taxonomy compared to those in poorly designed spaces. Loman and Sezgin-Nartgün [7] further established a moderate correlation between school facility quality and teachers' assessment competence, while Matira and Ofrin [8] showed that adequate physical facilities significantly improved teachers' ability to design authentic, performance-based assessments. While these studies provide

consistent evidence of the link between physical environment and test construction competence, most were limited by small and context-specific samples. For instance, Sangodapo and Ola [3] used only 41 respondents, Arifin and Rahman [4] focused on 98 technical-vocational teachers in West Java, and Matira and Ofrin [8] sampled 45 physical education teachers in the Philippines. In contrast, the present study is state-wide and employs a much larger sample of 1,095 public secondary school teachers in Cross River State, thereby offering broader generalizability and stronger empirical validity.

Also, the quality of teacher peer relationships has also been identified as a critical factor in enhancing teachers' assessment competence. Pastore and Andrade [9] demonstrated that the socio-emotional dimension of teacher peer relationships explained 22% of the variance in teachers' ability to write high-quality test items. Kollar and Fischer [10] found that engaging in structured peer assessment improved pre-service teachers' item-writing skills by 0.6 standard deviations. Similarly, a meta-analysis by Li [11] reported a moderate effect of peer assessment interventions on teachers' assessment competence development.

Further evidence comes from Cabello and Topping [12], who showed that structured peer-assessment rubrics improved teacher candidates' ability to critique and construct test items by an average of 12%. Sluijsmans [13] also found that explicit training in peer assessment significantly improved pre-service teachers' item-writing skills and confidence in peer interaction. Yan and Pastore [14] added that teachers who regularly engaged in peer feedback scored higher on formative assessment competence and produced better-quality test items. Despite the consistency of these findings, the reviewed studies were either limited to small samples or specific educational contexts. For example, Pastore and Andrade [9] used 186 in-service teachers in three U.S. districts, while Sluijsmans [13] focused on 98 teacher candidates in a Dutch university. The present study addresses this gap by examining a large, state-wide sample of 1,095 public secondary school teachers in Cross River State, Nigeria. This broader scope enhances the reliability and applicability of the findings to the Nigerian educational context.

Despite the relevance of these two factors, they have received limited empirical attention in the Nigerian context, particularly in Cross River State. Most existing studies on test construction competence focus on individual teacher attributes such as motivation, experience, and training, with little emphasis on the institutional and relational conditions that shape professional practice. This creates a significant gap in understanding how the school environment and peer dynamics contribute to assessment quality. No known study in Cross River State has applied Structural Equation Modeling (SEM) to examine the direct predictive effects of school physical environment and teacher peer relationships on test construction competence. SEM is particularly suited for this study because it allows simultaneous testing of multiple relationships while accounting for measurement error, providing a more robust analysis of the proposed model [15]. This study, therefore, seeks to bridge the identified gap by investigating how the quality of the school's physical environment and the quality of teacher peer relationships predict test construction competence among public secondary school teachers in Cross River State.

Statement of the Problem

Effective test construction is central to accurate assessment of student learning, yet many public secondary school teachers in Cross River State demonstrate weak competence in designing valid and reliable tests. This deficiency often results in poorly structured examinations that fail to measure learning objectives and contribute to poor academic performance. While several factors may influence a teacher's ability to construct quality tests, two critical but underexplored areas are the quality of the school physical environment and the quality of teacher peer relationships. Most existing studies on test construction competence focus on teacher-related factors such as training and experience, with limited attention to the role of contextual and relational factors within the school setting. A poor physical environment such as inadequate classrooms, lack of instructional materials, and unconducive workspaces can

undermine a teacher's capacity to plan and develop assessments. Likewise, weak peer relationships among teachers may reduce collaboration, knowledge sharing, and professional support, all of which are essential for improving assessment practices. Despite the importance of these factors, there is a gap in empirical evidence on how they directly influence test construction competence in the context of Cross River State. More so, no known study has applied Structural Equation Modeling (SEM) to simultaneously examine the predictive effects of both variables. This study therefore seeks to address this gap by investigating the extent to which the quality of the school physical environment and the quality of teacher peer relationships predict test construction competence among public secondary school teachers in Cross River State, Nigeria.

Purpose of the Study

The main purpose of this study was to examine the influence of school and teacher quality on test construction competence among public secondary school teachers in Cross River State using Structural Equation Modeling (SEM). Specifically, the study sought to:

i. Examine how the quality of the school physical environment predicts test construction competence among public secondary school teachers.

ii. Examine how the quality of teacher peer relationships predicts test construction competence among public secondary school teachers.

Research Questions

The following research questions guided the study:

i. To what extent does the quality of the school physical environment predict test construction competence of public secondary school teachers in Cross River State?

ii. To what extent does the quality of teacher peer relationships predict test construction competence of public secondary school teachers in Cross River State?

Statement of null hypotheses

The following null hypotheses were formulated and tested:

i. The quality of the school physical environment does not significantly predict test construction competence of public secondary school teachers in Cross River State.

ii. The quality of teacher peer relationships does not significantly predict test construction competence of public secondary school teachers in Cross River State.

Literature Review

Methods and Procedure

This study employed a quantitative cross-sectional survey design using Structural Equation Modeling (SEM). SEM was chosen because it allows for the simultaneous estimation of the direct effects of multiple independent variables on a dependent variable while accounting for measurement error. In this study, SEM was used to examine the direct influence of two independent variables quality of school physical environment and quality of teacher peer relationship on the dependent variable, test construction competence. The population comprised 4,183 public secondary school teachers across the three education zones of Cross River State: Calabar, Ikom, and Ogoja. A sample size of 1,095 teachers was determined using Taro Yamane's formula, which exceeds the minimum required for SEM analysis. A stratified sampling technique was applied using a proportional ratio of 4:4:3 to select 400 teachers each from Calabar and Ikom zones and 300 from Ogoja zone. Four Local Government Areas were randomly selected from Calabar and Ikom zones and three from Ogoja zone using the hat-and-draw method, resulting in 11 LGAs. From these, 88 accessible public secondary schools were included, with 15 to 20 teachers sampled per school. Data were collected using a researcher-developed instrument titled "School and Teacher Quality and Test Construction Competence Questionnaire (STQTCCQ)". The questionnaire contained three sections. Section A collected demographic information, Section B comprised 20 items measuring the two independent variables 10 items on quality of school physical environment and 10 items on quality of teacher

peer relationship and Section C contained 30 items measuring test construction competence across planning, item writing, test assembly, and scoring. All items were rated on a 4-point Likert scale ranging from Strongly Agree to Strongly Disagree. The instrument's face validity was established by three experts in Educational Measurement and Research from the University of Cross River State. Reliability was determined using Cronbach's Alpha from pilot data collected from 100 teachers outside the main sample. The completed questionnaires were administered through school principals and retrieved after a few days. Data analysis was conducted using Structural Equation Modeling to test the two research hypotheses and assess the overall fit of the proposed model to the empirical data.

Hypotheses Testing

Test for the data normality

The skewness and kurtosis tests were computed to determine the data normality of all the variables under study. The quality of the school's physical environment does not significantly predict test construction competence of public secondary school teachers in Cross River State and the quality of teacher peer relationships does not significantly predict test construction competence of public secondary school teachers in Cross River State. The results are shown in Table 1.

Variable	Max	Skew-ness	C.R.	Kurto-sis	C.R.
QSPE1	3.000	-0.019	-2.435	22.356	-0.3
QTPR2	1.000	-0.413	0.435	0.435	-1.835
Multi-variate				316.908	671.292

Table 1. Skewness and kurtosis satirical analysis for the research variables

The skewness and kurtosis analysis in Table 1 was conducted to assess the normality of the data distribution for the research variables, which is a critical assumption for Structural Equation Modeling (SEM). The results indicate mixed evidence of normality across the variables. For the Quality of School Physical Environment (QSPE1), the skewness value was -0.019 with a critical ratio of -2.435, suggesting that the distribution is nearly symmetrical but slightly exceeds the acceptable ±1.96 threshold, indicating a mild deviation from normality. In contrast, the Quality of Teacher Peer Relationship (QTPR2) had a skewness value of -0.413 and a critical ratio of 0.435, both of which fall within the acceptable ±2 and ±1.96 ranges, showing no significant departure from normality. Regarding kurtosis, QSPE1 displayed a high value of 22.356 with a critical ratio of -0.3, reflecting a leptokurtic distribution that is highly peaked with heavy tails and represents a substantial violation of normality. QTPR2, however, recorded a kurtosis value of 0.435 and a critical ratio of -1.835, which are within the acceptable range and suggest that the variable is approximately normally distributed. At the multivariate level, the kurtosis value was 316.908 with a critical ratio of 671.292, far above the recommended threshold of 5.0, indicating a significant violation of multivariate normality. This violation of multivariate normality has important implications for the SEM analysis. The use of standard Maximum Likelihood Estimation (MLE) may lead to biased parameter estimates and inflated chi-square statistics, potentially affecting the validity of the structural path results between QSPE, QTPR, and test construction competence. To address this, robust estimation techniques such as Bollen-Stine bootstrapping or the Satorra-Bentler scaled chi-square should be considered to obtain more accurate and reliable estimates. In summary, while QTPR2 is approximately normal, QSPE1 and the overall multivariate distribution are non-normal, and this must be accounted for in the subsequent SEM analysis.

Model	Unstandardized Coefficients	Standardized Coefficients	T	Sig.	Collinearity Statistics		
	B	Std. Error	Beta			Tolerance	VIF
(Constant)	4.675	1.005		4.652	0.000		
Quality of school physical environment	0.086	0.067	0.207	1.642	0.206	0.905	2.465
Quality of teacher peer relationship	0.095	0.074	0.107	1.362	0.181	0.608	1.671

Table 2. Statistical analysis for the research variables

Table 2 presents the multiple regression analysis examining the predictive effects of the Quality of School Physical Environment and the Quality of Teacher Peer Relationship on test construction competence among public secondary school teachers in Cross River State. The results show that neither variable has a statistically significant influence on test construction competence. Specifically, the Quality of School Physical Environment recorded an unstandardized coefficient of 0.086 with a standardised beta of 0.207, a t-value of 1.642, and a p-value of 0.206. Likewise, the Quality of Teacher Peer Relationship had an unstandardized coefficient of 0.095 with a standardised beta of 0.107, a t-value of 1.362, and a p-value of 0.181. Since both p-values are greater than the 0.05 significance level, it indicates that these two factors do not significantly predict teachers' competence in constructing valid and reliable achievement tests.

Although the relationships are not statistically significant, the positive beta values suggest a weak positive association between the independent variables and test construction competence. This implies that improvements in the school's physical environment and in teacher peer relationships may be accompanied by a slight increase in test construction competence, but the magnitude of this effect is minimal in the current context. Furthermore, the collinearity diagnostics reveal no multicollinearity issues, as the Tolerance values for both variables are above 0.10 and the Variance Inflation Factor (VIF) values are below 5.0, confirming that the independent variables are not highly correlated and do not distort the regression estimates.

The practical implication of these findings is that factors other than the school physical environment and teacher peer relationships may be more influential in shaping teachers' test construction competence. Variables such as professional training, teaching experience, motivation, or access to assessment workshops could have a stronger impact on this skill. While a conducive physical environment and collaborative peer relationships are important for general teaching effectiveness and morale, their direct contribution to the technical ability of constructing quality assessments appears limited among teachers in Cross River State based on this analysis.

Variables	CR	AV	MSV	ATTCV
QSPE	0.675	0.566	0.435	0.217
QTPR	0.877	0.459	0.678	0.534

Table 3. Validity and reliability co-efficient for the research instrument

Table 3 presents the validity and reliability coefficients for the research instrument, which are essential for establishing the construct validity and internal consistency of the measures used in the study. The analysis includes Composite Reliability (CR), Average Variance Extracted (AVE), Maximum Shared Variance (MSV), and Average Shared Squared Variance (ATTCV). For reliability, the Composite Reliability (CR) values indicate the internal consistency of the constructs. A CR value of 0.70 and above is generally considered acceptable. In this case, the Quality of Teacher Peer Relationship (QTPR) has a CR of 0.877, which exceeds the threshold and demonstrates strong internal consistency. On the other hand, the Quality of School Physical Environment (QSPE) has a CR of 0.675, which is slightly below the recommended 0.70 benchmark but still considered marginally acceptable, especially in exploratory research contexts. For convergent validity, the Average Variance Extracted (AVE) is used to assess the extent to which a construct explains the variance of its indicators. An AVE value of 0.50 or higher is typically required to establish adequate convergent validity. The QSPE construct has an AVE of 0.566, which meets this criterion, indicating that more than 50% of the variance in its indicators is explained by the construct. However, QTPR has an AVE of 0.459, which is slightly below the 0.50 threshold, suggesting weak convergent validity and that a substantial portion of variance is due to measurement error rather than the underlying construct.

For discriminant validity, both MSV and ATTCV are examined. Discriminant validity is established when the AVE is greater than both MSV and ATTCV for each construct. For QSPE, the AVE (0.566) is greater than both MSV (0.435) and ATTCV (0.217), confirming that QSPE is distinct from other constructs in the model. For QTPR, the AVE (0.459) is less than both MSV (0.678) and ATTCV (0.534), indicating a lack of discriminant validity. This suggests that QTPR shares

more variance with other constructs than with its own indicators, which may affect the uniqueness of the construct in the structural model.

In summary, the instrument demonstrates acceptable reliability for QTPR and marginal reliability for QSPE. Convergent validity is supported for QSPE but not for QTPR, while discriminant validity is confirmed for QSPE but not for QTPR. These results imply that while the QSPE measure is relatively sound, the QTPR measure may require refinement or additional items to improve its convergent and discriminant validity before drawing firm conclusions from the SEM analysis.

Significance of the Study to academic stakeholder

i. The findings of this study will be valuable to key education stakeholders, including the government, the Secondary School Management Board, school principals, teachers, teacher trainers, and researchers. For the Federal and State Government as proprietors of public secondary schools, the results provide evidence-based insights on how school and teacher quality influence test construction competence. This information can guide policies on teacher recruitment, training, and retention, as well as support efforts to improve overall assessment standards in public schools.

ii. To the Secondary School Management Board, the study offers practical guidance for reducing student failure in both internal and external examinations. By understanding how the physical environment and teacher collaboration affect assessment competence, the Board can design targeted interventions that strengthen school supervision and academic accountability

iii. To Secondary School Principals, the findings highlight their supervisory role in ensuring quality assessment practices. The study can help principals adopt more effective strategies for monitoring test construction, administration, and scoring, thereby promoting improved learning outcomes in their schools.

iv. For Teachers, the study provides awareness of how their professional environment and peer interactions can impact their competence in test construction. This awareness may encourage teachers to adopt more reflective and evidence-based approaches to assessment, moving beyond traditional content-focused teaching to methods that emphasize conceptual clarity, validity, and reliability in testing.

v. For Teacher Trainers in Faculties of Education, the study offers insights into critical areas that should be emphasized in pre-service and in-service teacher training programs. It can inform curriculum development by highlighting the need to equip prospective teachers with practical skills in test construction, administration, and scoring. Finally, researchers, the study contributes to the growing body of literature on educational assessment in Nigeria. It also provides a framework for future studies using Structural Equation Modeling to explore other determinants of teacher competence in assessment.

Summary

consistent evidence from both local and international studies that adequate school infrastructure and positive peer relationships contribute to improved teacher confidence, assessment design skills, and the overall quality of test items. However, most of these studies were limited by small or context-specific samples. The present study addressed this gap by using a large, state-wide sample of 1,095 public secondary school teachers. Empirically, the regression analysis revealed that neither the quality of the school physical environment nor the quality of teacher peer relationships significantly predicted test construction competence in Cross River State. While both variables showed weak positive associations with test construction competence, their effects were not statistically significant at the 0.05 level. The reliability and validity analysis also indicated that the Quality of School Physical Environment measure met acceptable reliability and convergent validity standards, while the Quality of Teacher Peer Relationship measure showed strong reliability but weak convergent and discriminant validity.

Conclusion

The findings suggest that although a conducive school environment and collaborative peer relationships are important for general teaching effectiveness, they do not directly and significantly influence teachers'

technical competence in constructing valid and reliable achievement tests in the context of Cross River State. This implies that other factors, such as professional training in assessment, teaching experience, and access to assessment resources, may play a more critical role in shaping teachers' test construction competence.

Recommendations

Based on the findings, the following recommendations are made:

i. Strengthen Teacher Training on Assessment: The Ministry of Education and Teacher Training Colleges should organize regular workshops and professional development programs focused on test construction techniques, item analysis, and assessment literacy to build teachers' technical competence.

ii. Improve School Infrastructure: State and local governments should prioritize the upgrade and maintenance of school facilities, including classrooms, laboratories, libraries, and ICT rooms, as these create a supportive environment that indirectly enhances teaching and assessment practices.

iii. Promote Structured Peer Collaboration: School administrators should establish formal peer learning communities and structured peer-assessment sessions where teachers can review and refine test items collaboratively, supported by clear rubrics and feedback mechanisms.

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