

Original Research Article

Structural Equation Modeling of Teacher's Motivation and Adherence to Test-Construction Principles as Determinants of Test Construction Competence of Public Secondary School Teachers in Cross River State, Nigeria

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Abstract: The study examined Structural Equation Modeling of teacher's motivation and adherence to test-construction principles as determinants of Test Construction Competence of Public Secondary School Teachers in Cross River State, Nigeria. The research design used for this study was Ex-Post Facto design. The area of the study was Cross River State. The population of the study consist of 4183 public secondary school teachers. The stratified sampling technique was used to select the sample. The sample of this study was 1095 public secondary school teachers. The instrument used for collecting data was questionnaire. Data analysis and modeling of the variables was carried out using SPSS AMOS version 24. at 0.50 and above level of significant. The hypotheses tested using structural equation modeling and the results reveals that all the hypotheses were significant. Hypothesis one revealed that Motivation significantly influence test constructions competence of public secondary school teachers. Hypothesis two revealed that Adherence to test-construction principles significantly influence test construction competence of public secondary school teachers. Based on the conclusion, it recommended among others that, Government and principals of Schools should always encourage their teachers by retraining them on test construction and giving them incentive to motivate them in discharging their duties. Public secondary school teachers should also be encouraged to have empathy on their students.

Keywords: Motivation, to Test-Construction Principles, Structural Equation Modeling, Test-Construction.

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INTRODUCTION

Globally, education stakeholders are collaborating efforts aimed to increase learning to span the entire city of the human organism, covering the cognitive, affective and psychomotor domains for personal and natural development. Consequently, the issue of students' mass failure in examinations has attracted the attention of parents, educators, policy makers and the general public in Nigeria. Another source of worry is why some students who are adjudged to be brilliant perform poorly in some examinations. Some critics point to the teacher-made tests and examination papers as invalid and unreliable and therefore do not provide accurate assessment of students' learning outcomes. For instance, one often hears students either complain that the tests items administered were out of the

content taught by their teacher or that the time was so short for them to finish the test, or that language used in these tests were ambiguous and capable of misleading and confusing even the bright students. Yet, most achievement tests used in Nigerian schools for continuous assessment are teacher-constructed tests.

The current situation in many Nigerian secondary schools is far from this ideal. Evidence from examination bodies, school administrators and students consistently points to a widespread lack of test construction skills among teachers and examiners are often characterized by poorly phrased questions, items that fail to match learning objectives, and an over-reliance on items that only test rote memorization and other lower-order objectives rather than critical thinking. As a result, these assessments do not truly measure

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students' abilities, leading to inaccurate evaluations and hindering the improvement of teaching and learning practices. This weakness in assessment practices undermines curriculum implementation, affects student outcomes and erodes confidence in the education system.

Teachers motivation according to Nwosu and Okundamiya (2024) refers to the driving forces that initiate and sustain an individual's behavior towards achieving a particular goal. According to Bernard, Steven, & Forest, (2015) welfare package are those additional benefits that employers designed for their employees to make them happy which in turn enhance job productivity. Regular payment of salary, staff training and monetary reward can enhance growth in an organization so he put it to administrators that, they should strive to create conducive work environment where change is recognized so that individual can adapt to change more easily.

Adherence to test-construction principles means that the design, development, and scoring of a test follow established, research-based guidelines that ensure the instrument measures what it is intended to measure (validity) and does so consistently (reliability). In practice, this involves systematically applying steps such as (a) defining the construct and purpose, (b) creating a test blueprint that aligns items with learning outcomes, (c) writing items that are clear, unbiased, and appropriately difficult, (d) piloting and revising items based on item-analysis data, and (e) establishing scoring rubrics and standard-setting procedures (American Educational Research Association, American Psychological Association, & National Council on Measurement in Education, 2014).

Purpose of the Study

The main purpose is to develop the structural model of teacher's motivation and adherence to test-construction principles as determinants of test constructions competence of public secondary school teachers in Cross River State, Nigeria.

Specifically, the Study Sought To:

1. Examine how motivation influence teacher's test constructions competence.
2. Examine how adherence to test principles influence teacher's test constructions competence.

Research Questions

The following research questions were posed to guide the study;

1. To what extent does motivation influence test constructions competence of public secondary school teachers?
2. To what extent does adherence to principles influence test constructions competence of public secondary school teachers?

Statement of Null Hypotheses

The following null hypotheses were formulated to guide the study;

1. Motivation does not significantly influence test constructions competence of public secondary school teachers.
2. Adherence to principles does not significantly influence test constructions competence of public secondary school teachers.

LITERATURE REVIEW

In a study carried out by Kissi, Baidoo-Anu, Anane, and Annan-Brew (2023), one of the purposes was to study motivation and teachers' test construction competencies in examination-oriented educational system. The study made use of survey research design. Three null hypotheses were formulated to guide the study and tested with Regression analysis. By surveying 214 seniors-high teachers in Ghana, this study reveals gaps in item-writing skills, particularly in constructing higher-order multiple-choice questions. Motivation to improve testing emerged as a strong predictor of competence ($\beta = 0.42$, $p < .001$), highlighting the need for targeted professional development.

Another study carried out by Cahyanti, Purwoko, Khamidi, Hariyati, and Roesminingsih (2024), sought to study student motivation through teacher competence in test construction. Mixed-methods research design and two null hypotheses were use in the study. This mixed-methods study links teachers' assessment literacy to students' intrinsic motivation. The study population comprised of 100 teachers and the sample of the study was 50 teachers. Data was analyzed with Multiple Regression analysis and the results showed that teachers who received test-construction training reported higher confidence, and their students showed a 12 % increase in engagement scores. The paper underscores the motivational impact of competent assessment design.

In the study by Lotobi, (2021), the study examined adherence to principles as a Correlate of Students' Achievement and Interest in Chemistry. One of the purposes of the study was to find out the extent to which Chemistry teachers' adherence to test construction principles correlates with students' academic achievement and interest in Chemistry. To guide this study, four research questions and four hypotheses were also formulated. Correlational research design was adopted for the study. The population of the study comprised 1100 students in the public senior secondary schools selected. A total of three hundred and twenty-six (326) senior secondary school class two (S.S.2) students and fifteen (15) chemistry teachers that were selected constituted the study sample. The instrument used to generate the needed data was the Students Achievement Test (SAT), the adherence to principles Questionnaires (TATCPQ) and the Student Interest Test Questionnaires

(SITQ). Cronbach alpha reliability indices of 0.76 and 0.79 were obtained for TATCPQ and SITQ respectively, while Kuder Richardson, 20 was used for SAT with reliability index of 0.87. The findings of this study reveal that adherence to test construction principles by chemistry teachers does not correlate with test construction ability.

Francis, Francis and Andrews (2020) study the Issue of Non-Adherence to Test Construction Principles: Do Teachers' Commitment to Teaching or Attitude by the Teacher Really Matter? One of the purposes was to examine teachers' adherence to test construction principles. The study adopted the quantitative inquiry approach. Through the census survey method, 346 high school teachers in Sekondi-Takoradi Metropolis, Ghana, were engaged. Questionnaire was used to survey the teachers. Reliability of the instrument was 0.8. Data were analysed using Structural Equation Modeling (SEM), through AMOS software, and mediation analysis using Hayes' PROCESS. It emerged from the study that teachers' attitude towards test construction significantly mediated between teachers' skills and adherence to test construction principles, but teachers' commitment to work did not. Both teachers' commitment and attitude did not serially mediate the relationship between teachers' test construction skills and adherence to test construction principles.

METHODOLOGY

Research Design

The research design used for this study was Ex-Post Facto design. The area of the study was Cross River State. The population of the study consist of 4183 public secondary school teachers. This work is anchored on the technical, traditional or scientific theory of assessment propounded in 1977 by Ludvig Stevansson and

Structural Equation model by Spearman Wright (1904), Sewall wright (1921) and Otis Dudley Duncan (1966).

Instrumentation:

A 119 researcher-constructed instrument titled "Teachers' personal and Non-personal factors and Test Construction Competence Questionnaire" (TPNFTCCQ) was used to collect data for the study.

Sample and Sampling Procedure:

The sample of this study was 1095 public secondary school teachers. The Simple random sampling approach was used to select sample from the population of the study. Contacts were made with the selected respondents and they were briefed on the aim and importance of the study and their cooperation solicited with regards to their responses to the questionnaire items. After two weeks interval the completed questionnaire which numbered up to 1095 copies were retrieved.

Validity of the Instrument:

The questionnaire was subjected to face validation by three (3) experts one in Educational Psychology and the other two from Measurement and Evaluation. These experts scrutinized the relevance of the items in the instrument to the work, suitability of the number of items and appropriateness of the instrument in general to the purpose of the study and made useful correction.

Method of Data Analysis: Data analysis and modeling of the variables was carried out using SPSS AMOS version 24. at 0.50 and above level of significance.

RESULTS AND DISCUSSION

General Description of Data/Variables

Table 1: Descriptive Statistics of the Study Variables by Teachers' Educational Zone

Name of variable	Edu. Zone	N	Mean	Std. Deviation	Std. Error	Minimum	Maximum
Motivation	Calabar	273	33.4945	1.50274	.09095	32.00	35.00
	Ikom	548	31.0000	1.00091	.04276	30.00	32.00
	Ogoja	274	33.5000	1.50274	.09078	32.00	35.00
	Total	1095	32.2475	1.78505	.05394	30.00	35.00
Adherence to test Construction Principles	Calabar	273	28.7949	2.54844	.15424	23.00	31.00
	Ikom	548	31.4763	1.75183	.07483	26.00	34.00
	Ogoja	274	30.6241	3.47797	.21011	23.00	34.00
	Total	1095	30.5945	2.71396	.08202	23.00	34.00
Test Construction Competence	Calabar	273	93.5568	4.52175	.27367	83.00	98.00
	Ikom	548	94.0803	3.22594	.13781	83.00	101.00
	Ogoja	274	93.1533	4.28455	.25884	86.00	100.00
	Total	1095	93.7178	3.87556	.11712	83.00	101.00

The results in Table 1 show that for motivation, Ogoja education zone had the highest mean score ($\bar{X}$ = 33.500), followed by those in Calabar education zone ($\bar{X}$ = 33.495), and the least were Ikom zone ($\bar{X}$ = 31.000). This pattern was repeated for adherence to test

construction principal. For attitude towards test construction, teachers in Ogoja zone came first ($\bar{X}$ = 34.219), followed by those in Ikom zone ($\bar{X}$ = 32.305), and the least were teachers in Calabar education zone ($\bar{X}$ = 31.954).

Test of Hypothesis:

Null Hypothesis One: Motivation Does Not Significantly Influence Test Constructions Competence of Public Secondary School Teachers:

To model this hypothesis, since the dependent variable (test constructions competence of public secondary school teachers) is continuous variable and the independent variable (Motivation) is also continuous variable. The statistical techniques used for modelling the hypothesis was Structural Equation Model. The results are presented in Table 2.

Table 2: Test of Structural Equation Model by Teacher's Motivation

VARIABLES			Estimate	S.E.	C.F.	p-value	Label
MTV1	<---	MOTIVATION	1.120	.228	4.915	.70	par 1
MTV2	<---	MOTIVATION	1.387	.248	5.602	.90	par 2
MTV3	<---	MOTIVATION	1.443	.256	5.640	.91	par 3
MTV4	<---	MOTIVATION	.872	.182	4.796	.70	par 4
MTV5	<---	MOTIVATION	1.123	.217	5.171	.78	par 5
MTV6	<---	MOTIVATION	1.000	.317	4.234	.88	par 6
MTV7	<---	MOTIVATION	1.490	.215	2.154	.78	par 7
MTV8	<---	MOTIVATION	1.321	.132	1.563	.90	par 8
MTV9	<---	MOTIVATION	1.448	.357	2.300	.96	par 9
MTV10	<---	MOTIVATION	1.213	.542	4.412	.98	par 10

*Significant at .05 level ($P < .050$)

The regression weights in Table 2 show the factor loadings of observed variables on their respective latent constructs, indicating how well each item represents its underlying factor. For Motivation sub-item, a loading ranging from 4.195 to 4.412 with their corresponding p-value ranging from .70 to .98 was generated. The results suggest that most items are

strongly related to their respective constructs with a high loading factor. Hypothesis one revealed that Motivation significantly influence test constructions competence of public secondary school teachers with ($p < .050$). Figure 1 shows Motivation sub-item Model error terms and the relationship in each of the items.

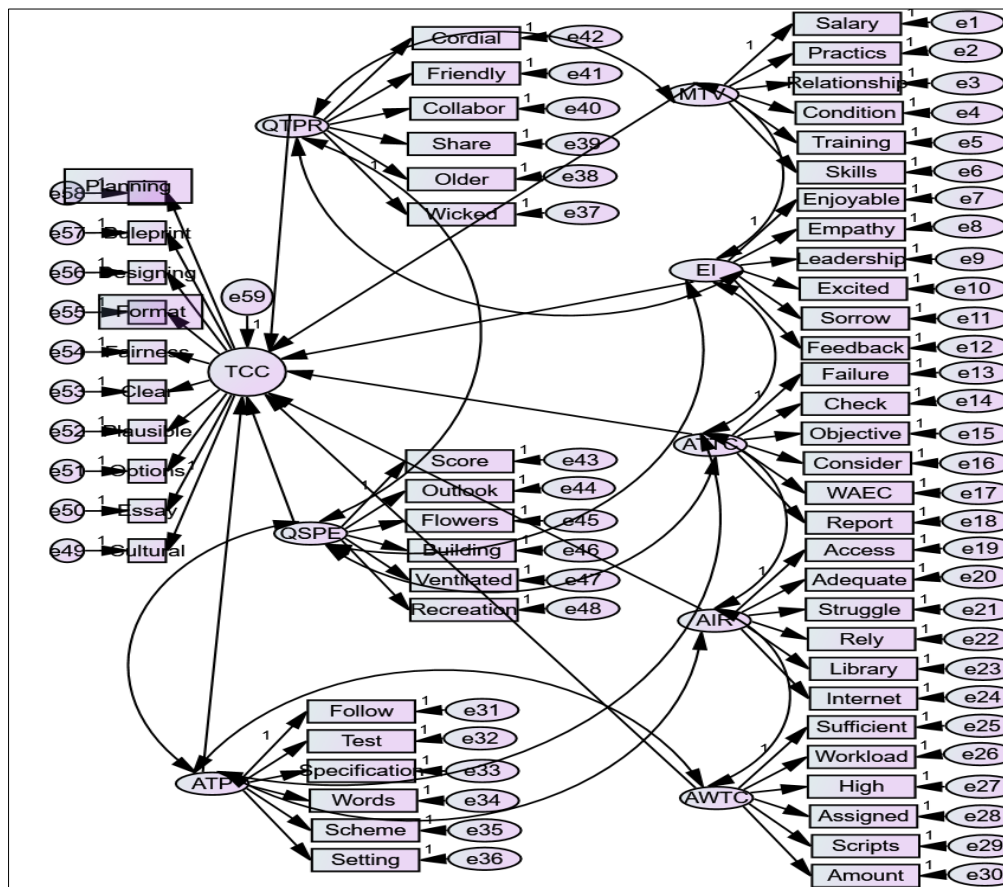


Figure 1: Motivation sub-item Model

Null Hypothesis Two: Adherence to Test Principles Does Not Significantly Influence Test Constructions Competence of Public Secondary School Teachers:

To test this hypothesis, since the dependent variable (test constructions competence of public secondary school teachers) is continuous variable and the

independent variable (Adherence to test principles) is also continuous variable was used. The statistical techniques used for modelling the hypothesis was Structural Equation Model. The results are presented in Table 3.

Table 3: Test of Structural Equation Model by Teacher's Adherence to Test Construction Principles

Variables			Estimate	S.E.	C.F.	p-value	Label
ATP1	<---	ADHERENCE TO TEST CONSTRUCTION PRINCIPLES	.872	.182	4.796	.367	par 1
ATP2	<---	ADHERENCE TO TEST CONSTRUCTION PRINCIPLES	1.123	.217	5.171	.214	par 2
ATP3	<---	ADHERENCE TO TEST CONSTRUCTION PRINCIPLES	1.000	.317	4.234	.123	par 3
ATP4	<---	ADHERENCE TO TEST CONSTRUCTION PRINCIPLES	1.490	.215	2.154	.226	par 4
ATP5	<---	ADHERENCE TO TEST CONSTRUCTION PRINCIPLES	1.321	.132	1.563	.245	par 5
ATP6	<---	ADHERENCE TO TEST CONSTRUCTION PRINCIPLES	1.120	.228	4.915	.251	par 6
ATP7	<---	ADHERENCE TO TEST CONSTRUCTION PRINCIPLES	1.387	.248	5.602	.482	par 7
ATP8	<---	ADHERENCE TO TEST CONSTRUCTION PRINCIPLES	1.443	.256	5.640	.622	par 8
ATP9	<---	ADHERENCE TO TEST CONSTRUCTION PRINCIPLES	.872	.182	4.796	.632	par 9
ATP10	<---	ADHERENCE TO TEST CONSTRUCTION PRINCIPLES	1.123	.217	5.171	.463	par 10

*Significant at .05 level ($P < .050$)

The regression weights in Table 3 show the factor loadings of observed variables on their respective latent constructs, indicating how well each item represents its underlying factor. For Adherence to test construction principles sub-item, a loading ranging from 4.796 to 5.171 with their corresponding p-value ranging from .367 to .463 was generated. The results mean that all items are strongly related to their respective

constructs with a high loading factor. Hypothesis seven revealed that Adherence to test construction principles significantly influence test constructions competence of public secondary school teachers with ($p < .050$). Figure 2 shows Adherence to test construction principles sub-item Model error terms and the relationship in each of the items.

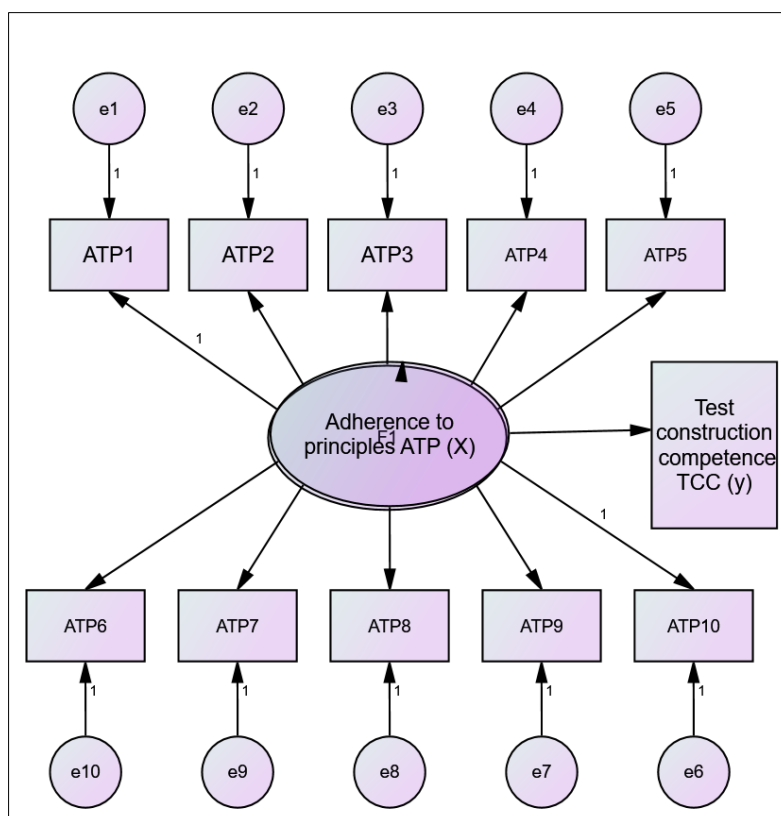


Figure 2: Adherence to test construction principles sub-item Model

DISCUSSION OF FINDINGS

The results reveal that all the hypotheses were significant. Hypothesis one revealed that Motivation significantly influence test constructions competence of public secondary school teachers. Hypothesis two revealed that Adherence to test-construction principles significantly influence test construction competence of public secondary school teachers.

CONCLUSION AND RECOMMENDATION

Based on the conclusion, it recommended among others that, Government and principals of Schools should always encourage their teachers by retraining them on test construction and giving them incentive to motivate them in discharging their duties. Public secondary school teachers should also be encouraged to have empathy on their students.

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