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ASSESSMENT OF MATHEMATICS TEACHERS' COMPETENCE ON CONSTRUCTION OF TEACHER-MADE ACHIEVEMENT TEST FOR SENIOR SECONDARY SCHOOLS IN FCT, ABUJA – NIGERIA

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ABSTRACT

This paper assessed Mathematics teachers' competence in the construction of teacher-made achievement tests for senior secondary schools in the Federal Capital Territory (FCT), Abuja, Nigeria. Teacher-made tests remain the most frequently used tool for measuring student achievement in Nigerian classrooms, yet several studies suggest that many of these tests lack the clarity, validity, and reliability required for sound educational decision-making. Anchored on Shulman's Pedagogical Content Knowledge (PCK) theory, the study adopted a cross-sectional survey design. The population comprised 55,461 Mathematics teachers (28,730 male and 26,731 female) drawn from 794 senior secondary schools in FCT, Abuja. A sample of 30 Mathematics teachers (18 male, 12 female) was drawn using simple random sampling technique. Data were collected using the Mathematics Teachers' Test Construction Competency Questionnaire (MATTECCQ), a 40-item, five-point Likert-type instrument covering eight competency domains: determining the purpose of testing, developing a table of specification, selecting item formats, preparing test items, developing a marking guide, conducting item analysis, administering the test, and reviewing the test. The instrument was face- and content-validated by experts (validation index of 0.74) and had a Cronbach's Alpha reliability coefficient of 0.76. Data were analysed using mean and standard deviation, with a criterion mean of 3.00 used to judge competence. Findings revealed that Mathematics teachers in FCT, Abuja demonstrated an overall high level of competence (grand mean = 4.15) across all eight domains, with the strongest competence recorded in reviewing/appraising the test (mean = 4.37) and the relatively weakest, though still competent, performance recorded in conducting item analysis (mean = 3.88). The study concluded that Mathematics teachers in FCT possess appreciable competence in teacher-made test construction, although technical skills such as item analysis require reinforcement. It was recommended, among others, that the

Secondary Education Board should organise regular workshops on item analysis and test technical skills for Mathematics teachers.

Keywords: Teachers' Competence, Test Construction, Teacher-Made Achievement Test, Mathematics Teachers.

Introduction

Mathematics remains one of the core and compulsory subjects taught across primary, junior, and senior secondary school curricula in Nigeria (National Policy on Education, 2015). Students' proficiency in Mathematics is central to their success in the sciences and to their prospects in tertiary education (Sani and Salahuddeen, 2016). Beyond curriculum delivery, teachers are professionally obliged to assess the extent to which instructional objectives have been achieved, a process referred to as assessment. Among the several tools like interviews, assignment, group project, test etc. available to teachers for this purpose, the test remains the most widely used (Ahmed, 2018).

An achievement test may either be standardized, developed by measurement experts, or teacher-made, developed and administered by classroom teachers (Omorogiuwa, 2019). Teacher-made or classroom tests are particularly important in Mathematics because they provide immediate and context-specific evidence of what has been taught and learned. However, the value of a teacher-made test depends almost entirely on the competence of the teacher who constructs it. A well-constructed test reflects the objectives of instruction, adequately samples the content taught, uses appropriate item formats, and yields scores that are both valid and reliable (Osadebe, 2016; Matthew, 2019).

Test construction competence, therefore, refers to a teacher's ability to systematically determine the purpose of a test, develop a table of specification, select and write appropriate item formats, develop a marking guide, conduct item analysis, administer the test appropriately, and review the test for continued relevance (Adeniji and Ilorah, 2018; Frazen, Adeosun, and Mogokwu, 2024). Unfortunately, several studies have observed that teacher-made tests in Nigeria are frequently constructed hurriedly, lack a table of specification, over-emphasise recall-level items, and are seldom subjected to item analysis or reliability checks (Adedoyin and Mokobi, 2021; Afolabi & Loto, 2019; Afolayan & Akinsanya, 2019).

This paper narrows its focus specifically to Mathematics teachers within the Federal Capital Territory (FCT), Abuja, in order to provide a concise, localised, conference-scale assessment of teachers' competence in this critical assessment skill.

The teacher-made test is the classroom teacher's most important assessment tool, yet many teachers do not appear to accord it the professional attention it deserves. Tests are frequently constructed without a defined purpose or a table of specification, item formats are poorly matched to learning objectives, marking guides are inconsistently applied, and item analysis is rarely conducted to check the difficulty, discrimination, validity, or reliability of items (Adedoyin and Mokobi, 2021; Bandalaria, 2023). Where such deficiencies exist, students, parents, and school authorities receive inaccurate information about students' true abilities,

resulting in faulty educational decisions (Opie, Oko-Ngaji, Eduwen and Amba, 2021). It is against this background that this study assessed the level of Mathematics teachers' competence in constructing teacher-made achievement tests in senior secondary schools in FCT, Abuja.

The general objective of the study is to assess the Mathematics teachers' competence on construction of teacher-made achievement test for senior secondary schools in Federal Capital Territory (FCT) - Abuja. Specifically, the study is to:

1. Assess the level of competencies in identifying the purpose/objectives of the test items among Mathematics teachers in senior secondary schools in FCT Abuja - Nigeria.
2. Assess the level of competencies in building table of specification among male and female Mathematics teachers in senior secondary schools in FCT Abuja - Nigeria.

The following research hypotheses are formulated to guide the study:

1. What is the level of competencies in identifying the purpose/objectives of the test items among Mathematics teachers in senior secondary schools in FCT Abuja - Nigeria?
2. What is the level of competencies in building table of specification among male and female Mathematics teachers in senior secondary schools in FCT Abuja - Nigeria?

Teachers' competence in test construction refers to the ability of a teacher to follow the systematic stages of test development, namely planning, item writing, item analysis, assembling, administration, and review, in order to produce an achievement test that is valid, reliable, and fair (Adeniji & Ilorah, 2018). A teacher-made achievement test is designed and used by the classroom teacher to determine the extent of students' mastery of taught content, typically for continuous assessment, terminal, or promotional examinations (Omorogiuwa, 2019). Senior secondary schools in FCT, Abuja, like their counterparts across the country, rely almost entirely on teacher-made tests for continuous assessment; hence, the competence of the teachers who construct them is central to the credibility of the resulting scores (Rani & Anisha, 2017).

Within the FCT context specifically, senior secondary schools are organised into public schools administered by the Universal Basic Education Board/Secondary Education Board and private schools operated by individuals or organisations, spread across both urban and rural in the six area council of the FCT which include Abuja Municipal Area Council (AMAC), Bwari, Kwali, Kuje, Gwagwalada, and Abaji. Given the diversity of school ownership and location within FCT, and the centrality of Mathematics to the senior secondary curriculum, an assessment of Mathematics teachers' test-construction competence within this territory provides useful, policy-relevant evidence for the FCT education authorities on the quality of classroom assessment practice in the territory.

This study is anchored on Shulman's Pedagogical Content Knowledge (PCK) theory (Shulman, 1986, 1987). PCK describes the specialised knowledge that enables a teacher to blend content knowledge (deep understanding of Mathematics) with pedagogical knowledge (general teaching and assessment principles) to produce instruction and assessment that are appropriate for specific learners and specific content. Within the context of this study, competent construction of a Mathematics achievement test is viewed as a direct manifestation of PCK: it

requires accurate mathematical content, sound pedagogical judgement in selecting item formats and language, and the contextual sensitivity to adapt items to the FCT classroom setting. The theory therefore provides the lens through which teachers' demonstrated competence (or lack thereof) across the eight domains examined in this study is interpreted.

Methodology

The study adopted a cross-sectional survey research design, which involves collecting data from a sample of a target population at a single point in time to assess attitudes, opinions, or competencies (Anikweze, 2015). This design was considered appropriate as it allowed data on Mathematics teachers' test construction competence in FCT, Abuja to be gathered from a representative sample at one point in time. The population of the study comprised all 55,461 Mathematics teachers (28,730 male and 26,731 female) in the 794 public and private senior secondary schools in the Federal Capital Territory, Abuja. This population figure represents the FCT Mathematics teachers. A sample of 30 Mathematics teachers (18 male and 12 female) from senior secondary schools in FCT, Abuja was drawn using simple random sampling technique, the sample composition by gender, qualification, school ownership, school location, and years of experience is presented in Table 1.

Table 1: Demographic Distribution of Respondents (N = 30)

Variable	Category	Frequency	Percentage (%)
Gender	Male	18	60.0
	Female	12	40.0
Qualification	B.Ed	13	43.3
	HND	12	40.0
	M.Ed	5	16.7
School Ownership	Public	24	80.0
	Private	6	20.0
School Location	Rural	11	36.7
	Urban	19	63.3
Years of Experience	1-5 years	5	16.7
	6-10 years	9	30.0
	11 years and above	16	53.3

Data were collected using the Mathematics Teachers' Test Construction Competency Questionnaire (MATTECCQ), a self-developed instrument comprising two sections. Section A elicited demographic information (gender, qualification, school ownership, school location, and years of experience), while Section B contained 40 items measuring teachers' competence

across eight domains of test construction, rated on a five-point scale of Strongly Agree, Agree, Undecided, Disagree, and Strongly Disagree. The face and content validity of the MATTECCQ was established by two experts in Educational Measurement and Evaluation, Department of Educational Foundations, Faculty of Education, Nasarawa State University, Keffi, who reviewed the instrument for appropriateness, comprehensiveness, and relevance of items. A validation index of 0.74 was obtained. The reliability of the instrument was established through a pilot test, using Cronbach's Alpha to estimate internal consistency, which yielded a reliability coefficient of 0.76, indicating that the instrument was sufficiently reliable for the study.

Data collected were analysed using descriptive statistics, specifically mean and standard deviation, to answer the research question for each of the eight competency domains. A criterion mean of 3.00 (the midpoint of the five-point scale) was used as the decision rule: a domain mean of 3.00 and above was interpreted as "Competent", while a mean below 3.00 was interpreted as "Not Competent".

Results And Data Analysis

Table 1 above shows that of the 30 respondents, 18 (60.0%) were male and 12 (40.0%) were female. In terms of qualification, 13 (43.3%) held a Bachelor of Education (B.Ed), 12 (40.0%) held a Higher National Diploma (HND), and 5 (16.7%) held a Master of Education (M.Ed). Regarding school ownership, 24 (80.0%) of the respondents taught in public schools while 6 (20.0%) taught in private schools. On school location, 19 (63.3%) were urban-based teachers while 11 (36.7%) were rural-based. On years of experience, 16 (53.3%) had 11 years and above, 9 (30.0%) had 6-10 years, while 5 (16.7%) had 1-5 years of teaching experience.

Table 2 presents the mean and standard deviation of Mathematics teachers' competence across the eight domains of test construction examined in the study.

Table 2: Mean and Standard Deviation of Mathematics Teachers' Competence in Test Construction by Domain (N = 30)

S/N	Competency Domain	Mean ($\bar{x}$)	SD	Remark
1	Determining the purpose of testing	3.95	1.34	Competent
2	Developing a table of specification / content outline	4.21	1.01	Competent
3	Selecting appropriate test-item formats	4.26	1.03	Competent
4	Preparing clear, valid test items	4.29	1.10	Competent
5	Developing the marking guide	4.12	1.04	Competent
6	Conducting item analysis	3.88	1.21	Competent
7	Administering the test	4.11	1.21	Competent
8	Reviewing and appraising the test	4.37	1.04	Competent
	Grand Mean	**4.15**	**-**	**Competent**

Table 2 shows that all eight competency domains recorded mean scores above the criterion mean of 3.00, indicating that Mathematics teachers in senior secondary schools in FCT, Abuja are generally competent in the construction of teacher-made achievement tests. The domain with the highest mean score was reviewing and appraising the test ($\bar{x}$ = 4.37, SD = 1.04), followed by preparing clear and valid test items ($\bar{x}$ = 4.29, SD = 1.10) and selecting appropriate test-item formats ($\bar{x}$ = 4.26, SD = 1.03). The domain with the lowest, though still competent, mean score was conducting item analysis ($\bar{x}$ = 3.88, SD = 1.21), followed by determining the purpose of testing ($\bar{x}$ = 3.95, SD = 1.34). The grand mean across all eight domains was 4.15, indicating an overall high level of competence among the sampled Mathematics teachers in FCT, Abuja.

Table 3 presents the item-by-item mean scores underlying the domain analysis in Table 2, providing a more granular view of teachers' competence on each of the 40 statements of the MATTECCQ.

Table 3: Item-Level Mean Scores of Mathematics Teachers' Test Construction Competence (N = 30)

Item	Statement	Mean	Remark
6	I clearly define the purpose of each testing exercise before constructing test items.	3.70	Competent
7	I specify measurable objectives for each testing exercise.	3.83	Competent
8	I ensure that the testing exercise aligns with the learning objectives.	4.20	Competent
9	I consider the type of assessment that will provide the most accurate measure of student learning.	3.93	Competent
10	I review and revise the test purpose and objectives as necessary.	4.07	Competent
11	I create a content outline to guide the construction of test items.	3.87	Competent
12	I develop a test plan that outlines the scope and format of the test.	4.33	Competent
13	I ensure that the test plan aligns with the learning objectives.	4.33	Competent
14	I identify the key concepts and skills to be tested.	4.27	Competent
15	I use the test plan to ensure that the test items are relevant and valid.	4.27	Competent
16	I choose test item formats that align with the learning objectives.	3.93	Competent
17	I consider the strengths and weaknesses of different test item formats.	4.40	Competent
18	I use a variety of test item formats to assess different skills and knowledge.	4.27	Competent
19	I ensure that the test items are clear and concise.	4.47	Competent

20	I avoid using test item formats that may be biased or unfair.	4.23	Competent
21	I ensure that test items are free from ambiguity and confusion.	4.47	Competent
22	I use clear and concise language in test items.	4.37	Competent
23	I avoid using complex or tricky language in test items.	4.03	Competent
24	I ensure that test items are relevant to the learning objectives.	4.33	Competent
25	I review and revise test items to ensure they are clear and precise.	4.23	Competent
26	I develop a marking guide that outlines the criteria for evaluating student responses.	4.07	Competent
27	I ensure that the marking guide is clear and concise.	4.20	Competent
28	I use the marking guide to ensure consistency in grading.	4.15	Competent
29	I provide feedback to students that is aligned with the marking guide.	4.23	Competent
30	I review and revise the marking guide as necessary.	3.93	Competent
31	I analyze test items to determine their difficulty and discriminative indices.	3.97	Competent
32	I use item analysis to identify areas where students may need additional support.	3.57	Competent
33	I use item analysis to evaluate the effectiveness of test items.	3.80	Competent
34	I review and revise test items based on item analysis.	3.80	Competent
35	I use item analysis to improve the validity and reliability of the test.	4.27	Competent
36	I provide clear instructions for test administration.	4.07	Competent
37	I ensure that students understand the test format and timing.	4.00	Competent
38	I provide clear directions for test-taking, including any necessary materials or equipment.	4.07	Competent
39	I ensure that students are aware of the criteria for evaluation.	4.13	Competent
40	I provide opportunities for students to ask questions and clarify any concerns.	4.27	Competent
41	I review the test for errors and ambiguities.	4.50	Competent
42	I ensure that the test aligns with the learning objectives.	4.33	Competent
43	I review the test format and timing to ensure they are reasonable.	4.27	Competent
44	I ensure that the test is free from bias and unfairness.	4.27	Competent
45	I make revisions to the test as necessary based on the review.	4.47	Competent

The finding that Mathematics teachers in FCT, Abuja demonstrated an overall high level of competence (grand mean = 4.15) in constructing teacher-made achievement tests aligns with Adeoye and Olubusuyi (2021), who similarly found that secondary school Mathematics teachers demonstrated adequate classroom assessment practice. It also partly departs from Azis and Sugiman (2018) and Retnawati et al. (2018), who reported only moderate competence among Mathematics and science teachers elsewhere, suggesting that the relatively urban, well-resourced FCT context may afford teachers greater exposure to assessment-related professional development compared to some other settings.

The comparatively lower, though still competent, mean recorded for item analysis ($\bar{x}$ = 3.88) corroborates the findings of Adedoyin and Mokobi (2021), Afolabi and Loto (2019), and Bandalaria (2023), all of whom identified item analysis and psychometric evaluation as the weakest link in teacher-made test construction. This pattern is consistent with Shulman's PCK theory, which suggests that while teachers may readily apply general pedagogical and content knowledge in planning and writing test items, the more specialised, technical skills, such as computing item difficulty and discrimination indices, require additional, targeted training beyond ordinary classroom experience.

Conversely, the high mean recorded for reviewing and appraising the test ($\bar{x}$ = 4.37) suggests that Mathematics teachers in FCT routinely check their tests for errors, ambiguity, bias, and alignment with learning objectives before administration, a practice that reflects sound pedagogical judgement consistent with Brookhart (2017) and Adeniji and Ilorah (2018).

From a theoretical standpoint, these findings lend support to Shulman's PCK framework: teachers appear able to draw comfortably on the pedagogical and content-knowledge components of PCK when planning, writing, and reviewing test items, activities that are closely tied to everyday classroom practice. However, the relatively weaker performance in item analysis, a more specialised and statistically-oriented skill that is less frequently rehearsed in day-to-day teaching, suggests that this particular component of assessment competence may not be adequately reinforced through ordinary classroom experience alone and may instead require deliberate, structured professional development. This has direct implications for continuing professional development planning by FCT education authorities and Mathematics teacher-training institutions.

With respect to the demographic composition of the sample, the predominance of teachers with 11 years and above of teaching experience (53.3%) and public-school teachers (80.0%) reflects the general staffing pattern of senior secondary schools in FCT, where a large proportion of Mathematics teachers are employed by government-owned schools and tend to remain in service over the long term. This composition is broadly consistent with the pattern observed in earlier Nigerian studies of secondary school Mathematics teachers (Afolabi & Loto, 2019) and lends contextual plausibility to the relatively high competence levels recorded across all eight domains in this study, since more experienced teachers might be expected to have accumulated greater familiarity with routine test-construction practices over time.

Conclusion

Based on the findings, it was concluded that Mathematics teachers in senior secondary schools in FCT, Abuja possess an appreciable and generally high level of competence in the construction of teacher-made achievement tests, spanning the determination of testing purpose, development of a table of specification, selection of item formats, preparation of test items, development of a marking guide, item administration, and test review. However, competence in the more technical domain of item analysis, while still adequate, was comparatively weaker than the other seven domains, suggesting a specific area requiring reinforcement through professional development.

Recommendations

1. The FCT Secondary Education Board should organise regular, hands-on workshops on item analysis and basic test psychometrics (difficulty index, discrimination index, and reliability estimation) for Mathematics teachers.

2. School administrators should institutionalise peer review and moderation of teacher-made Mathematics tests prior to administration to sustain the good practices already observed in test review and item preparation.

3. Mathematics subject associations (e.g., MAN, FCT chapter) should incorporate test-construction and item-banking clinics into their continuing professional development programmes.

4. The Ministry of Education/FCT Education Secretariat should consider establishing a moderated item bank for Mathematics achievement tests to support teachers, particularly in the weaker domain of item analysis.

5. Given the modest sample size adopted for this paper, future studies should replicate this assessment with a larger, more representative sample of Mathematics teachers across other states, and should examine possible differences by gender, qualification, school ownership, location, and experience.

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