



## Assessment of Test Items Development Skills of Secondary School Mathematics Teachers in Delta State, Nigeria

Queen E. Igabari

Department of Guidance and Counselling, Delta State University, Abraka, Nigeria

### ABSTRACT

Published Online: June 23, 2026

The importance of test development skills in Mathematics can never be over emphasized because of the nature and place of the subject, and for its role in determining learners' progress. This research is intended to assess the test development skills of the mathematics teachers in secondary schools in Delta State of Nigeria. The aim of the study was to determine the test development skills possessed by Secondary School Mathematics Teachers and the extent to which the teacher is competent in writing, analysis and validation of test items. The study adopted the descriptive survey research design, with population consisting of about 500 trained mathematics teachers in Government owned senior secondary schools in Delta State. A simple random sample of 106 Mathematics teachers was drawn from the population. A four-scale self-constructed instrument was used for data collection. The instrument was validated by experts in educational tests and measurements and Cronbach Alpha technique was used to obtain a reliability coefficient of 0.83. Results showed that the item development skills possessed by secondary school Mathematics teachers in Delta State are test item printing and administration with a mean score of 3.09, item marking and scoring with a mean score of 2.89, item composition and drafting (2.86), item planning (2.74) and item writing (2.73). The results further showed that the teachers were poorly skilled in item analysis and item validation. Amongst others, the study recommended regular in-service training seminars and workshops on test development skills as well as robust follow-up monitoring and evaluation mechanism that will assess the extent of application of test development skills.

### KEYWORDS:

Test item development skills, Mathematics Teachers.

### INTRODUCTION

Common psychometric models have been employed extensively to simulate and predict the course and impact of programmes and activities in both educational and social activities within a population of interest. For instance, Nduka and Igabari (2007) used the generating function model to generate the moments of a measured attribute of a population group. Also Mamadu et al (2020) developed a numerical collocation approach to explain a disease transmission process, just like Onyemarin et al (2023) employed a time series model to explain infant mortality data in Nigeria.

*Corresponding Author: Queen E. Igabari*

*\*Cite this article: Igabari, Q.E. (2026). Assessment of Test Items Development Skills of Secondary School Mathematics Teachers in Delta State, Nigeria. International Journal of Social Science and Education Research Studies, 6(6), 755-761*

Aghanenu et al (2022) investigated the effect of some control strategies in epidemic spread. Also, Ehiwarior et al (2023) used a psychometric lifetime probability model to compute survival and hazard rate indices from certain types of epidemic data. All these are instances of use of mathematical models in explaining population related issues. According to Igabari (2017), population density of an environment has a way of influencing desired outcomes in all spheres of human endeavour. In all, psychometry has always been useful in bringing out the best results from human efforts. However, Osemeke et al (2024) sounded a note of caution concerning model assumptions.

Mathematics as a subject is considered as the basis of all sciences. Its knowledge is the foundation of all scientific advancements (Edikpa et al (2025)). It's relevance to mankind cannot be overemphasized in the society, because it is very important in developing the individual's ability in logic and serves to advance the nation in the knowledge of science and technology. Mathematics teachers at all levels

are, therefore, required to possess adequate competency and knowledge to equip learners with solid foundation in the subject. Despite the importance of this key subject in our educational system, particularly in the secondary schools, a lot of students are still faced with the challenge of poor achievement in both internal and external examinations. This poor performance of students in Mathematics can be linked to factors such as students' negative attitude toward it, inadequate Mathematics competence by the teachers, inadequate instructional materials, teaching method and poor assessment skills in the area of developing test items. Oguguo & Eze (2026) emphatically stated that, for a teacher to achieve the basic goals of teaching and learning it is mandatory for that teacher to have competency development of test items.

Mawak et al (2026) gave some reasons accountable for students' poor performance and the reasons are between the methods of teaching used by teachers, availability of instructional materials, quality of teachers' made test used in assessing the students, teachers' level of experience in the subject and security of the environment among others. In addition, Mathematics teachers may not also have enough time to organize, construct or simply review Mathematics programs in the schools due to excess work load and large class sizes. Thus they are faced with numerous obstacles, which have continued to increase (Jian et al, 2022).

Tests are very crucial components of the educational system. A test is an instrument with organized measures used to assess learner's personalities and academic achievement with the aid of some numerical scale. In evaluating the teaching and learning processes, there are two major forms of tests used in our educational system. These are the teacher made test and the standardized test. Osadebe (2018) sees standardized test as one that are prepared and administered over a group of learners with the same level of abilities. It is prepared by experts in test construction, while the teacher-made test is prepared by the class/subject teacher internally and within the school. It prepares students for external examinations and enable administrator, guidance, parents and community leaders to know what's happening and the extent to which students are ready for their external examination conducted by either the West African Examinations Council (WAEC) or the National Examinations Council (NECO) amongst others.

The analogy shows that the effectiveness of a teacher-made test can greatly predict the result that will come out of the standardized tests. Many studies and reviews on the effect of teacher-made test on students' academic performance in standardized examinations have not be encouraging as a result of many factors which include lack of testing skills in developing test by the teachers. Test development that will produce the desired outcome from the students requires special knowledge, understanding and attention by test experts. Such a test must be valid, reliable

and meet the standard it is prepared for. In constructing a test, there are basically four steps to be considered. They are: identifying the purpose of the test, preparing a table of specification, selecting the right items and writing the items (Ovat & Ofem, 2017). Outside these steps, there are other steps which are content analysis, purpose of the test, face validity and item review. an in-depth knowledge and necessary skill is required by the teacher to construct a valid and reliable test in order to efficiently plan and develop a teacher-made test. Good test is developed by following stipulated skills. Such tests are usually developed using stipulated skills and guidelines which include writing the items appropriately, provide good instructions for the test and the right skills in gathering the items together in order to achieve the desire purpose.

Osadebe (2013) outlined the steps to be taken when developing a teacher-made or standardized tests. The steps involve planning, item writing, item analysis, composition of items, reliability, printing and administration, marking, scoring of the test and test manual. A test that is considered good requires identifying the behavioural objectives to be achieved, the content area to be covered, determining the test format of the test and preparing a test blue-print that will help to establish the content validity of the test. On test construction, Ede et al (2021) explained that after developing the test items with the help of a test blue-print, such test will be subjected to item analysis which helps to determine the difficulty level, discriminatory index and the pseudo guessing items. The effectiveness of a test administered by a teacher is directly related to its capacity to deliver the necessary information regarding the students. According to Oguguo & Eze (2026), in a study on Mathematics teachers' skills in the development of valid and reliable classroom based tests, emphasized that a well-written test enables the teacher to precisely and consistently assess the level of students' understanding of a particular subject matter covered in class. These test result gives the teacher a partial indication of how effective their lessons have been. On the other hand, test items that are badly designed can result in erroneous assessment of learning by the students and give inaccurate information about the performance of students and efficiency of teaching.

The study of Oguguo & Eze (2026) revealed that Mathematics teachers rarely possess the necessary skills in developing teacher/classroom based tests because of poor knowledge of the relevant skills involved in test development. In addition, most Mathematics instructors lack test-development expertise and may be utilizing shoddy assessments to gauge their students' Mathematics proficiency. According to Quansah et al (2018), test development is a major concern for teachers in Nigerian schools, especially those who are less experienced in the field. The concern is as a result of the teachers' inability to construct tests probably because much emphasis was not laid on test development during their training.

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The importance of test development skills in Mathematics can never be over emphasized because of its role in test administration. There is need for teacher to develop the skills of constructing valid and reliable Mathematics test items for better performance of students when faced with standardized test. In a study conducted by Quansah et al (2018) on attitude of senior high school teachers towards test construction showed that, teachers demonstrate negative attitude toward test construction, which may have also led to poor construction of questions among them. Quansah et al (2018) is also of the opinion that many Ghanaian teachers have limited skills in constructing test. Buabeng et al (2019) in another study observed that teachers go through a lot of challenges in test development in teacher-made test because they see it as a rigorous task.

Quansah et al (2018) carried out a study in Cape Coast metropolis on teachers' test construction skills of senior high school, the result revealed that the teachers have limited skills in test construction skills in their terminal examinations. Also, Ede et al (2021) conducted an experimental study on effective behavioral active engagement training on test construction skills among primary school teachers in Nigeria. The findings revealed that the experiment was effective in improving test item construction among teachers. Those who participated in the study performed better than their counterpart who did not, it could be because the teachers were not prepared properly for the test development during their training. In addition, Edikpa et al (2025) in a study evaluated the impact of school-based intervention on work stress. Their focus was on assessing the efficacy of cognitive behavioural intervention in challenging and altering negative perception associated with occupational stress among mathematics teachers and administrators. The research concluded that test development was challenging especially with the less experienced and those who have no access to training workshops.

The above analogy shows that test development skill is a short fall among mathematics teachers in secondary schools. This is what prompted the need to assess test development skills among mathematics teachers in secondary schools in Delta State. Therefore, the problem of this study is to assess the test development skills of mathematics teachers in secondary schools in Delta state, and specifically, the main purpose of the study is to determine the:

- i. test development skills possessed by secondary school teachers in Mathematics.
- ii. extent to which mathematics teachers possess item writing skills.
- iii. extent to which mathematics teachers possess item analysis skills.

## Research Question

Considering the objectives of this study, the following questions were postulated to guide the study:

- i. What are the skills possessed by secondary school mathematics teachers for developing test items?
- ii. To what extent do mathematics teachers possess items writing skills needed for developing test items?
- iii. To what extent do mathematics teachers possess item analysis and item validation skills required in developing test items?

## METHODOLOGY

Descriptive survey research design was adopted for this study. The population of the study comprised all the 500 secondary school Mathematics teachers (Ministry of Basic and Secondary Education, 2023/2024 academic session) in Government owned schools in Delta State. The study adopts simple random sampling technique to select 106 Mathematics teachers from public secondary schools in the area of study. A four-scale self-constructed instrument titled "Test Development Skills of Secondary School Teachers (TDSST)" with the options of Strongly Agree, Agree, Disagree and Strongly Disagree on each item was used for data collection. The research instrument was validated by experts in Measurement and Evaluation at Delta State University, Abraka, Nigeria. The final draft of the questionnaire was pilot tested with 24 Mathematics teachers who were not part of the main study. To establish the internal consistency of the instrument, Cronbach Alpha measure was used to obtain a reliability coefficient of 0.83. Mean and Standard deviation measures were used to answer the research questions. The decision rule was that any statement having a mean score of 2.50 and above stood for skills possessed by mathematics teachers while a mean score below 2.50 was regarded as inadequate skill by the mathematics teachers.

## Presentation of Results

The results of responses to various test development skills are presented in Table 1 to Table 7.

**Table 1. Mean rating of responses on planning skills for developing test items.**

| S/N | Items on planning skills                      | N   | Mean | Std. Dev. | Decision* |
|-----|---|-----|------|-----------|-----------|
| 1   | Stating the test objectives                   | 106 | 2.65 | 0.88      | Skilled   |
| 2   | Outline of course contents                    | 106 | 2.70 | 0.89      | Skilled   |
| 3   | Table of specifications                       | 106 | 2.91 | 0.99      | Skilled   |
| 4   | Assigning weights to instructional objectives | 106 | 2.53 | 0.78      | Skilled   |

|                                  |                                   |     |      |      |         |
|----------------------------------|-----------------------------------|-----|------|------|---------|
| 5                                | Provision for learners' abilities | 106 | 2.89 | 0.92 | Skilled |
| Overall mean for planning skills |                                   |     | 2.74 | 0.89 |         |

\*Bench mark for accepting a skill as adequate is a mean score of at least 2.50.

**Table 2. Mean rating of responses on writing skills for developing test items.**

| S/N                             | Items on writing skills              | N   | Mean | Std. Dev. | Decision* |
|---------------------------------|--------------------------------------|-----|------|-----------|-----------|
| 1                               | Use of standard textbooks            | 106 | 2.82 | 0.81      | Skilled   |
| 2                               | Preference for long test items       | 106 | 2.80 | 0.93      | Skilled   |
| 3                               | Distribution as per Bloom's taxonomy | 106 | 2.63 | 0.87      | Skilled   |
| 4                               | Use of question banks                | 106 | 2.68 | 0.74      | Skilled   |
| Overall mean for writing skills |                                      |     | 2.73 | 0.84      |           |

**Table 3. Mean rating of responses on Analysis skills for developing test items.**

| S/N                              | Items on analysis skills                | N   | Mean | Std. Dev. | Decision* |
|----------------------------------|---|-----|------|-----------|-----------|
| 1                                | Attaching importance of item analysis   | 106 | 2.39 | 0.56      | Unskilled |
| 2                                | Establishment of difficulty index       | 106 | 2.32 | 0.71      | Unskilled |
| 3                                | Establishment of discriminating indices | 106 | 2.41 | 0.67      | Unskilled |
| Overall mean for analysis skills |   |     | 2.37 | 0.65      |           |

**Table 4. Mean rating of responses on items validation skills**

| S/N                                      | Items validation skills                        | N   | Mean | Std. Dev. | Decision* |
|--|--|-----|------|-----------|-----------|
| 1  | Always establish item validity and reliability | 106 | 2.33 | 0.73      | Unskilled |
| 2  | Establish internal consistency of test items   | 106 | 2.26 | 0.91      | Unskilled |
| 3  | Cross-vetting by colleagues                    | 106 | 1.95 | 0.85      | Unskilled |
| Overall mean for items validation skills |  |     | 2.18 | 0.83      |           |

**Table 5. Mean rating of responses on composition skills for developing test items.**

| S/N                                 | Items on composition skills          | N   | Mean | Std. Dev. | Decision* |
|-------------------------------------|--------------------------------------|-----|------|-----------|-----------|
| 1                                   | Smooth language in item construction | 106 | 2.53 | 0.93      | Skilled   |
| 2                                   | Due regard for timing                | 106 | 2.96 | 0.75      | Skilled   |
| 3                                   | Logical presentation of items        | 106 | 2.70 | 0.75      | Skilled   |
| Overall mean for composition skills |                                      |     | 2.86 | 0.81      |           |

**Table 6. Mean rating of responses on marking and scoring skills.**

| S/N   | Items on marking and scoring skills           | N   | Mean | Std. Dev. | Decision* |
|---|---|-----|------|-----------|-----------|
| 1   | Availability of marking guide                 | 106 | 3.12 | 0.86      | Skilled   |
| 2   | Adherence to marking guide                    | 106 | 2.70 | 0.78      | Skilled   |
| 3   | Regard for the concept of marking and scoring | 106 | 2.86 | 0.75      | Skilled   |
| Overall mean for marking and scoring skills |   |     | 2.89 | 0.80      |           |

**Table 7. Mean rating of responses on printing and administration skills.**

| S/N  | Items on printing and administration skills | N   | Mean | Std. Dev. | Decision* |
|--|---|-----|------|-----------|-----------|
| 1  | Enough copies for testees                   | 106 | 3.22 | 0.59      | Skilled   |
| 2  | Clear and legible prints                    | 106 | 3.06 | 0.86      | Skilled   |
| 3  | Conducive environment for examination       | 106 | 3.00 | 0.68      | Skilled   |
| Overall mean for print / administration skills |   |     | 3.09 | 0.71      |           |

\*Bench mark for accepting a skill as adequate is a mean score of at least 2.50.

## Research Questions

### Research Question 1

What are the skills possessed by secondary school Mathematics teachers in Delta State in developing test items?

**Table 8: Summary of the test development skills possessed by the respondents**

| S/N                             | Test Development Skills          | Mean | Std. Dev. | Decision       |
|---------------------------------|----------------------------------|------|-----------|----------------|
| 1                               | Item printing and administration | 3.09 | 0.71      | Highly skilled |
| 2                               | Item marking and scoring         | 2.89 | 0.80      | Skilled        |
| 3                               | Item composition and drafting    | 2.86 | 0.81      | Skilled        |
| 4                               | Item planning                    | 2.74 | 0.89      | Skilled        |
| 5                               | Item writing                     | 2.73 | 0.84      | Skilled        |
| 6                               | Item analysis                    | 2.37 | 0.65      | Poorly Skilled |
| 7                               | Item validation                  | 2.18 | 0.83      | Poorly Skilled |
| Grand mean for test development |                                  | 2.69 | 0.78      |                |

From Table 8, almost all the skills required for test development by teachers scored above the bench mark of 2.50. Hence, the item development skills possessed by secondary school Mathematics teachers in Delta State are:

- test item printing and administration with a mean score of 3.09,
- followed by item marking and scoring with a mean score of 2.89,
- then item composition and drafting (2.86),
- then Item planning (2.74) and
- item writing (2.73).

The results showed that in the case of item analysis and item validation, the teachers were poorly skilled with scores of 2.37 and 2.18 respectively.

In summary secondary school Mathematics teachers in Delta State possess the test development skills with a grand mean of 2.69 and standard deviation of 0.78.

### Research Question 2

To what extent do Mathematics teachers possess items writing skills needed for developing test items?

Table 2 clearly revealed the result of findings on secondary school Mathematics teachers' writing skills. In summary, all the items in Table 2 had a mean score above 2.50 and with an overall mean of 2.73 and a standard deviation of 0.84. This is an indication that secondary school Mathematics teachers possess adequate item writing skills for test development.

### Research Question Three

To what extent do mathematics teachers possess item analysis and item validation skills required in developing test items?

Table 3 clearly revealed the result of findings on secondary school Mathematics teachers' item analysis skills. In summary, all the items in Table 3 had a mean score slightly below 2.50 and with an overall mean of 2.37 and a standard deviation of 0.65. This is an indication that secondary school Mathematics teachers item analysis skills falls short of the level that can be regarded as adequate.

Similarly, Table 4 clearly revealed the result of findings on secondary school Mathematics teachers' item validation skills. In summary, all the items in Table 4 recorded a mean score that is below 2.50. The overall mean was 2.18 with standard deviation of 0.83. This is an indication that secondary school Mathematics teachers in the study area do not possess the skill of item validation in good measure.

### DISCUSSION OF FINDINGS

The findings from research question one revealed that all the steps analyzed in the study are the skills secondary school Mathematics teachers possessed and required for test development, such as planning skills which is the first step in test construction, followed by writing and composition skills, validity and reliability, marking and scoring skills, printing and administration skills. This finding agrees with Ovat & Ofem, (2017) who identified four basic steps in test construction. The steps include: identifying the purpose of the test, preparing a table of specification, selecting and writing the right items, content analysis, validity of the items for the purpose of meeting the standard it is meant for. The plausible reason for this is because an in-depth knowledge is required by the teacher to construct a valid and reliable test to efficiently develop a teacher-made test. This is also in agreement with Ede et al (2021) & Edjere (2021) that the effectiveness of a test administered by a teacher is directly related to its capacity to deliver the necessary information regarding the students.

The finding of the study relating to research question two showed that secondary school Mathematics teachers possess adequate item writing skills for test development. This finding is in agreement with Oguguo & Eze (2026) that a well written test enables the teacher to precisely and consistently assess the level of students' understanding of a particular subject matter covered in the class. The main reason for this finding, that Mathematics teachers possess item writing skills is because test result gives the teachers a partial indication of how effective their lessons have been. In other words, test items badly constructed can lead to erroneous assessment of the students. This finding is in line with the view of Ede (2021) that test item writing is the development of items which enables examination to correctly

measure the skills, knowledge, understanding and ability of the testees.

Data relating to research question three showed that Mathematics teachers do not competently possess test development skills in item analysis and item validation. The plausible reason for this finding may be attributed to the fact that many of the Mathematics teachers in secondary schools were not exposed to the item analysis skills that will detect the difficulty level, discriminatory indices and the pseudo guessing, Ede et al (2021). Added to this, some of the teachers are less experienced in test development and may have been poorly taught during their training. This finding is in tandem with the work of Quansah et al (2018) in a study on teachers' test construction skills of senior high school. The result revealed that teachers have limited skills in test construction. This finding also agree with Ede (2021) in an experimental study on test construction, the finding showed that teachers who took part in the training experience improvement test items construction than those who did not participate in training.

## CONCLUSION

Based on the findings of this study, it could be concluded that secondary school Mathematics teachers in Delta State possess some level of competency in skills for developing test items with the exception of item analysis and item validation. Efforts should be made so that they can improve in establishing the difficulty level of test items, discriminatory indices and establishing reliability indices. Periodic training is required for the teachers to improve in item analysis which is very critical in the teaching-learning equation. The powerful reason is that Mathematics as a core subject requires sufficient care and attention at every stage of the learning process.

## RECOMMENDATIONS

In line with the findings of this study, the following recommendations were made:

- ❖ Regular training programmes, seminars and workshops on test development skills should be organized by Education Boards for teachers to improve on test items development.
- ❖ Teachers should form the habit of following the various stages in test development, in order to improve their skills and design, correct and standard test that will measure correctly what the test is designed for in the student.
- ❖ The Government should provide funds to assist Mathematics teachers to attend conferences, seminars and workshops where test development skills are taught.
- ❖ There should be a robust follow-up monitoring and evaluation mechanism that will assess the extent of

compliance among secondary school Mathematics teachers.

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