

DEVELOPMENT AND VALIDATION OF PERFORMANCE TEST IN MATHEMATICS FOR SENIOR SECONDARY SCHOOL II IN ABIA STATE

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Abstract

The study was to developed and validated Performance Test for Senior Secondary School Mathematics in Abia State. Two research questions guided the study and one null hypothesis was formulated and tested at 0.5 level of significance. The accessible population of the study was made up of 28,720 Senior Secondary Two Mathematics students which comprises 13391 males and 15329 female students. The sample size comprised 200 Mathematics students of which 122 are males and 78 are females obtained through Simple random sampling technique. Instrumentation design was the design of the study, with four Senior Secondary School Mathematics in Abia State while sample of two hundred (200) SS2 students was used. The researcher developed an instrument titled Students' Mathematics Performance Skills Test (SMPST) with reliability co-efficient of 0.89. The instrument was used to carry out the study. Data obtained were subjected to statistical analysis. Scheuneman statistic was used to answer research questions and the hypothesis. The analysis of the data indicated that the developed Students Mathematics Performance Skills Test Senior Secondary Schools has high psychometric properties in terms of validity and high reliability index estimated to be 0.89. That the thirty two (32) items which fall within the b-value range of -3 to +3 had negative difficult estimates indicating easy items while twenty eight (28) items within the same range had positive difficulty estimates indicating difficult items. Based on this information, none of the items were rejected in terms of difficulty levels and that Students Mathematics Performance Skills Test (SMPST) of senior secondary school II students of Abia State are good for students' assessment tools. Based on the findings, it was recommended among others that the developed Mathematics Performance Skills Test instrument should be used by Mathematics teachers and the items of the SMPST developed should serve as template to develop other Performance Skills Test in Mathematics.

Keywords: Development, validation, performance test, mathematics

Introduction

Education is perceived and embraced as a strategic approach to address the challenges of national development. To achieve national development through human capacity building, citizens must be equipped with knowledge, skills, and competencies that facilitate critical thinking, problem-solving, and adaptation to societal demands. In this pursuit, Mathematics emerges as a crucial vehicle for addressing national development issues. Mathematics is the science of structure, order, and relation that has evolved from elemental practices of counting, measuring, and describing the shapes of objects. It deals with logical reasoning and quantitative calculation, and its development has involved an increasing degree of idealization and abstraction of its subject matter (Ezewu, 2014).

Mathematics is the science and study of quality, structure, space, and change. Mathematicians seek out patterns, formulate new conjectures, and establish truth by rigorous deduction from appropriately chosen axioms and definitions. (Anaekwe, 2014). Through abstraction and logical reasoning Mathematics evolved from counting, calculation, measurement, and the systematic study of the shapes and motions of physical objects. Mathematics has been a human activity for as far back as written records exist. Today, Mathematics is used throughout the world as an essential tool in many fields, including natural science, engineering, medicine, and the social sciences.

Mathematics enhances understanding in other subjects that require numerical, scientific thinking, and logical reasoning. Additionally, it contributes to rational decision-making through statistical data collection and analysis. Moreover, Mathematics is a prerequisite for pursuing further education in various fields, including pure science, technology, social science, and many disciplines within the humanities. Recognizing this, the Federal Republic of Nigeria (2017) has mandated the subject's compulsory inclusion in the basic and secondary school curricula. Academic success in Mathematics serves as a significant predictor of overall academic achievement among students. Understanding and excelling in Mathematics are crucial components in comprehending how society functions, given the discipline's pervasive significance in our daily lives. Mastery of an appropriate level of mathematical knowledge is deemed essential for success in any chosen career path as without mastery mathematical knowledge, failure becomes an inevitable outcome.

In the face of the acknowledged importance of mathematical knowledge and its applications, the teaching and learning of Mathematics in Nigerian secondary schools have long been plagued by a myriad of difficulties and challenges. The analysis of students' performance in Mathematics during the May/June West African Senior School Certificate (WASSCE) examinations showed pass rates of 38.50%, 35.66%, 51.73%, 56.17%, 47.39%, 46.87%, 44.93%, and 50.52% in 2015, 2016, 2017, 2018, 2019, 2020, 2021, and 2022, respectively. Consequently, the Mathematics pass rate has consistently hovered around 46.47% over the last decade, as reported in the (WAEC Chief Examiners' reports, 2015-2022). This Continued decline in students' performance has been a cause for concern among various stakeholders.

The persistently low pass rates have prompted an examination of the factors contributing to students' poor achievement in Mathematics, creating a ripple effect on overall academic performance. The need to address these challenges has become a shared concern among educators, policy makers, parents, and other stakeholders involved in the educational landscape. These issues, as identified by Educators, researchers, and the Chief Examiners of the West African Examinations Council (WAEC), encompass a range of concerns, including incomplete content coverage, teachers skipping crucial topics, inadequate assessment methods, students struggling with mathematical calculations, challenges in graphical presentation and interpretation, among other issues (Orluwene & Ottawa, 2017). Another major adverse factor is teachers not taking into cognisance extensive assessment of Performance Test during teaching and learning even at marking stage which eventually affects the students negatively during SSCE.

In a specific instance from 2015, the report revealed a weakness among candidates in their inability to solve questions involving Performance Test like graph, construction, charts, drawings . Subsequent years, particularly in 2019 and 2020, witnessed candidates struggling to compute values from graphs. This weakness directly impacted their academic performance in Mathematics. Furthermore, in both 2021 and 2022, the Chief Examiners noted that a substantial portion of examinees with low grades exhibited deficiencies in basic quantitative skills and an

inability to follow examination instructions. This deficiency was evident in their incompetence in solving questions involving psychomotor skills. The need for addressing these challenges has become a focal point for educational improvement and reform.

The poor performance of students in Mathematics during senior secondary school external examinations may be attributed to various challenges, as highlighted by the WAEC Chief Examiner in 2022. The decline in students' performance compared to previous years underscores the urgency to enhance academic achievement through improved internal assessments that adequately prepare students for external examinations, such as those conducted by the West African Examination Council (WAEC).

Problems of students not responding positively to the Performance Test related questions can be traced to the class room where teachers do not give attention to process evaluation on the topics that demand process examination of every step that matters. Rather most teachers evaluate psychomotor questions in the same method and marking styles of cognitive questions thereby denying the students the required skills of Psychomotor attributes (Anazia, 2019). Then the students be not properly equipped or informed with the requirement from the classroom will be unaware of the required features which will eventually affect the process and methods of attending to questions in external examinations. And this will definitely leads to poor students' performance in external examinations. A performance test is a type of assessment that evaluates an individual's ability to perform specific tasks or skills in a real-world or simulated setting. Unlike traditional tests that focus on knowledge recall or understanding of concepts, performance tests assess a person's practical application of skills and abilities (Obinne, 2018). Performance tests are commonly used in educational, professional, and vocational settings to measure proficiency in tasks that require hands-on demonstration or practical application.

In essence, performance tests which is majorly testing of Performance Test should be made a common form of assessment just like cognitive evaluation and this will play a vital role in identifying the extent of learners' mastery of knowledge and skills. Akanwa and Ihechu (2019) posit that assessment is pivotal to the overall quality of teaching and learning. For a norm-referenced performance test to be effective and acceptable, certain properties are crucial, namely, test validity and reliability. Unfortunately, it has been observed that many secondary school teachers, particularly in Mathematics, face challenges in constructing tests (Osadebe, 2019). Addressing this issue is vital to ensure that assessments accurately measure student performance and contribute meaningfully to the overall improvement of Mathematics education bearing in mind the students' Performance Test development. Encouraging professional development for teachers in test construction and fostering a collaborative approach to assessment can play a key role in addressing these challenges and enhancing the effectiveness of Mathematics education in secondary schools. In the realm of Measurement and Evaluation, experts universally agree that one of the paramount considerations in test assessment is the degree of validity. Drost (2018) succinctly defines validity as the extent to which a test measures the underlying construct it is intended to measure.

Consequently, a comprehensive understanding and application of validity principles contribute significantly to the development and execution of effective assessments in educational settings. Reliability, another crucial psychometric property of a test instrument, is defined by Drost (2018) as the extent to which test items used for measurements are repeatable when different examinees perform equally on various occasions, under different conditions, and with alternative instruments that measure the same construct or skill. Mustapha and Yunusa (2014)

further elaborate that reliability refers to the degree of consistency or stability of the measures obtained from an instrument (test). It can be understood as the degree to which the measure of a construct is consistent or dependable. Importantly, it's noted by Agbaegbu, Akanwa and Ihechu (2017) that a test can be reliable yet not valid, meaning it may yield consistent results without measuring what it is intended to measure. Reliability and validity, identified as essential psychometric properties of measurement scales, are integral in ensuring the adequacy and accuracy of scientific research procedures (Bajpai & Bajpai, 2014). Akazue, (2019) revealed that the test has high content validity, the items of the test are suitable in terms of its difficulty and discriminatory indices and also the test and its entire subsections have high degree of internal consistency with a low standard error of measurement. Dorothy, Ezenwa and Ezeudu, (2015) conducted a study on the development and validation of a test instrument for assessing student's practical performance in electrical installations and found that the reliability of the instruction determined by Cronbach-Alpha revealed that reliability for the eight electrical installations tasks ranged from 0.86 to 0.97. Oribhabor and Osaze (2016) revealed that the developed Mathematics Achievement Test instrument for Senior Secondary schools has high psychometric properties in terms of difficulty and discrimination index and reliability index.

In light of this background, the researcher aims at development and validation of performance test in Mathematics which is the most valuable instrument in measuring psychomotor skills. The development of instruments refers to the process of creating and refining tools or measures to collect data, assess performance, or evaluate outcomes in various fields. Well-developed instruments enable accurate data collection, informed decision-making, and meaningful research findings. And these can be achieved through validation. Validation of instruments refers to the process of evaluating and confirming the accuracy, reliability, and effectiveness of a measuring instrument, such as a survey, test, or assessment tool. It ensures that the instrument measures what it is intended to measure and produces consistent results (Abonyi, 2018). The development of this test aligns with the broader goal of addressing the need for a valid and reliable instrument for assessing students' Performance Test in senior secondary school Mathematics. The focus on Abia State underscores the specificity and relevance of the research, emphasizing the importance of creating a tailored and validated assessment instrument for this particular educational context.

Research Questions

The research questions were posed for the study:

1. What is the Validity of Students Mathematics Performance Skills Test (SMPST) for Senior Secondary School II (SS2)?
2. What is the reliability of the Students Mathematics Performance Skills Test (SMPST) for Senior Secondary School II (SS2)?
3. What are the difficulty indices of Students Mathematics Performance Skills Test (SMPST) for Senior Secondary School II (SS2)?

Hypotheses

The null hypotheses formulated were tested at 0.05 level of significance.

H₀₁: Items of Students Mathematics Performance Skills Test does not significantly differ between high and low achievers based on the difficulty indices.

Methodology

This study adopted an instrumentation research design. According to Kpolovie (2020), instrumentation research is specifically employed for test construction when the goal is to measure and evaluate psychological traits. The study was conducted in Abia State, Nigeria. The target population consisted of all Senior Secondary School Two (SS2) students enrolled in Mathematics in public Senior Secondary Schools across the state. The accessible population comprised 28,720 SS2 Mathematics students, including 13,391 males and 15,329 females (Statistics Unit, Abia State Ministry of Education, 2021). The sample size for the study was 200 Mathematics students, comprising 122 males and 78 females. A simple random sampling technique was used to select four public secondary schools for the study. The research instrument for data collection was the Students' Mathematics Performance Skills Test (SMPST). This test was developed by the researcher to measure students' performance in Mathematics and ensure uniformity. The draft SMPST was validated by three experts in Science Education (Measurement and Evaluation Unit and Mathematics Unit) at Michael Okpara University of Agriculture, Umudike. To establish the reliability of the SMPST, the instrument was subjected to trial testing. It was administered to a sample of 50 SS2 Mathematics students randomly selected from public secondary schools in Imo State, which was outside the study area. The scores from the trial testing were analyzed using Cronbach's alpha formula to determine the internal consistency of the SMPST, yielding a reliability coefficient of 0.89.

The researcher prepared 200 copies of the SMPST and personally visited the four selected government secondary schools with the consent and approval of the school authorities. The SMPST was administered directly to the students, with the researcher present during the exercise to provide clarifications where necessary. Each student was allocated 2.5 hours to complete the SMPST questions. The researcher remained on-site throughout the exercise to monitor the process and collect the completed test copies immediately afterward. The administration of the SMPST was carried out in stages over six weeks. Students were required to answer 10 items per week, culminating in a total of 60 items. These 60 items were systematically divided into six units, with each unit containing 10 items. This staggered approach ensured that students were not overburdened and could respond accurately and focused. The data collected were analyzed according to the research questions and hypotheses formulated for the study. Scheuneman statistics were employed to address research questions 1-2, while Kendall's Coefficient of Concordance (W) was used for research question 5. A point biserial correlation of at least 0.3 was considered for each item to determine the discrimination level. The pilot test revealed that the SMPST was both reliable and valid for assessing the performance of SS2 Mathematics students. The high reliability score demonstrated consistent performance across test items, while the validity measures confirmed alignment with the targeted psychomotor skills. However, minor revisions were made to improve clarity and efficiency, including adjustments to item wording and time allocation.

Results

Research Question 1

What is the validity of Students Mathematics Performance Skills Test (SMPST) for Senior Secondary School II Students in Abia State?

Table 1: Validity of Mathematics Performance Skills Test(SMPST)

Items	Infit	Outfit	Items	Infit	Outfit
1	1.03	1.11	31	1.24	1.36
2	1.06	1.09	32	1.25	1.39
3	0.74	0.85	33	1.34	1.47
4	1.34	1.44	34	1.36	1.41
5	0.61	0.97	35	1.01	1.03
6	0.70	0.91	36	0.88	0.97
7	1.04	1.08	37	1.05	1.09
8	0.97	1.05	38	0.82	0.87
9	0.76	0.86	39	0.91	0.96
10	1.05	1.09	40	0.92	0.98
11	0.74	0.78	41	1.06	1.10
12	0.81	0.86	42	0.96	0.99
13	0.94	0.98	43	0.76	0.83
14	0.65	0.93	44	0.88	0.92
15	1.06	1.09	45	0.94	0.98
16	1.03	1.07	46	1.86	2.48
17	1.36	1.48	47	0.86	0.98
18	1.68	1.74	48	1.84	1.97
19	0.74	0.95	49	1.69	1.71
20	1.03	1.11	50	1.01	1.32
21	0.75	1.05	51	0.96	1.07
22	1.08	1.11	52	1.06	1.10
23	0.85	0.91	53	0.91	1.04
24	0.86	0.91	54	0.95	1.05
25	0.85	0.92	55	0.91	0.97
26	0.74	0.78	56	0.77	0.82
27	0.81	0.87	57	0.84	0.89
28	0.88	0.91	58	0.94	0.99
29	0.82	0.86	59	0.87	0.94
30	0.95	0.99	60	1.05	1.11
Mean	0.99	1.09			
SD	0.49	0.54			

Table 1 shows the result of the fit statistic of validity of Students Mathematics Performance Skills Test (SMPST) for Senior Secondary School II Students in Abia State. The result showed that the Mathematics Performance Skills Test had the infit statistic ranging from 0.61 to 1.86; and outfit statistic range from 0.78 to 2.48 respectively. In the items of SMPST, It is only item numbers 18 (that has infit of 1.68 and outfit of 1.74), 46 (has infit of 1.86 and outfit of 2.48), 48 (that has infit of 1.84 and outfit of 1.97) and 49 (has infit of 1.69 and outfit of 1.71), beyond the accepted range of 0.7 – 1.5. The fit statistic of the Students Mathematics Performance Skills Test apart from item 18, 46, 48 and 49 indicate that all the items are perfectly valid. The mean of the infit and outfit are 0.99 and 1.09 respectively. The spread of the infit and outfit and their mean indicate highly valid items (since their mean are sufficiently close to one). This implies that, apart from items 18, 46, 48 and 49 of SMPST, all other items of SMPST are valid and showed unidimensionality.

Research Question 2

What is the reliability of the Students Mathematics Performance Skills Test (SMPST) for Senior Secondary School II Students of Abia State?

Table 2: Reliability of Mathematics Performance Skills Test (SMPST)

Cronbach's Alpha formula	Cronbach's Alpha formular 21 Based on Standardized Items	N of Items
	.893	60

Table 2 revealed that the reliability index of the Students Mathematics Performance Skills Test Instrument was estimated to be 0.89 using Cronbach's Alpha formula. This shows that the Students Mathematics Performance Skills Test Instrument developed is highly reliable.

Research Question 3

What are the difficulty indices of Students Mathematics Performance Skills Test (SMPST) for Senior Secondary School II Students in Abia State?

Table 3: Item threshold values (difficulty estimates) of Students Mathematics Performance Skills Test (SMPST) for Senior Secondary School II Students of Abia State

Items	Threshold	Items	Threshold	Items	Threshold
1	0.31	21	0.77	41	0.14
2	-0.34	22	-0.03	42	-0.77
3	-0.91	23	-0.23	43	-0.26
4	1.05	24	1.56	44	1.26
5	-0.71	25	0.44	45	0.95
6	-1.01	26	0.31	46	-0.34
7	-0.51	27	-0.88	47	-0.56
8	1.73	28	-1.04	48	1.47
9	-1.24	29	0.73	49	0.66
10	-1.31	30	-1.05	50	-0.34
11	-0.71	31	-0.55	51	0.97
12	1.13	32	1.93	52	1.06
13	1.52	33	-1.25	53	-0.65
14	-0.22	34	-1.33	54	1.15
15	0.64	35	-0.71	55	0.76
16	1.33	36	1.33	56	1.79
17	-0.21	37	1.76	57	-1.25
18	-0.83	38	-0.21	58	-1.79
19	-0.32	39	-0.64	59	0.96
20	1.31	40	1.33	60	-0.76
Mean			0.89		
SD			0.45		

Table 3 showed the item difficulty estimates or difficulty measures of Students Mathematics Performance Skills Test (SMPST) for Senior Secondary School II Students in Abia State. The results revealed that thirty two (32) items (53%), that is items 2, 3, 5, 6, 7, 9, 10, 11, 14, 17, 18, 19, 22, 23, 27, 28, 30, 31,33, 34, 35, 38, 39, 42, 43, 46, 47, 50, 53, 57,58, and 60 within the b-value range of -3 to +3 had negative difficult estimates while twenty eight (28) items (47%),

that is items, 1, 4, 8, 12, 13, 15, 16, 20, 21, 24, 25, 26, 29, 32, 36, 37, 40, 41, 44, 45, 48, 49, 51, 52, 54, 55, 56 and 59 within the b-value range of -3 to +3 had positive difficulty estimates. The negative estimates imply that 32 items are easy while 28 items are difficult. Based on this information, none of the items was rejected in terms of difficulty levels. This implies that Students Mathematics Performance Skills Test (SMPST) for Senior Secondary School II Students in Abia State are good for students’ assessment tools because they are within the b-value range of -3 to + 3.

Hypothesis One

Items of Students Mathematics Performance Skills Test does not significantly differ between high and low achievers based on the difficulty indices

Table 4: Chi-square Summary of students’ scores on the percentage of easy and difficult Students Mathematics Performance Skills Test items

Difficulty	Percentage	Item favoured due to DIFFICULTY	Df	Chi-square	Sig.(2-tailed)
Easy	53	32(30)			
Difficult	47	28(30)	1	2.172	0.141
Total	100	60			

χ^2 tabulated at 0.05 level of significant with 1 DF = 3.84

Data in Table 4 shows that the chi-square calculated value of 2.172 is less than the tabulated chi-square value of 3.84 when tested at 0.05 level of significance with 1 degree of freedom. Therefore, the null hypothesis which states that ‘Items of Students Mathematics Performance Skills Test does not significantly differ between high and low achievers based on the difficulty indices is thereby upheld. It implies that Items of Students Mathematics Performance Skills Test does not significantly differ between high and low achievers based on the difficulty indices.

Discussion of the findings

The study showed that the developed Students Mathematics Performance Skills Test for Senior Secondary Schools has high psychometric properties in terms of validity. The fit statistic of the Students Mathematics Performance Skills Test apart from item 18, 46, 48 and 49 indicate that all the items are perfectly valid. The finding is in agreement with the finding of Akaezue, (2019) who found out that the test has high content validity, the items of the test are suitable in terms of its difficulty and discriminatory indices and also the test and its entire subsections have high degree of internal consistency with a low standard error of measurement.

The study showed that the developed that the developed Students Mathematics Performance Skills Test(SMPST) of Senior Secondary School II Students of Abia State has high reliability index estimated to be 0.89. The finding is in agreement with the finding of Dorothy, Ezenwa and Ezeudu, (2015) conducted a study on the development and validation of a test instrument for assessing student's practical performance in electrical installations and found that the reliability of the instruction determined by Cronbach-Alpha revealed that reliability for the eight electrical installations tasks ranged from 0.86 to 0.97. The reliability for the whole instrument was 0.93. And this indicated that the instrument was highly reliable.

The study revealed that thirty two (32) items which fall within the b-value range of -3 to +3 had negative difficult estimates indicating easy items while twenty eight (28) items within the same range had positive difficulty estimates indicating difficult items. The negative estimates

imply that 32 items are easy while 28 items are difficult. Based on this information, none of the items were rejected in terms of difficulty levels. This implies that Students Mathematics Performance Skills Test (SMPST) for Senior Secondary School II Students in Abia State are good for students' assessment tools. The corresponding hypothesis affirmed that affirmed that Items of Students Mathematics Performance Skills Test does not significantly differ between high and low achievers based on the difficulty indices. The findings is in agreement with the findings of Oribhabor and Osaze (2016) who revealed that the developed Mathematics Achievement Test instrument for Senior Secondary schools has high psychometric properties in terms of difficulty and discrimination index and reliability index.

Conclusion

The study developed and validate instrument for assessment of students' Performance Test for Senior Secondary School Mathematics in Abia State. Based on the findings of the study, the researcher concludes that the developed Students Mathematics Performance Skills Test for Senior Secondary Schools has high psychometric properties in terms of validity. The fit statistic of the Students Mathematics Performance Skills Test apart from item 18, 46, 48 and 49 indicate that all the items are perfectly valid and that the developed Students Mathematics Performance Skills Test (SMPST) of senior secondary school II students of Abia State has high reliability index estimated to be 0.89.

The researcher concluded that thirty two (32) items which fall within the b-value range of -3 to +3 had negative difficult estimates indicating easy items while twenty eight (28) items within the same range had positive difficulty estimates indicating difficult items. The negative estimates imply that 32 items are easy while 28 items are difficult. Based on this information, none of the items were rejected in terms of difficulty levels. This implies that Students Mathematics Performance Skills Test (SMPST) for Senior Secondary School II Students in Abia State are good for students' assessment tools.

Recommendations

Based on the findings of the study the following recommendations were made:

1. That the developed Mathematics achievement test instrument should be used by Mathematics teachers and the items of the SMPST developed should serve as template to develop other Performance Skills Test in Mathematics.
2. That the psychometricians and measurement expert should organize workshops to educate teachers on test development.
3. That the examination bodies and teachers should be encouraged to adopt (IRT) in developing test items used in measuring students ability in Mathematics.

References

- Abonyi, O.S. (2018). *Instrumentation in behavioral research. A practical approach. Enugu Fulladu Publishing Company.*
- Agbaegbu, C.N., Akanwa, U.N & Ihechu, K. J. P. (2022). Differential Item Functioning of 2015-2017 Agricultural Science Multiple Choice Questions Conducted by the National Business and Technical Examination Board *Journal of Evaluation July 2022, (7)1, 11-24*

- Akaezue, N.N. (2019). *Construction and Validation of Physics Aptitude Test for enior Secondary School Student in Delta State. Unpublished M.Ed. project, Delta State University, Abraka, Delta State.*
- Akanwa, U.N & Ihechu, K.J.P. (2019). *Effect of Peer- Assessment Strategy on Senior Secondary School Students' Achievement in Agricultural Science in Imo State.* Viewed at Google.com/cita
- Akanwa, U.N.& Ihechu, K.J.P. (2016). Evaluation of the Availability and Utilization of Audio Visual Aids in Teaching and Learning of Home Economics in Imo State Junior Secondary Schools. *Journal of Theoretical and Empirical Studies in Education, (A Journal of the Department of Educational Foundations, NnamdiAzikiwe University, Awka) September, 2016, Vol. 5(1),265-276*
- Anaekwe, M. C. (2014). Aims and objectives in education. In C. N. Agbaegbu, S. A. Ezeudu, & M. N. V. Agwagah (Eds.), *Educational measurement and evaluation for colleges and universities* (pp. 60 - 79) Owerri: Cape Publishers Int'l Ltd.
- Anazia, I.U. (2019). Quantitative and Verbal Aptitudes as Predictors of Senior Secondary School Students Performance in Economics. *IAFOR Journal of Education, 7 (1), 8-81.*
- Bajpai, S. R., & Bajpai, R. C. (2014). Goodness of Measurement: Reliability and Validity. *International Journal of Medical Science and Public Health, 3(2), 112-115.*
- Drost, E., A. (2018). Validity and reliability in social science research. *Education Research and Perspectives, 38(1), 105-124.*
- Ezewu, E. E. (2014). Towards taxonomy of educational objectives in the psycho productive domain. *Nigerian Journal of Technical Education. NBTE: 2(1), 23 -34.* Federal Republic of Nigeria (2014). *National policy on education (4th ed.)*. Lagos: NERDC Press.
- Federal Government of Nigeria (2017). *National Policy on Education*. Lagos: Nigeria
- Kpolovie, E.B. (2020). *Test and Measurement*. Lagos: Bolabay Publications.
- Mustapha, D. G., & Yunusa, R B., (2014). *Educational research: an introduction to Educational measurement and evaluation: Theory and practice* (pp. 110-122). Nsukka: Educational Research and Development Council Press.
- Obinne, A.D.E. (2018). *Psychometric properties of senior certificate Biology examinations conducted by West African Examinations council: Application of item response theory*. Onitsha: Summer Educational Publishers (Nig.) Limited.
- Oribhabor, C. B., & Osaze, D. E. (2016). Determining the reliability and content validity of mathematics tests constructed by senior secondary school mathematics teachers in Edo State, Nigeria. *African Journal of Education, Science and Technology, 3(2), 83-87.*
- Osadebe, P. U. (2019). *Procedures for construction, validation, and standardization of tests*. [Seminar Paper]. Delta State University, Abraka.
- West African Examination Council. (2015-2022). *Chief Examiners' reports*. Lagos: