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Item Arrangements Mix on Academic Performance of Students in 2024 WASSCE Mathematics Multiple Choice Test in Lagos Metropolis

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Abstract
The study investigated Item Arrangements Mix on Academic Performance of Students in 2024 West Africa Senior School Certificate Examination (WASSCE) Mathematics Multiple Choice Test in Lagos Metropolis. Two null hypotheses were formulated to guide the focus of this work as Survey Research Design was used in the work. Population of the study comprised of all the 2025 Public Senior Secondary School Three (SSS 3) students in selected LGAs in Lagos State. A sample of eight hundred and forty students was selected across eight (8) schools from eight (8) Local Government Areas in the state through multi-stage sampling procedure. The 2024 Mathematics West Africa Examination Council Multiple Choice Test (2024-WAECMCT) containing 50 items on 4-Option format was used for data collection. The test was content validated by measurement experts in Lagos State University, Ijanikin, Lagos. Through test re-test reliability co-efficient value 0.890 was obtained as Analysis of Covariance, ANCOVA statistical analysis was used to analyze the data with the aid of Linear Structural Relations Statistical Software (LISREL) and tested at 0.05 significant level. Findings reveal that no difference in the academic performance of students in the 2024 SSCE Mathematics Test by test forms and by gender. It concluded that 2024 West Africa Senior School Mathematics Multiple Choice Tests yielded no difference in the academic performance when item arrangements were introduced. Again gender played no difference in their scores. It was recommended among others that test developers should determine difficulty index for each item as it would guide in item arrangement into specified magnitude.
Keywords: Item Arrangements Mix, Academic Performance, Students, Multiple Choice Tests

Introduction

Mathematics is one of the global school subjects that have bedrock to all scientific and technological breakthroughs in Nigeria education system. It is one of the core subjects taught at the secondary school level. Mathematics expose students to the knowledge of solving

complex problems relating to geometry, probability, angle of elevation and depression, construction, trigonometry, surd and other complex problems where use of basic operations, rational knowledge, reasoning and logic are needed. The knowledge of mathematics help students make informed choices and take decisions given alternatives, building on real life situation through knowledge base of operational assumptions. The Comparative Education Study and Adaptation Center, (CESAC, 2012) and National Policy on Education (FRN, 2020) identified the goals for teaching of mathematics at the secondary school level to include, improvement in computational abilities, cultivate a desire and capacity for accuracy, develop a rational capacity to describe abstract thought, improve capacity to identify issues and apply mathematical knowledge to solve them; teach the basics in mathematics that is required for higher education. The Knowledge of Mathematics makes assessment easy for both educators and students.

According to Orheruata and Omorogiuwa (2015) assessment technique used in determination of achievement in Mathematics can take different form and measure. One of the most commonly used assessment technique is test. A Test can take the form of teacher made, standardized, achievement, aptitude, power, subject or content centred tests. The appropriate development of a test and use of assessment are essential requirements for professional practice in educational testing and measurement. Tests are recognized by their standards which can be determined by their adherence to basic construction principles (use of Table of Specification or Test blue print), standardization and psychometric properties (Orheruata & Omorogiuwa, 2015).

In assessing large test takers simultaneously, examination bodies adopt the use of achievement test in measuring students' abilities. Achievement test is one test type that is widely used by West African Examination Council (WAEC) to measure performance of students in standardized examinations. The scores from the examination determine the level of students' ability which is used for decision making. In a trend report by West Africa Examination Council, WAEC, (2020-2024) disclosed in 2024, that 27.8% failure rate was recorded in Mathematics, 37.9% failure rate in 2023; 25% failed mathematics in 2022; 20% failed mathematics in 2021 and 67.8% failure rate in mathematics was recorded in 2020 respectively.

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The above statistics from WAEC shows that poor performance of students in mathematics over the past five years cannot be overemphasized as it remains an annual challenge faced by teachers, students, test developer, psychometricians, examination bodies and other relevant stakeholders. With the drop in poor performance in mathematics between 2020 and 2024 it is believed that various efforts and policy measures to correct and improve on the performance of students to the barest minimum is gradually yielding results but not as expected. The issue has prompted researchers in mathematics to consider the adoption of other measures like determination of difficulty index for each item, arrangement of items in the magnitude of increasing and decreasing order of difficulty power, weight of items, guessing parameter determination among others (Ogunka & Orluwene, 2019). It is obvious from the above report that student performance could be influence by the arrangement of items based on their difficulty level. In other words, the order in which items are presented can affect the difficulty level of the test and influence how students perform.

Item arrangement of a test is defined as the deliberate and conscious arrangement of a test based on conditions of randomness, magnitude of ascending or descending order of difficulty level (Gholam-Reza & Hanieh, 2019). The sequence of arrangements is designed to determine the path and pattern of students' responses to a set of test item. Item arrangement state in specifics certain dynamics test developers consider and choice of preference in the course of pooling items in a scale. Item arrangements factor a process where test items are tailored in relation to point introduction in classroom situation. Arrangements of item can assume ascending, descending and non-consistent order. By implication when items are arranged from most simple to complex form, such items are classified as ascending order (Higher Lower Order). While from complex to simple is classified as descending (Lower Higher Order). Meanwhile when test items don't follow any particular order but seen to adhere to mix form, it is called randomized formed (Non-Consistent Order).

The design of multiple-choice mathematics tests, particularly in Nigeria, plays a pivotal role in assessing students' mathematical understanding and abilities. One important aspect of test design is the sequence of items, which can follow a progression from easy to hard, hard to easy or randomized order. Each of these approaches has unique implication on how students approach the test and consequently, how their performance is evaluated. The easy-to-hard sequence generally begins with simpler questions to build students' confidence before

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advancing to more complex tasks. This method can be beneficial in that it helps students establish a rhythm, potentially enhancing their performance on more difficult questions later in the test. In the Nigerian context, the approach is often seen in high-stakes examinations like the West African Senior School Certificate Examination (WASSCE), where students may be more familiar with straight forward questions at the start (Egede, 2023).

The easy-to-hard order also has its limitations as it can lead to students overestimating their abilities early in the test. If students perform well on the initial easy questions, they may become complacent and approach the harder questions with less focus or effort. This sequence may also induce anxiety when students reach the more difficult questions toward the end of the test. In Nigeria, where examinations like the Unified Tertiary Matriculation Examination (UTME) often have a high level of pressure attached to them, such an approach could exacerbate test anxiety and hinder performance on difficult questions (Ogunleye & Aina, 2020). Additionally, this test design could cause students to misjudge their preparedness based on the initial success, ultimately skewing the assessment of their true mathematical ability.

In contrast, Ogundele and Ojo (2020) stated that adopting the hard-to-easy sequence begins with more challenging questions and ends with simpler ones. This sequence can help mitigate test anxiety, as students face the toughest questions first, when their mental energy is highest. Some students might appreciate this approach as it allows them to tackle the most difficult questions while they are still mentally fresh. In the Nigerian context, students preparing for the UTME or WASSCE might find this approach less overwhelming because the easier questions at the end serve as a confidence boost. However, this sequence can have its downsides (Ogundele & Ojo, 2020). For instance, students may spend too much time on difficult questions at the beginning, leading to time constraints later in the test. This approach can also lead to frustration if students feel overwhelmed by the complexity of the initial questions.

A randomized order of test items, on the other hand, has been gaining traction in mathematics assessments in Nigeria. Randomization ensures that the sequence of questions is not predictable, which reduces any test-taking strategies that students might employ, such as answering all the easy questions first. By randomizing the order, all questions, whether easy or hard, are treated with equal importance and challenge. The order has the advantage of testing a student's ability to engage with the entire range of questions without the psychological bias

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introduced by a fixed progression. In high-stakes examinations like the WASSCE or UTME, randomizing the questions can encourage students to rely on their mathematical knowledge and skills without relying on strategies based on question order (Sulaimon & Eniola, 2020). Moreover, randomization can provide a more accurate reflection of a student's true ability, as they are not given an opportunity to approach the test in a biased or formulaic way.

Randomized order also mitigates the potential for pattern recognition, which is a common issue in multiple-choice testing. In tests with a fixed sequence, students might recognize patterns in the answers (e.g., a series of answers being 'A', 'B', 'C') and use this recognition to guess the answers to subsequent questions. With randomized items, such patterns are less likely to emerge, making the test more reliable in assessing students' true mathematical understanding. Furthermore, randomization can reduce the anxiety that some students experience when confronted with an overwhelming number of difficult questions at the start or end of the test. In the context of Nigerian examinations, randomizing the order of questions may level the playing field for students, ensuring that no student has an undue advantage based on the structure of the test (Oluwatoyin & Adeyemi, 2020).

Item arrangement centres on the ability of students to respond favorably to an item the way the topics were arranged in the teaching process by the teacher (Margret & Victor 2017). Margret and Victor (2017) restated that the choice and sequence of test items may sometimes afford students the ability to recall things dependent on the order in which they were exposed to in the class. The arrangement of items in a multiple-choice test can have a significant impact on the academic performance of students. If easy items are placed at the beginning of the test and difficult items at the end, students may become discouraged or demotivated early on if they struggle with the easier questions. On the other hand, if difficult items are placed first, students may become overwhelmed and lose confidence, leading to poorer performance overall. A student's score in a test is not an accurate measure or estimate of the student's true score due to various conditions that are associated or responsible for the response pattern of students towards a test. Be it power test, speed test or tailored test, test takers response to items especially to multiple choice test type is greatly influenced by the difficulty index of the items. When students' ability in Mathematics test is being examined, there are other unknown factors like random or chance factors that do influence the score obtained by a student in such a test.

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The structure of test items in a mathematics multiple-choice examination whether easy-to-hard, hard-to-easy, or randomized order has profound implications for student performance. The easy-to-hard sequence might be beneficial in building confidence but risks leading to complacency and anxiety. The hard-to-easy sequence can provide a confidence boost at the end but may lead to time mismanagement and frustration. Randomized item order, however, ensures fairness and eliminates any bias introduced by question sequencing. For mathematics assessments in Nigeria, such as those for WASSCE and UTME, randomization may provide a more accurate and equitable measure of a student's mathematical competence, offering a clear picture of their ability to handle different levels of cognitive demand (Durojaiye & Ajayi, 2020).

The arrangement of items may affect students' ability to use test-taking strategies effectively. For example, if similar items are clustered together, students may be able to apply a common strategy to answer them more efficiently. However, if items are randomly arranged, students may have to constantly switch between different strategies, which can be confusing and lead to errors.

Furthermore, the arrangement of distractor options in multiple-choice items can also impact student performance. If distractors are placed strategically to mimic common misconceptions or errors, students may be more likely to choose the incorrect answer. On the other hand, if distractors are placed haphazardly, students may be more likely to choose the correct answer through process of elimination. To estimate the appropriate response pattern of test takers towards an item, it has become imperative for test developers to design an appropriate template which specifies in specifics the appropriate order of difficulty index that best suits test takers especially when confronted with Mathematics multiple choice test. As this could help to promote academic success and enhance the overall learning experience for students.

Statement of the Problem

One of the fundamental problems confronting stakeholders in education and the general populace in the results of the Senior Secondary School Certificate Examination is students' poor academic performance in Mathematics. This deficiency in Mathematics performance is one of the factors that has led many students to study courses different from their choice course,

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some may experience delay in meeting admission process while others never get the privilege to advance in academic endeavours.

Nevertheless, a cursory study by Nwankwo (2015), Adebayo & Liu (2023) revealed that one variable that may influence students' academic performance is item arrangement. Item arrangement is primarily concerned with identification of item difficulty and pooling of items using specified magnitude. None of the studies to the knowledge of the researcher have investigated how arrangement of test items following a magnitude has the likelihood to influence performance. The arrangement of items in multiple-choice tests is an important factor to consider when designing assessments. With the importance of Mathematics as a subject to enhance science and technological development of a nation, it is also out to improve concern of academic performance of students in Mathematics and other stakeholders in education. However could item arrangement in mathematics multiple choice items therefore be related to students' academic performance in Senior Secondary School Certificate Examination? These are a few challenges the study is out to address. Hence this study estimates the Influence of Item Arrangements Mix on Academic Performance of 2024 West African Senior School Certificate Examination Mathematics Multiple Choice Test in Lagos.

Purpose of the Study

This study is out to achieve two core objectives among which include:

1. Assess the difference in the academic performance of students in the 2024 SSCE Mathematics Multiple Choice Test by test Forms.
2. Justify the difference in the academic performance of students in the 2024 SSCE Mathematics Multiple Choice Test by Sex.

Hypotheses

Two hypotheses were formulated and tested at significant level of 0.05

1. There is no significant difference in the academic performance of students in the 2024 SSCE Mathematics Multiple Choice Test by test Forms.
2. There is no significant difference in the academic performance of students in the 2024 SSCE Mathematics Multiple Choice Test by Sex.

Significance of the Study

The findings of this study will afford students the needed skills and knowledge to recall response from items correctly. By implication students will be better guided with necessary

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information on ability to recall correct keys, identify appropriate response for a defined stem and also build self-confidence and latent ability towards a well- structured test. The study will provide teachers with feedback mechanism on appropriate domain levels to consider when constructing tests. Teachers will further benefit from this work as it would provide a bench mark to consider when arranging tests in order of magnitude; Researchers will find it useful as it hopes to provide them with empirical literature and contemporary materials on influence of item arrangement on academic performance of students in School certificate Mathematics; Psychometric experts will benefit as it will provide them with right measurement procedure to be deployed in the preparation of test items.

Theoretical Framework

This study hinges on the use of Classical Test Theory. Charles Spearman developed Classical Test Theory (CTT) in 1904. In the classical test theory, the basic assumption is that a student's observed score 'X' is the simple sum of a true score 'T' (which reflects the true amount of the attribute score 'E' (which reflects the effects of extraneous influences of the measurement process at the fundamental measurement). Thus, the fundamental equation of Classical Test Theory is X= T+E.

This study anchors on the Classical Test Theory in its theoretical framework as it explains that the test scores obtained by each student in the test which is X, has a true score T and an error score E, which could arise environmental influences/distractions or even from the students themselves. Since multiple choice objective test encourages guessing, guessing an answer whether correctly or not is equally an error variable.

The relevance of this Classical Test Theory is that it provides an insight into how item arrangements in multiple-choice tests can impact reliability, validity and overall test performance. Educators and test developers can apply principles from CTT to design assessments that minimize the negative effects of item arrangement, ensure fair and accurate appraisal of test-takers' knowledge and skills. Careful consideration of item arrangement enhances the effectiveness of assessments leading to more meaningful interpretations of test results.

Methodology

The research design used in this work was a survey research design. This is a design that relies on enquiry into data with the intent of providing exact information about the

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conditions of the independent variables as population of the study comprised of all 2025 Public Senior Secondary School Three (SSS 3) students in selected LGAs in Lagos State. A sample of eight hundred and forty students who sat for 2025 WASSCE was selected across eight (8) schools from eight (8) Local Government Areas in the state through multi-stage sampling procedure. The 2024 Mathematics West Africa Examination Council Multiple Choice Test (2024-WAECMCT) containing 50 items on 4-Option format was used for data collection. The test was content validated by measurement experts in Lagos State University, Ijanikin, Lagos. Through test re-test reliability co-efficient value 0.890 was obtained.Analysis of Covariance, ANCOVA statistical analysis was used to analyze the data with the aid of Linear Structural Relations Statistical Software (LISREL) and tested at 0.05 significant level.

Data Presentation and Interpretation

H_{01}: There is no significant difference in the academic performance of students in the 2024 SSCE Mathematics Test by Forms.

Table 1: ANCOVA analysis of the academic performance of students in the 2024 SSCE Mathematics Test by Forms

Tests of Between-Subjects Effects

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	.068[a]	3	.023	.884	.456
Intercept	.003	1	.003	.120	.731
FORM A 2024	.004	1	.004	.154	.696
FORM B 2024	.067	1	.067	2.635	.111
FORM C 2024	.003	1	.003	.114	.737
Error	1005.174	837	1.21		
Total	1978.564	840			
Corrected Total	1.241	835			

a. R Squared = .851 (Adjusted R Squared = .573)

Source: Fieldwork, (2025) Dependent Variable: Academic Performance

Table 1 shows no significant difference in the academic performance of students in the 2024 SSCE Mathematics Test by Forms. As Form A shows significant difference in the academic performance of students in the 2024 SSCE Mathematics where $F(1,840) = 0.154$, $P>0.05$); Form B where $F(1,840) = 2.635$, $P>0.05$) and Form C where $F(1,840) = 1.114$, $P>0.05$). Thus the null hypothesis is hereby retained.

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There is no significant difference in the academic performance of students in the 2024 SSCE Mathematics Test by Sex

Table 2: ANCOVA analysis of the academic performance of students' in the 2024 SSCE Mathematics Test Forms by Sex

Tests of Between-Subjects Effects

Dependent Variable: GENDER 2024

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	.091[a]	3	.030	.592	.623	.032
Intercept	.000	1	.000	.007	.933	.000
FORM A 2024	.056	1	.056	1.21	.261	.064
FORM B 2024	.066	1	.066	.057	.812	.051
FORM C 2024	.099	1	.099	.953	.333	.072
Error	892.754	837	1.066			
Total	1267.000	840				
Corrected Total	2.845	838				

a. R Squared = .649 (Adjusted R Squared = .744)

Source: Fieldwork, (2025)

Table 2 above shows no significant difference in the academic performance of students in the 2024 SSCE Mathematics Test by Sex. From Form A, the difference in the academic performance of students in 2024 SSCE Mathematics Test by Sex where $F(1,840) = 1.21$, $P>0.05$); For Form B, $F(1,840) = 0.057$, $P>0.05$); $F(1,840) = 0.953$, $P>0.05$). From the above analysis, the null hypothesis is retained which implies that there is no significant difference in the academic performance of students in the 2024 SSCE Mathematics Test forms by Sex.

Discussion of Findings

The result shows that the null hypothesis 1 was retained as it explains how there is no difference in the academic performance of students in the 2024 SSCE Mathematics Test by Test Forms. The outcome of this work conforms to study of Adeniyi, et al (2023) who stated that there was no significant difference in the academic performance of students since their performance is influenced by factors such as understanding of the subject matter and content,

test-taking skills and therapies, familiarity with national testing structures and patterns, clarity and structured question design, reduced writing and time demands skills. Since test takers have better knowledge of items, arrangement of items based on magnitude would in no particular order influence their performance.

The result from hypothesis two was also retained showing that there is no significant difference in the academic performance of students in the test forms by gender. The outcome corroborates with that of Ayoola (2019) who claimed that the academic performance of students in 2024 WASSCE Mathematics Multiple Choice Test is not influenced by gender. The condition of weight, time and test formats have the likelihood of influencing the performance of students as against gender which shows no propensity that can bring about any difference in their performance. The result aligns that gender did not in any way contribute significantly to the difference in the performance of students as both male and female students are fully prepared and exposed to test items which measures same ability level. However likely exogenous factors like intelligence, socioeconomic factor, learning environment, teachers mode of instruction, learning environment, interest among others may contribute to the difference in performance but not gender, the moderator variable as observed in 2024 WASSCE test forms.

Conclusion

Based on the findings, this study concluded that 2024 West Africa SSCESSCE Mathematics Multiple Choice Test yielded no difference in the academic performance of students when item arrangement was introduced. Furthermore it concluded that either of the gender (Male and female) outperforms each other in the test forms. In other to minimize any form of measurement error and poor academic failure and poor performance, items arrangements did not in any way contribute or influence students' performance.

Recommendations

Based on the findings of this study, the following recommendations were made.

1. Test developers should determine difficulty index for each item as it would guide in item arrangement into specified magnitude.
2. Test experts need adopt non-consistent or randomized test type in future examinations since it develop students' skills and guide against examination malpractice.

3. Psychometricians should write items that will discriminate among students of different achievement levels as this will produce a varied score across learners.

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