

Use of Post Hoc Analysis in Determination of Students' Performance in 2023-2025 Mathematics WASSCE Multiple Choice Test in Lagos State, Nigeria

¹Iberedem, Theresa Ikhiakonotse, PhD

Department of Guidance and Counselling,
Ambrose Alli University,
Ekpoma Edo State, Nigeria.
Email: tessyonotse@aauekpoma.edu.ng

²Udofia, Imoh Godwin, PhD

Department of Guidance and Counselling,
College of Specialised and Professionalised Education,
Lagos State University of Education, Nigeria.
Email: udofiaig@lasued.edu.ng

Abstract

Post-Hoc analysis is undertaken when a tested hypothesis is rejected and there is further need to identify the variable that is responsible for the difference. The study investigated use of Post-Hoc analysis in determination of Students' Academic Performance in 2023-2025 Mathematics WASSCE in Ojo LGA, Lagos State as three null hypotheses were formulated for this study. It employed survey research design using the descriptive approach as population comprised Senior Secondary School III Students who sat for the 2023-2025 WASSCE. Multi-staged sampling procedure was employed in selection of sample. First, simple random sampling adopting ballot and hat method was used to select Ojo LGA; then, inclusive method was employed to select 30 public secondary schools. Thirdly, proportionate sampling procedure using 50% was introduced to select 15 students each from the 30 schools to form a sample of 450 students. The 2023-2025 Mathematics WASSCE Tests was used for data collection.. Content and construct validity was established by the examination body itself in the course of validating the items. Test retest form of reliability yielded an index of .895(2023), .790(2024) and .861(2025) respectively. Analysis of Variance (ANOVA) and Post-Hoc statistics were used to analyse data with the use of LISREL software and all hypotheses tested at .05 level of significance. The study revealed Post-Hoc analysis was useful only in 2025 Mathematics test alone. It concluded that the difference in 2025 Mathematics Test was attributed to ability of test takers, latent traits and interest level of male students. It recommended that female students need to be encouraged and motivated to build careers around Mathematics- related subjects.

Keywords: Post-Hoc Analysis, Students, Performance, Multiple Choice Test, West African Senior Secondary School Certificate Examination.

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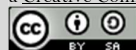
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*Corresponding author: tessyonotse@aauekpoma.edu.ng

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INTRODUCTION

In Nigeria's educational system, Mathematics as a subject occupies a central position in her secondary school curriculum due to its significance to scientific advancement, technological development and improvement in socio-economic growth and development. Just like any other compulsory subject. Mathematics remains one of the core subjects written in the West African Senior School Certificate Examination (WASSCE) conducted by the West African Examinations Council (WAEC). Students' performance in Mathematics is often used as a key indicator of academic competence and readiness for higher education. Research indicates that students' achievement in Mathematics at the secondary school level significantly predicts subsequent academic performance in tertiary institutions, thereby underscoring the importance of accurate and robust assessment practices (Fehintola, 2019).

In large-scale assessments, the examination bodies in Nigeria like West African Examination Council, National Examination Council etc, adopts the use of an achievement test as an objective for measuring students' performance. The scores from the examinations

determine the level of students' academic achievement, which are useful for decision making, certification, selection, prediction, research and development, promotion, experimental process among others. According to examiners report, the West Africa Examination Council revealed the record of students performance between 2023-2025 where 37.9% failure rate was recorded in 2023, 27.8% in 2024 and 36.2% in 2025 respectively. The unstable trend remains a concern for teachers, students, test developers, psychometricians, examination bodies and other relevant stakeholders.

The persistent fluctuations and not too seemingly accepted performance in Mathematics public examinations can be widely attributed to several factors, including teaching methods, teacher quality and learning environments, latent ability, gender disparity, difficulty level of items, among others (Olawoyin & Isuku, 2019; Oribhabor, 2020). Studies employing experimental and quasi-experimental designs in Nigeria have demonstrated significant differences in students achievement across instructional approaches, often identified through inferential statistics (Sunday et al., 2020). These underlined factors that prompt variation in students' performance necessitate more rigorous analytical approaches that go beyond descriptive statistics to uncover significant differences among groups, schools or instructional strategies. As a result, the application of inferential statistical techniques, particularly post hoc statistics, becomes critical in educational research and evaluation. Without Post-Hoc analysis studies may fail to clearly specify or identify the group or groups that contributes towards the significant difference as a result limiting the extent of indepth investigation and interpretation.

The concept of Post-hoc statistical analysis is one of the advanced analytical tool used after an initial analysis of variance (ANOVA) to identify specific group differences responsible for statistically significant results. Post-Hoc procedure is employed in order to conduct pairwise comparison while controlling for type 1 error inflation. They help control error rates associated with multiple comparisons and provide more precise interpretations of academic performance data. In educational studies, post hoc tests such as Tukey, Scheffé and Student Newman Keuls (SNK) are commonly applied to determine where significant differences lie among student groups or instructional conditions. Samaru, et al (2022) stated that appropriate selection of post hoc methods enhances the reliability of findings by minimizing comparison wise and experiment wise error rates, thereby improving decision making in educational research.

Given the increasing emphasis on data-driven educational policy and accountability, the use of post hoc statistics in analysing WASSCE Mathematics performance is both timely and necessary. It provides a more nuanced understanding of students' achievement patterns and supports evidence-based interventions aimed at improving learning outcomes. Therefore, this study examined the use of post hoc analysis in determining students' performance in the 2023-2025 Mathematics WASSCE Multiple Choice Test in Ojo, LGA, Lagos State with a view to enhancing the precision and validity of the scale.

Statement of the Problem

The 2025 Examination cycle of West African Senior Secondary School Certificate especially with respect to Mathematics, a required subject for students to sit for has generated a mixed reaction as stakeholders in the field of education admitted to been disappointed in the performance of students due to the not too seemingly acceptance in performance rate in the state. This unstable performance rate may be associated to poor mastery level, difficulty and discrimination of items, time allocated, gender disparity, environmental and socio-economic factors among others.

Despite numerous interventions targeted at improving instructional quality and learning outcomes, persistent fluctuations in performance levels suggest underlying analytical and evaluative lacuna on how performance information are interpreted and utilised. With over reliant on descriptive statistics of mean and percentage rates which may likely not captured the complexity and variability inherent in examination result, the use of Higher Order Component (HOC) statistics offer a more sophisticated analytical framework capable of providing deeper insights into students' performance patterns.

Research revealed that there is insufficient application and integration of Post-Hoc statistical methods in determining and interpreting students' performance in standardised examinations, hence the study investigated the Use of Post-Hoc analysis in determination of Students' Performance in 2023-2025 Mathematics West African Senior Secondary School Certificate Multiple Choice Test in Lagos State.

Purpose of the study

The main purpose of this study was to explore the use of Post-Hoc Analysis in Determination of Student' Academic Performance in 2023-2025 Mathematics Senior Secondary Certificate Examination Multiple Choice Test in Ojo LGA of Lagos State. Specifically, the study was out to:

1. determine the academic performance of students in 2023 Mathematics Senior Secondary Certificate Examination Multiple Choice Test by gender.
2. determine the academic performance of students in 2024 Mathematics Senior Secondary Certificate Examination Multiple Choice Test by gender.
3. determine the academic performance of students in 2025 Mathematics Senior Secondary Certificate Examination Multiple Choice Test by gender.

Research Questions

The study provided answers to two questions posed by this study and they included:

1. What is the difference in the academic performance of students in 2023 Mathematics Senior Secondary Certificate Examination Multiple Choice Test by gender?
2. What is the difference in the academic performance of students in 2024 Mathematics Senior Secondary Certificate Examination Multiple Choice Test by gender?
3. What is the difference in the academic performance of students in 2025 Mathematics Senior Secondary Certificate Examination Multiple Choice Test by gender?

Hypotheses

Two null hypotheses were formulated and tested at .05 level of significance:

- H0₁: There is no significant difference in the academic performance of students in 2023 Mathematics Senior Secondary Certificate Examination Multiple Choice Test by gender.
- H0₂: There is no significant difference in the academic performance of students in 2024 Mathematics Senior Secondary Certificate Examination Multiple Choice Test by gender.
- H0₃: There is no significant difference in the academic performance of students in 2025 Mathematics Senior Secondary Certificate Examination Multiple Choice Test by gender.

METHODOLOGY

The study employed survey research design using the descriptive approach as population comprise Senior Secondary School III Students who sat for the 2023-2025 West African Senior Secondary Certificate Examination, WASSCE. Multi-staged sampling procedure was employed in selection of sample. First, ballot and hat method was used to select Ojo LGA; then, inclusive method was employed to select 30 public secondary school from Ojo, LGA. Thirdly, proportionate sampling procedure using 50% was introduced to select 15 students each from the 30 schools; finally, simple random sampling procedure was adopted to select a sample of 450 students. The 2023-2025 Mathematics WASSCE Tests was used for data collection. It meets content and construct validity as presumed by the examination body. Test retest form of reliability yielded an index of .895(2023), .790(2024) and .861(2025) respectively. Analysis of Variance, ANOVA and Post-Hoc statistics were used to analyse data with the use of LISREL software and all hypotheses tested at .05 level of significance.

RESULTS

H0₁: There is no significant difference in the academic performance of students in 2023 Mathematics Senior Secondary Certificate Examination Multiple Choice Test by gender.

Table 1: ANOVA showing academic performance of students in 2023 Mathematics WASSCE Multiple Choice Test by gender

		Sum of Squares	Df	Mean Square	F	Sig.	Remark
Performance	Between groups	.698	1	.698			
	Within groups	3796.360	448	8.474	.082	.774	Retain H0 ₁
	Total	3797.058	449				

The ANOVA result in Table 1 shows an F-value of .082 and a p-value of .774 testing at an alpha level of .05. Since the p-value is greater than the alpha level ($p > 0.05$), the null hypothesis is retained, showing that there is no significant difference in the academic performance of students in the 2023 WASSCE Mathematics multiple-choice by gender. With no significant value, a Post-Hoc test of comparison to determine where the difference lies is not needed.

H0₂: There is no significant difference in the academic performance of students in 2024 Mathematics Senior Secondary Certificate Examination Multiple Choice Test by gender.

Table 2: ANOVA showing academic performance of students in 2024 Mathematics WASSCE Multiple Choice Test by gender.

		Sum of Squares	Df	Mean Square	F	Sig.	Remark
Performance	Between groups	.733	1	.733	.109	.742	Retain H0 ₂
	Within groups	3028.387	448	6.760			
	Total	3029.120	449				

The ANOVA result in Table 2 shows an F-value of .109 and a p-value of .742 testing at an alpha level of .05. Since the p-value is greater than the alpha level ($p > 0.05$), the null hypothesis is retained, showing that there is no significant difference in the academic performance of students in the 2024 WASSCE Mathematics Multiple-Choice Test by gender. With no significant value, a Post-Hoc test of comparison to determine where the difference lies is not needed.

H0₃: There is no significant difference in the academic performance of students in 2025 Mathematics West African Senior Secondary Certificate Examination Multiple Choice Test by gender.

Table 3: ANOVA showing Academic Performance of students in 2025 Mathematics WASSCE Multiple MCT by gender

		Sum of Squares	Df	Mean Square	F	Sig.	Remark
Performance	Between groups	1.937	1	1.937	.230	.032	Reject H0 ₃
	Within groups	3774.083	448	8.424			
	Total	3776.020	449				

The ANOVA result in Table 3 shows an F-value of .230 and a p-value of .032, testing at an alpha level of .05. Since the p-value is less than the alpha level ($p < 0.05$), the null hypothesis is rejected, showing that there is a significant difference in the academic performance of students in the 2025 WASSCE Mathematics Multiple-Choice Test by gender. With a significant value, Post-Hoc test of comparison to determine where the difference lies is determined.

Table 4: Post-Hoc Test for Multiple Comparisons of the Differences in Academic Performance of Students in 2025 WASSCE Mathematics Multiple Choice Test by gender

(I) WASSCE 2025	(J) WASSCE 2025	Mean Difference (I-J)	Sig.
1 (Male)	1	.120	.624
	2	.862*	.004
2 (Female)	2	-.120	.039
	1	.741*	.012

1(Male); 2(Female)

Table 4 shows the LSD Post-Hoc Test used to determine the direction of difference in 2025 WASSCE Mathematics Multiple Choice Test, 1 to 1 is non-significant at .624 with mean difference of .120, 1 to 2 is significant at .004 with mean difference of .862; 2 to 2 is significant at .039 with mean difference of -.120, 2 to 1 is significant at .012 with mean difference of .741 respectively. Hence the difference in 2025 Mathematics test lies in 1 (Male) where sig-value of 0.004 ($P < .05$).

Discussion of Findings

Result from hypothesis one shows that there is no significant difference in the academic performance of students in 2023 WASSCE Mathematics Multiple Choice Test by gender. From the result in 2023 WASSCE Mathematics Multiple Choice Test, gender of the students did not in any way influence the performance level of students. In aligning with a growing body of evidence suggests that sex-related performance gaps in Mathematics have widened in recent years due to none influence of gender. This finding corroborates with that of Hyde, et al. (2019) who affirmed that given equal learning opportunities and access to resources, male and female students would perform similarly in standardized Mathematics tests irrespective of the test condition and time of administration. This non-differential can be attributed to reduction of societal stereotypes and increased advocacy for gender equity in STEM education. All things

being equal both male and female students in the 2022 cohort have relative equal opportunities and comparable levels of preparedness for the WASSCE Mathematics examination.

Also, result from hypothesis two shows that there is no significant difference in the academic performance of students in 2024 WASSCE Mathematics Multiple Choice Test by gender. In 2024 WASSCE Mathematics Multiple Choice Test gender of the students did not in any way influence the performance level of test takers. The absence of a statistically significant difference by gender supports the argument that performance variations in Mathematics is less of a function of biological differences and more influenced by learning environment, instructional quality and motivation. This finding aligns with study carried out by Liu and Wilson (2020) who identified classroom practices, teacher expectations and access to learning aids as stronger predictors of Mathematics achievement than gender. In the confines of 2024 WASSCE Mathematics Multiple Choice Test, they suggested that both male and female students may have benefited from similar curriculum coverage, teacher competence and exposure to past questions, leading to parity in performance outcomes.

Meanwhile findings from hypothesis three, revealed that there is a significant difference in the academic performance of students in the 2025 WASSCE Mathematics Multiple Choice Test by gender. In 2024 WASSCE Mathematics Multiple Choice Test, gender of the students did influenced the performance level of students. The finding that male students performed better than female students in the 2025 West African Senior School Certificate Examination (WASSCE) Mathematics Multiple Choice Test can be situated within the broader empirical literature on gender differences in mathematics achievement, particularly in objective or multiple-choice assessments. Studies from Mafikuyomi and Udofia (2025); Meremikwu et al., (2014) alluded that male students tend to exhibit higher performance in mathematics tasks that emphasize spatial reasoning and objective testing formats. Male students are naturally drawn to cognitive associated tasks where their mental ability is put to high test, function the most and most especially, quantitative related assignments. Unlike the female gender that prefers language related responsibilities, their male counterparts prefer tasks that demands less mental tasks where formulars and use of calculations are of high demand.

CONCLUSION

Based on the findings, it was concluded that given 2023-2025 SSCE Mathematics Multiple Choice Test, there was no significant difference in students' academic performance by gender in 2023 and 2024 test, while significant difference exists in 2025 Mathematics SSCE Multiple Choice Test by gender. The difference in 2025 Mathematics SSCE Multiple Choice Test was attributed to the ability, latent and interest level of male students.

RECOMMENDATIONS

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

1. Item developers should write items that will discriminate among students of different achievement levels. This will produce a varied score across learners.
2. Female students should be encouraged and motivated to develop interest and build careers around Mathematics related subjects.
3. Test developers must always introduce the use of table of specification as a guide when constructing tests.
4. Mathematics teachers should be advised to cover content of the subject while making the subject interesting for students in classes.

REFERENCES

- Fehintola, J.O. (2019). Evaluation of university freshmen scholastic achievement based on SSCE, UTME, gender and age in South West Nigeria. *European Journal of Open Education and E-learning Studies*.
- Field, A. (2018). *Discovering statistics using IBM SPSS statistics* (5th ed.). Sage Publications.
- Howell, D.C. (2013). *Statistical methods for psychology* (8th ed.). Cengage Learning.
- Longjohn, I.T., & Audu, L.C. (2020). Comparative analysis of students' academic performance in school-based assessment and external examination in Rivers State. *International Journal of Innovative Mathematics, Statistics & Energy Policies*.
- Mafikuyomi, J.A. & Udofia, I.G. (2025) Use of Post Hoc Analysis on Pupils Literacy Skills Outcome in Public Primary Schools in Ojo Local Government of Lagos State Nigeria. *Fudma Journal of Research, Educational Psychology and Counselling*.(FUJREPAC) VOL. 3, NO. 3, DEC, 2025. ISSN 3027 - 0138 e- ISSN 3027 – 08
- Makinde, S.O., & colleagues. (2010). Gender differences in mathematics and science achievement. *Journal of Modern Mathematics and Statistics*.
- Meremikwu, A.N., Ekwueme, C.O., & Enuokoha, O.I. (2014). Gender pattern in participation and performance at mathematics olympiads. *Advances in Social Sciences Research Journal*.
- Olawoyin, M. A. & Isuku, E.J. (2019). Students' academic achievement as influenced by teachers' quality: Evidence from Southwest Nigeria. *European Journal of Education Studies*.
- Oribhabor, C.B. (2020). Evaluating the effect of activity-based method of teaching mathematics on Nigerian secondary school students' achievement in mathematics. *ArXiv Preprint*.
- Pallant, J. (2020). *SPSS survival manual: A step by step guide to data analysis using IBM SPSS* (7th ed.). McGraw-Hill Education.
- Samaru, S., Ibrahim, U.I., Dikko, H.G., Tasiu, M.I., Damisa, A.S., & Falgore, J.Y. (2022). Comparison and evaluation of different post-hoc test statistics in engineering and education. *Royal Statistical Society Nigeria Conference Proceedings*.
- Sunday, A.O., Olaoye, A.E., & Audu, H. (2020). Effects of cooperative and competitive teaching strategy on statistics achievement of students in secondary schools in Abuja, Nigeria. *Sapientia Foundation Journal of Education, Sciences and Gender Studies*.
- Tabachnick, B.G. & Fidell, L.S. (2019). *Using multivariate statistics* (7th ed.). Pearson.
- West African Examinations Council (WAEC). (2025). *WASSCE 2025 results statistics report*. <https://giftconsult.com.ng/female-candidates-outperform-males-in-wassce-2025-as-waec-withholds-9-75-of-results-over-malpractice/>