

Inter-Agency Differential Analysis of Student Mathematics Grading in Senior Secondary Certificate Examination

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Abstract – The study analysed student Mathematics grading in the senior secondary certificate examinations conducted by the West African Examination Council (WAEC) and the National Examination Council (NECO) in Andoni Local Government Area (ANOLGA) of Rivers State, Nigeria. Analytical survey design of the expost-facto research type was adopted for the study. The population of the study comprised 19,800 students who sat for WASSCE between 2000 and 2018 and NSSCE between 2000 and 2011 in Mathematics from the eleven senior secondary schools in ANOLGA. Systematic sampling technique was used to select the grades of 3640 students who sat for WASSCE and NSSCE Mathematics between 2000 and 2018 from the five mixed public schools randomly selected for the study through their master list. Three research questions and three hypotheses guided the study. The Student Mathematics Grade Sheet (SMGS) was the instrument used for data collection. The validity of SMGS was established by experts in Mathematics Education. Using test-retest method and the Spearman's Rank-Order Correlation (SROC), a reliability coefficient of 0.70 was obtained. Mean and standard deviation were used to answer the three research questions while t-test and Analysis of Variance (ANOVA) were used to test the hypotheses at 0.05 levels of significance. Findings of the study revealed that students' Mathematics grades in WASSCE and NSSCE were high and not significantly different. Also, there was no significant difference between the male and the female students Mathematics grades in both examinations. The study concluded that WAEC and NECO are of similar standard and do not contribute to the abysmal performance of students being reported in Mathematics. The study therefore recommended among others that students, teachers and parents should not prefer WAEC to NECO or vice versa during registration because student Mathematics grades in both examinations were not different.

Keywords – Inter-Agency, Differential, Analysis, Mathematics, Grading, Examination.

I. INTRODUCTION

Mathematics is one of the compulsory subjects in the national curriculum that students offer at the basic and post-basic levels of education in Nigeria because it plays a prominent role in national development. The central position of Mathematics in science, technology and engineering makes it very relevant and indispensable in this digital and knowledge-based economy era. The subject of Mathematics is the bedrock of science, technology and engineering. Mathematics is positively correlated to the sciences,

engineering and technologies; which are the tripod of modern national development. This tripod of development of any nation cannot stand without improved Mathematics knowledge and competencies among the citizens. This study therefore, seeks to analyze the differences in the student Mathematics grades in senior secondary certificate examination conducted by the West African Examination Council (WAEC) and the National Examination Council (NECO) agencies with the aim of comparing their performances in both examinations over time.

Sequel to the development and implementation of subject-based curriculum in the secondary schools, Nworgu (1992) in Kpolovie (2002), opined that examination agencies were set up to promote education, to co-ordinate educational programmes, and to control and monitor the quality of education in educational institutions, the essence of which is the organization of public examinations so as to provide uniform standards to all test takers, irrespective of the type or method of instruction they have received. Agencies such as the WAEC, NECO, National Business and Technical Examination Board (NABTEB) and Joint Admissions and Matriculation Board (JAMB) were established to oversee the conduct of examinations. WAEC and NECO in particular were established to assess, certify and prepare the students for tertiary education. NABTEB is to evaluate students in technical and vocational colleges while JAMB is to conduct and give provisional admission to students seeking admission into tertiary institutions within Nigeria. The WAEC and the NECO independently conduct the Senior Secondary Certificate Examination (SSCE) annually in Nigeria.

The WAEC was established in 1952 with the following functions:

- 1) Review and consider annually the examinations to be held in West Africa in the public interest;
 - 2) Conduct such examinations as the Council may think appropriate in pursuant to this Act and to award certificates and diplomas on the results of examinations so conducted;
 - 3) Consider the advisability of inviting and if thought fit to invite any other examining body to conduct examinations in West Africa and to-
 - i. Award certificates and diplomas on the results of such examinations;
 - ii. Advise anybody so invited on such adaptations of their examinations as the Council may think necessary for the purposes of this Act; and
 - iii. Assist anybody so invited in the conduct of such examinations in West Africa, so however that no examinations having a lower standard than any examination of equal status conducted pursuant to this Act shall be conducted in West Africa by any such body.
- By the establishment of the NECO in April 1999, the following functions were delegated to the Council:
- 1) Revising and considering, annually, in the public interest the examinations to be held for admission into Federal Government colleges and other allied institutions;
 - 2) Collecting and disseminating information on all matters relating to admission into Federal Government colleges and other allied institutions;
 - 3) The general control and conduct of the National Common Entrance Examinations for admission into Federal Government colleges and other allied institutions;
 - 4) Developing and administering selection examinations into the Suleja Academy in accordance with such guidelines as may be approved from time to time, by the Minister;
 - 5) Developing, administering and conducting aptitude tests for all candidates into Federal Government colleges and other allied institutions;
 - 6) Monitoring, collecting and keeping records of continuous assessment in all Federal Government colleges and other allied institutions and in the Suleja Academy toward the award of the Junior and Senior Secondary School Certificates;
 - 7) The general control of the conduct of the Junior Secondary School Certificate Examinations in all Federal Government colleges, and other allied institutions and in the Suleja Academy;
 - 8) The general control of the conduct of the internal and external Senior Secondary School Certificate Examinations in Nigeria without prejudice to the existing powers and functions of the West African Examination Council;
 - 9) Conducting a Standard National Assessment of Educational Performance at junior and senior secondary school levels;
 - 10) Conducting researches leading to national improvement of testing and examination procedures at junior and senior secondary school levels;
 - 11) Preparing and submitting to the Minister the annual report on standards of examinations and such other related matters as the Minister may, from time to time, require; and
 - 12) Carrying out such other activities as are expedient for the discharge of all or any of the functions conferred on the Council under or by this Act.

Students in senior secondary class three register as candidates to sit for either of the examinations or both to obtain the senior secondary certificate which is a compulsory requirement for admission into tertiary institution. Candidates are expected to pass at least five relevant subjects to their course of study including General Mathematics and English Language at credit level. However, over the years many researchers kept reporting and lamenting students poor grades in the annual national examinations conducted by these two examination agencies. Onipede (2003) reported that students performed below expectation in Senior Secondary Certificate (SSC) examinations in many subject areas especially in English Language and Mathematics. Students' poor performance in WAEC and NECO Mathematics has been the concern of teachers, parents, researchers and curriculum planners. Zalmon and Wonu (2017), reported that though there is abysmal performance of students in Mathematics in West African Senior Secondary Certificate Examinations (WASSCE), but students' performance improved significantly with time. It is against this background that the study seeks to carry out an inter-agency differential analysis of student Mathematics grading in senior secondary certificate examination in Andoni local government area of Rivers State.

II. STATEMENT OF THE PROBLEM

Despite the importance of Mathematics, many students seem not to develop interest in learning it. Students are diagnosed with Mathematics phobia which has consequently engendered their massive failure in Mathematics in internal and external examinations. Based on this fact several hypotheses had been put forwarded to explain why students fail WAEC and NECO yearly. Researchers have identified different factors responsible for student Mathematics failure in WAEC and NECO. Some of the factors identified include: lack of personal confidence, emotional instability and temperamental tendency towards extraversion, mathophobia, deficiency in basic mathematical skills, lack of positive student-teacher relationship, poor quality of instruction and many more. Keeping these variables constant, this study is poised to find out if examination agencies or the process of conducting examination by the agencies also contributes to the abysmal performance or grades of students in Mathematics. Therefore, this study shall provide answers to these questions: What is the difference between the Mathematics grades of students in the West Africa Senior Secondary Certificate Examination (WASSCE) and the National Senior Secondary Certificate Examination (NSSCE) in Andoni local government area?

Do the male students perform better than the female students or verse versa in Mathematics in WASSCE and NSSCE?

III. AIM AND OBJECTIVES OF THE STUDY

The aim of this study is to analyse the difference between student Mathematics grades in the West Africa Senior Secondary Certificate Examination (WASSCE) and the National Senior Secondary Certificate Examination (NSSCE) in Andoni local government area. The objectives of study are to:

1. Analyse the difference between student Mathematics grades in the WASSCE and the NSSCE.
2. Determine the difference between the male and the female student Mathematics grades in the WASSCE and the NSSCE.
3. Ascertain the difference between student Mathematics grades in WASSCE and NSSCE from 2000-2008 and 2009-2017 examination years.

IV. RESEARCH QUESTIONS

The following research questions were asked to guide the study:

1. What is the mean difference between student Mathematics grades in the WASSCE and the NSSCE?
2. What is the mean difference between the male and the female student Mathematics grades in the WASSCE and the NSSCE?
3. What is the mean difference between student Mathematics grades in WASSCE and NSSCE from 2000-2008 and 2009-2017 examination years?

V. HYPOTHESES

In this study, three null hypotheses were formulated and tested at 0.05 significant level to guide the study:

1. There is no significant mean difference between student Mathematics grades in the WASSCE and the NSSCE.
2. There is no significant mean difference between the male and the female student Mathematics grades in the WASSCE and the NSSCE.
3. There is no significant mean difference between student Mathematics grades in WASSCE and NSSCE from 2000-2008 and 2009-2017 examination years.

VI. METHODOLOGY

An analytical survey design of the expost-facto research type was adopted for the study because students' Mathematics grades in WASSCE (2000-2018) and NSSCE (2000-2011) were collected from students' master list. The population of the study comprised 19,800 students who sat for WASSCE and NSSCE in Mathematics between 2000 and 2018 from the eleven senior secondary schools in Andoni Local Government Area (ANOLGA) of Rivers State. Systematic sampling technique was used to select a sample of 3640 students (male, 2060; female, 1580) who sat for WASSCE (2279) and NSSCE (1361) Mathematics between 2000 and 2018 from the five mixed public schools randomly selected for the study. Systematic sampling technique was adopted to select students' grades in Mathematics of the examination years through their examination numbers as contained in the master list. The master list contained students' names, which enable the researcher to classify the students into male and female, students' examination numbers and grades. Both WAEC and NECO use the 9-point grading system as follows: A1 = excellent; B2 = very good; B3 = good; C4 = credit; C5 = credit; C6 = credit; D7 = pass; E8 = pass; F9 = fail. However, grades in this study were coded on the reverse as follows: A1 = 9 points; B2 = 8points; B3 = 7points; C4 = 6points; C5 = 5points; C6 = 4points; D7 = 3points; E8 = 2points; F9 = 1points. The instrument used for data collection was the 'Student Mathematics Grade Sheet

(SMGS)'. The instrument had two parts A and B. Part A generated the bio-data of the candidates to include name of school, candidate's name, examination agency, examination year and gender while part B elicit information on the students' grades in the both examination bodies. A mean criterion cut-off point of 5.0 was used in the study. Any mean score below 5 points ($\bar{x} < 5$) was considered as failed while mean score of 5 or above ($\bar{x} \geq 5$) as passed. The study viewed C6 grade which represent 4 points as a weak pass because the grade falls below the mean criterion cut-off point. The research instrument: SMGS was validated face and content wise by three experts in Mathematics Education. The reliability of SMGS was established using test-retest method. SMGS was used to collect the grades of twenty students each in WASSCE in Mathematics from two schools which were not part of the sampled schools. The grades of the students from the schools were correlated using the Spearman's Rank-Order Correlation (SROC) and a reliability coefficient of 0.70 was obtained. Mean and standard deviation were used to answer the three research questions. T-test was used to test hypothesis one while hypotheses two and three were tested using Analysis of Variance (ANOVA).

VII. RESULTS

Research question one: What is the mean difference between student Mathematics grades in the WASSCE and the NSSCE?

Table 1: Mean (M) and Standard Deviation (SD) of student Mathematics grades in WASSCE and NSSCE

Agency	n	Mean	SD	Difference	
				Mean	SD
WAEC	2279	5.67	1.78	0.08	0.20
NECO	1361	5.59	1.58		
Total	3640	5.63	1.68		

Data in table 1 showed that the difference between student Mathematics grades in WASSCE (M=5.67, SD=1.78) and NSSCE (M=5.59, SD=1.58) was M=0.08, SD=0.20 in favour of WAEC.

Research question two: What is the mean difference between the male and the female student Mathematics grades in the WASSCE and the NSSCE?

Table 2: Mean and standard deviation of the male and the female students Mathematics grades in WASSCE and NSSCE

Agency	Gender	n	Mean	SD	Std. Error	95% Confidence Interval for Mean	
						Lower Bound	Upper Bound
WAEC	Male	1327	5.64	1.77	.049	5.55	5.74
	Female	952	5.70	1.78	.058	5.56	5.82
NECO	Male	733	5.60	1.59	.059	5.49	5.72
	Female	628	5.58	1.57	.063	5.46	5.71
	Total	3640	5.64	1.71	.028	5.58	5.69

Data in table 2 showed the mean and standard deviation of the male and the female student Mathematics grades in WASSCE and NSSCE. Table 2 revealed that the female (M=5.70, SD=1.78) students had a higher grade than their male (M=5.64, SD=1.77) counterpart in WASSCE while in

NSSCE, the male (M=5.60, SD=1.59) students had a higher grade than their female (M=5.58, SD=1.57) counterpart.

Research question three: What is the mean difference between student Mathematics grades in WASSCE and NSSCE from 2000-2008 and 2009-2017 examination years?

Table 3: Mean and standard deviation of Mathematics grades of students in WASSCE and NSSCE from 2000-2008 and 2009-2017

Examination interval	n	Mean	SD	Std. Error	95% Confidence Interval for Mean	
					Lower Bound	Upper Bound
WAEC 2000-2008	1125	5.66	1.91	.06	5.55	5.77
WAEC 2009-2017	1154	5.68	1.64	.05	5.59	5.77
NECO 2000-2008	274	5.46	1.22	.07	5.32	5.61
NECO 2009-2017	1087	5.62	1.66	.05	5.53	5.72
Total	3640	5.64	1.71	.03	5.59	5.69

Data in table 3 showed the mean and standard deviation of Mathematics grades of students in WASSCE and NSSCE from 2000-2008 and 2009-2017 examination years. Table 3 revealed that student Mathematics grades slightly improved with time in both WASSCE (M=5.68, SD=1.64) and NSSCE (M=5.62, SD=1.66). However, the difference between student Mathematics grades in WASSCE and

NSSCE from 2000-2008 and 2009-2017 examination years was minimal.

HO₁: There is no significant mean difference between student Mathematics grades in the WASSCE and the NSSCE.

Table 4: Summary of t-test statistics on student Mathematics grades in WASSCE and NSSCE

Agency	n	Mean	SD.	df	t _{cal.}	t _{crit.}	Sig.
WAEC	2279	5.67	1.78				
NECO	1361	5.59	1.58	3638	1.36	1.96	0.17

Data in table 4 showed that there is no significant mean difference between student Mathematics grades in the WASSCE and the NSSCE ($t_{(3638, 0.05)} = 0.17, p > 0.05$); $t_{cal.}(1.36) < t_{crit.}(1.960)$. Therefore, the null hypothesis one is retained and the alternate hypothesis rejected.

HO₂: There is no significant mean difference between the male and the female student Mathematics grades in the WASSCE and the NSSCE.

Table 5: Summary of ANOVA statistics on student Mathematics grades in WASSCE and NSSCE

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	7.12	3	2.37	.82	.49
Within Groups	10560.52	3636	2.91		
Total	10567.64	3639			

$F_{crit} = 4.28$

Data in table 5 showed that there is no significant mean difference between the male and the female student Mathematics grades in the WASSCE and the NSSCE ($F_{(3, 3636)} = 0.49$, $p > 0.05$); $F_{cal.}(0.82) < F_{crit.}(4.28)$. Therefore, the null hypothesis two is retained and the alternate hypothesis rejected.

HO₃: There is no significant mean difference between student Mathematics grades in WASSCE and NSSCE from 2000-2008 and 2009-2017 examination years.

Table 6: Summary of ANOVA statistics on student Mathematics grades in WASSCE and NSSCE from 2000-2008 and 2009-2017 examination years

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	11.05	3	3.68	1.27	.28
Within Groups	10576.93	3636	2.91		
Total	10587.98	3639			

$F_{crit} = 4.28$

Data in table 6 showed that there is no significant mean difference between student Mathematics grades in WASSCE and NSSCE from 2000-2008 and 2009-2017 examination years ($F_{(3, 3636)} = 0.28$, $p > 0.05$); $F_{cal.}(1.27) < F_{crit.}(4.28)$. Therefore, the null hypothesis three is retained and the alternate hypothesis rejected. In other words, student Mathematics grades in both WASSCE and NSSCE did not significantly improve over time.

VIII. DISCUSSION OF FINDINGS

Difference between student Mathematics grades in the WASSCE and the NSSCE

Data in table 1 showed that the difference between student Mathematics grades in WASSCE ($M=5.67$, $SD=1.78$) and NSSCE ($M=5.59$, $SD=1.58$) was $M=0.08$, $SD=0.20$ in favour of WAEC. Data in table 4 showed that there is no significant mean difference between student Mathematics grades in the WASSCE and the NSSCE ($t_{(3638, 0.05)} = 0.17$, $p > 0.05$); $t_{cal.}(1.36) < t_{crit.}(1.960)$. This finding corroborated with that of Kpolovie, Ololube and Ekwebelem (2011), who examined the performance of secondary school students in WAEC and NECO senior secondary certificate examinations from 2004 to 2006 to establish their comparability across subjects including Mathematics and found a statistically significant positive relationship between

candidates' performance in WAEC and NECO senior secondary certificate examinations in Mathematics and other subjects. Seyi and Clement (2012) also reported that there is significant positive relationship between students' achievement in Mathematics conducted by WAEC and NECO.

Difference between the male and the female student Mathematics grades in the WASSCE and the NSSCE

Data in table 2 revealed that the female ($M=5.70$, $SD=1.78$) students had a higher grade than their male ($M=5.64$, $SD=1.77$) counterpart in WASSCE while in NSSCE, the male ($M=5.60$, $SD=1.59$) students had a higher grade than their female ($M=5.58$, $SD=1.57$) counterpart. Data in table 5 showed that there is no significant mean difference between the male and the female student Mathematics grades in the WASSCE and the NSSCE ($F_{(3, 3636)} = 0.49$, $p > 0.05$); $F_{cal.}(0.82) < F_{crit.}(4.28)$. Contrary to the finding of this study, Oloda (2017) reported that there is gender disparity in the academic performance of students in Mathematics periodic tests and terminal examination with the male students performing significantly better than their female counterparts. This difference in the findings of this study and that of Oloda (2017) could be due to the difference in the area of study. Also, Adah and Sule (2019) indicated that there is an association between gender and

students' academic performance in Mathematics in senior secondary certificate examination (NECO).

Difference between student Mathematics grades in WASSCE and NSSCE from 2000-2008 and 2009-2017 examination years

Data in table 3 revealed that student Mathematics grades slightly improved with time in both WASSCE ($M=5.68$, $SD=1.64$) and NSSCE ($M=5.62$, $SD=1.66$). However, this difference between student Mathematics grades in WASSCE and NSSCE from 2000-2008 and 2009-2017 examination years was minimal. Data in table 6 showed that there is no significant mean difference between student Mathematics grades in WASSCE and NSSCE from 2000-2008 and 2009-2017 examination years ($F_{(3, 3636)} = 0.28$, $p > 0.05$; $F_{cal.}(1.27) < F_{crit}(4.28)$). This finding varies with that of Zalmon and Wonu (2017), who noted abysmal performance of students in Mathematics but observed that there was a comparatively significant improvement in students' Mathematics achievement over time in national examinations. The difference in the geographical scope of the studies could be the reason for the variation in the results.

IX. CONCLUSIONS

The study analysed the difference between student Mathematics grades in the West Africa Senior Secondary Certificate Examination (WASSCE) conducted by WAEC and the National Senior Secondary Certificate Examination (NSSCE) conducted by NECO in Andoni local government area. The study found out that there is no significant difference between student Mathematics grades in the WASSCE and the NSSCE. There is also no significant difference between the male and the female student Mathematics grades in the WASSCE and the NSSCE. Student Mathematics grades in WASSCE and NSSCE did not significantly improve with time. The study concluded that WAEC and NECO, the two senior secondary certificate examination conducting agencies in Nigeria are of similar standard and do not contribute to the abysmal performance of students being reported in Mathematics. The result of the study revealed that students Mathematics grades in both WAEC and NECO were high, indicating good performance.

X. RECOMMENDATIONS

The following recommendations were made from the finding of the study:

1. Students, teachers and parents should not prefer WAEC to NECO or vice versa during registration

because student Mathematics grades in both examinations were not different.

2. Mathematics teachers and parents should discourage gender disparity in Mathematics learning among students because gender did not significantly influence student Mathematics grades in WASSCE and NSSCE.
3. Teachers should adopt innovative methods and materials in Mathematics instruction for the sustainability of students' high grades and possible significant improvement over time in WASSCE and NSSCE.

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