Gender Differences in the Academic Performance of Students in Senior Secondary School Mathematics

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Abstract:- This study examined Gender Differences in the Academic Performance of Students in Senior Secondary School Mathematics. The population of the study comprises eighteen (18) Senior Secondary Schools in Yola North Local Government Area of Adamawa State, Nigeria who registered and sat for General Mathematics at West African Senior Secondary Schools Examination (WASSCE) for the period of five (5) years 2013 – 2017. Six (6) mixed schools were sampled out of the population of the study with a total number of three thousand seven hundred and sixty four (3764) students of which two thousand one hundred and sixty (2160) students representing 57.4% of the sampled population are male students and one thousand six hundred and four (1604) students representing 42.6% of the sampled population are female students. A simple random sampling technique was used in the selection of the six (6) sampled schools. An expo facto design was adopted for this study. Simple percentages and T-test analysis were used for the data analysis. The analysis essentially involves the statistical testing of the hypotheses at 0.05 alpha level which form the basis for the acceptance or rejection of each null hypothesis stated. The study revealed that the distribution of performance of male and female students in Mathematics in the period sampled for the study varies as it kept changing over the years examined. It shows that less than 50% of the students who sat for West African Senior Secondary Schools Examination (WASSCE) Mathematics over the years had credit pass A1 – C6. This means that there is a significant difference in gender based academic performances of students in Mathematics in the selected sampled schools in the period examined for the study. The study recommends that female students ought to be admonished to approach science subjects especially Mathematics without inferiority complex to the male students.

Abbreviation: West African Senior Secondary Schools Examination (WASSCE)

Keywords:- Academic Performance, Gender Difference, Mathematics, Students.

I. INTRODUCTION

Academic Performance is the quality and quantity of knowledge, skills, techniques and positive attitudes, behaviour and idea that students achieve or acquire. This achievement is weighed up by the mark or grade that students make in a term or education cycle. Academic performance has a great impact on a student's motivation, confidence and determination in education. Poor academic performance or high rate of failure can lead to many negative consequences such as unacceptable levels of attrition, reduction or zero admission opportunities for students seeking to enter tertiary institutions. Academic performance of students is among the main concern of parents and the educational institution hence a constant topic of interest for educators.

Academic Performance concept has been a subject of discussion for a very long time. It has received much philosophical discussion but less application than deserved. Pearson (2003) defined performance as something important that one succeed in doing by his own effort. Performances in education therefore involve assessment and measurement of educational success attainment of an individual. Furthermore, is impossible to define performance of an individual by the action the individual but rather by judgmental and evaluative processes (Ilgen and Schneider, 1991; Motowidlo *et al*., 1997). Campbell *et al*. (1993) further stressed that performance is constituted only by an action that can be scaled or measured. He maintained that the outcome aspect refers to the consequence or result of the individual's behavior. The above described behaviors may result in outcomes such as students reading proficiency, sales figures or number of successful heart operations among others. In many situations, the behavioral and outcome aspect are related empirically, but they do not overlap completely.

Binder (1999) defines academic performance testing in relation with performance requirements. Thus, he stressed that performance tests are designed to validate performance requirements which are expressed either as time interval in which a student must accomplish a given task, as performance throughout. Also, Gao *et al*. (2003) defines performance test as an activity to validate the student performance and measure his capacity. In relation to educational research, an academic performance of students can be regarded as the observable and measurable behavior of students in a particular situation. James (2000) declared that academic performance really involves how much a student has learned. Academic performance is the outcome of education; the extent to which a student, teacher or institution has achieved their educational goal. Annie *et al*. (1996) stressed that academic performance is commonly measure by test, examination or continuous assessment however there is no generally unique agreement on how it is best or which aspect are most important; procedural knowledge such as skills or declarative knowledge such as facts.

Poor academic performance of students in Secondary Schools in Nigeria has been a much discussed educational

issue. In solving any problem however, it is pertinent to understand the causes of such problems. Many factors have been put to study as the etiological starting point for investigating the phenomena of school failure or success. These factors include the supposed responsibilities of the students, teachers, parents or family, school environment, society, government etc. Most famous work that discussed these among others are effects of students' study habits (Ayodele & Adebiyi, 2013), school environment (Adesoji & Olatunbosun, 2008), teachers' competencies (Akiri & Ugborugbo, 2009), parents' economic status (Osonwa *et al*, 2013), continuous assessment (Kolawole & Ala, 2014), educational funding (Ugwulashi, 2012). However, gender difference is one of the major factors discussed in literatures with significant effects on academic performance of students especially in Mathematics and other science base subjects.

Gender is viewed as the range of physical, biological, mental and behavioral characteristics pertaining to and distinguishing between the feminine and masculine (female and male) population (Okeke, 1990). The significance of investigating students academic performance in relation to gender is based primarily on the socio-cultural differences between girls and boys. Some duties and work are believed to be attributed for men only. For instance engineering, arts and crafts work, agriculture among others. Whereas professions like catering, typing, nursing etc., is acclimatize for women. Most at times parents assigned domestic functions like car washing, grass cutting, bulbs fixing and climbing ladders to fix or remove things to the boy child. Alternatively, domestic work like dishes washing, cooking, cleaning up the house is assigned to the girl child. In general, it is believed that any task that is demanding or complex in nature should be handled by the boys whereas less demanding or relatively easy task should be allocated to the girls. As a result of this arbitrary way of thinking and/or belief by the larger society, girls are seen as the weaker sex. Thus, an average Nigerian girl child goes to school with these fixed stereotypes (Dania, 2014).

The significance of investigating relationship in instructional strategy to gender is primarily based on the socio-cultural differences between girls and boys (Abra, 1991). Traditionally, girls in our society have been encouraged to conform, whereas boys are expected to be active and dominant risk takers. Corroborating this view, Hassan and Ogunyemi, (2008) acknowledge that most boys are provided with toys that enhance their visual-spatial

ability such as trucks, toys consisting of plastic building blocks and other components and model. Spencer (2004) also affirms that that the games of girls are often highly structured requiring turn taking and rules. Thus, social expectations and conformity pressures may create cultural blocks to girls. Fabunmi (2004) in a study discovered that gender composition has a significant relationship with students' academic performance and that gender composition has a significant influence academic performance of Secondary School students.

In view of the notion that the gender of a student influences the academic performance of students, it is therefore important to find out whether any relationship exists in academic performance of students on the basis of gender difference in Mathematics in Senior Secondary Schools.

II. METHODOLOGY

A. Research Design
The research design adopted for this study is an ex-post factor documentary study. This involved the use of past results of West African Senior Secondary Certificate Examination (WASSCE) General Mathematics for the period of five years starting from 2013 to 2017. The data was used to determine the Gender Difference in the academic performance of students in Mathematics in some selected Senior Secondary Schools for this study.

B. Population of the Study
The study population comprises of eighteen (18) Senior Secondary Schools in Yola North Local Government Area of Adamawa State who registered and sat for General Mathematics at West African Senior Secondary Schools Examination (WASSCE) for the period of five (5) years 2013 – 2017. Statistics from the Ministry of Education Yola Adamawa State showed that eleven thousand and fifty (11050) students sat for General Mathematics examination in the 18 schools of Yola North Local Government Area in the period selected for the study. Six thousand three hundred and ninety one (6391) were boys while four thousand six hundred and fifty nine (4659) were girls. However, not all the schools in the Local Government Area have West African Examination Council centre recognition and record of West African Senior Secondary Schools Examination (WASSCE) over the period selected for the study.

S/N	NAME OF SCHOOLS	SCHOOL TYPE	POPULATION (2013 – 2017)		
			MALE	FEMALE	TOTAL
1	GDSS Gwadabawa	Mixed	495	310	805
2	GDSS Doubeli	Mixed	435	304	739
3	GDSS Old GRA	Mixed	293	244	537
4	GMMC Yola	Male	946	0	946
5	GDSS Karewa	Mixed	304	230	534
6	GDSS Luggere	Mixed	488	358	846
7	GDSS Capital	Mixed	495	364	859
8	GDSS Jambutu	Mixed	324	229	553
9	GDSS Army Barrack	Mixed	524	381	905
10	GGSS yola	Female	0	722	722
11	Aliyu Mustapha Academy	Mixed	236	169	405
12	Bosco Comprehensive School	Mixed	311	219	530
13	Concordia College	Mixed	184	124	308
14	Elshadai Model School	Mixed	222	163	385
15	FAAN Academy	Mixed	266	196	462
16	IQRA Academy	Mixed	306	213	519
17	Light of Life Academy	Mixed	274	210	484
18	Redemption Anglican Academy	Mixed	288	223	511
	TOTAL		6391	4659	11050

Table 1: The Distribution of Population of the Study

SOURCE: Ministry of Education, Yola Adamawa State

C. Sample and Sampling Techniques

Six (6) schools were selected at random out of the population of eighteen (18) Senior Secondary Schools in Yola North Local Government Area, Adamawa State. According to some writers, sample is worthless unless it reflects the entire population upon which generalization is made. In light of this fact, this study adopted all that sat for General Mathematics WASSCE for the year 2013 – 2017 of the selected schools.

S/N	NAME OF SCHOOLS	SCHOOL TYPE	SAMPLED POPULATION		
			MALE	FEMALE	TOTAL
1	GDSS Capital	Mixed	495	364	859
2	GDSS Karewa	Mixed	304	230	534
3	GDSS Luggere	Mixed	488	358	846
4	Redemption Anglican Academy	Mixed	288	223	511
5	Light of Life Academy	Mixed	274	210	484
6	Bosco Comprh. School	Mixed	311	219	530
	TOTAL		2160	1604	3764

Table 2: The Schools and the Number of Students Sampled

To ensure factual information needed for this study, the researcher devised the use of past West African Senior Secondary Schools Examination (WASSCE) results for the period of five (5) years (2013 to 2017) selected for the study. The content analyses enable the researcher to sift through the volume of data with relative ease in a systematic fashion (U.S GAO 1996).

D. Method of Data Analysis

The data collected was analyzed using both descriptive and quantitative statistics. Simple percentage and T-test analysis were used for the data analysis. The results from past West African Senior Secondary Schools Examination (WASSCE) for the period of five years (2013 to 2017) of the sampled schools provides data which was scrutinized and then used for computer data analysis. To test the hypothesis, a t-test statistical analysis was employed. The method was used because it is considered to be the most appropriate method of comparing means of two groups, which are subjected to the same condition. The mean scores of the male and female students' academic performance in Mathematics were compared at an alpha level of 0.05 or 95% confidence interval of difference.

E. T-Test Governing Equation

The t-test is any statistical hypothesis test in which the test statistic follows a Student's t-distribution under the null hypothesis. It can be used to determine if two sets of data are significantly different from each other, and is most commonly applied when the test statistic would follow a

normal distribution if the value of a scaling term in the test statistic were known.

T-test uses means and standard deviations of two samples to make a comparison. The formula for T-test is given below:

$$t = \frac{\bar{x}_1 - \bar{x}_2}{S_{\bar{\Delta}}}$$ where;

$\bar{x}_1$ = Mean of first set of values

$\bar{x}_2$ = Mean of second set of values

$S_{\bar{\Delta}}$ = Estimated standard error of the mean

$$S_{\bar{\Delta}} = \sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}$$

s_1 = Standard deviation of first set of values

s_2 = Standard deviation of second set of values

n_1 = Total number of values in first set

n_2 = Total number of values in second set.

The formula for standard deviation is given by:

$$s = \sqrt{\frac{\sum (x - \bar{x})^2}{n - 1}}$$

x = Values given
$\bar{x}$ = Mean
n = Total number of values

III. APPLICATION OF T-TEST TECHNIQUES TO GENDER DIFFERENCE IN THE ACADEMIC PERFORMANCE OF STUDENTS IN MATHEMATICS

The research questions, hypotheses and results obtained in the study are presented as follows:

A. Research Question

Is there any significant relationship between the male and the female students' academic performance in Secondary School Mathematics?

To answer this research question, the percentage distribution of performance of male and female students based on the number of candidates with credit and above (A1-C6) in General Mathematics WASSCE for the year 2013 – 2017 of the selected schools was used.

Year	N	n	a	b	Remark
2013	748	412	102	24.8	Low
2014	734	450	98	21.8	Low
2015	785	455	147	32.3	Low
2016	849	478	190	39.7	Low
2017	648	365	112	30.7	Low
TOTAL	3764	2160	649	30.0	Low

Table 3: Percentage Distribution of Performance of Male Students in WASSCE General Mathematics

N – Total number of Candidates for the year 2013-2017 respectively of the entire sampled schools.
n – Number of male students for each year selected
a – Number of male candidates with credit and above for the selected period
b – Percentages of male candidates with credit and above for the selected period

Table 3 reveals the number and percentages of male students having credit and above (A1-C6) in Mathematics over the periods of five years (2013-2017) which are 24.8,

21.8, 32.3, 39.7 and 30.7 percent respectively. The pattern reveals that the performance over the years were not stable, for it varied from year to year in which less than 50% of the male students passed Mathematics at credit level and above (A1-C6). It also indicates that in the year 2016, the students had the best performance with 39.7%, followed by 2015, 2017, 2013 and 2014 with 32.3, 30.7, 24.8, and 21.8 percent respectively. However, the year 2014 has the least percentage with 21.8% passed.

Year	N	n	a	b	Remark
2013	748	336	93	27.7	Low
2014	734	284	86	30.3	Low
2015	785	330	102	30.9	Low
2016	849	371	146	39.4	Low
2017	648	283	98	34.6	Low
TOTAL	3764	1604	525	32.7	Low

Table 4: Percentage Distribution of Performance of Female Students in WASSCE General Mathematics

N – Total number of Candidates for the year 2013-2017 respectively of the entire sampled schools.
n – Number of female candidates for each year selected
a – Number of female candidates with credit and above for the selected period
b – Percentages of female candidates with credit and above for the selected period

Table 4 shows the number and percentage of female students with credit and above (A1-C6) in Mathematics over the periods of five years (2013-2017) which are 27.7, 30.3, 30.9, 39.4, and 34.6 percent respectively. The patterns reveals that the performance over the years were not stable, for it varied from year to year in which less than 50% of the students passed Mathematics at credit level and above (A1-

C6). It also indicates that in the year 2016, the female students had the best performance with 39.4% followed by 2017, 2015, 2014 and 2013 with 34.6, 30.9, 30.3 and 27.7 percent respectively. However, the year 2013 has the least performance with 27.7% passed.

B. Hypothesis
There is no significant difference between the academic performance of male and female students in mathematics.

To test the null hypothesis, T-test analysis was used to test the difference between male and female students academic performance in mathematics. Summary of the analysis is shown in Table 5 and 6 below.

Gender	Mean	N	Std. Deviation	Std. Error Mean
Male	129.80	5	38.797	17.351
Female	105.00	5	23.685	10.592

Table 5: The Descriptive Statistics of the Gender Based Performances of the Students with Credit and Above (A1-C6) of the Sampled Students in Mathematics

Table 5 showed the mean performance of the students with credit and above (A1-C6) of the entire sampled students results (male and female) for the period of five years 2013-2017 in WASSCE general Mathematics. It showed that the male students perform better compared with the female students. However, the male students vary a little around average compared to the female students with majority of the male students having more than average performance.

Variable	Df	Mean Difference	t-value	Sig. (2-tailed)	Remark
Male	4	24.8	3.068	0.037	Significant
Female					

Table 6: T-test of the Gender Based Performances of the Entire Sampled Students

Table 6 showed the T-test statistics of the students' gender performances. It revealed that 24.8 extra marks obtained by the male students was considerable since the significance value of the test (0.037) is less than 0.05.

C. Summary of Findings
From the research question answered and the hypothesis tested, the following are the summary of the major findings of the study:
- The distribution of performances of male and female students in West African Senior Secondary Schools Examination (WASSCE) General Mathematics sampled for the study in Yola North Local Government Area of Adamawa State was not stable as it kept changing over the period studied, which revealed that less than 50% of the candidates who sat for WASSCE Mathematics over the years had credit pass (A1-C6).
- There is a significant difference in gender based academic performances of the students in WASSCE General Mathematics in the chosen sampled schools in the period selected for the study.

IV. RESULTS AND DISCUSSION

The results of the study were discussed based on the examined question answered and the hypothesis tested.

The distribution analysis of the performance in this study has shown that the performance distribution kept changing with time in an upward and downward manner. This suggested that the series varies at different time intervals.

The result from tables 5 and 6 showed a significant slightly difference in the performance of the male students which is better than that of the female students in Mathematics (i.e. mean difference = 24.8; t-test = 0.037 at 0.05). The higher variation around the mean of the male students shows that the performance of the male students is not as uniform as the female counterparts. That is, the whole female students performance is similar as opposed to the male students.

V. CONCLUSION

Based on the findings of this study, it could be inferred that the students' academic performance in Mathematics at WASSCE General Mathematics in Yola North Local Government Area of Adamawa State has been so far consistently unstable and poor. Since less than 50% of the total number of candidates was not able to pass Mathematics at credit level and above (A1-C6) over the period reviewed.

Finally, it could be concluded that there is a significant disparity in gender based academic performance of students in WASSCE General Mathematics for the period of five (5) years studied.

VI. RECOMMENDATIONS

The following recommendations were highlighted based on the findings of the study, this is to help advance the academic performance of male and female Students in Mathematics:

- Teachers should encourage students to develop interest in Mathematics and challenge the students to be actively engage during the lessons.
- Parents/Guardians are urge to give equal opportunity to right education affordable for both the male and the female child.
- Female students ought to be admonished to approach science subjects especially Mathematics without inferiority complex to the male students.
- Federal Government should create policies to support the absorbance of female students into further study in Mathematics at tertiary institutions.
- In other to improve the students' academic performance in Mathematics, workshop and seminar should be organized for the subject teachers to help them update their knowledge on the method and criteria of measurement and evaluation strategies use by the examination bodies like West African Examination Council (WAEC) and National Examination Council (NECO) among others.
- Curriculum planners should create awareness of the students-centered, activity based by including it as well as other indigenous knowledge which is relevant to the learners' need and experience in the Mathematics curriculum.
- The government should employ professional Mathematics teachers in order to facilitate qualitative and sound education. This will help in boosting the academic performance of students in the subject.
- There should be a research into methods of creating gender sensitive policies by stakeholders in the education industry.
- Parent and guidance should provide adequate material resources that will facilitate the children learning in Mathematics such as textbooks and as well as other resources.
- Government should provide a standard library with adequate and updated textbooks that will ease the students' study (research).

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