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A Comparative Study of Male and Female Students' Performance in Mathematics in Federal College of Education (Technical) Gombe, Gombe State

[1]**Ahmed Nazif Kirfi**

[1]**Bello Daniel Oluyinka**
preferreddaniel@gmail.com

[1]**Yusuf Aliyu Ahmed**

[1]**Yunusa Samson**

[1]**Sakina Aliyu Deba**

[1]**Ikwebe Joy Blessing**

[1]**Muhammad Hauwa Alhajiyel**
[1]*Department of Mathematics*
Federal College of Education (Technical), Gombe

Abstract
Mathematics has been viewed as a subject favouring male students due to factors like attitude, methods used for teaching and so on. This has resulted to gender differences between male and female students in Mathematics performance. The paper compares the performance of male and female students in Mathematics in the Department of Mathematics, School of Science Education, Federal College of Education (Technical) Gombe; with the intent to investigate the differences in performance of male and female students. The result of students from 2016 academic session to 2019 session with a sample size of 370 students was used. Independent sample t-test was used to analyse the data obtained from the examination office; it was discovered that there is significant difference based on gender on the performance of students in Mathematics. It was also discovered that there is no significant difference between the performance of male and female students in mathematics among the three academic sessions 2016/2017, 2017/2018 and 2018/2019. It was recommended that female mathematics students should be encouraged in their quest to excel in mathematics and public enlightenment should be intensified to dispel the notion that mathematics is only for male students.
Keywords: comparative, performance, mathematics, gender, Gombe

Introduction

Mathematics is one of the most useful and fascinating division of human knowledge. It includes many topics of study such as logarithms, surds, set theory, statistic, mensuration etc. Mathematics arises from the need for system of counting and calculating area, surface and value of the objects; it influences our daily lives. Mathematics is the gate and key of science; It is more a part of our everyday lives than many would think, and allows us to better understand the world around us. From the foregoing, it is clear that both males and females need mathematics in their private life, working life, socio-economic and political life of the country of which they are citizens.

There is mutual influence between the quality of mathematics that are taught to students and their attitudes towards it as well as their subsequent enrolment and performance in that particular subject. In seeking to achieve quality mathematics that is necessary to develop desired skills for sustainable development, it is important to explore students' perceptions and attitudes towards mathematics subjects. Quality education encompasses equal opportunity for girls and boys. Therefore, gender differences in learning should no longer be regarded as an issue and should aim at reducing the gaps in performance in mathematics subject. Currently, policies, initiatives and strategies promoting girls' enrolment in mathematics and science subjects are being implemented in Nigerian educational system (Kestelyn, 2010). These policies and initiatives include the Girls' Education Strategic Plan that was approved in 2009, the First Lady's National Awards for the best performing girls and the School Campaign, the National Taskforce for the Coordination of Girls' Education that was established in 2005, and sanitation and hygiene facilities that are provided in every newly constructed school. The strategies put in place to implement these policies include strengthening gender sensitive and learner-centred methodologies and promoting affirmative action policies, where appropriate, to ensure equal opportunities for girls. All these policies and initiatives aim at promoting equality in education where gender sensitivity is a key principle (Kestelyn, 2010). Keller (2002) indicated that identifying students' gender related attitudes towards a subject is important in promoting their achievement and interest in that particular subject.

The issue of gender difference in mathematics education had been tackled in various studies (Amelink, 2009; Kiptum, et al., 2013; Owiti, 2011). While most of these research studies were focusing on gender issues in mathematics or gender disparities in mathematics (Amelink, 2009), few studies focused on students' attitudes by gender (Owiti, 2011; LaFleur, 2011). Very few research studies which explored the gender component in the context of Rwanda focused on girls' education in general, but without paying particular attention to mathematics education (Huggin, & Randell,

2007; Kestelyn, 2010). In African countries, gender issues in mathematics education were explored in countries like Kenya (Owiti, 2011) and Tanzania. These issues include students' enrolment, participation, performance, stereotypes, gender mainstreaming policies etc. In this regard, Owiti's (2011) study revealed that students' gender and their attitudes towards mathematics are correlated. Regarding the student's attitudes and participation in mathematics class, males substantially demonstrated more positive attitudes towards mathematics (Owiti, 2011) and higher level of participation in no-mandatory levels of mathematics than females.

Some recent studies have revealed that gender differences in mathematics education seem to be narrowing in many countries. However, studies indicate that as students reach higher grades, gender differences favour increase in mathematics achievement by males (Mullis, Martin, Fierros, Goldberg, & Stemler, 2000). As the work of Forgasz, Griffith, and Tan (2006) have shown, in more open teaching approaches, boys achieve at the same levels as they do in traditional approaches, but girls enjoy mathematics and achieve at higher levels when they receive opportunities to engage more actively. Recent research on gender differences in women's and men's brains offers explanations for the preference of girls toward more conceptual and connected teaching approaches, but the reasons for girls' preferences are less important than the fact that when mathematics is taught in an open, discursive, and connected way, girls and boys achieve equally and participation for both is increased and equal. However, they ascertained that higher proportions of male students scored higher grades at advanced level mathematics test which indicates that male students performed better than their female counterparts in mathematics and other science related subjects.

Gender difference in attitudes had been found to be highly linked to the developmental level (Amelink, 2009), to educational level and to social trends (Huggin & Randell, 2007). As Amelink (2009) has observed, gender disparity in enrolment and performance at primary school may exist, but gender difference is almost non-existent at primary school levels (Amelink, 2009). It rather starts emerging with adolescence and increases at advanced levels of education. As for the factors behind female low enrolment in mathematics, Amelink (2009) indicated that they include fear of failure, gender biased classroom practices, girls' lack of confidence in solving mathematics problems, stereotypes by students themselves or influential people, as well as gender difference in experiences in the same classroom. In contrast, in LaFleur's (2011) study, specific classroom did not show significant effects on students' participation or attitudes about mathematics. In order to investigate the nature of gender differences performance in Mathematics found in the national testing in the Netherland, Davis, Clarke, and Van Den Heuvel-Panhuizen (2005) found out that girls do not score lower than boys in all mathematical domains.

Gender matters have been in the forefront of the world. Women education and career development from time immemorial has suffered discrimination globally because of socio-cultural factors. Past educational research on issues of gender and sex has largely fallen short in providing clear, theoretically grounded definitions of adopted terminology. Glasser and Smith (2008) highlighted "the pattern of unclear, conflated, and even synonymous use of the terms" (p. 343) gender and sex observed in educational research, and they called for future scholars' increased clarity in their conceptualizations of gender. Mathematics education research is no exception, as noted in its by-and-large problematic use of gender to describe sex differences or differences in mathematics achievement and participation according to students' biological sex, namely, being female or male (Damarin & Erchick, 2010). This conceptual drawback in not distinguishing between gender and sex, according to Damarin and Erchick (2010), is particularly troubling for the future of mathematics education research because its "difference-as-deficit" (p. 320) views perpetuate a long-standing myth of male superiority on mathematics assessments that disallows agency among women and other marginalized groups as well as dismiss the complexities of gender as a social construct.

Research on gender in mathematics education can be interpreted through the lens of achievement, and characterized primarily by comparisons of females' and males' mathematics learning outcomes and task performance. Several achievement studies conceptualized gender and sex as the same construct and did not take into consideration intersex and gender nonconforming people. Research has confirmed gender differences, even in primary education, in mathematics self-concept, self-efficacy, and interest, suggesting that boys generally have better motivational profiles in mathematics than have girls (Kurtz-Costes, Rowley, Harris-Britt, & Woods, 2008). Participants' sex or "gender," therefore, was treated as a variable in quantitative analyses to document "gender differences" (Birenbaum & Nasser, 2006) in mathematics achievement and task performance.

In conjunction with other social institutions of the society, education dispenses on life ideology skills to male students who are traditionally destined to hang on the society dominant position. The gender society looks at certain courses as masculine and others as feminine, because they are differently positioned in society and because of the learning style and how they perceive and process reality. Many mathematics classroom discourse, are organized to accommodate male learning pattern, hence their high performance in mathematics; these differences have implications for the kind of instructional procedure that are to be adopted for setting up an appropriate teaching and learning environment for mathematics, that is suitable to both genders.

This study examined the difference between the performance of male and female student in mathematics at Federal College of Education (Technical), Gombe, in Gombe State. It is within this background that this study examined gender differences in terms of mathematics performance in FCE (T), Gombe. The motivation to conduct this study was prompted by the fact that there are still very few research studies in mathematics education which focus on gender component in the Nigerian education system. This study may therefore be among the few empirical studies in Nigeria which have examined comparison of male and female performance in mathematics education, with focus on gender issues. It seeks to contribute to a deeper understanding of some issues in mathematics education in Nigeria with hope that the findings may bring about attitudinal changes as far as mathematics curricula and mathematics teaching methods are concerned.

Statement of the problem

Globally, the issue of gender gap in mathematics has produced inconclusive results. Throughout the senior high school years, male superiority in mathematics is well pronounced and more males than female are frequently reported as doing better on problem solving task and application. Li (2004) gave two reasons for differences in mathematics performance as internal and external factors. Internal factors have been defined as biological, cognitive and affective factors. The external factors are classroom interaction that directly influence learning, and significant others including peers, parent, friends among others; while the classroom factors may be related to the teachers with whom the individual interact in the learning environment.

This study is an attempt to investigate the difference between the performance of male and female students in mathematics at Federal College of Education (Technical) Gombe, at the NCE level. It is often assumed that male performed much better than female students in mathematics, the researchers attempt to investigate and find out whether this assertion was true or false.

Significance of the study

The importance of this study and findings would be of valuable use to the mathematics teachers, students, parents and other stakeholders in the field of education and the society at large. The findings will bring about attitudinal changes as far as mathematics curricula and mathematics teaching methods are concerned.

Purpose of the study

The major purpose of the study is to establish the difference between male and female students' performance in mathematics at Federal College of Education (Technical) Gombe. Specific objectives of the study are to:

i. Investigate the differences in performance of male and female students in mathematics in the three sessions.

ii. Compare the difference in performance of students in mathematics based on gender.

Research questions

The following research questions guided the study:

1. Is there any difference in performance of male and female students in mathematics among the three sessions?
2. Is there any difference based on gender on the performance of students in mathematics?

Hypotheses

The following hypotheses were tested at 0.05 alpha level of significance:

Ho1: There is no significant difference between the performance of male and female students in mathematics among the three sessions.

Ho2: There is no significant difference based on gender on the performance of students in mathematics in Federal College of Education (Technical) Gombe.

Methodology

Based on the purpose of the study, the research was design to compare the performance of male and female students in mathematics in terms of studies at N.C.E level. The study takes on both qualitative and quantitative approach. The research design was survey as it examined scores collected from the Exams Office, School of Science. The population of this study comprise of 720 students offering Mathematics courses in the School of Science for the three academic sessions under investigation. A sample size of one hundred and twenty-five (125) students from 2016/2017 session, one hundred and five (105) students from 2017/2018, and one hundred and forty (140) students from 2018/2019 session, comprising of male and female students was randomly selected from target population of the three consecutive sessions. Thus, the sample of three hundred and seventy (370) students from Department of Mathematics was considered viable for the study. This is the required sample size by the Research Advisors (2006).

Table 1: Population and sample

Sessions	**Population**			**Sample Size**		
	Male	**Female**	**Total**	**Male**	**Female**	**Total**
2016/2017	140	100	240	65	60	125
2017/2018	120	100	220	55	50	105
2018/2019	140	120	260	72	68	140
Grand Total	400	320	720	192	178	370

The final year results of students in mathematics from N.C.E 3 were used as data for the study. The students consist of male and female which were noted. The data collected comprises of three consecutive sessions 2016/2017, 2017/2018 and 2018/2019. The hypotheses were tested using independent samples t-test at 0.05 alpha level of significance.

Presentation of results

The following results were obtained:

Ho: There is no significant difference between the performance of male and female students in mathematics among the three sessions 2016/2017, 2017/2018 and 2018/2019.

Table 2: Descriptive statistics of analysis of the performance of male and female students in Mathematics between the first two sessions (2016/2017 and 2017/2018)

	Sessions	**N**	**Mean**	**Std. Deviation**	**Std. Error Mean**
Performance	2016/2017 session	125	2.4305	.86474	.07734
	2017/2018 session	105	2.4099	.85640	.08358

Table 3: Independent samples t-test

Sessions	N	Mean	df	t-value	P	Decision
2016/2017	125	2.43				
			228	.181	.875	Accept Ho
2017/2018	105	2.41				

From table 3, the p-value is 0.875 (2-tailed). Since p (0.875) is greater than 0.05 alpha level of significance, therefore the null hypotheses of no any significant difference is hereby accepted; hence, there is no significant difference between the first two sessions (2016/2017 and 2017/2018) on the performance of male and female students in mathematics in Federal College of Education (Technical), Gombe.

Table 4: Descriptive statistics on the analysis of the performance of male and female students in Mathematics between the first and the third sessions (2016/2017 and 2018/2019)

	Sessions	N	Mean	Std. Deviation	Std. Error Mean
Performance	2016/2017 session	125	2.4305	.86474	.07734
	2018/2019 session	140	2.3149	.97137	.08210

Table 5: Independent samples t-test

Sessions	N	Mean	df	t-value	P	Decision
2016/2017	125	2.43				
			263	1.025	.306	Accept Ho
2018/2019	140	2.31				

From table 5, the associated p value is 0.306 (2-tailed test). Since p (0.306) is greater than 0.05 alpha level of significance, the null hypotheses that there is no significant difference among the sessions is accepted. This has indicated that there is no significant difference between the two sessions (2016/2017 and 2018/2019) on the performance of male and female students in mathematics in Federal College of Education (Technical), Gombe.

Table 6: Descriptive statistics on the analyses on the performance of male and female students in Mathematics between the second and the third sessions (2017/2018 and 2018/2019)

	Sessions	N	Mean	Std. Deviation	Std. Error Mean
Performance	2017/2018 session	105	2.4099	.85640	.08358
	2018/2019 session	140	2.3149	.97137	.08210

Table 7: Independent samples t-test

Sessions	N	Mean	df	t-value	P	Decision
2017/2018	105	2.41				
			243	.797	.426	Accept Ho
2018/2019	140	2.31				

From table 7, the p value is 0.426 (2-tailed test). Since p (0.426) is greater than 0.05 alpha level of significance, the null hypotheses that there is no significant difference between the two sessions on the performance of male and female students in mathematics is accepted. This has indicated that there is no significant difference on the performance of male and female in mathematics in Federal College of Education (Technical), Gombe between the sessions 2017/2018 and 2018/2019.

Ho2: There is no significant difference based on gender on the performance of students in mathematics in Federal College of Education (Technical), Gombe.

The result is shown in the table below:

Table 8: Descriptive statistics on the analysis of performance of male and female students in Mathematics

	Gender	N	Mean	Std. Deviation	Std. Error Mean
Performance	Male	192	2.5522	.93642	.06758
	Female	178	2.1961	.83008	.06222

Table 9: Independent samples t-test

Gender	N	Mean	df	t-value	P	Decision
Male	192	2.55				
			368	3.860	.000	Reject Ho
Female	178	2.20				

From table 9, the *p*-value is .000 (2-tailed test). Since *p* (.000) is less than .05 level of significance, the null hypothesis that the mean performances for males and females are the same is rejected. This implies that there is a significant difference in mean performance for males and females, hence, there is significant influence of gender on the performance of students in mathematics in Federal College of Education (Technical), Gombe.

Discussion of the findings

From the findings of this study, it was shown that there is significant difference between male and female students' performance in mathematics. This finding is in line with the findings of Forgasz, Griffith, and Tan (2006) who ascertain that higher proportions of male than female students are awarded highest grades which may likely suggest that male students performed better than their female counterparts in mathematics and other science related subjects.

This result also corresponds to the findings of Davis, Clarke and Van Den Heuvel-Panhuizen (2005), which suggests that the potential for gender differences in mathematical performance is still a concern from a wider international perspective; and as reported that in early child education, male students' performance is found to be better than that of the female students.

Conclusion

It can be concluded that there is significant difference based on gender on the performance of students in mathematics, after series of t-tests were performed on the data which gave a lots of pair comparisons. Hence, it is concluded that male students do perform better than female students as there is significant difference that exists between the performance of male and female students in mathematics among the three sessions 20162017, 2017/2018 to 2018/2019 in Federal College of Education (Technical), Gombe.

Recommendations

Based on the research findings of this study, the following recommendations are given:

1. Female mathematics students need encouragement to pursue mathematical courses and to stand up against discrimination and harassment. They also need to be made aware of the opportunities open to them in mathematical courses.
2. Public enlightenment campaign should be intensified to dispel the notion that mathematics is the exclusive right of male students only.
3. Seminar/workshop can be organized where women who have excelled in mathematics are invited as guest lecturers to talk about their experience in mathematics and science. They could share with the girls what challenges they faced, how they succeeded and benefited from mathematics in their lives.
4. Teachers of mathematics should be encouraged to be gender-sensitive when teaching mathematics.
5. Provision of career guidance particularly for female students at colleges' level should be made, to encourage them to study mathematics and not to shy away from it.
6. Government should as a matter of urgency intervene to remove all biases and discrimination against females.
7. There should be workshops and seminars to educate women mathematically to overcome fear.
8. Mathematics and science clubs should be encouraged. However, here mathematics programme for girls can be organized. The aim is to provide girls with fun and interactions over mathematics.
9. Special incentives in the form of scholarship should be given to female students who undertake and excel in mathematics course as a way of encouragement in the area.

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