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Gender Effect on the Performance of Junior Secondary School Students in Mathematics: A Case Study of Schools in Ibadan Municipal

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Abstract

This study investigated gender effect on the performance of Junior Secondary School (JSS) students in mathematics in Ibadan municipal. It is a descriptive survey using an ex-post-facto research design. This study made use of the Junior School Certificate Examination results of students for the year 2003-2009 from twenty junior secondary schools in five different Local Government Areas in Ibadan municipal. The selected schools consisted of 13 co-educational and 7 single-sex schools. Four schools were randomly selected from each Local Government Area and the results of a total of 24,476 students were sampled. Five research questions were raised and five null hypotheses tested at 0.05 level of significance using simple percentages and t-test analysis. The results showed that general mean performance of male students (4.02%) is greater than that of female students (3.88%). Results from other studies have shown that there has been continued gender disparity in performance in favour of boys and that boys contribute more to classroom interaction and dominate in hands-on activities, such as laboratory work and computer sessions. Consequent upon this, it was recommended that cognizance should be taken of the

gender difference in the designing and implementation of educational programmes and policies.

Background

The phenomenon of gender differences has been a critical issue in the past decades. Many people, ministries, companies and society in general, especially in this part of the world (West Africa), believe in gender role. There is a long standing belief in gender role, even in chores at home, in which some believe a particular task is meant for a particular gender. For example, some fathers do not support the idea of male children working in the kitchen. This idea has gone a long way in influencing the choice of careers by students. Some studies have revealed that the reason for shortage of women in the sciences, mathematics, engineering and technical fields can be traced to gender differences in the cognitive abilities of middle school students (American Association of University Women, 1992).

In most African countries, there is high level of gender stereotype, the gender of an individual has played and continues to play a role in the placement of the individual and this often affects their status in life. A girl desiring a field of study believed to be male domain (aeronautic engineering) is being discouraged by parents, teachers and even friends and is diverted to study another course believed to be feminine. Umoh (2003) pointed out that male are naturally endowed, have power and prestige and thereby having higher and superior status than female, thus illustrating the high level of gender stereotype in education. Again, Okeke (2003) pointed out that many developing societies have specific roles for different sexes to the extent that this is evident and further encouraged in textbooks through pictorial illustration which are powerful means of communication. Umoh (2003) opined that men are often portrayed as doctors, lawyers, engineers, professors while women are portrayed as nurses, cooks, mothers etc. This creates a mental picture in the mind of the role expectation from society.

Most times, even the teachers who should motivate and encourage learners to become all that he/she is capable of being, tend to encourage gender stereotype by giving different treatment to male and female students by paying or giving more attention to male students which may

make female students in the same class or subject develop low self-esteem, inverted confidence and reduce interest in their learning (Okeke, 2003). Studies of mixed sex classrooms have consistently shown that boys, compared to girls, receive more attention from teachers and that teachers place more importance on boys learning generally.

Many investigations have been focused on gender differences in mathematics performance. Anatsasi (2008) in her classic differential psychology test stated that differences in numerical aptitude favoured boys and gender differences in computation favoured female students and also that male students excelled in tests of numerical reasoning. Furthermore, the conservative argument for single sex schools is that they enable the boys and girls to be inducted into the prescribed roles demanded by the society. Feminist advocates of single sex schools argue the contrary; that single sex schools allow boys and girls greater freedom to choose subjects not associated with their gender and to flourish in a wider range of school subjects than conventionally acceptable in mixed sex schools. Single sex groups enable girls to feel freer to answer questions and to participate more in lessons and boys to work harder without worrying about their own image as a learner. Single sex classes could thus improve motivation, behaviour and achievement (Seed, 2006). Also Maccoby and Jacklin (2004), in their investigation concluded that one of the sex differences that were fairly well established was that 'boys do excel in mathematics ability' especially with pupils of about age one to thirteen (1-13) years when boys' mathematical skills increase faster than girls.

Similarly, hardly can you find men in some professions like nursing, catering, and some jobs believed to be feminine. This discrimination might be due to the background belief that must have been implanted into children during their developmental stage. It is a common observation that at higher level fewer female students take mathematics than male students. Female students do not prefer mathematics at higher level because they perceive it as a male domain. Hausmann, Tyson and Zahidi (2009) reported that there is no country in the world that has yet reached equality between women and men in different critical areas. Borde (1998) stated that empirical data available

suggested that performance of students is persistently characterized by gender differences. In Jordan, for instance, gender stereotyping is still prevalent in almost all aspects of life (Albedour, 2004; Nabulsi, 2002).

Jacobs (2002) submitted that girls get higher grades and complete high school at a higher rate compared to boys. He further hinted that an international aptitude test administered to 4th graders in 35 countries revealed that female outscored male on reading literacy in every country. Though there were no differences between boys and girls in 4th grade in mathematics, boys however, began to perform better than girls on science tests in 4th grade, while girls exhibit higher verbal ability throughout high school but begin to lose ground to boys after 4th grade on tests of both mathematical and science ability (Jacobs, 2002). Female students hear better than males which would call for male students to sit closer to the front of the classroom to hear instruction better; as male students usually are seated in the rear of the classroom (Sax, 2002).

Hedges and Nowels (1995) also found that female students outperform male students on several verbal skills task, verbal reasoning, verbal fluency comprehension and understanding logic relation while male students on the other hand outperform female students on spatial skills tasks such as mental rotation, spatial perception and spatial visualization (Voyer, Voyer & Briden, 1995). Self concept of ability and task value in mathematics decline for both gender between 1st and 12th grades with no real difference between girls and boys trajectories over time; but by the 12th grade, girls valued mathematics more than boys when controlling for self concept of ability in mathematics (Jacobs, Lanaz, Osgood, Eccles & Wigfields, 2002). Generally, girls are recognized nationally to outperform boys at all levels of schooling (Woodfield & Earl-Novell, 2006). Female undergraduates performed significantly better in academic assessment than male counterparts (Lawrence et al., 2006).

According to Femema, Sowder and Carpenter (1991), gender differences do not, however, apply to all aspects of mathematical skills. Their findings revealed that male and female do equally well in basic mathematics knowledge and girls actually have better conceptual

skills, though performance in mathematical reasoning and geometry shows the greatest difference. Male students also display greater confidence in their mathematics skills, which is a stronger predictor of mathematics performance (Casey, Nutall & Pezaris, 2001).

Smith (2004) found that disparities in achievement were attributed to the fact that male students and female students perform the role of student in different ways; while female students were more conscientious, less likely to miss lecture and more likely to believe their marks reflected their ability than their male peers. He further pointed out that male students have a greater tendency to be absent from classes due to other commitments, laziness and arbitrary engagement in sports which some of them saw as an important part of life at a time they should be facing their academic work.

It is true that the biological development of girls and boys differs. In particular, research showed that prenatal hormones circulating in the brain encourage differential development in the hemisphere of male and female fetuses (Berenbaum, Korman & Leveroni, 1995). According to Planin (2000) research has revealed that a female child reaches full maturity in terms of brain development earlier than her male counterpart. Females also have higher levels of estrogens in the brain which reduce aggressive behaviour and create a calmer classroom atmosphere. One report showed that there is 15-20% more neural activity in girls' brain than in boys' at a given time. A boy's brain shuts off (enters a rest state) more times per day than a girl's brain tends to do. As a result, boys and girls generally have different approaches to paying attention, visioning their future, completing a task, de-stressing, feeling emotion, relating to others, becoming bored and even having basic conversations (Gurian, 2006).

The fact that the brain of women appears to be built differently from that of men does not imply that girls are better or smarter than boys or vice versa. To use simple analogies; apples and oranges are different but this does not mean that apples are better than oranges; and ovaries and testicles are different but none is better than the other. It is evident that socio-cultural factors may influence attitudes of girls towards mathematics and science as parents tend to view mathematics as more

important for boys whereas language, art and social studies are regarded as more important for girls (Andre, Whighan, Hendrickson & Chamber, 1999). Consequently, parents are more likely to encourage their sons to take advanced high school courses in mathematics, physics, and chemistry and have higher expectations for their success (Wigfield, Battle, Keller & Eccles, 2002).

Statement of the problem

It is obvious that gender discrimination and gender stereotyping has been a great barrier limiting the scope of vision for the majority of females. This has become a cankerworm that has eaten so deep into the mindset of many females such that they do not even have the boldness of venturing into some particular fields believed to be male domain. The genesis of this problem, most of the time, begins from birth. From birth, there is always an initiative and unrealistic belief about what a girl is capable of doing, so she is trained based on the belief her parents has about her gender. Based on this premise, this study investigated gender effect on the performance of JSS students in mathematics in schools in Ibadan municipal of Nigeria.

Research questions

The following research questions were raised and answered:

- i) Do male students from co-educational schools perform better than their female counterparts?
- ii) Do male students from single-sex schools perform better than female from single-sex schools?
- iii) Do male students from co-educational schools perform better than male students from single-sex schools?
- iv) Do female students from co-educational schools perform better than female students from single-sex schools?
- v) Do male students perform better than female students in general?

Methodology

Ex-post-facto research design which made use of the Junior School Certificate Examination results of students between the year 2003 and 2009 was used for this study. The population for this study was all

Junior Secondary School students in Ibadan municipal. There are five Local Government Areas in Ibadan municipal; four schools were randomly selected from each Local Government Area making a total of twenty schools which yielded results for a total of 24,476 students that served as the sample for this study. T-test and simple percentages were used to analyse the data collected at 0.05 alpha level.

Population and sample

The population for this study comprises all the Junior Secondary School Students, who did their Junior School Certificate Examination within the year 2003 and 2009 in Ibadan Municipal, Oyo state, Nigeria. Samples of the study consist of (24,476) students who attempted JSSCE in the selected years and were taken from five different local government areas namely: Ibadan North, Ibadan North-East, Ibadan North-West, Ibadan South-West, Ibadan South-East local governments. Four schools were randomly selected from each of the local government area, making a total of twenty schools. The selected schools consisted of both co-educational (13) and single-sex (7) schools and were owned and managed by the Oyo State government of Nigeria and are therefore governed by the same principles. The results of all the students who attempted the examination from the selected schools and selected years were then used for the study since randomization is impossible in ex-post-facto design. T-test and simple percentages were used to analyze the data collected at 0.05 alpha level.

Assumptions

The following assumptions were made:

- i) The mathematics syllabus used for all the students were the same for all selected schools since they were all owned and controlled by the same state government.
- ii) All the schools are government owned and are controlled by the same principles in terms of teaching and learning procedures, recommended textbooks and are taught by qualified teachers.
- iii) Majority of the selected sample are from the same socio-cultural background since majority were born and schooled in Ibadan Municipal.

Results

Hypothesis 1

There is no significant difference in the performance of male students from mixed schools and that of male students from single sex school.

Table 1a

Comparing the Performance in Mathematics of Male Students from Mixed School with Male Students from Single Sex School

Sex	Performance										Total
	Absent		Fail		Pass		Credit		Distinction		
	No	%	No	%	No	%	No	%	No	%	
Male (mixed school)	405	5.0	811	10.0	1683	20.8	4742	58.7	440	5.4	8081
Male (Single school)	391	6.9	763	13.4	575	10.1	3756	65.9	212	3.7	5697
Total	796	5.8	1574	11.4	2258	16.4	8498	61.7	652	4.7	13778

Table 1a reveals that greater percentage (69.6%) of male students from single sex schools performed better than male students from mixed schools. The majority (64.2%) had credit and above. However, a greater percentage of male students (13.4%) from single sex schools failed the JSCE as compared with male from mixed schools with (10.0%) who failed the same examination.

Table 1b

T-test Analysis of the Performance of Male Students from Mixed School with Male Students from Single Sex School

From the result of the t-test analysis carried out as shown in table 1b, the significant value of the performance of the male students from co-educational schools and male students from single-sex schools in mathematics is 0.000 and is less than 0.05 indicating that there is significant difference in their performance in mathematics. The mean value for male students from single-sex school is 4.9764 with standard deviation 1.33532 which is greater than the mean value for male students from co-educational schools 4.0403 with standard deviation

1.72886 indicating that male students from single-sex schools performed better than male students from co-educational schools.

Hypothesis 2

There is no significant difference in the performance of male and female students from single sex schools.

Table 2a

Comparing the Scores of Male and Female in Single Schools

Type of school	Performance										Total
	Absent		Fail		Pass		Credit		Distinction		
	No	%	No	%	No	%	No	%	No	%	
Boys Only	391	6.9	763	13.4	575	10.1	3756	65.9	212	3.7	5697
Girls Only	295	6.3	407	8.7	789	16.9	2914	62.4	266	5.7	4671
Total	686	6.6	1170	11.3	1364	13.2	6670	64.3	478	4.6	10368

Table 2a shows a higher percentage (5.7%) of female students from single sex schools performed with distinction as against their male counterparts with 3.7% who had distinction in mathematics at the same JSCE. Again a greater percentage of the male students (13.4%) compared with that of female (8.7) failed the examination.

Table 2b

T-test Analysis of the Performance of Scores of Male and Female from Single Sex Schools

Variable	N	Mean	Std	T-Test	Sign. Value
Boys Only	5697	4.9764	1.33532	7.814	0.000
Girls Only	4671	4.0864	1.83536		

From the result of the analysis carried out, the significant value of the independent sample T-test between the performance of boys students only and the performance of girls students only in mathematics done at 95% confidence interval is 0.000 and is less than 0.05 indicating that there is significant difference between the performance boys and the performance of girls in mathematics. The mean performance of male students is 4.9764 with standard deviation 1.33532 and is greater than the mean performance of the female students which is 4.0864 with standard deviation of 1.83536 indicating that the male students are likely to or performed better in mathematics than the female students from single-sex schools.

Hypothesis 3

There is no significant difference in the performance of female students from mixed schools and that of female students from single sex school.

Table 3a

Frequency and Percentage Distribution of the Performance in Mathematics of Female Students from Co-educational Schools with Female Students from Single Sex Schools

Variable	Performance										Total
	Absent		Fail		Pass		Credit		Distinction		
	No	%	No	%	No	%	No	%	No	%	
Female (Co-educational school)	624	10.4	641	10.6	1312	21.8	3216	53.4	234	3.9	6027
Female (single-sex school)	295	6.3	407	8.7	789	16.9	2914	62.4	266	5.7	4671
	919	8.6	1048	9.8	2101	19.6	6130	57.3	500	4.7	10698

Table 3a reveals that female students from single sex schools had greater percentage of credit (62.4%) and distinction (5.7%) as against (53.4%) and (3.9%) respectively for female students from mixed schools. Also, the percentage failure of female students from single sex school (8.7%) is less than that of female students from mixed schools (10.6%).

Table 3b

T-test Analysis of the Performance of Female Students from Mixed Schools with Female Students from Single Sex Schools

Variable	N	Mean	Std	T-Test	Sign. Value
Female (Co-educational school)	6027	3.6992	1.99568	2.818	0.000
Female (Single sex school)	4671	4.0864	1.83536		

From the result of the analysis carried out as shown in the table 3b, the significant value of the performance of the female students from co-educational school and female students from single-sex school in mathematics is 0.000 and is less than 0.05 indicating that there is significant difference in the performance of students in mathematics. The mean performance for female from single-sex-school is 4.0864 with standard deviation 1.83536 and is greater than the mean performance for female students from Co-educational school which is 3.6992 with standard deviation 1.99568, indicating that female students from single-sex schools are likely to or performed better than female students from co-educational schools.

Hypothesis 4

There is no significant difference in the performance of male and female students from mixed schools.

Table 4a

Frequency and Percentage Distribution of the Performance in Mathematics of Male and Female from Co-educational Schools

Sex	Performance										Total
	Absent		Fail		Pass		Credit		Distinction		
	No	%	No	%	No	%	No	%	No	%	
Male (co-educational school)	405	5.0	811	10.0	1683	20.8	4742	58.7	440	5.5	8081
Female (co-educational school)	624	10.3	641	10.6	1312	21.8	3216	53.4	234	3.9	6027
Total	1029	7.3	1452	10.3	2995	21.2	7958	56.4	674	4.8	14108

Table 4a above reveals that male students from co-educational schools performed better in almost all grade levels than female students from co-educational schools and a smaller percentage of male students (10.0) than that of female students (10.6) fail mathematics.

Table 4b

T-test Analysis of the Performance of the Scores of Male and Female from Mixed Schools

Variable	N	Mean	Std	T-Test	Sign. Value
Female (co-educational school)	6027	3.6992	1.99568	10.947	0.000
Male (co-educational school)	8081	4.0403	1.72886		

From the result of the analysis carried out, the significant value of the scores in mathematics between male and female students in co-educational schools is 0.000 and is less than 0.05 indicating that there is significant difference in their performance. The mean value for the male students is 4.0403 with standard deviation of 1.72886 and is greater than the mean value for female students, which is 3.6992 with standard deviation 1.99568, indicating that the male students performed better than female students in mathematics.

Hypothesis 5

There is no significant difference in the performance of male and female students in general.

Table 5a

Comparing the Performance of Male and Female in General

Variable	Performance										Total
	Absent		Fail		Pass		Credit		Distinction		
	No	%	No	%	No	%	No	%	No	%	
Male	796	5.8	1574	11.4	2258	16.4	8498	61.7	652	4.7	13778
Female	919	8.6	1048	9.8	2101	19.6	6130	57.3	500	4.7	10698
Total	1715	7.0	2622	10.7	4359	17.8	14628	59.8	1152	4.7	24476

Table 5a above show that 61.7% of male students had credit while 57.3% of female students had credit; however, a larger percentage of male students (11.4%) failed in mathematics compared with 9.8% of female students that failed.

Table 5b

T-test Analysis of General Male and Female Performance

Variable	N	Mean	Std	T-Test	Sign. Value
Male	13778	4.02	1.777	6.043	0.000
Female	10698	3.88	1.853		

From the result of the analysis carried out, the value of the independent sample t-test between the performance of male students and the performance of female students in mathematics in all the schools done at 95% confidence interval is 0.000 and is less than 0.05 indicating that there is significant difference between male students performance and the performance of female students in mathematics. The mean value of male students in the performance is 4.02 and is greater than the mean value of the female students which is 3.88 indicating that male students are likely to or performed better in mathematics in all the schools.

Discussion

Hypothesis 1

The findings of this study show that gender has effect on the performance of students. It was observed that the mean performance in mathematics of female students (4.0864) with standard deviation (1.8326) from single sex schools was better than the mean performance of male students (3.7783) from single sex schools. Furthermore, the percentage failure (8.7%) of female from single sex school was less than that of male students (13.4%) from single sex school. This result

agrees with the findings of Jacobs (2002) who submitted that girls get higher grade and complete high school at a higher rate compared to boys. Also, Smith (2004) in a study carried out at Brunel University found that women consistently outperformed men in a geography course. Similarly, Sheard (2009) submitted that female students significantly outperformed their male counterpart. Furthermore, Bridgeman and Wander (1991); Odell (1989); Wainer and Steinberg (1992) pointed out from their studies that female students mostly obtained higher grade while Sugden (2009) commented that female students of all ages and social ethnic group outstrip male undergraduate in almost every subject.

Hypothesis 2

This was revealed in Table 3a and 3b, where the percentage failure (10.6) of female students from mixed school was greater than that of female students (8.7) from single school and the percentage of distinction (5.7%) and credit (62.4%) of female students from single sex school were greater than that of female students (3.9%) and (53.4%) respectively from mixed schools. This result is in line with that of Valjeaner (2008) who discovered that when students are placed in a single sex classrooms, both girls and boys performed better when separated by gender as opposed to co-educational class when both girls and boys are routinely placed in the same classroom. The implication of this is that the stakeholders of education need constant reviewing of educational policies to improve students' performance.

Hypothesis 3

This result reveal that female students from single sex schools had greater percentage of credit (62.4%) and distinction (5.7%) as against (53.4%) and (3.9%) respectively for female students from mixed schools. Also, the percentage failure of female students from single sex school (8.7%) is less than that of female students from mixed schools (10.6%). The t-test mean score (3.1182) of female students from mixed school is less than mean score (5.7564) of female students from single school in mathematics and the P value is 0.000 which is less than 0.05 indicating that the difference in their performance is significant. This finding is in line with that of Australian Council for Educational Research (2008) which found that girls attending single sex schools

produced higher tertiary entrance scores than those in coeducational schools. Also, Saidin and Brahim (2011), in a study carried out in single-sex schools in Malaysia, found that boys performance in English and foreign languages, and girls performance in maths and science improved in single gender settings. The study further revealed that in gender separate classroom, students have higher motivation and higher confidence levels which offer them better educational opportunities.

Hypothesis 4

This revealed that the percentage failure of female students (10.6%) was greater than that of male students (10.0%). The percentage of male students with distinction (5.5%) was also greater than that of female students (3.9%). The mean performance of male students from mixed schools (4.0463) was moreover greater than that of female students from the same type of school. This finding is in line with the observation of Francis (2004) that most studies have indicated that boys contribute more to classroom interaction and dominate in hands-on activities such as laboratory work and computer sessions. Mburu (2013) noted that there has been continued gender disparity in performance in favour of boys in Kericho and Kipkelion districts of Kenya. In 2006, out of the 299 students who attained grade B and above in KCSE examination from the top 15 secondary schools in the two districts, 193 (65%) were boys and only 106 (35%) were girls (Mburu, 2013). This implies that the presence of boys in the classroom is seen as having a negative effect on girls' academic engagement and achievement (Mburu, 2013).

Hypothesis 5

The general comparability of male and female grades as shown in Table 5a and 5b revealed that the general mean performance of male students (4.02%) is greater than that of female students (3.88%). However, a larger percentage of male students (11.4%) fail in JSCE mathematics compared with 9.8% of female students who failed in the same examination. The findings of this study, that the general performance of male students is better than that of female students, is in line with that of Voyer, Voyer and Bryden (1995) which showed that male students outperformed female students on spatial skills task such as mental rotation, spatial perception and spatial visualization. However, Hedges and Nowell (1995) submitted that female students outperform male

students on several verbal skill tasks, such as verbal reasoning, verbal fluency, comprehension and understanding logical relation.

Récommendations

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

- ✍ Parents, teachers, policy makers and administrators should always take cognizance of gender difference in the cognitive abilities of their children/students.
- ✍ Single sex schools should be encouraged so as to enhance the performance of the students as revealed by this study. It may be that the presence of boys in the classroom is having a negative effect on girls' academic engagement and achievement.
- ✍ The right approach must be employed in the training, designing and implementation of educational programmes and policies as this will help to improve the performance of students' irrespective of their gender.

Conclusion

The study affirms that gender has a role to play in students' academic performance. It revealed that both male and female students from single sex schools performed better than their colleagues from mixed schools. It also revealed that female students from single sex schools had greater percentage of credits and lower percentage of failure than their colleagues from mixed schools. It further revealed that male students from mixed schools performed better in almost all grade levels than their female counterparts. The study showed that male students generally performed better than their female counterparts.

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