

Female Students' Participation and School Location on Performance in Further Mathematics in Senior Secondary Schools (2009 -2012)

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Abstract
The study investigated the female students' participation and school location on performance in further mathematics in Ijebu Ode between 2009 and 2012. Three research questions and descriptive survey research type were used. Four hundred and twenty three candidates whose results were released for further mathematics from six Senior secondary schools were used for this study. One hundred and forty senior students 2 (89 urban schools and 51 rural schools). A computer format was designed to collect results of candidates participated. A forty-five minute, 30 item multiple choice Further mathematics achievement test (FMAT). The instrument had reliability coefficient value of 0.87 using Kuder-Richardson-20 (KR-20) formula and Lawshe method was used to establish the content validity value of 0.78. The results revealed that female students' participation in further mathematics is very low and there is a significant difference between the scores of male and female students' performance on further mathematics from urban and rural schools. However, one of educational implications is that teaching and evaluation strategies in further mathematics classes should be gender-bias free. Thus, further mathematics teachers must be sure to call on girls for answers to questions, and to give them quality praise when appropriate.
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Introduction

Mathematics is very important to the intellectual development and career choice of individuals regardless of sex. Mathematics at the basic and secondary of education is compulsory (Federal Government of Nigeria (FRN, 2004 & 2013). Students wishing to pursue career that will lead to the desired scientific competence would need to have strong mathematical background. The knowledge of mathematics and further mathematics prepare the students for science and technical or technical professions such as Engineering, Medicine, and Computer science. In the same vein, the revised edition of the Senior secondary further mathematics formulated in the curriculum objectives are:

a. it helps the students to develop conceptual and manipulative skills in mathematics so to prepare them for further studies in mathematics and its applications;

b. it reflects continuity with those used in Universities, Polytechnics, Colleges of education and Colleges of science and technology, so that graduates of the syllabus have noting to learn on entering any of the above mentioned institutions;

c. it is meant for potential mathematicians, engineers and scientists (Nigerian Educational Research Development Council (NERDC), 2007).

In the syllabi, West African Examinations Council (WAEC) and National Examinations Council (NECO) between 2006 and 2009, have the following objectives for the candidates who wish to write examination for further mathematics at Senior secondary certificate examination:

1. further conceptual, manipulative and computational skills;
2. precise, logical and abstract thinking,
3. aspects of mathematics which prepare the child for advanced level mathematics in higher institutions.

This aimed at ensuring the inculcation of Mathematics literacy and the associated equipment with logical and abstract thinking needed for living, problem solving and educational furtherance. For full realization of these laudable objectives of Mathematics education, subject mastery and demonstrated achievement, this should be evenly distributed across gender. Unfortunately, gender inequality in education has remained a perennial problem of global scope (Bordo, 2001; UNESCO, 2003; Reid, 2003).

Mathematics is a science subject and some gender-based science researchers have reported that what both the 'feminist empiricists' and the 'liberal feminist critics' seem to agree is that females in principle will produce exactly the same scientific knowledge as males provided that sufficient rigour is undertaken in scientific inquiry (Barton, 1998; Howes, 2002; Sinnes, 2006). They also believe that initiatives that build on the assumption that females and males are equal in their approach to science, and that inequality in science and science education is caused by political, educational and social factors external to science, would be expected to focus on removing these external obstacles. There is need therefore to give boys and girls exactly the same opportunities and challenges. In Nigeria, gender-achievement studies include Abiam and Odok (2006) who

found no significant relationship between gender and achievement in number and numeration, algebraic processes and statistics. They however found the existence of a weak significant relationship in Geometry and Trigonometry. Though globally the issue of gender inequality in Science, Technology and Mathematics Education (STME) has produced inconclusive results, one meta analysis covering the period 1974 – 1987 on Mathematics and gender led to two conclusions: the average gender gap is very small (statistically insignificant), and the fact that the differences tend to decline with time (Friedman, 1989).

It has been observed that female participation and performance at their final examination in this subject has been negatively skewed consecutively for the past few years. According to Ifamuyiwa (2004), female students' credit passed in this subject in 2000-2002 is 16.1%; 16.5% and 10.01% respectively. In addition, Amoo (2002) reported that female students' credit passes at Ikeja local government areas of Lagos state to be 21.0%; 20.0% and 10.1% respectively for 1997-1999. Reflecting the studied of Badru (1993); Oyedeji (1996) and Adedoyin (1999) that poor performance of girls in the mathematical science is a major issue of concern in mathematics education. It has been observed that lack of interest in mathematical sciences among girls is more of a product of social and psychological factors than inherent abilities (Amoo, 2002; Ifamuyiwa, 2004). Past studies have therefore suggested that attitude of girls in participation in mathematics is low (Adesoka, 2002 & Adeyegbe, 2005).

By and large, one can then imagine that the reaction to Mathematics by students in general have shown that female students exhibit an attitude which is less positive to Mathematics than male students and they have also demonstrated less superiority in Mathematics performance at the Secondary level (Ogwuazor, 1992). This probably might be due to the stereotyping of tasks that take place with more attention given to the training and education of males in the use of science. According to Afolabi (2002) and Adebule and Aborisade (2012) found that female students run away from Mathematics in the Senior secondary schools but they are preferred to attend humanity courses than practical work. Furthermore, girls may be unfavorably disposed towards Mathematics and Physical science because of the patterns in their upbringing in which they are derived opportunity for developing attitudes that promote scientific attitudes such as creativity, visual spatial skills and critical thinking whereas these traits are readily associated with the male in society (Erinosho, 1997; Erinosho, 1998).

Another determinant factor on students' performance in further mathematics is school location. Schools are located in both urban and rural settings. It cannot be said of the Nigerian communities with regard to social amenities, the urban and rural areas are still unequal. Students in urban setting could have more access to libraries, laboratories, etc than those in rural setting. According to Adelabu (2008), lack of social amenities in rural areas impinges on the education services, such amenities are electricity, pipe-borne water, technical resources, safe and secure facilities that are essential to successful educational programmes. He further explained that rural schools tend to be smaller than urban schools and this carries a number of benefits for rural students. Class sizes tend to be smaller, students enjoy more individual attention from their teachers, and teachers often know most, if not all, of the students. There is also some evidence that small rural schools can be more effective in helping their students learn better, behave better, and participate more in civic life. Rural students express a clear awareness of and strong attachment to the benefits of attending small schools (Adeyela, 2000; Adepoju, 2001; & Adebusuyi, 2002). Despite these advantages, small rural schools face challenges that can lead to unfavourable educational outcomes for their students. One problem is that it is difficult for small rural schools to attract and retain qualified teaching staff. Staffing issues, in turn, often result in related problems revolving around high turnover rates. Small rural schools have to compete with larger urban schools in recruiting and hiring teachers (Howley, 2002). Given the widespread shortage of and demand for specialty teachers, rural schools often have to fill their vacancies with younger, less experienced teachers. These teachers are unlikely to remain in the positions for more than a year or two, contributing to high staff turnover rates. Beyond their lack of experience, these young teachers face a number of obstacles to effective teaching. They are often burdened with heavy workloads, routinely teaching courses in four or five different subject areas—some of which fall outside of their teaching specialties. New teachers in rural settings have little or no access to mentoring and may not receive adequate administrative and classroom support. Further, new teachers may struggle to build productive relationships with students who are wary of strangers who drop into their communities only to leave again within a year or two. Rural schools that are unable to attract and retain specialty teachers are unable to offer the same range of courses found in larger urban schools. Rural students consequently have fewer opportunities to take certain kinds of courses, particularly the senior science courses often required for admission to post-secondary institutions. When rural schools do offer these courses, the lack of specialized teachers in rural areas sometimes means that non-science specialist teachers teach them. As a result, rural students may be limited in their ability to pursue certain areas of post-secondary education.

Rural schools are also at a disadvantage relative to urban schools with respect to access to and use of information and communication technology (ICT).According to the available data; over 97% of Canadian schools have computers and are connected to the Internet. This high rate of connectivity holds for both urban and rural schools; however, urban schools may be better able to make use of this connectivity. Rural schools are till

hampered by slower internet connections: more than 20% of rural schools still use dial-up connections, while less than 5% of urban schools do so (Abiam & Odok, 2006).
In addition, fewer rural schools have strategies for helping teachers learn how to use ICT and fewer rural schools include ICT learning in teacher development. These facts are particularly problematic given that ICT can provide effective tools for counteracting the difficulties small schools encounter in trying to support their teachers and offer a full range of courses (Ogunleye, 2002; Ndukwu, 2002; Odinko, 2002 & Warwick (1992).

School location is a variable in achievement and rural students, who constitute the majority group in Nigeria, tend to manifest more simple social relationships than their urban counterparts, probably due to greater interpersonal ties in rural settings. Hence, one is led to wonder whether gender disparities exist in the Mathematics achievement of rural and urban secondary school students in Ogun state.

However, the choice of this topic is predicated on the current world trend and research emphasis on gender issues following the millennium declaration of September, 2000 (United Nations, 2000), which has as its goal, the promotion of gender equity, the empowerment of women and the elimination of gender inequality in basic and secondary education by 2005 and at all levels by 2015. In the light of above, this study therefore is investigated Female students' participation and school location on performance in further mathematics in Senior secondary schools between 2009 and 2012 in order to improve students' performance in the subject.

Research questions

The study addressed the following research questions:

1. what is the trend in female students' participation in May/June Senior secondary certificate examinations (SSCE) further mathematics between 2009 and 2012?
2. what is the trend in female students' performance in May/June Senior secondary certificate examinations (SSCE) further mathematics between 2009 and 2012?

3a. is there any significant difference between the further mathematics performance of rural male and female students?

3b. is there any significant difference between the further mathematics performance of urban male and female students?

Methods

The research design used for this study was non-experimental descriptive survey research of ex-post facto type. The population consisted of all candidates sat for West African Senior Secondary Examinations (WAEC) on further mathematics between 2009 and 2012 academic sessions and Senior secondary school 2 (SS2) students who are offering further mathematics in Ijebu-ode local government area in Ogun state.

The schools were stratified technique from Ijebu-Ode local government area into rural and urban. The rural schools are schools not situated in Ijebu-Ode township. The urban schools are the schools within Ijebu-Ode township. The simple random sampling technique was used to select three schools from each group.

Four hundred and twenty three candidates whose results were released for further mathematics between 2009 and 2012 academic sessions from six Senior secondary schools in Ijebu-ode local government areas were used for this study. All students in the further mathematics classes from six selected schools were participated in the study. That is, one hundred and forty students (89 from urban schools and 51 from rural schools).

Instrumentation

A computer format was designed to collect results of candidates participated in further mathematics May/June SSCE between 2009 and 2012. It contained candidates' gender, school location (rural and urban), sessions and grades obtained.

A forty-five minute, thirty (30) item multiple choice Further mathematics achievement test (FMAT) of four options, A to D, was constructed by the researchers based on the prescribed senior secondary two (SS II) curriculum to cover the basic areas of number and numeration, Algebraic processes, Geometry and Mensuration, Trigonometry and Statistics/probability. Students were expected to encircle the option bearing the answer. The instrument had reliability coefficient value of 0.87 using Kuder-Richardson-20 (KR-20) formula and was certified content valid by three independent experts (two of Mathematics education and one of educational measurement and evaluation). Lawshe method was used to establish the content validity and the value obtained was 0.78. The item difficulty values, pi are such that $0.40 < pi < 0.82$.

Data analysis

The results of WAEC from six selected schools were purposely used for this study because the candidates in the Ogun state Senior secondary schools are compulsory to register for WAEC but NEC is optional for the candidates. Therefore, it is ease for the researcher to lay hand on the available data in the schools in Ogun state. This data was analysed using descriptive statistics. Moreover, the scores in FMAT was using student's t-test

formula.

Results and discussion

Research question 1: What is the trend in female students' participation in May/June Senior secondary certificate examinations (SSCE) Further mathematics between 2009 and 2012?

Table 1: Students' participation in five selected schools in further mathematics

School type	2009		2010		2011		2012	
	Male	Female	Male	Female	Male	Female	Male	Female
Rural	-	1	-	6	-	7	-	6
Rural	8	5	9	6	12	5	18	6
Rural	7	8	9	2	4	-	8	1
Urban	16	-	25	-	20	-	14	-
Urban	6	-	6	10	7	2	6	1
Urban	32	7	29	8	42	3	46	15
Total	69	21	78	32	85	17	92	29

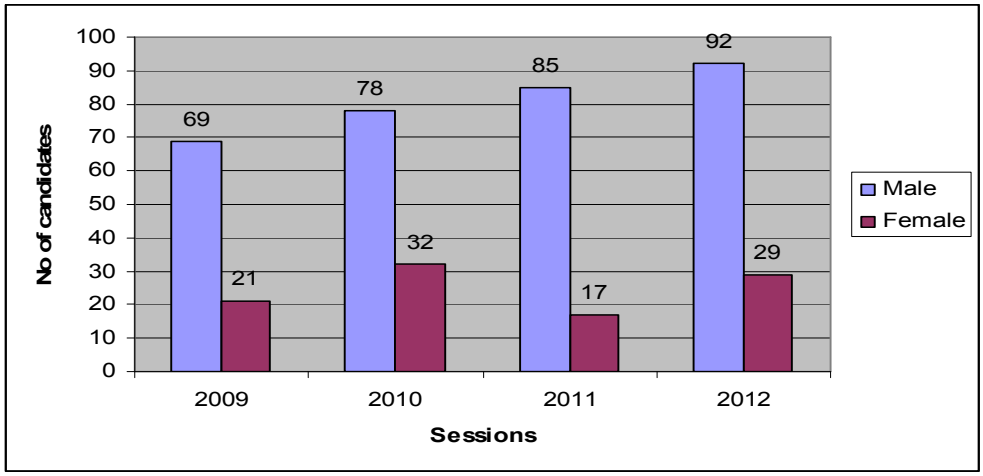

Figure 1: Students' participation in Further mathematics between 2009&2012

The above table 1 reveals that four hundred and twenty three candidates sat for West African Senior Secondary Schools Examinations Certificate in six selected schools in Ijebu-ode local government areas, Ogun state. Three hundred and twenty four candidates were male of a percentage 76.6%; it was observed that there was increase in the number of candidates offering further mathematics at every session as illustrated in the figure 1 above. While ninety-nine candidates were female for 23.4% of the representation but number of females, offering further mathematics showed zigzag patterns. The study revealed that female students' participation in further mathematics is very low. This finding is confirming the earlier findings of some researchers that have worked on similar subject (Erinosho, 1998; Erinosho, 1997; Ebeh, 2000; Ifamuyiwa, 2004).

Research question 2: What is the trend in female students' performance in May/June Senior secondary certificate examinations (SSCE) Further mathematics between 2009 and 2012?

Table 2: Students' performance in further mathematics according to Grading

Sessions	Grades								
	Distinction		Credits		Pass		Fail		
	M	F	M	F	M	F	M	F	Total
2009	16	-	15	9	24	9	11	6	90
2010	17	1	19	4	40	20	6	3	110
2011	20	-	38	3	18	7	10	6	102
2012	20	8	30	11	21	7	19	5	121
Total	73	9	102	27	103	43	46	20	423

Table 2 shows the patterns of the results reflecting the percentage pass at various grade levels and revealed the academic performance of males and females across the sessions. The number of male candidates with passed grade 278 (65.7%) were more than the number of female candidates with passed grade 79 (18.7%) but only female candidates (20) had F9 grade compared to the number of male candidates (46) that had F9 grade.

Table 3: Gender performance at Credit level in further mathematics at SSCE

Sessions	Number of Candidates at Credit level			
	Male	%	Female	%
2009	31	34.4	09	10.0
2010	36	32.7	05	04.5
2011	58	56.9	03	02.9
2012	50	41.3	19	15.7

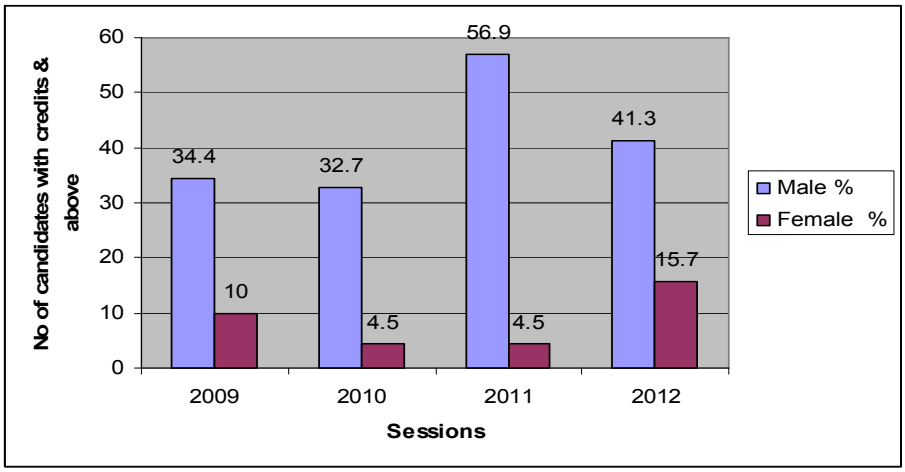

Figure 2: Students' performance in further mathematics between 2005&2008

Table 3 and figure 2 show an overview of candidates that sat for further mathematics May/June Senior secondary schools certificate examination between 2009 and 2012 academic sessions. It indicated that the female performance at credit level had little difference each session. However, the performance of male candidates at credit level was better than female. It has been said the female have been under represented in mathematics, science and technological career (Badru, 1993; Erinosho, 1998; Ndukwu, 2002).This study agreed with others that findings as less than 25% of those candidates sat for further mathematics at senior secondary schools certificate examinations were to be female. This however may also a reflection of the population at large since out of a population of 34,034 candidates registered for last May/June SSCE (2012) in Ogun state, 936 (2.8%) female candidates only sat for Further mathematics (State Ministry of education, Abeokuta, 2013). The implication of this figure is that fewer female candidates will be qualified to enroll for mathematics, science and technical programmme in tertiary institution. The availability of teachers and expectation pupils themselves and their well-wishers also come into play in affecting female performances. Most teachers' expectation for girls low indicating male concerns are more important and essential (Maduabum, 1994; Ebeh, 2000). In addition, the Socio-cultural practices in which girls marry early and engage in various activities like Hawking, Baby minding and so on work against them. Even though male performance is generally better, but few female offered, the subject performed excellent (Ogwuazor, 1992; Adepoju, 2001).

Research question 3a: is there any significant difference between the further mathematics performance of rural male and female students?

Research question 3b: is there any significant difference between the further mathematics performance of urban male and female students?

TABLE 4: t-test on students' performance on school location

Types	Variables	N	Mean	SD	Df	t	Sig. 2tailed	Remark
Urban	Male students Female students	72 17	29.3 17.9	1.85 2.63	88	17.0	0.00	*
Rural	Male students Female students	46 05	23.5 16.8	2.91 2.75	50	5.15	0.02	*

* = Significant @ 2-tailed level of $P < 0.05$

Table 4 above shows that there is a significant difference between the scores of male and female senior secondary students' performance on further mathematics from urban schools ($t = 17.0$; $df = 88$ and $P < 0.05$). Male students performed better than as their female students' counterparts. It is however, necessary to observe that the mean scores on further mathematics on students' performance is very high for both male and female students. Male students and female students obtained mean scores of 29.3 and 17.9 respectively out of the total obtainable score of 30. This study, therefore, reveals that students' overall performance in further mathematics is above average.

Table 4 also shows that there is a significant difference between the scores of male and female senior secondary students' performance on further mathematics from rural schools ($t = 5.15$; $df = 50$ and $P < 0.05$). Male students performed better than as their female students' counterparts. It is however, necessary to observe that the mean scores on further mathematics on students' performance is very high for both male and female students. Male students and female students obtained mean scores of 23.5 and 16.8 respectively out of the total obtainable score of 30. This study, therefore, reveals that students' overall performance in further mathematics is above average. The outcomes of this study is in agreement of the study of Adepoju, (2001), found that gender difference in students' performance about girls in mathematics and science changes significantly, depending on the location of the school; namely, the difference is smaller in urban schools than in rural schools. Further scrutiny of the data shows that male students in urban schools hold more positive performance about girls in mathematics and science than male students in rural schools. In urban schools, male students hold more positive performance than female students do. Nevertheless, in rural schools, male students, compared to their female counterparts, hold more negative performance about girls in mathematics and science (Emmanuel; Igber & Michael, 2012).

Conclusion and implications

The study revealed a low enrolment of female for further mathematics. The percentage pass of male is also higher than the female. The implication of this study is that female's representation in mathematics, science and technology will continue to remain low unless urgent steps are taken to address the issue at the Secondary school level particularly at the Senior secondary schools. This cannot be said of single-sex schools in which there are no representations of both sexes and as such, male and female students could not compete, collaborate and gain from one another in mathematics teaching and learning. Thus, the healthy rivalry between sexes, which could raise their level of motivation, and consequently their performance is lacking.

However, the results of this study could be seen the gender difference in further mathematics performance in terms of school location.

The educational implications for this study are three folds. First, more institutions that are co-educational should be established to engender greater healthy rivalry between male and female students in mathematics education. Second, rural schools should be funded and enriched learning environment provided so that their capacity for efficiency and productivity can be improved. Third, teaching and evaluation strategies in further mathematics classes should be gender-bias free. Thus, further mathematics teachers must be sure to call on girls for answers to questions, and to give them quality praise when appropriate.

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