Influence of school type on the achievement of secondary school students in mathematics and science in Makurdi Local Government Area of Benue State, Nigeria

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Full Length Research

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This study investigated the difference in the mathematics and science achievement of single-sex schools and mixed schools in WASSCE (2007-2010) in Makurdi local government area of Benue state. The study is important to the extent that it bothers on the achievement of students based on school type at SSCE which is used for entrance into tertiary institutions of learning. It also looked at the difference in the achievement of students according to school type. The ex post facto research design was employed in carrying out the study. This involved the use of already existing data on the mathematics and science achievement of 480 students in six secondary schools in Makurdi local government area of Benue state. To this end, two research questions and corresponding two hypotheses were formulated to guide the study. Using t-test statistics, it was found that there existed a significant difference in both mathematics and science achievement between single-sex schools and mixed schools in favour of the former at a 0.05 level of significance. The study therefore recommended that single-sex schooling should be encouraged among students at the secondary school level. However, this should not be made mandatory but through proper guidance and counseling.

Keywords: Mathematics, science, correlation, achievement, secondary schools, WASSCE, significant relationship

INTRODUCTION

Many mathematics and science teachers in Nigeria are aware of the relatively low number of female students studying in the sciences as confirmed by Olorode (2005). Female students give reasons for not choosing sciences mainly that it is either “difficult” or “hard” or that it is “a male subject”. The issue of the disparity between female and male performances has been of prime concern to most researchers in mathematics and science education. While some researchers argue that males perform better than their female counterparts, others insist that females can actually prove their mettle and achieve at par with the males as we shall see in the following segments.

A UNESCO report on Education for All in 2007 stated that girls do better in mathematics and science related courses when boys are not in the class, while boys tend to perform better than girls in co-educational schools. Eriba and Achor (2010) stated that “…studies have variously shown that the type of school and the teachers’ gender do have an influence on a number of variables”. These may include variables that lead to achievement in mathematics and science at the senior secondary school level. However, Abiam and Odok (2006) who found a weak differential between the performance of boys and girls assert that girls in co-educational schools, because of the presence of boys apparently develop such faculty of power and synthesis that was formerly the exclusive attribute of the boys. Yusuf and Adigun (2010) found that whether a student attends a single-sex school or mixed sexed school, it does not make a difference in his academic performance. However, the differential effects
that may exist are generally believed to have no biological basis, but rather socio-cultural (Bassey, Joshua and Asim, 2009; Ifegbesan, 2009, UNESCO, 2000).

Literature review
Tracing the history of gender biased schools in Africa, Bosire, Mondoh and Barmao (2008) stated that among traditional African systems, informal education tended to separate girls from boys as the knowledge, skill and values given were extremely stereotyped. This trend continued even when education became more and more formalized. Education was preferred to the boys than to the girls. Although an extension was later granted to the girls, they were usually taught separately, which led to predominance of single-sex schools. The co-opting of girls and boys into mixed schools was reached only after pressure and advocacy for the recognition of equal rights and freedom of education. However, in Nigeria today, the championing of single-sex schooling is evident among the Catholic mission schools, however some public schools (both federal and state) are also structured by gender.

Yusuf and Adigun (2010) observed that some parents believe that their children cannot perform very well academically in co-educational schools (mixed). To this end, many of them would prefer to register their children in single sexed schools for Senior School Certificate Examination to enhance better academic performance. This corroborates the UNESCO (2007) report especially for students in mathematics and science. On the contrary, Bosire, Mondoh and Barmao (2008) argued that the debates on single-sexed schools have hinged their arguments on disciplinary issues rather than academic. Education of girls in a knowledge based world is becoming scientific. Today education for girls is widely encouraged as one of the most effective investment towards the development a nation can make. Education for girls raises economic productivity, reduces infertility rates, lowers infant and maternal mortality, improves health, nutrition and well being of families and ensures better prospects for education for all children (Anyor, 2005; UNESCO, 2007; Ando, 2008). Research on single-gender education and the impact on mathematics achievement is contradictory and inconclusive (Bosire, Mondoh and Barmao, 2008; Tully and Jacobs, 2008). Another dimension is the issue of single-sex schools which are encouraged in Benue state especially by the Catholic missionaries, on which (Tully and Jacobs, 2008) asserted that:

...Controlling for student background and school resources, a Nigerian study confirmed the increased performance in mathematics achievement of female students from public single gender schools. However, male students from single-gender schools underperformed in comparison to male students from a co-educational environment...

While Bosire, Mondoh and Barmao (2008) stated that boys in some single-sex schools did not perform better than their counterparts in co-educational schools; girls appeared to do better. But with further control of variables the better performances noticed on the part of the girls tended to disappear.

Since mathematics is the language of science and technology which are in turn indices for development, it becomes necessary that if female participation in science and technology is to improve, their performance in mathematics must improve. According to Anyor (2005) studies have indicated that achievement of boys and girls in mathematics and science does not reveal any significant difference. However a decline in girls’ achievement begins to be glaring during the senior secondary school years, a period when they become mostly unpredictable. It has also been observed that while biology is popular among boys and girls, more boys than girls are said to enroll for physics and chemistry.

Problem of the study
The debate on the difference in the performance of students in mixed versus single schools has been heated among stakeholders and researchers. Some argue that the preference for students to attend single sex schools is bothered on morals rather than on academic achievement. While others believe that students in single sex schools can actually do better than their counterparts in mixed schools especially at external examinations in mathematics and science. Thus the main thrust of this research is: what is the difference in the achievement of students in mixed and single sex schools in mathematics and science?

Purpose of the study
The purpose of this research is to find out:
1. The difference between the mean achievement of students in single-sex schools and co-educational schools in mathematics at WASSCE.
2. The difference between the mean achievement of students in single-sex schools and co-educational schools in science at WASSCE.

Research questions
1. To what extent does school sex influence the achievement of students in mathematics at WASSCE?
2. To what extent does school sex affect the achievement of students in science at WASSCE?

Research hypotheses
Ho1. Students in single sex schools do not significantly achieve better than their counterparts in co-educational schools in mathematics at WASSCE.
Ho2. Students in single-sex schools do not significantly achieve better than their counterparts in co-educational schools in science at WASSCE.

Significance of the Study
This research involves the investigation of a disparity in the achievement in single-sex and co-educational schools in mathematics and science at the senior secondary school certificate examination. Assertions on this issue are said to be inconclusive in research; while some hold that both boys and girls do better in single-sex than in co-educational schools, others tend to dispute. It throws light on the difference between the achievement of students in single sex schools and co-educational schools by evaluating their achievements using the WASSCE. The findings of this study may be useful to researchers for comparing findings and drawing conclusions. Parents, guardians, teachers and students may also find the study and invaluable reference point for school choice decisions.

Importance of the study
The study is important to both scholars and readers in the sense that it bothers on the achievement of students in mathematics and science at the secondary school level. Performance of students at this level of education has been a source of concern to all stakeholders in education. Hence findings may be used for future decision making for the government, teachers as well as parents/guardians.

Research design
This study employed the ex post facto design because its nature does not warrant a control and manipulation of variables.

Area of study/sample and sampling
The area of this study is Makurdi Local Government Area of Benue State, Nigeria. Six schools out of the 54 SSCE approved secondary schools within the area under study have been sampled. The sampling is multi-staged, in that the six schools are purposefully selected for the study while bearing in mind the nature of each school (mixed/single-sex). This is done in this manner in order to vary the types of school to cover single, mixed, and science oriented.

A total of 480 students were sampled by means of proportional sampling from each of the schools, i.e. the more the number of students, the more the sample. This makes up 60 boys and 60 girls, i.e. 120 students from each of the years from 2007-2010, these years are chosen for the research for contemporary reasons. In mixed schools however, the researcher ensured gender balance by sampling the same number of male and female students.

Instrumentation
As already mentioned in some sections of this research, the data used for analysis in this research is the already scored and recorded S.S.C.E examination results of sampled students from the schools also selected. This implies that the instrument relied upon is the standardized test reliability developed and updated by the West African Examinations council (WAEC) usually conducted as a summative examination in May/June of each year .

METHODOLOGY
Method of data collection
All the schools selected for the study were personally visited by the researcher where written applications for results data were made to the principal of each of the schools. These were attached to the letter of introduction given and authenticated by the Head of Department of Curriculum and Teaching. The researcher then adopted a direct inspection of the original print outs for each set of students ranging from 2007-2010. In addition the result analysis for each set was used while paying special attention to the science students’ scores.

Method of data analysis
The WAEC graded scores were grouped in a four-point weighted scale as follows: (A1, B2, B3)-4, (C4, C5, C6)-3, (D7, E8)-2 and F9-1; where the independent samples t-test was then employed for analysis.

Table 1 presents data and information on the achievement of students in single-sex and mixed schools in mathematics. This shows the t-calculated (3.944) higher than the table value (1.96). This indicates that there is a significant difference in the achievement in mathematics in favour of the single sex schools.

Table 2 indicates that for the years under study a t-calculated (10.10) is significantly higher than the table value (1.96) which can be interpreted that there is a significant difference in the achievement of students in single-sex schools and mixed schools. It is again to be noted that science is treated here in an integrated manner, i.e. the scores in chemistry, physics and biology are grouped as one entity.

Findings on achievement in single-sex and mixed schools in mathematics and science
Achievement in mathematics and science with regards to school type is not unanimous as it is controversial. Yusuf and Adigun (2010) assert that whether a student attends a single-sex school or mixed sexed school, it does not make a difference in his academic performance. While Abiam and Odok (2006) found a weak differential between the performance of boys and girls asserted that girls in co-educational schools, because of the presence of boys apparently develop such faculty of power and synthesis that was formerly the exclusive attribute of the boys.

However, Eriba and Achor (2010) stated that “…studies have variously shown that the type of school and the teachers’ gender do have an influence on a number of variables”, which is in agreement with UNESCO (2007) which ascribes to single-sex schools especially for girls to enhance performance in mathematics and science. In
addition, Tully and Jacobs (2008) asserted that controlling for student background and school resources, there may be an increased performance in mathematics achievement of female students from single sexed schools.

Conversely, the differential effects that may exist are generally believed to have no biological bases, but rather socio-cultural (Bassey, Joshua and Asim, 2009; Ifegbesan, 2009, UNESCO, 2000). Bosire, Mondoh and Barmao (2008) caps it all by arguing that the debates on single-sex schools have hinged their arguments on disciplinary issues rather than academic.

This research found that for the student’s scores which were sampled and analysed, there existed a significant difference in the achievement of students in single-sex type schools and those in mixed schools with regards to mathematics as well as in science. This is in favour of single-sex type schools. This led to the rejection of hypothesis one and two, which agrees with the findings of Bosire, Mondoh and Barmao (2008) on the effect of streaming by gender on student achievement in mathematics. Generally the results indicated that based on gender improved the overall student achievement in mathematics and especially among the girls.

The researcher is of the opinion that the reasons for the significant difference in the performance of students in single-sex and mixed schools may be as a result of:

1.) Single-sex schools do away with the unnecessary gender comparisons and bias that tend to be a common phenomenon in mixed schools. This causes the girls to withdraw into some form of shells and engender male dominance.

2.) It has been observed that single-sex schools tend to have less crowded classrooms. This has very productive implications on the teaching/learning of mathematics and science, since overcrowded classrooms have been highlighted to be one of the banes of the achievement of students in the subject.

3.) Students themselves are less distracted and overcome phobia of been mocked or jeered at by their peers of the opposite sex, especially when mistakes are made in class work by them.

On single-sex education, the study found out those students in single-sex schools did not only do better in mathematics but tended to out-perform their counterparts in mixed schools. It may be inferred that mathematics and science teachers in single schools are more disposed to dropping the gender inclinations that are often found in mixed classrooms but concentrate rather on the content, thereby encouraging improved performances.

**CONCLUSION**

Going by the findings that students in single-sex schools performed significantly better than their counterparts in mixed schools, the study also concluded that single-sex schools have positive implications on the achievement of students by SSCE worth.

**Recommendations**

1. This study encourages the establishment of single-sex schools. However, students are not to be compelled by their parents/guardians to attend such schools but rather through proper guidance and counseling.

2. The researcher recommends that stakeholders in education are to hold interactions on the way forward to education of children at the secondary school level. Stakeholders here include representatives of the government with regards to policy formulation; teachers, students, parents/guardians.

**Limitations of the study**

This study was carefully undertaken. However, there is likelihood that some limitations may exist. These may include:

1. Some heads of schools were generally un-cooperative in the release of records, while some school examination records were poorly stored and handled. This delayed the access of the needed data for the study and could pose a threat for the overall integrity of the research.

2. The research used only schools in Makurdi local government area. Although this is sufficient for an ex post facto research, it could have been widened to include one or two other local government areas within the geo-political zone.

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**Table 1:** T-test for difference between single-sex schools and mixed schools in mathematics

<table>
<thead>
<tr>
<th>School</th>
<th>N</th>
<th>Mean</th>
<th>S.D</th>
<th>t-calculated</th>
<th>df</th>
<th>t-critical</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single</td>
<td>118</td>
<td>2.7</td>
<td>1.1</td>
<td>3.944</td>
<td>478</td>
<td>1.96</td>
</tr>
<tr>
<td>Mixed</td>
<td>362</td>
<td>2.3</td>
<td>0.59</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

**Table 2:** T-test for difference between single-sex schools and mixed schools in science

<table>
<thead>
<tr>
<th>School</th>
<th>N</th>
<th>Mean</th>
<th>S.D</th>
<th>t-calculated</th>
<th>df</th>
<th>t-critical</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single</td>
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<td>2.86</td>
<td>0.68</td>
<td>10.10</td>
<td>1438</td>
<td>1.96</td>
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<tr>
<td>Mixed</td>
<td>1086</td>
<td>2.46</td>
<td>0.54</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>
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