Faculty of Natural and Applied Sciences Journal of Mathematics and Science Education
Print ISSN: 2814-0885 e-ISSN: 2814-0931
www.fnasjournals.com
Volume 5; Issue 3; March 2024; Page No. 36-42.

Examining the Influence of Gender and School Location on Academic Achievement in Algebra Among Senior Secondary School Students

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Abstract
This study examined the influence of gender and school location differences on students' academic progress in Algebra among senior secondary students in Ogun State, Nigeria. The study focuses on underrepresentation and societal prejudices in mathematics. The quasi-experimental study included 356 SS 2 students from eight public senior secondary schools, with a pretest-posttest control group design consisting of 211 and 145 students from urban and rural schools, respectively. A multiple-choice Algebra achievement test comprising 50 items with a reliability coefficient of 0.93 was presented to the selected sample which lasted for 12 weeks. The data collected were analysed using ANCOVA, which focuses on two research questions and three hypotheses. The results show no significant difference in Algebra achievement based on gender disparities. However, considerable variations were discovered based on school location, with urban area students outperforming those in rural locations. The findings also revealed a substantial interaction effect between gender and school location on student achievement. The study indicated that learners of Mathematics should be handled equally by the teacher during the class, regardless of gender, and that a conducive learning environment that will accommodate both male and female pupils should be implemented, regardless of school location.

Keywords: Achievement, Gender, School Location, Algebra

Introduction

Many social divide factors are responsible for learners' underperformance at the secondary school level, including gender disparity, access to resources, quality of education, and cultural and linguistic differences. Addressing social divides and promoting equity in education requires systemic efforts to reduce disparities in resources, opportunities and support systems. These include policies and interventions to improve access to high-quality education, reduce socioeconomic segregation, foster inclusive school environments and address the root causes of social inequalities. Gender differences have been observed in different subjects, including mathematics (Ajai & Imoko, 2015; Saleh & Rahman, 2016). As scholars work to address the underrepresentation of girls at the senior school level of mathematics, gender disparities in mathematics achievement have become a significant concern (Asante, 2010). Many students have misconceptions about mathematics; they think it is a topic only for men and not for women, that it is boring and reserved for nerds, and that there are many formulas to learn without understanding why they are learning them (Ajai & Imoko, 2015). According to Mutemeri and Mygweni (2005), the belief that mathematics is a subject best left to males may cause females to be less motivated and widen the attainment gap between genders in the subject. Hyde and Mertz (2009) asserted that there is a correlation between gender and the poor enrollment of female students in secondary school-level mathematics topics during their high school years. They said that female students have taken just as many advanced Mathematics classes as male students and that this mentality has altered in the twenty-first century. Studies have shown that female students accomplish better than male students (Arnot et al., 1999). They discovered that female students had achieved equality with males in mathematics performance, majorly in senior schools, where a gap existed. They acknowledged that females outperform male students in tasks that require problem-solving skills.

Cite this article as:
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In Nigeria like many other nations, it has been claimed that cultural upbringing reinforces male domination over the female gender (Bassey et al., 2007). This suggested that many reasons can be connected with the gender gap, such as the location, gender attitude towards the subject, and social and cultural norms (Ajai & Imoko, 2015); all these have consequences for determining the kind of instructional methods to be adopted for a conducive environment for teaching and learning of mathematics suitable for both genders. The school location is one factor affecting students' achievement (Akpan, 2001). Schools in rural areas usually face challenges such as a deficiency of competent teachers and resources. This has an undesirable impact on students' motivations and achievement. For example, Hu (2003) and Arnold et al. (2005) mentioned that the educational ambitions of students who schooled in rural areas are weaker than those of their peers in urban areas. A relatively small number of researchers have looked into how gender affects mathematics proficiency in the setting of Algebra. (Dugdale et al., 1998; McCoy, 2005). The decision to focus on Algebra for the study was informed from the Chief examiners' reports (Mathematics) for the West African Examinations Council (WAEC) on the Senior School Certificate Examination from May/June 2015 to May/June 2022, a review of related studies in Mathematics Education which showed students underperforming in Algebra and perhaps Algebra is one of the most essential themes in Mathematics at secondary school. Algebra is a subdivision of mathematics that employs letters instead of numbers (Iroko & Olaoye, 2021). The topics selected under Algebra for the study were due to weaknesses of students as reported by the Chief examiner, their fundamental importance in the study of Algebra and their relationship as a bridging gap between the topics in Mathematics except for those topics that neither need formula nor leading to equations. Furthermore, a review of past WAEC and NECO questions confirmed that questions on Algebra surfaced most frequently in internal and external examinations, among other themes.

Gender is a socially constructed trait of males and females in a given community, different from sex. Gender differences in academic performance in Mathematics have been controversial and generated considerable interest in educational research over the years (Ajai, 2018). Gender stereotyping pervades the educational system from elementary to tertiary levels and manifests itself in a variety of ways. Some researchers have reported the frequency of significant gender disparities in student performance in Mathematics, some in favour of males and others of girls. In contrast, others found no difference (Ariaga & Nwanekezi, 2018). Ajai and Imoko (2015) investigated the fact that female students outclassed their male counterparts in Algebra using the PBL strategy, though the difference is not statistically significant. (Adeniran et al., 2018; Agwaga, 1993; Skolverket, 2006) also support female students' dominance over male students. In contrast, (Adeneye, 2011; Lawal et al., 2015; Maduabum & Odili, 2007; Odumosu, 2001) supported the efficacy of male students ahead of their female counterparts. The insignificance of gender is also supported by (Eugene & Ezeh, 2016; Nwachukwu, 2003).

School location could also have an impact on students' success in mathematics. School locations refer to a place concerning other parts of the physical environment where the school is located (Nbiti & Edoho, 2017; Owoeye & Yara, 2011; Yusuf & Adigun, 2010) proved in their study that students in urban areas had improved academic achievement over their rural counterparts while (Agbaye & Awodiran, 2014; Eugene & Ezeh, 2016; Faisal et al., 2016) found significant difference in favour of rural students.

Statement of the Problem

Many factors are responsible for students' underachievement in Mathematics at the high school level, and studies have shown that the societal divide could lead to unequal opportunities and outcomes for students. Goals four and Five of the Sustainable Development Goals dwelled on quality education and gender equality, respectively, where students are expected to receive a quality education regardless of gender, learning environment, parental socioeconomic status, sociocultural context and other factors that could show class among individuals. Moreover, Societal norms and expectations could impact students' access to educational resources, support and opportunities and, as a result, would probably affect their learning experiences. Students in rural areas may face unique challenges due to traditional gender roles and limited access to educational opportunities compared to their counterparts in urban settings. Similarly, students in urban areas may encounter socioeconomic pressures and academic expectations that differ from those in rural communities.

However, this study investigates whether gender and school location as societal divides could affect students' academic achievements in Algebra at Senior Secondary.

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Research questions

1. What is the difference between the male and female students' achievement in Algebra?
2. What is the main effect of School location on students' achievement in Algebra?

Null Hypotheses

$Ho_{1:}$ There is no significant difference between the male and female students' achievement in Algebra
$Ho_{2:}$ There is no significant difference in the main effect of school location on students' achievement in Algebra
$Ho_{3:}$ There is no significant interaction effect of gender and school location on students' achievement in Algebra

Methodology

The study used a quasi-experimental pretest, post-test nonequivalent control group 2x2 factorial design consisting of two levels of gender and two levels of school location with the population of all students in 333 public senior secondary schools in Ogun State. Eight schools were randomly selected from the population, and four schools were carefully chosen from Urban areas while the remaining four schools were also selected from the rural areas of the state. Eight intact classes of 356 SS 2 students formed the sample for the study. A multiple-choice achievement test that contains 50 items on Algebra with a reliability index of 0.93 was administered to the selected sample before and after the treatment which continued for 12 weeks. The data collected were analysed via Mean, Standard deviation and Analysis of Covariance (ANCOVA) at a level of significance of 0.05

Results

Research Question 1: What is the difference between the male and female students' achievement in Algebra?

Table 1: Table of gender scores in Algebra

Gender	Mean	Std. Deviation	N
Male	27.0888	7.36209	169
Female	29.0321	9.11156	187

Results from Table 1 show that female students had the higher score (Mean = 29.03, S.D = 9.11) while male students had the lower score (Mean = 27.09, S.D = 7.36) in the posttest of the Algebraic achievement test. This means female students scored higher than their male counterparts on the Algebra achievement test. To establish whether the experimental effect was significant, hypothesis one was tested.

H_{o1} There is no significant difference between the male and female students' achievement in Algebra

Table 2: Table of Analysis of Covariance for Algebra Achievement Test

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	18608.955[a]	17	1094.644	58.974	.000
Intercept	2054.779	1	2054.779	110.701	.000
Pre-Achievement	1283.355	1	1283.355	69.141	.000
Gender	.015	1	.015	.001	.977
School Location	538.352	1	538.352	29.004	.000
Gender * School Location	136.619	1	136.619	7.360	.007
Error	6273.772	338	18.561		
Total	306175.000	356			
Corrected Total	24882.728	355			

a. R Squared = .748 (Adjusted R Squared = .735)

The hypothesis one was tested, and the outcomes are shown in Table 2. The result showed no significant difference between the male and female students' achievement in Algebra. [F(3,338) = 0.001; p > .05]. Therefore, the hypothesis that there is no significant difference between the male and female students' achievement in Algebra is

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not rejected. Although female students might achieve better than male students in Algebra tests, gender is statistically insignificant in students' achievement.

Research Question 2: What is the main effect of school location on students' achievement in Algebra?

Table 3: Table of school location achievement Scores

School Location	Mean	Std. Deviation	N
Urban	29.6682	8.55647	211
Rural	25.8414	7.56883	145

Table 3 shows that students in urban schools possessed the higher score (Mean = 29.67, S.D = 8.56), whereas the students in rural schools possessed the lower score (Mean = 25.84, S.D = 7.57) in the post-test of the Algebra achievement test. The students in urban schools accomplished higher on Algebra tests than those students in rural schools. To establish whether the experimental effect was significant, hypothesis two was tested.

H_{o2} There is no significant difference in the main effect of school location on students' achievement in Algebra.

The hypothesis was tested, and the results are shown in Table 2. The result showed a significant difference in the main effect of school location on students' academic achievement in Algebra. [F (3,338) = 29.004; p<.05]. Therefore, the hypothesis that there is no significant difference in the main effect of school location on students' achievement in Algebra is rejected. The significant test upholds the discrepancy in the mean achievement scores of students based on their school location in support of urban school students.

$H_{o3:}$ There is no statistically significant interaction effect of gender and school location on students' achievement in Algebra

The hypothesis was tested, and the results are revealed in Table 2. The result showed a significant interaction effect of school location and gender on students' academic achievement in Algebra. [F(3,338) = 7.360; p<.05]. Therefore, hypothesis three, which states there is no significant interaction effect of gender and school location on students' academic achievement in Algebra, is at this moment rejected.

Discussion

Table 1 indicated a substantial discrepancy in the post-achievement scores of masculine and feminine students, indicating that the mean scores of the feminine students are more significant than the mean scores of the masculine students. The findings in Table 2 show that male and female students are not statistically significantly different in post-achievement tests. This indicates that the effect of gender on students' achievement in Algebra is insignificant. According to the investigations of this study, the instructional strategy used in the class was not gender sensitive. The study is in support of (Arigbabu & Mji, 2004) (Ilorah et al. 2018, Lawal et al., 2017) (Lin et al., 2017 Sule et al., 2016; Yaghmor, 2016), which indicates that no substantial difference between the performance of students attributed to their gender. The study did not support the findings of (Ahmad, 2016; Mohammed, 2019; Olaoye & Iroko, 2018; Onyejekwe et al., 2018), who revealed a significant discrepancy in students' performance based on gender. Similarly, Adegoke (2011) also found a significant effect of gender on students' academic achievement in Algebra. It is widely believed that male students tend to achieve more academically than their female counterparts in mathematics. In contrast, this study proved otherwise, and it is open to view that female students out-distance male students when it comes to the juxtaposition of their achievement. Although the gender effect on student's achievement in Algebra is insignificant, the mean scores showed that female students accomplished higher than their male counterparts. Some male students were exceptional in some schools, but female students generally achieved better. Female students should not hide under the belief that Mathematics is meant for male students. Female students are as proficient as male students in solving Mathematical problems.

The mean and standard deviation in Table 3 show substantial variations in post-achievement scores between students in rural and urban area schools, suggesting that the mean scores of students in urban schools are higher than those of students in rural schools. The findings in Table 2 also indicated that urban and rural school students are

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statistically significantly different in post-achievement tests. This study is consistent with Musa's (2013) finding that topographical locations attenuate the impact that gender has on students' learning goals and overall academic success. Alokan and Arijesuyo (2013) discovered no significant difference in the performance between students from rural and urban areas. In the study of Owoeye and Yara (2011), students in urban regions had higher academic accomplishments than their rural counterparts, while (Eugene & Ezeh 2016 Faisal et al., 2016) discovered a considerable disparity in favour of rural students. The environment where students are taught determines their proposed achievement. It is open to the view that an encouraging environment will eventually lure students into a more significant or stupendous achievement. Students who live and school in urban areas would be able to stand taller in achievement than the acclaimed students in rural locations due to the availability of internet facilities, high-tech social amenities, and other factors that can optimize students' proposed achievement. Table 2 showed a significant interaction effect of gender and school location on students' academic achievement in Algebra. The intersection of gender and school location further complicates the societal divide. For example, girls in rural areas may face unique challenges due to traditional gender roles and limited access to educational opportunities compared to boys in urban settings. Similarly, boys in urban areas may encounter socioeconomic pressures and academic expectations that differ from those in rural communities. Understanding these intersectional dynamics is crucial for addressing the complex factors contributing to educational disparities.

Conclusion

This study examined how school location and gender affect students' Algebra achievement. The study's results revealed insignificant differences in the critical impact of gender on students' academic achievement, a substantial disparity in the main impacts of school location on students' achievement, and a significant interaction effect of school location and gender on students' achievement in Algebra. Addressing the societal divide in education requires comprehensive strategies to promote equity, inclusivity, and access to worthy education for all students, regardless of gender or geographic location. This may involve targeted interventions such as providing additional resources to underserved communities, implementing inclusive curriculum and teaching practices, and challenging societal stereotypes and biases through education and advocacy. Bridging the societal divide in education is essential for building a more equitable and prosperous society.

Recommendations

1. The teacher should treat mathematics learners equally during the lesson, regardless of gender.
2. A conducive environment for learning that will accommodate both masculine and feminine students should be implemented, irrespective of school location.

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