



Gender Effect on Mathematics Anxiety of Secondary School Students in Ogun West Senatorial District, Nigeria

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Author's contribution

The sole author designed, analysed, interpreted and prepared the manuscript.

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ABSTRACT

Mathematics has become an important and compulsory school subject in many countries of the world but it has been recognized by many researchers as causing panic and fear for many students and this has often made most of such students to fail the subject. This study therefore sought the effect of gender on the mathematics anxiety of senior secondary school students in Ogun West Senatorial District. The sample size for this study were 270 senior secondary school students 2 (SS2) who were selected through stratified random sampling technique. The Mathematics Anxiety Rating Scale-revised (MARS-R) was the only instrument used for the study. The data collected were analysed through Analysis of covariance (ANCOVA) and t-test. Results revealed a significant difference effect of gender on students' mathematics anxiety. The study also revealed higher mathematics anxiety scores for male students than the female. The researcher recommended that counselors should use this study as a theoretical and empirical basis to help counselors see the need to help male students focus more on the subject so as to avoid being anxious. Schools should also sponsor seminars/workshops especially for male students on the importance of mathematics for career progression.

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1. INTRODUCTION

Mathematics anxiety has become a continuous research among scholars especially in Nigeria because of its detrimental effect on students' academic performance. For instance, there has been much complaint and worries by stakeholders in Nigeria on the continuous poor performance of students in mathematics especially in the the West African Examinations Council (WAEC) [1]. Asikhia, [2,3] Okoye and Nlemadum [1] also found that many secondary school students in Nigeria do not like mathematics and this is shown by the fear they have for mathematics. This explains why Minara, [4] defines mathematics anxiety as the fear, helplessness, frustration and mental disorganisation people have when they are trying to solve mathematical problems. Makari, also defines mathematics anxiety as disorders that makes people to be nervous, afraid, worried and apprehensive when solving mathematical tasks. This definition agrees with the findings of Khatoon and Mahmood [5] that mathematics anxiety makes people to avoid mathematics.

Furthermore, some studies (Degaldo, Espinoza and Fonseca, [6]; Ramrez, Hooper, Kersting, Ferguson and Yeager [7] showed that mathematics anxiety negatively influences learners' performance in mathematics. Mathematics failure often brings frustration to individual students as some of them eventually drop out of school. This makes many students who would have been admitted into the university and develop their career in reputable areas to forfeit such opportunities and become less than they ought to be. Meanwhile mathematics is a compulsory and important subject for entrance into higher institution of learning in Nigeria and many countries of the world. This makes it very dangerous to neglect the greater need for mathematics as a subject and the adverse effects of mathematics anxiety.

In this study, focus of the researcher is on the effect of gender on the mathematics anxiety level of students. Gender was considered as a variable in this study in order to draw the attention of policy makers, counselors, teachers, government and other researchers on the particular gender that has higher level of mathematics anxiety. The purpose of the present study therefore is twofold:

- (i) To examine the level of mathematics anxiety male and female students in secondary schools in Ogun State, Nigeria.
- (ii) To find out whether there is a significant difference in the effect of gender on the mathematics anxiety of secondary school students.

1.1 Hypotheses

The two hypotheses that were tested for this study were:

- 1) There is no significant difference in the mathematics anxiety level of male and female secondary school students.
- 2) There is no significant difference in the effect of gender on secondary school students' mathematics anxiety

2. LITERATURE ON MATHEMATICS ANXIETY

2.1 Meaning of Mathematics Anxiety

Mathematics anxiety has been studied by many scholars over the years. However, a concrete definition of mathematics anxiety is difficult to describe because of the various causes and degree of intensity identified by different scholars. For instance, Ashkraft and Ridley [8], define mathematics anxiety as the condition of fear, tension and dread that individuals who are engaged with mathematics experience. This definition implies that mathematics anxiety puts the individuals who engage in it into situations beyond what they can control by themselves. Makari, also defines mathematics anxiety as a name given to several disorders that causes nervousness, fear, apprehension and worrying. This definition is similar to that of Chang and Beilock [9] who regard mathematics anxiety as psychological and physiological symptoms and feelings that occur among students when solving mathematical tasks. This is because examples of psychological and physiological symptoms and feelings that happen when individuals are doing mathematical tasks are worries, nervousness, fear and apprehension. Such symptoms are often beyond the individual's control and that is why such individuals need therapeutic techniques to help them out. Some of the variables that has been measured with mathematics anxiety are gender, academic achievement, study habit, home background,

geographical region, grade level and the likes. However, the variable that will be used in this study is gender.

2.2 Gender Effects on Mathematics Anxiety

There has been some inconsistencies in studies that have to do with gender and mathematics anxiety. For instance, some studies have found significant differences in gender and mathematics anxiety; [10-16] while some researches did not find such significant differences [17-24].

In addition, the study of Penner [25] on the effect of gender in mathematics and science tests scores across ten countries found that there were significant gender differences in mathematics and science test scores in the ten countries and that these differences consistently favoured males. Craske [26] also suggested gender should be connected to biological predisposition for anxiety disorder. The South Africa study of Mutodi and Ngirande [27] also found that there was a significant difference in the in mathematics anxiety levels of male and female learners in the country. This finding is consistent with the studies of Woodard [28] and Karimi and Venkatesan [14], which have also found significant gender differences in mathematics anxiety with female students exhibiting higher math anxiety than their male counterparts.

However, these findings contradict those of Marsh [18] and Stevens (2013) which conclude that there is no relationship between mathematics anxiety and gender. The study of Omirin [29] finds no significant difference between male and female students' scores. Likewise, in Nigeria, the findings of Adebule [30] shows no significant difference between male and female students' scores in mathematics. The study thus concluded that gender does not have such significant influence on mathematics anxiety scores of students. In another study by Tarpia and Marsh [18] the findings also shows that mathematics anxiety has no relationship with gender. The studies of Clarice, Allyssa, and Ferdinand [31] also revealed a non-significant relationship of mathematics anxiety with gender.

2.3 Mathematics Anxiety Levels of Male and Female Students

On the levels of maths anxiety among males and female students, studies like those of Boomstalter, [12], Redber, Isiksal and Koc, Sayeda [16] and Woodward [28] among others found that female students were more mathematically anxious than their male counterparts while the studies of Hess (2014) revealed a higher mathematics anxiety score in male students than female students. The study of Yüksel-Şahin [13] on mathematics anxiety among Turkish elementary school students also reveals that female students have higher levels of mathematics anxiety than their male counterparts.

However, a cursory look at literature on gender and mathematics anxiety, shows that it is inconclusive. The researcher therefore justifies the belief that gender could act as a moderating variable in this study.

3. METHODOLOGY

3.1 Research Design

Descriptive survey was used to get self-reported information from senior secondary school students 2 in Ogun West Senatorial District about their level of mathematics anxiety and the effect of gender on their mathematics anxiety levels.

3.2 Participants

Stratified random sampling technique was used to select 360 students from three schools after which mathematics anxiety rating scale-revised (MARS-R) was used to select high mathematics anxious students among them. Thus, only 270 students with mathematics anxiety were eventually selected. The 270 students were eventually broken down into two groups of male and female students (Making a total of 90 students in each school).

3.3 Measures and Procedure

Mathematics Anxiety Rating Scale - Revised (MARS-R) by Plake and Parker [32] that was used in this study involves a 24-item self-report statements that rates participants' mathematics anxiety level. The degree of mathematics anxiety is measured through five point Likert type scale from 1 (no anxiety) to 5 (high anxiety). According

to Plake and Parker, [32], the scale has been able to demonstrate a reliability of .98. This scale is relevant to this study because Plake and Parker [32] showed that it has sound psychometric properties. Moreover, the scale has been used by other scholars such as Gierl and Bisanz [33], Campbell & Evans [34], Woodward [28] and Marci [35], Eden, Heine and Jacobs [36] and Pletzer, Wood, Scherndi, Kerschbaum and Nuerk [37] among others.

3.4 Method of Data Analysis

Statistical analysis for this study was done through analysis of covariance (ANCOVA) and t-test. ANCOVA was used to compare the effects of cognitive restructuring and problem-solving techniques (independent variables) on mathematics anxiety (dependent variable). It was also used to take care of differences that might exist between and within the groups.

4. RESULTS

A total of 270 male and female students who had high mathematics anxiety were used as participants in this study.

4.1 Hypothesis 1

There is no significant difference in the mathematics anxiety level of male and female students.

In Table 1, the mean scores of male mathematics anxious students was 52.11 while that of the female was 42.71. However, in order to discover the existence of any significant gender effect further analysis was done on the result and is presented in Table 2 below.

Based on the estimated marginal means:

- i. The mean difference is significant at 0.05 level
- ii. Adjustment for multiple comparisons-Least significant difference (equivalent to no adjustment)
- iii. An estimate of the modified population marginal mean (J)
- iv. An estimate of the modified population marginal mean (I)

The above table showed a significant means difference of male and female (I-J) of 9.4000; $P < 0.05$ was significant. Thus, the hypothesis of

no significance for the hypothesis is rejected. The result also revealed that male participants had higher mathematics anxiety scores than the female.

4.2 Hypotheses 2

There is no significant difference in the effect of gender on students' mathematics anxiety.

F tests the effect of Gender. This test is based on the linearly independent pairwise comparisons among the estimated marginal means.

In Table 3 above, it was shown that the F ratio of 122.86 is significant at 0.05 level of significance with a significant value of 0.00 of male and female anxious students. The implication of this is that there is a significant difference effect of Gender on students' anxiety in mathematics. The F ratio of 122.86 significant at 1 and 27 degree of freedom is less than 0.05 level of significance ($F = 3.872; P < 0.05$). The null hypothesis of no significant difference is therefore rejected. Thus, mathematics among secondary school students is gender sensitive.

5. DISCUSSION

The first hypothesis which states that there is no significant difference in the mathematics anxiety level of male and female students was rejected. This conclusion was reached because significant differences were found in the mathematics anxiety levels of male and female students as male students' mathematics anxiety scores were higher than those of their female counterparts. This result may be due to the fact that male students often love to engage in other co-curricular activities such as football, games and if these activities take more of their time, they may focus less on their school subjects (especially mathematics which is likely to demand more of their attention). This eventually makes them panic and become more fearful of the subject. This result agrees with that of Hess which found mathematics anxiety in male students to be higher than that of female students. The studies of Hembree [10] and Bernstein, Reilly and Cobe-Bonanno [38] is also similar to the findings of this study as they found that male students had a higher level of mathematics anxiety than the females. South African studies of Halele and Karimi and Venkatesan [14] support the finding of this study. However, the findings of most studies such as Boomstalter, [12], Miller and

Table 1. Descriptive statistics of male and female students' mathematics anxiety scores

Gender	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Male	52.11	2.45	24.00	95.00
Female	42.71	2.01	21.00	84.00

a. Evaluated of covariates appeared in the model: Anxiety in mathematics pre-test = 89.5417

b. Based on modified population marginal mean.

Table 2. Pairwise comparison of the differences in the mathematics anxiety scores of male and female anxious students, 95% Confidence Interval

GENDER (I)	Gender (J)	Mean Difference (I-J)	Std. Error	Sig(s)	Lower Bound	Upper Bound
Male	Female	-9.40	3.19	0.05	-3.02	-15.78
Female	Male	9.40	3.19	0.05	3.02	15.78

Table 3. Univariate Analysis of Covariance differences in the mathematics anxiety scores of male and female students

	Sum of Square	Df	Mean square	F	Sig.
Contrast	8474.67	1	8474.67	122.85	.000
Error	1862.57	27	68.98		

Bichsel, Redber, Isiksal and Koc, Sayeda [16] and Woodward [28] did not agree with the present study as they found out that the anxiety levels of female students were more than those of their female counterparts.

The second hypothesis which states that there is no significant difference in the effect of gender on students' mathematics anxiety was also rejected because the result of the study proved otherwise. The finding of Gire [39] that the way students perceives mathematics as either a male or female domain affects their performance on the subject may be an explanation for the significant difference in the mathematics anxiety found among male and female students. Other studies that agrees with the present study are those of [10,11,12] and [13,14,40,16]. Woodard [28], Yüksel-Şahin [13], Bernstem et al. [38] also support the finding of this study. However, the findings of this study did not support those of Omirin [30], Ma and Xu, [17] Tapia,[18]; Egbochukwu and Obodo, [19]; Dede, [20] Arigbabu, Balogun, Oladapo, Ojedokun, Opayemi, and Emikanosuelu, [21] Samson, Abayomi and Olaitan; [22] Muhammad, [23] and Yavuz, [24] which did not find any significant difference between mathematics anxiety scores of male and female students. Studies of Lussier [41] and Adebule, [31] do not also agree with the findings of this study as it didn't find a significant relationship between gender and mathematics anxiety.

6. CONCLUSION AND RECOMMENDATIONS

This study has been able to offer insight into the significant effect of gender on students' mathematics anxiety and the fact that male students are prone to mathematics anxiety than females. This suggests that this study can serve as a theoretical basis for counselors during counseling sessions as they will be able to ensure that male students focus more on mathematics rather than being anxious. In line with this, schools should also sponsor seminars/workshops especially for male students so that they can be equipped with the understanding of how important mathematics is to them and the society as a whole.

CONSENT AND ETHICAL APPROVAL

The participants of this study were given a comprehensive explanation of the research topic and the purpose of the research after which their consents were sought and given. The ethical clearance of the study was given by Faculty of Education Post Graduate Coordinator of Olabisi Onabanjo University, Ogun State Nigeria, the Ado- Odo Ota Zonal Education Officer of the Teaching Service Commission, Ogun State, Nigeria and the principals of the three schools used for the study.

COMPETING INTERESTS

Author has declared that no competing interests exist.

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