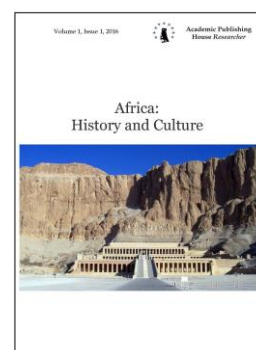


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## Math Anxiety and Achievement among Male Senior High Students in the Eastern Region of Ghana

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### **Abstract**

This study measures the math anxiety levels and related math achievement of selected male senior high students in the Eastern Region of Ghana. A simple random sampling method was used to select 25 male students in within the General Science Programme. Results show significantly low math anxiety levels in both Core and Elective Math subjects. However, the mean for Core Math related anxiety was higher than Elective Math. In addition, significant positive correlations and differences exist among the performances of male students on Core and Elective Math achievement. This study has implications for pedagogy, psychology and policy.

**Keywords:** Ghana, male, math achievement, math anxiety, senior high, students.

### **Introduction**

Historically, there is an ancient negative stereotype among different cultures that males naturally perform better in math-related subjects than females (Tobias, 1993). In recent times, research had showed that this gender gap does not exist among elementary and high school students (Hyde, Lindberg, Linn, Ellis, & Williams, 2008).

Originating as a form of anxiety, math anxiety seems to affect the performance and general achievement in the field of mathematics and other related sciences. Fiore (1999) describes math anxiety as “*the panic, helplessness, paralysis, and mental disorganization that arises among some people when they are required to solve a mathematical problem*” (p. 403).

Math anxiety is caused by several factors. In addition, it is a negative attitude of fear developed towards mathematics. Research shows that reduction of math anxiety has a negative correlation with achievement and performance (Wilbert, 2006). While students’ math attitudes and achievement leading to math anxiety are often caused by parents and teachers (Jacobs, Davis-

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Kean, Bleeker, Eccles, & Malanchuk, 2005), peers' attitudes and behaviours may also lead to math anxiety (Ryan, & Patrick, 2001). Students with math anxiety do not only perform poorly but have little interest in mathematics-related subjects (Maloney, & Beilock, 2012).

Notwithstanding these, little is known about the level of math anxiety among male students in Ghana regarding Core and Elective Math. Little have been documented on the nature of students' performances with respect to math anxiety in Ghana. Based on these findings, we hypothesised that significant differences would exist among the levels of math anxiety towards Core and Elective Mathematics among male senior high students. In addition, we hypothesized there would be significant relationships between the performances male senior high students on Core and Elective Mathematics within a term. Finally, our prediction was that higher there would be significant differences among the performance of male senior high students on Core and Elective Mathematics.

### Method

Twenty-five (25) students who read both Core and Elective Mathematics within the General Science Programme at Senior High School level were randomly selected in the Eastern Region of Ghana. Their average years of education and chronological ages were approximately 12 and 17 years respectively. Students in the General Science Programme in Ghana generally read the following subjects;

1. English Language
2. Integrated Science
3. Social Studies
4. Core Mathematics
5. Elective Mathematics
6. Elective Chemistry
7. Elective Physics
8. Elective Biology

It is important to note that mathematics play and essential role in their academic career as it forms the key basis of approximately 63% of their core studies. This makes math anxiety and its consequences very undesirable to students, parents and teachers within this arena.

Using self-administered questionnaires that were developed by the authors, quantitative responses about the factors that contribute to math anxiety were collected. In addition, their respective scores in both Core and Elective Mathematics were taken from their end of term examination results. The following terms were selected based on the basis that these students were in their second year, third term. Their first year, first term results were not used because the authors reasoned that it would be much unfair since students came from different Junior High Schools [both *elite and less-endowed*] and would need that term to stabilise.

Results used included;

- i. First Year, Second Term
- ii. Second Year, First Term
- iii. Second Year, Second Term

Following strict ethical standards, data collecting and handling were done appropriately. This study was part of a bigger project which looked at factors affecting math attitudes and performance among male senior high students in Ghana.

### Results

From our analysis in Table 1, Tests of Between-Subjects Effects showed that math anxiety has a significant effect on both Core Math [ $F_{(1, 24)} = 7.26, \rho = .013, \eta^2 = .240$ ] and Elective Math [ $F_{(1, 24)} = 10.54, \rho = .004, \eta^2 = .314$ ] subjects.

**Table 1.** Tests of Between-Subjects Effects of Math Anxiety on Both Core and Elective Math

Variables	Levels	Mean	SD	F	$\rho$	$\eta^2$
Core Math	Low Anxiety	831.81	97.50	7.26	.013	.240
	High Anxiety	697.14	46.12			
Elective Math	Low Anxiety	681.25	00.29	10.54	.004	.314
	High Anxiety	526.07	25.02			

Notes:

- i. SD = standard deviation
- ii.  $N = 25$
- iii.  $df = 1, 24$
- iv. *R Squared for Core Math = .240 (Adjusted R Squared = .207)*
- v. *R Squared for Elective Math = .314 (Adjusted R Squared = .284)*

From the analysis in [Table 1](#), it is also clear that the mean (standard deviation) of low Core Math anxiety is greater than high Core Math anxiety  $\{[831.81(97.50)] > [697.14 (46.12)]\}$ . Similarly, the mean (standard deviation) of low Elective Math anxiety is also greater than high Elective Math anxiety  $\{[681.25(00.29)] > [526.07 (25.02)]\}$ .

Nonetheless, it is again obvious that the mean (standard deviation) of high Core Math anxiety is greater than the mean (standard deviation) of high Elective Math anxiety  $\{[697.14 (46.12)] > [526.07 (25.02)]\}$ .

[Table 2](#) measured the paired sample relationships and differences of Core and Elective Math performances among selected male students over three consecutive terms.

The first pair indicates a significant positive correlation [ $r_{(24)} = .607, \rho = .001$ ] and difference [ $t_{(24)} = 4.190, \rho = .000$ ] among the performances of male students on Core and Elective Math respectively in First Year, Second Term.

In addition, the second pair shows a significant positive correlation [ $r_{(24)} = .723, \rho = .000$ ] and difference [ $t_{(24)} = 4.774, \rho = .000$ ] among the performances of male students on Core and Elective Math respectively in Second Year, First Term.

Likewise, the third pair reveals a significant correlation [ $r_{(24)} = .566, \rho = .003$ ] and difference [ $t_{(24)} = 4.091, \rho = .000$ ] among the performances of male students on Core and Elective Math respectively in Second Year, Second Term.

**Table 2.** Tests of Paired Sample Correlations and Differences of Core and Elective Math Performances

Programme of Students		Mean $\pm$ SD	$r$	$t$
Pair 1	Tscore_F1T2CM	56.99 $\pm$ 8.59	.607*	4.190**
	Tscore_F1T2EM	50.00 $\pm$ 10.00		
Pair 2	Tscore_F2T1CM	56.60 $\pm$ 7.51	.723**	4.774**
	Tscore_F2T1EM	50.00 $\pm$ 10.00		
Pair 3	Tscore_F2T2CM	57.40 $\pm$ 9.37	.566*	4.091**
	Tscore_F2T2EM	50.00 $\pm$ 10.00		

Notes:

- i. \* = .01
- ii. \*\* = .001
- iii. SD = standard deviation
- iv.  $N = 25$

- v.  $df = 24$
- vi.  $T_{score\_F1T2CM} = \text{Total Score for First Year, Second Term [Core Math]}$
- vii.  $T_{score\_F1T2CM} = \text{Total Score for First Year, Second Term [Elective Math]}$
- viii.  $T_{score\_F1T2CM} = \text{Total Score for Second Year, First Term [Core Math]}$
- ix.  $T_{score\_F1T2CM} = \text{Total Score for Second Year, First Term [Elective Math]}$
- x.  $T_{score\_F1T2CM} = \text{Total Score for Second Year, Second Term [Core Math]}$
- xi.  $T_{score\_F1T2CM} = \text{Total Score for Second Year, Second Term [Elective Math]}$

### Summary of results

- i. Math anxiety has a significant effect on both Core and Elective Math.
- ii. The mean (standard deviation) of low Core Math anxiety is greater than high Core Math anxiety.
- iii. The mean (standard deviation) of high Core Math anxiety is greater than the mean (standard deviation) of high Elective Math anxiety
- iv. A significant positive correlation and difference exist among the performances of male students on Core and Elective Math respectively in First Year, Second Term.
- v. A significant positive correlation and difference exist among the performances of male students on Core and Elective Math respectively in Second Year, First Term.
- vi. A significant correlation and difference exist among the performances of male students on Core and Elective Math respectively in Second Year, Second Term.

### Discussion

This study shows interesting results regarding the levels of math anxiety and performance in Core and Elective Mathematics among male senior high students in Ghana. From the results, majority of the selected boys in the General Science Programme have low Math anxiety. This result may not have necessarily been as a result of male gender superiority in mathematics (Preis, & Biggs, 2001), but probably due to a more complex multifactorial mechanism which are yet to be explained fully (Awanta, 2000).

This study also indicates that the mean of 'High Core Math Anxiety' is greater than the mean of 'High Elective Math Anxiety'. This may also be primarily due to the fact that students within the General Science Programme probably feel that Core Math is quite difficult or may have perceived some sense of fear of math failure vis-à-vis their programme [*which is purely math-inclined*] (Khatoon, & Mahmood, 2010; Makari, 2012). Nonetheless, this sense of math fear was less likely to have stronger negative effects on their performances in Core Math as the sample was generally less anxious (Lyons, & Beilock, 2010).

Undeniably, though significant differences do exist between Core and Elective Math performances over the three terms of participants' schooling in the Senior High, it is also noteworthy that there are positive relationships between their performances in these two related math subjects. Though these positive relationships are more expected, the difference can be due to different factors. These differences can be due to poor teaching approaches used in teaching by teachers or students' previous negative experiences with Elective Math after their first term in their first year (Rossnan, 2006; Sarfo, & Adusei, 2015).

### Conclusion

In conclusion, our findings show the level of math anxiety among male students in Ghana vis-à-vis Core and Elective Math. They also indicate the nature of students' performances with respect to math anxiety among boys. Math anxiety has the ability to negatively affect math achievement in math disciplines at the Senior High level. The finding that boys in the General Science Programme [*who take in addition to Core Math, Elective Math and related subjects like Elective Physics and Elective Chemistry*] have significant differences in the two main mathematics subjects is worrisome. Future studies to explain these successively consistent differences in Core and Elective Math achievement will not only increase our knowledge of the existing situation of math anxiety and math achievement but also help improve the teaching of math.

**Conflict of Interest**

The authors declare that there was no conflict of interest.

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