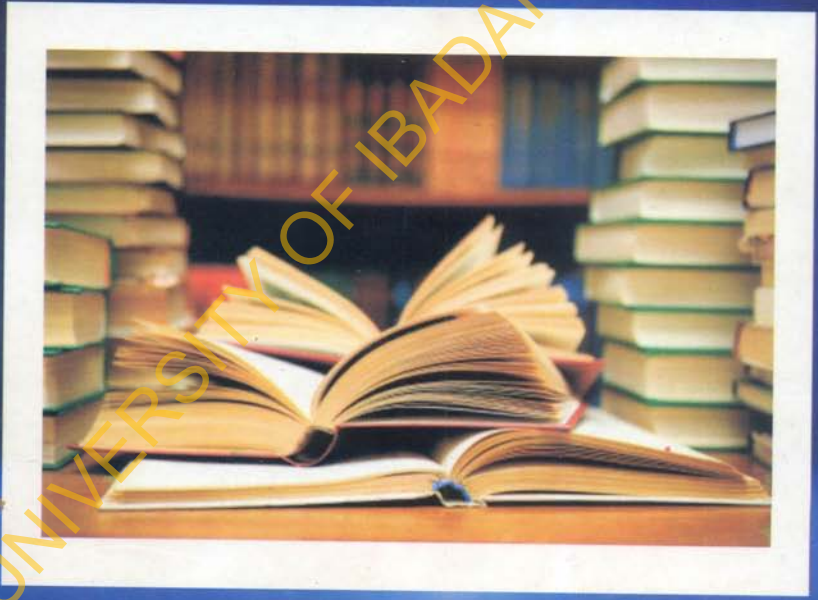
CONTEMPORARY ISSUES IN CURRICULUM AND EVALUATION RESEARCH



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CONTENTS

SECTION THREE: EMPIRICAL STUDIES

SECTION FIVE: QUALITY ASSURANCE IN EDUCATION

SECTION SIX: GENERAL EDUCATION

13

RELATIONAL ANALYSIS AMONG ANXIETY, ATTITUDE, GENDER AND STUDENTS' ACHIEVEMENT IN SECONDARY SCHOOL MATHEMATICS

Joshua O. Adeleke, Alade Abimbade & Sanni Rizqat Folawe

Introduction

In an attempt to understand how students learn an important subject like mathematics, it is quite difficult to separate affective factors from learning achievement. McLeod (1992) drew researchers' attention to an increasing recognition given affective factors while studying teaching-learning process in mathematics class. One effective factor that "has probably received more attention than any other area that lies within the affective domain" is anxiety towards mathematics (McLeod 1992). When people are experiencing events or circumstances they cannot control or are not sure of their outcome, people feel uneasy apprehensive or fearful. This emotional state is defined as anxiety. Mathematics anxiety is more specific; it is a feeling of frustration about the inability to perform mathematical functions. Students experience such anxiety in varying levels of intensity, but for some, simply going to mathematics class can be challenging. It can occur when participating in class, listening to a lecture, while doing a mathematics related problem, or during a test. Moreover, such anxiety can manifest on elementary school children, secondary school and college students. It is important to know that it can happen to anyone at any age no matter the level of mathematical ability. Mathematics anxiety has become fore-runner to test stress, low self-confidence, fear of failure, and negative attitudes towards mathematics learning. Mathematics anxiety involves intellectually and emotionally paralyzing fear of mathematics. Mathematics anxiety is often referred to as "the general lack of comfort that someone might experience when required to perform mathematically" (Woodard 2004) or the feeling of tension helplessness and mental disorganization one required to manipulate numbers and shapes (Trujillo & Hadfield 1999). Williams

(1988) gives clear description of mathematics anxiety as being "both an emotionally and a cognitive dread of mathematics". In each of these definitions, mathematics anxiety is considered to be a form or state of anxiety that is specific to mathematics instructions and mathematics related activities and it is weakly in nature in that it interferes with academic achievement in mathematics and inhibits subsequent learning. It is an emotional reaction to mathematics perhaps based on past unpleasant experience which harms future learning of mathematics.

Mathematics anxiety can result from environmental factors such as myths, teachers and parents (Steele and Arth 1998; Trujillo and Hadfield 1999). Anxiety can easily be prompted by learning styles, persistence failure (Olowojaiye 1999), self doubt and negative reinforecement (Trujille and Handfield 1999). Personality factors such as low self-esteem, and intimidation can also induce mathematics anxiety among students (Abadom 1993). Mathematics anxiety has real impact on people's academic choices, those students that are affected may likely have negative attitudes toward mathematics related activities such as those encountered when working with computers (Hembree 1990) or statistics (Woodard 2004) and eventually if they became school teachers, they may spend less time teaching mathematics and skipping some aspects of mathematics. Mathematics anxiety is linked to the affective domain of learning in various fashions. More specifically, on attitude variables.

Attitudes serve as functions including social expressions, value expression, utilitarian and defensive functions for the people who hold them (New bill 2005). In a specific way, attitude towards mathematics is a positive or negative emotional disposition towards mathematics (Mcmillan 2009). In educational domain classification, attitudes are typically classified as affective and it is one of the factors that affect students' learning and achievement in mathematics (Newbill 2005). Attitudes have been linked to action and can be categorised according to their focus. Thus, behavioural attitudes indicate a person's judgment of the performing behaviour. Clearly, other things being equal, the more favourable a person's attitude toward a behaviour, the more likely the person would intend to perform that behaviour. Reynolds and Walberg (1992) found attitude to be causal to student achievement in mathematics. The fact that attitude can determine achievement, presupposes that teachers' effort should not only be geared toward improving pupils' achievement in mathematics only but also attitude towards the learning of the subject. Other factor that can also influence achievement in mathematics is gender of the students.

Previous studies of Spelke (2005) and Adeleke (2007) reveal that, more males are found to be achieving better in the fields of mathematics than females. According to her, recent discussions of this disparity have focused attention on a pair of long standing claims. First, there are fewer females on mathematics field because fewer females exhibit high talent in these fields. Second, this gender difference has a genetic basis: females have less intrinsic aptitude for mathematics. Three claims for gender influences on mathematics achievement have received the greatest attention. One claim asserts that males and females are predisposed from birth to learn about different things: Male infants learn about objects and their mechanical relationships, whereas female infants learn about people, emotions and personal relationships (Cohen 2003; Browne 2002). From these beginnings, boys have more aptitude than girls to develop the knowledge and skills required by mathematics. The second claim according to Spelke (2005) focuses on the specific cognitive systems that give rise to effective reasoning in mathematics. Boys have better command over these systems, (Geary 1998; Kimura 1999). A third claim focuses on gender disparities at the upper end of the ability distribution: males show greater variability in inherent mathematical talent, and therefore they predominate in the pool of highly talented students from which future mathematicians will emerge (Nowell and Hedges 1998). Many discussions of the biological basis of boys and girls' cognitive capacity focus on evidence that sex hormones modulate performance on specific cognitive tasks (Kimura 1999, Halpern 2000 and Baron-Cohen 2003) the existence and nature of these effects may be relevant, if performance on tasks influenced by hormones gave one sex a cognitive advantage in mathematics. Based on this background, this study investigated the relationship existing among gender, anxiety, attitude and mathematics achievement.

Statement of the Problem

The rate at which many students show anxiety negative attitude to mathematics is becoming a matter of great concern to education experts. The anxiety and negative attitude to mathematics make many students lose interest in the subject. Many at times, their behaviour towards mathematics tends to affect their performance in mathematics. The issue of gender is not left out, male and female students do not perceive things the same way. This may be in the way they see themselves achieving in mathematics. This research therefore, is aimed at investigating the relationships existing among gender, anxiety, attitude and mathematics achievement.

Null Hypotheses

Based on the above stated problem, the following three null hypotheses were raised.

HO_1 Students' mathematics anxiety will not correlate significantly with their academic achievement in mathematics.

HO_2 There is no significant correlation between students' attitude and their academic achievement in mathematics.

HO_3 Students' gender will not influence their academic achievement in mathematics significantly

Methodology

Research Design

The correlation research approach was adopted to carry out the study. This design is considered suitable, for it has the ability to show the relationship between the variables under consideration.

Population

All the Senior Secondary Two (SSII) students in both private and public co-educational schools in Akinyele Local Government area of Oyo state constituted the population of the study.

Sample

Fifty SSII students (male and female) were randomly selected from five private and five public secondary schools using Stratified random sampling. In all, 500 students were therefore used for the study.

Instrumentation

The instrument used for the collection of data for the study includes:

(1) Students' Anxiety Scale (SAS)
(2) Attitude to Mathematics Scale(ATMS}
(3) Mathematics Achievement Test (MAT)

The Student Anxiety Scale: Section A is for the personal data of the students, while Section B consists of 10 items measuring student's anxiety towards mathematics with 5 likert scale response format. Strongly Agree (5), Agree (4), No Opinion (3), Disagree (2), or Strongly Disagree (1). The score is the sum of the ratings. The estimated reliability coefficient using reliability alpha analysis was 0.842. The inter-item correlation coefficient averaged 0.49. The indices show that the instrument is valid and reliable.

***Attitude to Mathematics Scale (ATMS)*:** The instrument is a questionnaire consisting of 20 items with 5 likert scale. Strongly Agree (5), Agree (4), No Opinion (3), Disagree (2), or Strongly Disagree (1). The score is the sum of the ratings. The psychometric properties of the instrument were also estimated. The estimated reliability coefficient using reliability alpha analysis was 0.836. The inter-item correlation coefficient averaged 0.37. The indices show that the instrument is also valid and reliable.

***The Mathematics Achievement Test (MAT)*:** This consists of two sections. Section A focused on the demographic data of the students that is: Name, School Name, Sex, Class, and Age. Section B focused on 10 topics. The topics are Number base, Fractions, decimals, standard form and approximation, Indices, Logarithms, Sequences, Set, Angles/Lines, Trigonometric ratio, Inequalities. The total no of test items is 50. The items were developed based on Bloom's Taxonomy learning outcomes i.e learning domains. The cognitive domain involves knowledge and the development of intellectual skills. This includes the recall or recognition of specific facts, procedural patterns, and concepts that serve in the development of intellectual abilities and skills. There are six major categories or levels; we have knowledge, Comprehension, Application, Analysis, Synthesis, and Evaluation. Starting from the simplest behaviour to the most complex, the levels can be thought of as degrees of difficulties. That is, the first one must be mastered before the next one can take place. The test achievement blue print in table 1 presents the distribution of items over different topics. The estimated Reliability coefficient of MAT using Kuder Richardson 20 (KR-20) formula was 0.64. Meaning that 64 percent variance in student achievement score in mathematics is measurable by MAT.

Table 1: Achievement Test Blue Print in Mathematics

Objectives/Contents	Cognitive Domain						
Topics	Knowledge	Comprehension	Application	Analysis	Synthesis	Evaluation	Total
Number Base		3			3		6
Fractions, decimals standard form & approximation	11	1	2				14
Indices			1	1			2
Logarithms				1			1
Sequences					6		6
Set		4		1			5
Angles/line				1			1
Trigonometric ratio		2		6		2	10
Inequalities						5	5
Total	**11**	**10**	**3**	**10**	**9**	**7**	**50**

Procedure for Data Collection

The researchers visited the selected schools to collect approval for administration of the research instruments to the students. The researchers trained ten research assistants so as to help in administering the tests. The administration will last for two weeks. The first week was for the administration of the SAS and the ATMS questionnaire. Then the other week was used for the achievement test. The order of administration of the instruments was presented in figure 1.

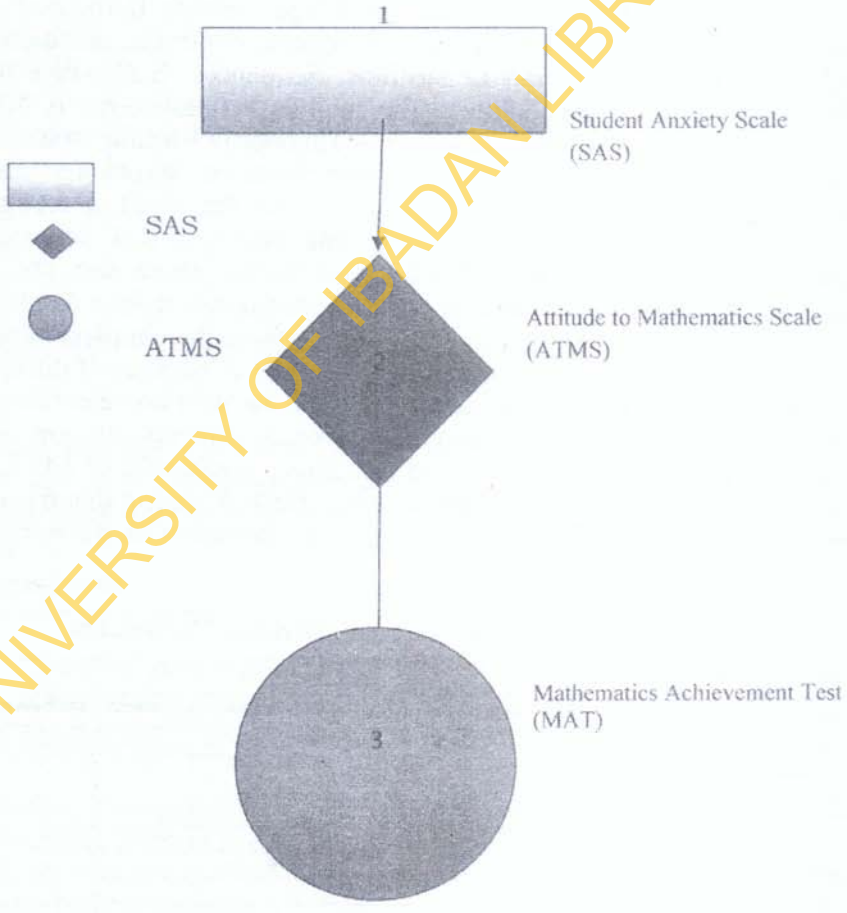

Fig. 1: Schematic Representation of the Test Administration procedures adapted from Adeleke 2007

Data Analysis

Pearsons Product Moment Correlation was used to analyze the data collected for the study to test the three stated null hypotheses.

Results

HO_1 Students' mathematics anxiety will not correlate significantly with their academic achievement in mathematics.

Table 2: Relationship between students' anxiety and students' Mathematics Achievement

Parameter	Value
Pearson Correlation Coefficient (r)	-0.230*
N	500
Pvalue	0.01

* Correlation significant at P < 0.05

Table 2 shows that the relationship between students' mathematics anxiety and students' mathematics achievement is negative but significant. (r= -0.230, df =994, p<0.05) hence, the null hypothesis one is therefore rejected. This means that, students with high level of anxiety achieve poorly in achievement in mathematics

HO_2 There is no significant correlation between students' attitude and their academic achievement in mathematics.

Table 3: Relationship between students' Attitude and students' Mathematics Achievement

Parameter	Value
Pearson Correlation Coefficient (r)	.061
N	500
Pvalue	0.174

Table 3 shows that relationship between attitude of students towards mathematics and their academic achievement in mathematics is positive, weak and not significant (r = 0.061, df = 994, p>0.05). This implies that as the attitude of students relates positively with their academic achievement in mathematics. Therefore, null hypothesis two is not rejected.

HO_3 Students' gender will not influence their academic achievement in mathematics significantly.

Table 4: Relationship between students' gender and students' Mathematics Achievement

Parameter	Value
Pearson Correlation Coefficient (r)	.027
N	500
Pvalue	0.554

Table 4 shows a positive, weak and not significant relation-ship between gender and students' achievement in mathematics ($r = 0.027$, $df = 994$, $p>0.05$). Therefore, null hypothesis three is not rejected. Implicit in this finding is that, as gender changes from male to female, students' achievement in mathematics improves.

Discussion

The result showed that anxiety significantly correlates with academic achievement of secondary school students in mathematics. It means that students who have high mathematics anxiety tended to achieve lowly in mathematic achievement test. The reason for this finding is obvious, because anxiety reduces rate of responding to some desirable stimulus perceived to be threatening. When students of mathematics are confronted with mathematical activities they have no mastery on or are not sure of the outcome of their responses will be, people feel uneasy apprehensive or fearful. Poor achievement comes not as a result of low mathematical ability but as a result of feeling of frustration about the inability to perform mathematical functions. The findings also corroborate previous findings; between mathematics anxiety, and academic achievement (Abadom 1993; Hembree 1990; Lee 1996; Ashcraft & Kirk 2001).

The study has revealed that no significant relationship is found between student, attitude and their academic achievement in mathematics. It is probably attributed to the influence of mathematic anxiety in student. Students who do well in mathematics have more positive attitude about the subject and have low anxiety, but those that have high anxiety perform poorly this may be due to the effects of the anxiety which make it difficult to hold new information in mind and soak up working memory resources and make it harder to learn mathematics, Ashcraft and Kirk (2001) in their own view, make it clear that mathematically anxious people have working memory problems as they do mathematics. Most teachers of mathematics would agree that mathematics anxiety stems primarily from student's fear of failure and feeling of in adequacy.

Students must direct their energies towards improving their mathematical abilities and solving problems not as scapegoats when students have difficulty with mathematics, they may feel helpless or frustrated. To

merely blame their textbook or their teacher is counterproductive. If a student cannot get adequate assistance from one source, say textbook, then he or she must look for a second source of aid (the individual that understands better than the student). The findings also show that female students performed better in the mathematics achievement test because achievement tends to be better as one approaches female code. High-performing females seem to be particularly vulnerable to the belief that "girls just can't do mathematics." Women who continue in mathematics perform just as well as their male peers throughout elementary school. However, when these same girls go on to high school where they learn topics such as calculus and geometry they fare less well than boys who have shown equal promise up to that point (Spencer & Steele 1994). This does not seem to be due to lack of persistence, because females work just as long on hard mathematics problems as males do (Spencer & Steele 1994), but for male this hard work pays off, while for female it does not. Spencer and Steele (1994) suggest that when female students are frustrated by the difficulty of mathematics problems, they associate this frustration with the belief that they as female are not supposed to be able to do mathematics. This leads to anxiety, which impairs performance.

No significant difference observed in the study supported the findings of Spencer and Steele (1994). They performed a number of experiments utilizing males and females who were highly skilled at mathematics and highly motivated to perform well. As was predicted, females scored as well as males on a test of moderate difficulty, but underperformed relative to males when the test was more difficult. This is in keeping with earlier findings. This same difficult test was given to another group of students with one minor change in the procedure: some students were told that the test was gender-fair (i.e. females performed as well as males on the test), while others were told that the test differentiated between males and females. When females believed that they could do as well on the test as males, they did so. There were no significant differences between males' and females' performance in this condition. Females who expected the test to be difficult for females showed the usual pattern of underperforming relative to males. Females should be encouraged from time to time that they can do well in mathematics.

Recommendations

Based on the discussions on the findings of this study, the following recommendations are offered to reduce anxiety in the students to enhance high or great achievement.

(1) Teachers should always create an environment in which students do not feel threatened; allow students to relax.
(2) Teachers should use cooperative grouping.
(3) Teachers of mathematics should try as much as they could to motivate their students during the course of instructions.
(4) Mathematics anxiety can be reduced by using some special methods in teaching and psychological intervention, which is applicable in the pedagogical domains and the improvement curriculum practices.
(5) Mathematics teacher should show their student a sincere, caring attitude to help them overcome mathematics anxiety.

Implication of the Study on Students' Assessment

The findings of the study also have implications on students' Mathematics Assessment. An effective mathematics teacher should take Students' Test-Taking Strategies with seriousness. Teachers and parents should assist students in the following areas:

***Preparing for Tests*:** Students should be sufficiently instructed to:

- Maintain good study habits. Do their class works.
- Have a clear understanding of homework assignments before leaving class.
- Keep a record of assignments received and completed.
- Make a study schedule and follow it.
- Tell their parents about schoolwork and homework.
- Turn in homework on time.
- Get make-up assignments when returning from an absence.
- See teachers for additional help.
- Seek and use past homework assignments, class notes, and available review materials.
- Follow directions.
- Find out when tests will be given out.
- Get a good night's rest and eat a normal breakfast before testing.

During Tests

- Read and pay careful attention to all directions.
- Read each passage and accompanying questions.
- Read every possible answer—the best one could be last.
- Read and respond to items one at a time rather than thinking about the whole test.

- Reread, when necessary, the parts of a passage needed for selecting the correct answer.
- Do not expect to find a pattern in the positions of the correct answers.
- Do not make uneducated guesses. Try to get the correct answer by reasoning and eliminating wrong answers.
- Decide exactly what the question is asking; one response is clearly best.
- Do not spend too much time on any one question.
- Skip difficult questions until all other questions have been answered. On scrap paper, keep a record of the unanswered items to return to, if time permits.
- Make sure to record the answer in the correct place on the answer sheet.
- Only change an answer if you are sure the first one you picked was wrong. Be sure to completely erase changed answers.
- Work as rapidly as possible with accuracy.
- After completion of the test, use any remaining time to check your answers.
- Keep a good attitude. Think positively!

After Tests

- Examine test scores; ask the teacher to explain tests scores if needed.
- Congratulate yourself on identified areas of strength.
- Identify areas of weakness to improve upon for a better performance next time.
- Ask teacher to suggest areas of study that will help you perform better in the next test.

Test Anxiety

Students may experience anxiety about tests and may experience heightened anxiety before a testing situation. A certain degree of test anxiety is normal and may help students prepare more effectively, work more efficiently, and remain focused during testing. Too much anxiety, however, can negatively affect performance: The following strategies may assist students, parents, and teachers in reducing test anxiety.

***Student Strategies for Reducing Test Anxiety*:** Each student should learn how to:

- Share feelings of anxiety with parents and teachers.
- Think of the test as an opportunity to show what one knows.
- Review homework and materials which pertain to the test topics.
- Relax, breathe deeply and stay focused on the test.
- Remember the test is only one way by which academic performance is measured.

Conclusion

This study investigated the correlation among four variables. The results revealed a significant negative, correlation between mathematics anxiety and achievement in mathematics. It was found that there is no significant correlation between students, students' gender and their academic achievement in mathematics. According to the results, achievement of students in mathematics can be influenced by mathematics anxiety. It is therefore imperative that efforts should be directed towards various strategies that will reduce anxiety in mathematics learners to have improved achievement in an important subject called Mathematics.

Suggestions for Further Research

Further researchers should explore more fully the links between - mathematics achievement values and anxiety. For instance, students who perform poorly in mathematics but attach little importance to it may not be anxious about mathematics. Students that performed poorly in mathematics but want to do well in the subject, may report higher levels of mathematics anxiety. Further research also should focus on the influence of perceptions of ability, mathematics values, and mathematics performance on mathematics anxiety may help to better explain the development of mathematics anxiety. It is worth mentioning that further research should be conducted on the mathematics anxiety in different stages of academic works. The scope in term of sample can be broadened in another study that will replicate this study to investigate whether a different pattern may emerge.

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