MATHEMATICS SELF-EFFICACY, TEST ANXIETY AND ATTITUDE TOWARDS MATHEMATICS: RELATIONSHIP TO MATHEMATICS ACHIEVEMENT AMONG SECONDARY SCHOOL STUDENTS

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Abstract
The study examined the relationship among mathematics self-efficacy, test anxiety and attitude towards mathematics on mathematics achievement of secondary school students. A sample of 200 senior secondary school 2 (SS2) students participated. Their age ranged between 12 and 17 years with mean age of 14.5 years. Data collected involved the use of three valid and reliable instruments to assess mathematics self-efficacy, test anxiety and attitude towards mathematics while mathematics achievement test was used as a measure of achievement. Multiple regression analysis was used to treat the data. The results obtained indicated that mathematics self-efficacy, attitude towards mathematics and test anxiety were potent predictors mildly associated to mathematics achievement. The implications of the findings for counselling practice, teachers and other stakeholders to promote positive attitudes towards mathematics were discussed.

Keywords: *Mathematics self-efficacy, attitude towards mathematics, test anxiety, mathematics achievement*

Introduction

Mathematics has been acknowledged as a subject needed for science and technology (Fehr, 1996; Akinsola & Tella, 2001). In a developed country like Nigeria where manpower is needed more especially in the sciences (medical, physical, social, etc.), a mastery of mathematics would ensure that more of this much – needed manpower is developed (Aremu, 2001). In spite of the importance of this subject in the present day society, the subject is not popular among the secondary school students. The persistent poor performance of students in it in both internal and external examination in the past decade (Umoinyang,

1999; Akinsola & Thani, 1999) has been a serious concern to all and sundry – the government, parents, educational administrators and the public at large (Jegede, 2000).

A lot of factors have been adducted for the poor performance of students in mathematics. Some of these, according to Oyedeji (1992), Iroegbu (1992) and Jegede (2000), include sex, family size and environment, teachers, school environment, relationship between teachers and students, availability of instructional aids, as well as home background. Research has established the importance of attitudes towards mathematics in achievement (Dwyer, 1993; Singh, Granville & Dike, 2002; Webster & Fisher, 2000).Attitudes influence success and persistence in the study of mathematics (Chang, 1990; Ma, 1997; Thorndike – Christ, 1991; Webb, Lubinski & Benbow, 2002).

Attitudes offer a great possibility for successful achievement in studies. They are an important motivator of behaviour, and affect the achievement of students. According to Crow and Crow (1979), a child's attitude towards his work affects his worth whileness in his activity. A great deal of literature provides an evidence for positive link between attitude and achievement. Burstein (1992) in a comparative study of factors influencing mathematics achievement found out that there is a direct link between students' attitude towards mathematics and student outcomes. Simpson et al (1994) cited by Abid (2006) reported a correlation of 0.84 between an affective behaviour checklist and achievement in Biology. Olatoye (2001) study revealed that students' attitudes towards science have significant direct effect on student achievement in the science. Adesokan (2002) and Onwu (1981) asserted that in spite of the recognition given to chemistry among science subjects, it is evident that students still show negative attitude towards the subject thereby leading to poor performance and low enrolments.

Trounce (1995) was of the opinion that anxiety is a very common symptom and a certain amount is useful to the individual as it acts as a stimulant and increases efficiency. However, there is a broad agreement in the empirical literature that test – anxiety is associated with lower academic performance. Mazzone, Ducci, Scoto, Passanti, Darrigo and Vitiello (2007) in their study among high school student found that all subjects with a high level of test anxiety had poor performance. Eysenck (cited by Sullivan, 2002) found a significant

relationship between a high level of test anxiety and lowered cognitive performance. In addition, Keoghi, Bond, French, Richards and Davids (2004) found that test anxiety was related to distraction and so school performance.

Research literature further had it that test anxiety has an impact on GPA (Masson, Hoyois, Gadot, Petit & Ansseau, 2004; Annet, Bender & Gordon, 2007; Jolyn, 2007). Chapell, Benjamen, Blanding, Micheal and Silverstein (2003) found that differences in levels (low, moderate and high) of test anxiety had produced significant differences in GPA scores among students. They found out that, students with a low-test anxiety had a higher GPA than the students with a moderate and higher test anxiety level and students with a moderate test-anxiety had a higher GPA than the students with a higher test anxiety level.

Another factor that influences achievement is self-efficacy. Self – efficacy is derived as the belief in one's ability to execute successfully a certain course of behaviour. Research supports propositions that self-efficacy will influence the choice of whether to engage in a task, the effort expended in performing it and the persistence shown in accomplishing it (Bandura, 1977; Bandura & Schunk, 1981; Barling & Beattie, 1983; Bouffard – Bouchard, 1990; Brown, Lent & Larkin, 1989; Hackett & Betz, 1989) as well as the standard of the performance. (Bandura, 1986; Locke & Letham, 1990; Mone, 1994; Robertson & Sadri, 1993; Wood & Locke, 1987).Research has been extensive on the relationship between self – efficacy and student achievement in educational setting (Marat, 2005). Researchers have been successful in demonstrating that self – efficacy beliefs are positively related to and influence mathematics achievement (Chanbarzadeh, 2001; Hodge, 2003; Kabiri, 2003; Pajares, 1996; Pajares & Kranzler, 1995).

A critical look unto the reviewed literature indicated there are significant correlations between each of test anxiety, attitude toward mathematics, self – efficacy and mathematics achievement as reported in the studies. It is against this background that this study is designed to investigate the joint and relative contribution of test anxiety, self – efficacy and attitude to the prediction of mathematics achievement among secondary school students in Ibadan.

Research Questions

1. To what extent would the mathematics self – efficacy, mathematics test anxiety and attitude towards mathematics when taking together predict mathematics achievement among the Senior Secondary School Students?
2. What is the relative contribution of each of the independent variables to each of the independent variables to the prediction of the dependent variable?

Measures

Four instruments were used for the study, the instrument consist of two sections. The first section (section A) contains bio-demographic data of the participants which includes gender, age, class, school status and types of school. Section B, the participant completed 4 questionnaires: Mathematics Self Efficacy Scale (MSES) by Marat (2005), Test Anxiety Scale (TAS) by Suinn (2002), Attitude towards Mathematics Scale (ATMS) by Fennema and Sherman (1976) and Mathematics Achievement Test (MAT).

Mathematics Self Efficacy Scale (Marat, 2005) was used to measure individuals' efficacy on mathematics. The scale has 69 items which were answered on a five-point Likert Scale ranging from 1= Not well at all to 5= Very well. The reliability co-efficient (Cronbach'salpha) for the scale was 0.85. The test-retest reliability was found to be 0.87.

Test Anxiety Scale (Suinn, 2002) was used to measure the individuals' anxiety on and mathematics Test. The scale has 48 items which were answered on a five-point Likert Scale ranging from 1= Not at all to 5= very much. The reliability co-efficient (Cronbach'salpha) for the scale was 0.76. The test-retest reliability was found to be 0.90.

Attitude towards Mathematics Scale (Fennema & Sherman, 1976) was used to measure the individuals' attitude towards mathematics. ATMS has 22 items made up 11 positively worded and 11 negatively worded constructed on a four – point Likert – type Scale ranging from 1= Strongly Disagree to 4= Strongly Agree. The reliability coefficient Cronbach alpha for the Scale was 0.82. The test-retest reliability was found to be 0.89.

Mathematics Achievement Test (MAT). This test was made up of 50 multiple – choice items with four options A – D. The test items were constructed by the researchers based on the syllabus for Senior

Secondary School (SSS) 2 classes. To establish the highest degree of reliability, the test was pre-tested on a small sample of (n=60) randomly selected from Senior Secondary School (SSS) 2 students. The internal consistencies reliability co-efficient (Cronbach's alpha) for the sub scale reported was 0.77. The test re-test reliability measure of the test with interval of 3 weeks was 0.79.

Procedure

Permissions were obtained from the principals of the sampled schools after which the researchers administered the questionnaires on the participants. All the participants of the study were administered the four instruments namely: Mathematics Self Efficacy Scale, Mathematics Test Anxiety Scale, Attitude towards Mathematics Scale and Mathematics Achievement Test in their respective schools by the researcher. The researchers with the cooperation of teachers participated in the distribution and collection of the questionnaires from the respondents. Informed consent of the participants was also sought before the administration of the questionnaire.

Data Analysis

The data were analysed using multiple regression analysis tested at the 0.05 level of significance in order to establish the prediction among the independent variables (Mathematics Self efficacy, Mathematics Test anxiety and Attitude towards mathematics) on dependent variable (Mathematics Achievement). It should be noted that the students' scores in Mathematics Achievement Test were used for computation.

Results

Table 1: Mean, Standard deviations and inter-correlations among the predictors and Mathematics Achievement (n= 200)

Variable	1	2	3	4
Mathematics Achievement	1.000			
Mathematics Self-efficacy	.309**	1.000		
Attitude towards Mathematics	.432**	.177*	1.000	
Test Anxiety	.302**	.518**	-.021	1.000
Mean	46.97	49.70	51.10	54.60
Standard Deviation	13.50	17.67	9.72	11.47

*P<0.05

The correlation matrix, mean and standard deviations of the measured variables are presented in Table 1. The results revealed that all the independent variables were significantly correlated with mathematics achievement. Mathematics self-efficacy (r = .309; p<0.05); Attitude towards mathematics (r = .432; p<0.05) and Test Anxiety (r = .302; p<0.05).

Table 2: **Regression summary table showing the joint effect of the independent variables on the Mathematics Achievement among Secondary School Students.**

R = 0.571
R^2 = 0.326
Adj. R^2 = 0.313
Std. Error = 9.5069

Source	**Df**	**SS**	**MS**	**F**	**Sig**
Regression	3	6615,580	2205.193	24.399	0.000
Residual	196	13647.620	90.382		
Total	199	20263.200			

Table 2 shows the prediction of all the three independent variables to the dependent variable yielded a coefficient regression R = .571, multiple R^2 = .326, Accounting for 32.6% of the variation in the Mathematics Achievement among the students. Thus, the result from table 1 shows that each of the independent variable (mathematics self-efficacy, test anxiety and mathematics attitude) jointly predicts the mathematics achievement among students. F (3; 196) = 24.399; P < 0.05.

Table 3: Relative contribution of the independent variables to the mathematics achievement among students

Variables	**B**	**SEB**	**(β)**	**T**	**Sig**
Mathematics self-efficacy	0.311	0.046	0.479	6.818	0.000
Mathematics attitude	0.208	0.065	0.245	3.195	0.002
Test anxiety	-4.863	-1.706	0.211	2.851	0.005

Results in Table 3 show the relative contribution of each of the independent variables to the prediction of the mathematics achievement among students. Mathematics self-efficacy
(B = 0.311, t = 6.818, P < 0.05); Mathematics Attitude (B = .208, t = 3.195, P < 0.05) and Test anxiety (B = -4.863, t = 2.851, P < 0.05).

Discussion

Results of the present study reveal that mathematics self-efficacy is a significant predictor of mathematics achievement. This finding is consistent with the earlier research findings of Busch (1995) and Hackett (1985, 1989) who found that self – efficacy beliefs are positively related to influence mathematics achievement. This result is easily explainable bearing in mind that self-efficacy which has turned to be an important predictor for achievement is likely to influence students to have an inherent inclination towards mathematics achievement. It is certainly not surprising that students who have strong efficacy are persistent in their effort reading and studying for their examination would have a high mathematics achievement than those who have weak self-efficacy and apply little effort at their studies.

The findings of this study indicate that attitude toward mathematics was found to be a significant predictor of mathematics achievement. This result is in consonance with prior studies Chang (1990); Ma (1997); Lubinski and Berbow (2002) who found that attitude influences success and persistence in the study of mathematics. The possible explanation for the result may not be unconnected with a functional perspective. Attitude is an important motivator of behaviour and affects the achievement of students. A child's attitude towards his work affects his worth whileness in his activities.

Test anxiety was found to be a significant predictor of mathematics achievement of the students. This result is in consonance with prior studies (Clute, 1984, Ma, 1999; Mazzone et al, 2004) who found that high achievement in mathematics is related to low anxiety for students. Anxiety is a very common symptoms and a certain amount is useful to the individual as it acts as stimulants and increases efficiency. An explanation for this finding is that any student who performs poorly in mathematics may be exhibiting test anxiety as a result of lack of interest in mathematics.

Implication of Findings for Educational and Counselling Practice

These findings have some implications for the work of teachers and counselling psychologists to note that test anxiety has been identified by many students as an important problem they want help in dealing with Counselling Psychologist should be prepared to offer remedial assistance.

There is need for Educational Psychologist and other stakeholders in education industry to organize periodic seminars and workshops for students, parents, teachers and school administrators to promote positive attitudes towards mathematics.

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