AFFECTIVE VARIABLES AS PREDICTORS OF JUNIOR SECONDARY SCHOOL STUDENTS' ACADEMIC ACHIEVEMENT IN SCIENCE AND MATHEMATICS IN OGOJA EDUCATION ZONE OF CROSS RIVER STATE, NIGERIA

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ABSTRACT: *This ex-post facto was conducted to investigate the extent to which affective variables predict academic achievement in Science and Mathematics among students in junior secondary three (JSS 3) in Ogoja Education Zone of Cross River State, Nigeria. One research question and hypothesis were formulated to guide the study. 490 participants were randomly drawn from a population of 3,464 within the research location. The Affective Variable Questionnaire (AVQ), Basic Science Achievement Test (BSAT) and Mathematics Achievement Test (MAT) served as data sources. Data were analyzed via the Multiple Regression analysis. Findings indicated that test anxiety, attitude, self-concept and social responsibility are significant predictors of achievement in Basic Science and Mathematics. However students' attribution, interest and gender are not significant predictors of Basic Science and Mathematics achievements. It is recommended that science and mathematics educators should develop positive relationship with students and also stress classroom activities that would encourage active students' participation.*

KEYWORDS: affective variables, test anxiety, attribution, science , mathematics   achievement

INTRODUCTION

In development of Nations, Science and Mathematics Education play a pivotal role. Ogunkola (2008) noted that without Science and Mathematics, there is no modern technology and without modern technology, there is no modern Society. Hence, any nation that seeks development must give the study of Science, Technology and Mathematics (STM) sufficient attention at various levels of her educational system. Salend (2012) affirmed that the main vocabulary that facilitates the comprehension of scientific concepts is mathematics, without which no meaningful learning could occur. In the same vein, Amoo (2013) asserted that mathematical ability influences students' learning in all areas of science that require mathematical skills. This makes proficiency in mathematics very imperative to every student in secondary school. Mathematics knowledge is necessary in learning other science subjects but inspite of its significance; one begins to wonder why academic achievement in the subject has been dwindling beyond measure over the years

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(Ogun Kola, 2016). The problem of under achievement in science and mathematics could hinder national development. For a nation like Nigeria whose attainments in science and technology is very vital, under achievement of students in science and mathematics has become a source of concern to parents, government and educators. Basic science and mathematics are core subjects in junior secondary school curriculum. Basic science in particular comprises cores subjects like Chemistry, Physics and Biology. It is most often perceived by junior students as a difficult subject. For this reason performance in the subject has always been poor. Explanation for the decline trend in performance has been based on some factors such as mathematics and science test anxiety, gender, student attitude towards mathematics and science, student self-concept, attribution of success/failure, student interest in science and mathematics and social responsibility. Mark and Ashcraft (2014) defined test anxiety as a feeling of strain, dread or fret which intrudes on academic achievement. Hembree (1999), portrays test anxiety as performance anxiety which generates from self-consciousness and self-doubt, it decreases success rate and increases the potentiality of failure.

Olatoye & Agbatogun (2009), had noted that test anxiety, motivation and self-concept have strong influence on academic achievement in science and mathematics. Salend (2012), outlined causes of test anxiety to include dread of failure, procrastination, prior under achievement, lack of self-confidence and distinctive properties of the test.

Madeleine (2013) defined attitude as a desire or tendency to approach or avoid something, person or situation. Madeleine explored the influence of attitude on science and mathematics achievement among fifth grade students in Southern part of Mississippi using a sample size of 266 respondents and questionnaire as research instrument. The result showed students' attitude as significant predictor of science and mathematics achievements.

Studies by Marsh, Trautwein, Koller & Baumert (2005) and Loni (2007) to determine the direction of relationship between self concept and academic achievement in science and mathematics are somewhat contradictory. The study of Marsh, Trautwein, Koller & Baumer in particular among eighth grade students showed self-concept as significant factor in science and mathematics achievement. Whereas similar study by Loni among ninth grade students in Johannesburg indicated that self concept is not a significant factor in science and mathematics achievements. Rana, Muammer and Zeynap (2011) observed that students put in more efforts when they believed that the outcome of an event in their life is dependent on their action while Kutanis (2010) argued that students who relate the outcome of an event to occurrences beyond their control will not be motivated enough to put in their best.

Interest as defined by Krapp (2002) is individual discrete entity demonstrated amidst intrigue-based actions that are impulsively driven by the concern to learn more about that entity of interest. This is demonstrated by expressing primarily positive feelings and value as the individual focuses on the entity. A study by Sunday and Gbone (2012) on students' attitude and interest as factors in

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science and mathematics achievement showed that interest in science and mathematics is a stronger factor than attitude. In the same vein, a longitudinal study of Andy and Tracy (2014) using interest inventory and sample size of 858 respondents for a period of seven years showed interest as a more significant factor in achievement in science and mathematics. However, similar study by Goulant and Bendi (2011) among 4th and 5th grades classes in Portugal showed that students' interest in science and mathematics do not significantly predict achievement in science and mathematics.

Kattey (2000) observed that social responsibility makes learning easier and enhance performance as well as promote positive interaction between teachers and students. Other educators like Parker and Asher (1987) maintained that social responsibility is related to other aspects of school activities. A study by Naderi, Abdullah, Aizan, Sharir & Kumar (2009) on gender as a factor in science and mathematics achievement in Malaysian University students showed that gender is not a significant factor in science and mathematics achievements. On the part of Akintunde & Yakassai (2010), their study on gender as determinant of academic achievement in science among secondary school students in Oyo State showed no factual disparity in achievement. Against this backdrop, this study investigated affective variables as predictors of academic achievement of junior secondary three (JSS 3) students in Ogoja Education Zone of Cross River State. It explores affective variables of test anxiety, attitude towards science and mathematics, attribution of success/failure, gender, self-concept, student interest and social responsibility as factors in science and mathematics achievements.

Statement of the problem

Academic achievement of students in basic science and mathematics in Nigeria schools has overtime been declining despite the increasing need of these subjects for technological advancement. Several explanations have been offered for the students' low trend in science and mathematics achievements, some of which are anchored on student motivation to learn mathematics and basic science, student interest and perception of the relevance of mathematics and science, teacher factors and instructional methods. This dwindling achievement has become an issue of major concern to parents, teachers, states and scholars. This present study therefore is an attempt away from the cognitive aspects of students variables that may affect academic performance to investigating affective variables as possible factors in achievement of students in science and mathematics. The problem of this study therefore is encapsulated in the question stated thus: To what extent is test anxiety, student attitude towards science and mathematics, self-concept, students' interest and social responsibility are they factors in science and mathematics achievement of junior secondary school students?

Purpose of the study

The main purpose of the study is to determine the extent to which affective variables predict achievement in basic science and mathematics. Specifically, the study seeks to determine the extent to which affective variables of test anxiety, student attitude towards science and mathematics, self-concept, gender, attribution of success/ failure, students interest in science and mathematics and social responsibility predict achievement in science and mathematics.

Research Questions

The research question that guided the study is stated thus:

1. How do affective variables of test anxiety, attitude, self-concept, gender, attribution of success/failure, students' interest in science and mathematics and social responsibility predict academic achievement in science and mathematics among junior secondary school three (JSS 3) students?

Research Hypothesis

One null hypothesis guided the study and was tested at 0.05 level of significance.

1. Affective variables of test anxiety, students' attitude towards science and mathematics, self concept, gender attribution of success/failure, students interest in science and mathematics and social responsibility do not significantly predict academic achievement in science and mathematics.

METHOD

Design: The study adopted ex-post facto research design. This is because the affective variables under investigation had already occurred and the researcher had neither direct control over their occurrence nor the capacity to manipulate them.

Sample

The sample comprised four hundred and ninety (490) junior secondary school three (JSS 3) students drawn through stratified and simple random sampling technique from a population of 3,464 in Ogoja Education Zone of Cross River State, Nigeria.

Instrumentation

Three instruments namely Affective Variables Questionnaire (AVQ), Basic Science Achievement Test (BSAT) and Mathematics Achievement Test (MAT) were used to collect data for the study. The affective variables questionnaire comprised thirty items with four response options of Always (A), Most times (M), sometimes (S) and Never (N) to measure test anxiety, and social responsibility while scale of Strongly Agreed (SA), Agreed (A), Disagreed (D) and Strongly Disagreed (SD) was used to measure attitude towards science and mathematics, self concept and

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attribution variables. An interest inventory with two response options of yes or no was used to measure students interest in science and mathematics.

The Basic Science Achievement Test (BSAT) and Mathematics Achievement Test had thirty-five items each drawn from the JSS 3 Basic Science and Mathematics Curricula. The reliability of AVQ using the cronbach alpha yielded a mean reliability estimate ranging for 0.63 to 0.79 for all the affective variables under investigation. For the BSAT and MAT their reliability estimate using Pearson product moment correlation gave 0.77 and 0.81 respectively. The instrument were afterwards administered to the respondents in their respective schools with the assistance of the subjects teachers who also doubled as the research assistants. To achieve this, the researcher sought for permission from principals of the sampled schools and this helps to provide an endearing opportunity for maximum cooperation and attention from the subject teachers to administer as well as retrieved copies of the research instruments from all the respondents. The data obtained were analyzed using the multiple regression analysis.

RESULT

The multiple regression analysis was used to test the hypothesis at 0.05 level of significance. The results of the study are presented in tables 1 and 2.

Table 1

Regression analysis of the contributions of affective variables to Basic Science achievement

Model	Beta in	T	Sig.	Partial correlation	Collinearity Statistics Tolerance
GENDER	.017	.389	.697	.018	1.000
ATTI	.081	1.892	.373	.040	.920
SEFC	.092	1.938	.047	.083	.915
ATTRIB	.049	1.076	.282	.049	.961
SOR	.059	1.301	.194	.059	.963
INTERS	-.146	-3.315	.001	-.149	.997

a. Dependent Variable: BAT
b. Predictors in the Model: (constant), TA
c. Predictors in the Model: (constant), TA, INTERS
d. Predictors in the Model: (constant), TA, INTERS, SEFC

Table 2
Regression analysis of the contributions of affective variables to mathematics achievement

Model	Beta in	T	Sig.	Partial correlation	Collinearity Statistics		
					Tolerance	VIF	Minimum Tolerance
GENDER	.002	.039	.969	.002	1.000	1.000	1.000
ATTI	.092	1.87	.305	.046	.920	1.087	.920
SEFC	.084	1.89	.148	-.066	.915	1.093	.915
ATTRIB	.010	1.218	.828	.010	.961	1.040	.961
SOR	.096	2.101	.036	.095	.963	1.038	.963
INTERS	-.045	-.992	.322	-.045	.997	1.003	.997

a. Dependent Variable: BAT
b. Predictors in the Model: (constant), TA
c. Predictors in the Model: (constant), TA, SOR
d. Predictors in the Model: (constant), TA, SOR, SEFC

The result in table 1 showed that test anxiety is a significant predictor of Basic science achievement. The predictive strength of attitude on achievement in basic science is not statistically significant (B = .081, t = 1.892, p > .05). Self-concept was found to be a significant predictor of basic science achievement (B = .092, t = 1.938, p < .05). Attribution to success or failure was not significant predictor of students' achievement in basic science (B = .49, t = 1.078, p < .05). Similarly gender was not a significant predictor of students' achievement in Basic science (B= .017, t = .389, p < .05) Interest was equally not significant (B =-.146, t = -.335, p < .05). Social responsibility showed slight influence but not statistically significant (B = .059, t = 1.301, p > .05).

The result in table 2 showed that the variable of gender has no significant predictive power (B = .002, t = 0.039, p < 0.01) on students' mathematics achievement scores, however attitude (B = .092, t = 1.87, p < .05, df = 400). And student self-concept were significant with (B = .084, t = 1.89 p < .05) respectively. Attribution was not significant predictor of students' achievement in mathematics (B = .10, t = .218, p < .05). Social responsibility was significant (B = .09, t = 2.101, p < .05) while Interest was not significant (B = -.045, t = .992, p < .05).

DISCUSSION

The result of the analysis presented in tables 1 and 2 showed that gender, attribution of success/failure and interest in science and mathematics do not contribute significantly to both basic science and mathematics achievements. The findings reaffirms Akintunde & Yakassai (2010) in the study of gender as determinant of achievement in Science in Oyo State showed no factual

disparity in achievement on the basis of gender. This implies that both male and female students are equal in their achievement in science and mathematics. The result also gives credence to Goulant & Bendi (2011) that students' interest in science and mathematics do not significantly predict achievement in the subject. The findings also lends support to Kutanis (2010) that students who attribute the outcome of an event to occurrences beyond their control will not be motivated enough to put in their best efforts.

The result in tables 1 & 2 further indicated that attitude towards science and mathematics, self-concept and social responsibility are significant predictors of achievement in both science and mathematics. This agrees with the work of Madeleine (2013) on the relationship between attitude and achievement in science and mathematics among fifth grade students in Southern part of Mississippi which showed attitude as significant predictor of achievement. The findings corroborates Marsh, Trautwein, Koller & Baumert (2015) but however contradicts Loni (2009) on students self-concept as a factor in academic achievement in science and mathematics. The work of Marsh, Trautwein, Koller & Baumert indicated students' self concept as significant predictor of achievement in science and mathematics whereas study of Loni revealed that self concept is not a significant factor in science and mathematics achievements.

The result equally showed that social responsibility is a significant predictor of achievement in science and mathematics. This agrees with Kattey (2000) who observed that social responsibility makes learning easier, enhance achievement, and promote positive interaction between teachers and students. The implication therefore is that a student who knows what is required of him or her by the society will obviously put in efforts to achieve his or her desired goal in life. Undeniably, students appear to be interested in knowing more about themselves and about other people around them. In their various attempts at making sense of their experiences they engage in analyzing their own behaviour against their expectations.

Educational Implications

From this study, both science and mathematics teachers may discover how self concept, attitude towards science and mathematics, attribution of success/failure and social responsibility predicts students' achievement in science and mathematics. Such awareness could enable them make necessary adjustments in the interest of building better teacher-student relationship in science and mathematics classrooms.

Students could appreciate the influence of certain affective variables on their cognitive development vis-à-vis academic achievement in science and mathematics. Such information would help them to work towards controlling such variables in the learning of science and mathematics.

CONCLUSION AND RECOMMENDATIONS

The result of this study showed that self concept, attitude towards science and mathematics, attribution of success/failure as well as social responsibility are significant predictors of both science and mathematics achievement. This implies that the key to effective education lies in building better relationship between learners and teachers.

On the basis of the findings of the study, the following recommendation are made

1. Science and mathematics learning in schools should be programmed in a manner that would emphasize the co-operative and problem-solving approach, so that the topic dealt with are those that highlight the utilitarian purpose in science learning.
2. Great scientific discoveries should also be taught and how they have changed the course of society and human life. This would help to improve interest of learners in science and mathematics.
3. Educational programs should focus on improving social responsibility, student attitude toward science and mathematics, self-concept, interest in science and mathematics etc. This can be achieved by incorporating into students program, a variety of instructional activities, community based projects and challenging work that could stimulate and build their interest, self-confidence and science processes to accomplish every given academic task.
4. The factors that enable students to decide to learn science and mathematics should be highlighted to them based on gender. What works better for boys or for girls should be used appropriately to stimulate their interest and thus improve their attitude towards the subjects.

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