CORRELATES OF SELF-CONCEPT, ATTITUDE AND MATHEMATICS PERFORMANCE OF SENIOR SECONDARY SCHOOL STUDENTS IN NIGERIA

Stephen Tizhe Kojigili
Department of Science Education, Faculty of Education, Adamawa State University, Mubi, Nigeria
stephenkojigili@gmail.com

Abstract

The study investigated the correlates of senior students' mathematics self-concept, attitude, and mathematics performance in secondary school level of Nigeria. The population comprised all the secondary school students from the six states in Northeast, Nigeria. From the population, a total of 589 students were sampled from 18 schools purposively selected from four out of the six states in the zone. The instruments employed for the data collections were Mathematics Achievement Test (MAT) and a Mathematics Self-concept and Attitude Scale (MSCAS). The instruments were validated and the reliability was determined through test re-test method. Using Cronbach alpha analysis, high reliability coefficients of 0.83and 0.915 were obtained for MAT and MSCAS respectively. The statistical tools used in testing the hypotheses were t-test, Analysis of Variance (ANOVA), correlation, and multiple regression analysis. The results of the findings revealed that the students' self-concept correlates significantly with their attitude; and relationship exists significantly among students' self-concept, attitude and their performance. It was recommended among other things that students' mathematics

self-concept and attitude be improved in schools by making the teaching of mathematics practical oriented such that students see it interesting and pleasurable.

Keywords

Self-Concept, Attitude, Mathematics Performance, Correlate

1. Introduction

It is a known fact that no nation can effectively develop meaningfully beyond the quality of education of its citizen especially in areas of science, technology and mathematics. The vital role mathematics plays in the development of a nation and in fact in the life of an individual is not contestable. However, in spite of the importance of mathematics and the prominence accorded to it as it is taught every school day in Primary and Secondary schools of Nigeria, a good number of secondary school students perform poorly in the subject. One of the things compounding this problem is the common erroneous belief among students that mathematics is a very difficult subject. Just as pointed by Sherman & Christian (1976), many students are not confident about their mathematical ability to solve problems and such exhibit negative attitude towards the subject. Several factors have been linked to the poor performances of students in mathematics in Nigeria among which are self-concept and attitude.

For students to be able to acquire mathematics skills, concepts and processes effectively, they have to develop self-concept and positive attitudes toward mathematics. Academic performance is very important in identifying students' self-concept and attitude towards a subject area like mathematics. The terms self-concept and attitude are very crucial in the study of an individual student's affective and cognitive domains. Self-concept is a person's perception or view of self formed as a result of experience. Self-concept is "life being aware of itself" (Fromm, 1956). Also, self-concept, according to Byrne (1987), is attitudes, feelings and knowledge that individuals have about their skills, abilities, appearance and social acceptability. Furthermore, in the view of Markus and Nuriu (1986), self-concept is not simply an emotional response to experience; it is a complex cognitive schema that the individual creates from experience. Attitude, on the hand, is a person's feeling or belief towards something, or a subject like mathematics. In other words, attitude is an individual's disposition towards an object, thing or a subject like mathematics. Attitude towards mathematics, according to Neale (1969), is the an aggregated measure of liking or disliking of mathematics as a tendency to engage in or avoid mathematics activities; a belief that one is good or bad at mathematics, and a belief that it is useful or is useless.

1.1 Theoretical Framework

There are several theories regarding self-concept, attitude and academic achievement. Self-concept and attitude theories have a variety of dimensions, variables, processes and influences, and based on these various models were developed. This study therefore, adapted Shavelson (1976)'s model of Self-concept and Achievement as its theoretical framework. The model states that the way an individual thinks and acts affect his/her self-concept, attitude and academic achievement. The Shavelson's model is comprised of a global self-concept which is divided into academic and non-academic components. That is, self-concept is divided into two types namely; academic self-concept and non-academic self-concept. Academic self-concept is subdivided into subject-specific such as mathematics self-concept, English self-concept, etc. The development of a positive attitude, positive self-concept, self-efficacy and self-esteem required by a school child are all with the aim of attaining academic achievement. Hansford and Hattie (1982) reported from a meta-analysis of hundreds of studies that while a strong positive relationship exists between self-concept and performance in some studies, there was also a negative relationship in others especially those that applied more rigorous research designs. A similar study conducted in Nigeria by Bakare (1986) showed that there was a correlation of 0.38 between academic self-concept and achievement. Also, Uguma and Akpama (2005) reported that students' self-concept and academic performance relates significantly at the secondary school level in Ogoja Local Government Area, Nigeria.

However, Kadijevich (2008), in a related study of 33 countries that participated in TIMSS 2003, reported the variability of the correlation of self-confidence in learning mathematics and mathematics achievement from country to country such as from 0.04 for Indonesia to 0.61 for Korea, though on a small scale. Similarly, in other studies in Nigeria and some parts of the world, it was reported that there exists positive correlation between mathematics attitude and mathematics achievement (Mustapha & Muhammed, 2016; Adown, 2016). Students with poor attitude towards mathematics are most often than not associated with low self-concept and feeling of incompetence which are manifested as depreciating remarks and complete lack of success in mathematics (Tobias, 1999 in Sherman and Christian, 1976). Oluwa (1990) as cited in Obidigbo (2002) reported that people's achievement is the function of their perception of self and that an individual is motivated by a need to achieve at a level which is consistent with his/her current self-perception.
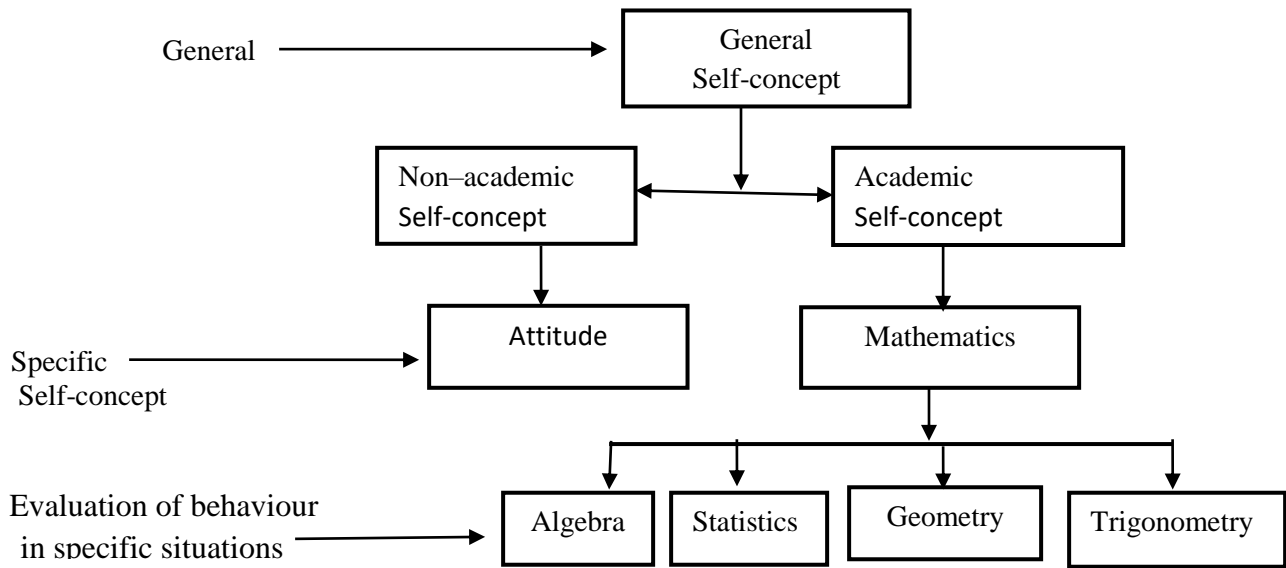
Figure 1: *Academic Self-Concept and Attitude Model*

Source: *Adapted from Shavelson, Hubner & Stanton (1976)'s Model of Academic Self-Concept*

The persistent poor mathematics performance among secondary school students in Nigeria in both internal and external examinations such as end of term examinations, examinations organized by West Africa Examination Council (WAEC) board, and National Examination Council (NECO) board has assumed prominence in the Northeast geopolitical zone is worrisome. This state of affairs has predated the emergence and problems of insurgency in the zone. There has been a persistent outcry regarding the students' low level of academic performance in mathematics in the secondary schools. This is evident in previous research reports such as those Yusa'u and Musa (2012), Kolawole (2013), Dahiru and Yusuf (2014), Kojigili (2015, 2017) and WAEC and NECO chief examiners' report over the years (from 2000 to 2019). Though there seems to be some progress recorded in mathematics performance in the 2014 and 2019 NECO examinations, there is still much to be desired. At least a credit pass in Mathematics is required for a student to enter tertiary level of education that would enable him/her study any science or science-related courses. The alarming poor performance of students in mathematics is a dangerous situation that could breed unrest and youth restiveness in the zone. Several studies carried out in Nigeria identified among others students' attitude and self-concept towards mathematics as principal factors for poor performance in the subject and this could constitute problem to the attainment of science and technological skills among the ever increasing youth population. It is however, not yet established whether the performance of the problem in the

Northeast, Nigeria, is related to mathematics self-concept and attitude of secondary school students in the region. It is on this basis that the study was carried out.

1.2 Purpose of the Study

The study was to set determine the correlates of students' self-concept, attitude, and mathematics performance. Specifically, the study was to determine:

i.   the extent of relationship exiting between students' self-concept and attitude to mathematics;

ii. the nature of students' self-concept and attitude to mathematics based on school type;

iii. correlates of students' self-concept, attitude and mathematics performance;

1.3 Research Questions

The research questions raised were as follows:

- What is the nature of students' self-concept and attitude to mathematics based on school type?

- What is the level of students' performance in mathematics?

- To what extent do self-concept and attitude affect students' mathematics performance?

- Which of self-concept and attitude is a better predictor of mathematics performance?

1.4 Research Hypotheses

The hypotheses formulated for the study includes:

- There is no significant correlation between self-concept and attitude of students towards mathematics at the secondary school level.

- There is no significant multiple relationship among students' self-concept, attitude and mathematics performance at the senior secondary school level.

- The performance of students attending Public and Private secondary schools does not differ significantly in mathematics.

- There is no significant gender difference in students' mathematics performance.

- The predictive patterns of self-concept and attitude to mathematics performance do not significant differ.

2. Methodology

The population for the study comprised all the senior secondary school students in Northeast, Nigeria made up of six states which are Adamawa, Bauchi, Borno, Gombe, Taraba and Yobe States.

From the population, 589 students were purposively selected from 18 senior secondary schools in four of the six states putting into consideration school type, location and school ownership. The sample comprised 352 males and 237 females. The study employed the use of descriptive survey design. The instruments used comprised Mathematics Self-Concept and Attitude Scale (MSCAS) developed by the researcher (Kojigili, 2014; Kolawoe & Kojigili, 2015) based on modified Likert's four-point scale and a Mathematics Achievement Test (MAT). The scale (MSCAS) had 45 items. The MAT on the other hand, had 50 objective test items with five multiple-choice options with mid-range difficulty items which were made bearing in mind the academic levels of the students. Even though the MAT items were from the relevant standardized WAEC past questions, they were given to some experts to ascertain the content validity. The validity of the other instrument, the MSCAS, was ascertained previously (Kojigili, 2014). Also, the reliability of the instruments was established through a pilot test on a sample of 100 students different from the targeted sample. The reliability indices yielded from Cronbach alpha analysis were 0.83 for MAT and 0.915 for MSCAS.

The instruments were later administered to the targeted sample in all the sampled schools during the normal school periods. The students' performances in the MAT were scored out of 50% while the students' responses to the MSCAS were scored using a rating point of 4, 3, 2 and 1 for Strongly Agree (SA) to Strongly Disagree (SD), respectively. Descriptive statistics, t-test statistics, correlation, and multiple regression analysis were used in analysing and testing the hypotheses postulated.

3. Results

Hypothesis One: There is no significant correlation between self-concept and attitude of students towards mathematics at the secondary school level.

Table 1: *Correlation of Students' Mathematics Self-concept and Attitude*

		Self-concept	Attitude
Self-concept	Pearson Correlation	1	.617[**]
	Sig. (2-tailed)		.000
	N	589	589
Attitude	Pearson Correlation	.617[**]	1
	Sig. (2-tailed)	.000	
	N	589	

		589

Table 1 indicates that P < .05. Thus, there is significant correlation between self-concept and attitude towards mathematics.

Hypothesis Two: There is no significant correlation between students' self-concept, attitude and performance in mathematics at the secondary school level.

Table 2a: *Descriptive Statistics of Students' Self-concept, Attitude and Mathematics Performance*

Variables	N	$\bar{x}$	Std. Deviation
Self- Concept	589	69.66	9.758
Attitude	589	66.70	10.543
Performance	589	15.62	7.133

Table 2a shows the mean scores and standard deviation of students' self-concept, attitude and mathematics performance at the secondary school level.

Table 2b: *Correlation of Students' Self-concept, Attitude and Mathematics Performance*

	Self-concept	Attitude	Performance
Self-concept	1		
Attitude	.617**	1	
Performance	.077	.103*	1

** Correlation is significant at the 0.01 level (2-tailed)
* Correlation is significant at the 0.05 level (2-tailed)

From Table 2b, it is shows that self-concept and attitude correlates positively at 0.677, self-concept and mathematics performance correlates at 0.077 while attitude and mathematics performance correlates at 0.103.

Hypothesis Three: The performance of students attending Public and Private secondary schools does not differ significantly in mathematics.

Table 3: *Summary of t-test Analysis of Students' Performance in Mathematics based on School Ownership*

Variables	N	$\bar{x}$	df	t	Sig. (2-tailed)
Public schools	397	19.79			
			587	8.521	.000
Private schools	192	24.93			

 P < 0.05

From Table 3, it is shown that P < 0.05 and the t-value is 8.521 at df = 587. Thus, the null hypothesis is rejected and is significant

Hypothesis Four: There is no significant gender difference in students' mathematics performance.

Table 4: *Summary of t-test Analysis of Mathematics Performance of Secondary School Students based on Gender*

Variables	N	$\bar{x}$	SD	Df	t	Sig. (2-tailed)
Male	304	15.90	7.63			
				587	1.006	0.315
Female	285	15.31	6.56			

P > 0.05

Table 4 indicates that the t-value is 1.006 and df = 587; P > 0.05. Hence, we fail to reject the null hypothesis and as such it is not significant.

Hypothesis Five: The predictive patterns of self-concept and attitude to mathematics performance do not significant differ.

Table 5a: *Analysis of Students' Mathematics Self-concept, Attitude and Performance*

Source f Variation	Sum of Squares	df	Mean Square	F	Sig.
Regression	325.959	2	162.980		
				3.227	.040
Residual	29593.325	586	50.501		
Total	29919.284	588			

P< 0.05

The result in Table 5a indicates a significant difference in the predictive patterns of self-concept and mathematics performance among students (F= 3.227, df =586; P< 0.05). Hence, it is significant.

Table 5b: *Multiple Regression Analysis of the Prediction of Self-concept and Attitude on Dependent Variable*

Predictors	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	R	R^2 Adj.
	B	SE	Beta				
Constant	10.478	2.231		4.698	.000	.104	0.008
Self-concept	0.015	0 .038	0.021	.405	.686		
Attitude	0 .061	0.035	0.090	1.724	.085		

$P< 0.05$

The prediction equation of the variable is: $Y = a + b_1x_1 + b_2x_2$ where

Y = the predicted score of dependent variable; a = constant; b_1, b_2 = values of the independent variables; x_1, x_2 = predictor values.

Thus, $Y = 10.478 + .015x_1 + .061x_2$.

4. Discussion

One of the findings of this study as presented in Table 1 reveals that there is significant relationship between the students' mathematics self-concept and attitude towards mathematics. This finding is similar to those of Ajayi, Lawani, & Adeyanju (2011), and Afgani, Suryadi & Dahlan (2019) when they took a research at secondary school and undergraduate levels respectively. Table 2a on the other hand shows the mean scores and standard deviation of secondary school students' self-concept, attitude and mathematics performance which is part of the analysis to hypothesis two. Of all the variables, mathematics performance has the least mean score (15.62). Further finding of the study reveals that there is significant correlation between students' mathematics self-concept, attitude and performance but correlates weakly with their mathematics performance as shown in Table 2b. This correlation between self-concept and attitude is in line with the findings of Fennema and Shermaan (1976); Vale and Leder (2004); Bryant, 2015; Adown (2016). Even though the results of the findings indicated that students' mathematics self-concept and attitude correlated, the variables correlated because of the students' lack of positive disposition towards mathematics which of course affects their performance in the subject. It is a proven fact that negative attitude towards mathematics

and low self-concept affects mathematics performance and even academic performance in mathematics-related subjects in schools. Furthermore, when the knowledge of mathematics is lacking, it will definitely affect the individual student's future participation in science and technology-related fields of endeavour and of course national development. The result of the analysis to hypothesis three as shown in Table 3 indicates that the mathematics performance of Public and Private secondary school students differs (t=8.521, df = 587; $P < 0.05$). That is, the private school students have better performance than those students attending public secondary schools. On the other hand, Table 4 shows that the mathematics performance of male and female senior secondary school students of Northeast, Nigeria has no distinction. This can be attributed to the fact that their attitude towards the subject is the same. This contrary to the findings of Lee & Yikung (2018) on Junior high school students in Taiwan and that of George, Onwumah, Fagbohun, Adebayo and Olonade (2019) on performance of students in ICT.

The regression analysis to hypothesis five as presented in Table 5a indicates that the F–value is 3.227 and $P < 0.05$. This means indicates that a significant correlation exists in mathematics self-concept, attitude and mathematics performance of the students. From Table 5b, the prediction equation of the variable $Y = 10.478 + .015x_1 + .061x_2$. This means, putting the other variable (attitude) constant, for every unit increase in self-concept, there is a corresponding increase in of .015 (1.5%) in students' performance. Also, putting the variable self-concept constant, for every unit increase in attitude, there is a corresponding increase of .061(6.1%) in performance. This analysis further implies that though the two variables are predictors of students' mathematics performance, attitude is a better predictor than self-concept. Also, the students' mathematics self-concept and attitude all together only account for 0.8% of their mathematics performance. This is an indication that the students' mathematics self-concept and attitude is not positively imparting on their mathematics performance. This means that they do not have positive disposition towards mathematics.

5. Conclusion and Recommendations

5.1 Research Limitations

This research is limited to only self-concept, attitude and performance of students in mathematics. It is also limited to only senior secondary schools in northeastern states of Nigeria. Other subjects that are taught at senior secondary school level in Nigeria are not included.

5.2 Conclusion

Generally, the result of the findings shows significant relationship between students' mathematics self-concept and attitude towards mathematics at the secondary school level in the Northeast. This is also in agreement to the findings of Bryant (2015). On the other hand, the students' mathematics performance is not encouraging and this performance differs between those attending Public and Private secondary schools. This means mathematics self-concept and attitude of the students (Ansuategui & Miravet, 2017) is not favourably disposed to mathematics. Thus, with the increasing demand for mathematics in all fields of endeavour therefore, the teaching and learning of the subject in schools is a task that must be done properly, skillfully and seriously.

5.3 Recommendations

Based on the findings o the study, it is recommended that:

1) Teachers of mathematics should to endeavor always employ different teaching strategies which can encourage full participation by all students especially those with low self-concept and negative attitude towards mathematics.

2) Various means of motivational strategies should be employed by teachers of mathematics in order to raise the students' morale and create in them positive self-concept and attitude towards mathematics so that they can meaningfully participate in mathematics related courses in the future and for better skill acquisition good citizenship.

3) Mathematics teaching should also be practical–oriented and learner-friendly through using concrete instructional materials and its usefulness not only for skill acquisition but also for scientific and technological advancement be constantly emphasized to the students at all levels.

References

Adekunle, S. E.; Adewale S., Boyinbode O. K. (2019). Appraisal on perceived multimedia technologies as modern pedagogical tools for strategic improvement on teaching and learning. *International Journal of Modern Education and Computer Science*. https://doi.org/10.5815/ijmecs.2019.08.02

Adown, M. (2016). Students' attitude and self-concept as correlates of their achèvement in senior secondary school mathematics in Ankpa local gouvernement area of Kogi state. Available at: https://oer.unn.edu.ng/read/students-attitude-and-self-concept-as-correlates-of-

theirachievement-in-senior-secondary-school-mathematics-in-ankpa-local-government-area-of-kogi-state?rdr=1

Afgani, M. W.; Suryadi, D. & Dahlan, J. A. (2019). Undergraduate students self-concept and their mathematics procedural knowledge: the relationship, Infinity Journal. http://orcid.org/0000-0003-3761-851X] https://doi.org/10.22460/infinity.v8i1.p99-108

Ajayi, K. O. Lawani, A O. & Adeyanju, H. I. (2011).Effects of Students' Attitude and Self-Concept on Achievement in Senior Secondary School Mathematics in Ogun State, Nigeria. Journal of Research in National Development, 9(2).

Ansuategui, F. J. A. & Miravet, L. M. (2017). Emotional and cognitive effects of peer tutoring among secondary school mathematics students. International Journal of Mathematical Education in Science and Technology. https://doi.org/10.1080/0020739X.2017.1342284

Bakare, C. K. M. (1986). Construction and validation of student problem inventory. Ibadan: Psychoeducational Research Productions.

Byrne, B. M. (1987).The general/academic self-concept Nomological network: A review of construct validation research. Review of Educational Research, 54, 427–456. https://doi.org/10.3102/00346543054003427

Dahiru, B. M. &. Yusuf, A. (2014). Poor performance in senior secondary school mathematics in Katsina state: Implication for national development Abacus: The Journal of Mathematical Association of Nigeria (MAN), 39 (1), 199 – 209.

Fennema, E. & .Sherman, J. A, (1976). Fennema-Sherman Mathematics attitude scale: Instruments designed to measure attitudes toward the learning of mathematics by Females and Males. JSAS Catalog of Selected Documents in Psychology, 6(1), 31, https://doi.org/10.2307/748467

Fromm, E. (1956). The art of loving In W. W. Purkey (1988). Overview of self-concept cheory for Counselors. Highlights: An ERIC/CAP Digest. ERIC clearinghouse on counseling and personal services. Ann Arbor MI. Overview of Self-concept.Theory.htm.

George, T. O.; Onwumah, A. C.; Fagbohun, M. O.; Adebayo, M. E. & Olonade. O. Y. (2019). Gender Differences in ICT Studies, chapter 8, IGI Global.

Hansford, B. C &. Hattie, J. A. (1982). The Relationship between Self and Achievement/Performance Measures. Review of Educational Research, 52(1), 123–142. https://doi.org/10.3102/00346543052001123

Jen, T-H & Chien, C-L. (2008). The influence of the academic self-concept on academic achievement from a perspective of learning motivation (Draft)" The Proceedings of IRC.

Kadijevich, D. (2008). Relating dimensions of mathematics attitude to mathematics achievement. TIMSS 2003. Serbia. Retrieved fromZbornik- 08-2-006. htm.Pdf, https://doi.org/10.2298/ZIPI0802327K

Kolawole, E. B. (2013). Kolawole's problem-solving methods (KPS); A panacea to mathematical and life's problems. Standard Journal of Education and Essay, 1(16), 131– 141, http://www.researchwebpub.org/wjer.

Kolawole, E. B. & Kojigili, S. T. (2015, Feb.). Development and Validation of Self-Concept and Attitude Scale for Senior Secondary School Students in Nigeria. SCIENCEDOMAIN International: British Journal of Education, Society & Behavioural Science, 7(1), 42– 49. https://doi.org/10.9734/BJESBS/2015/14635

Kojigili, S. T. (2014). Construction of a scale for measuring self -concept and attitude of secondary school students to mathematics in Northeast, Nigeria". Unpublished PhD thesis, Faculty of Education, Ekiti State University, Ado-Ekiti, Nigeria.

Kojigili, S. T. (2015). An investigation into mathematics performance of senior secondary school students in Northeast Nigeria: Implications for sustainable development. Adamawa State University Journal of Scientific Research (ADSUJSR), 3(2), 189 – 197.

Kojigili, S. T. (2017). The falling standard of education in Nigeria: What went wrong?. A seminar paper presented at the All Nigeria Conference of Principals of Secondary Schools (ANCOPSS), Adamawa State Branch, Held at Government of Secondary School Mubi from 3rd – 4th August.

Lee, C. Y. & Yikung, H. (2018). Math Self-Concept and Mathematics Achievement: Examining Gender Variation and Reciprocal Relations among Junior High School Students in Taiwan. EURASIA Journal of Mathematics, Science and Technology Education, 14(4): 1239–1252 https://doi.org/10.29333/ejmste/82535

Markus, H. &. Nurius, P. (1986). Possible selves. In T. K. Crowl, S. Kaminsky & D. M. Podell. (1997). Educational psychology: Windows on teaching. Brown & Benchmark publishers.

Mustapha, A. Y. & Muhammed, k. (2016). Relationship between Students' Attitudes, level of test wiseness and their performance in mathematics in Nigerian Air force schools in Jos, Plateau

state, Nigeria. International Journal of Research in Science, Technology and Mathematics Education, 4(2), 255 – 262.

Neale, D. C. (1969).The role of attitudes in learning mathematics. The Arithmetic Teacher, 16, 631– 640.

Olowu, A. (1990). Contemporary issues in self-concept studies. In G. C. E. Obidigbo. (2002). The relationship between self-concept and academic performance of Nigerian students. Ife PsychologIA. An International Journal, 10(2), 20 – 26. https://doi.org/10.4314/ifep.v10i2.23451

Shavelson, R. J.; Hubner, J. J & Stanton, G. C. (1976). Self-concept: Validation of construct interpretations". Review of Educational Research, 46, 307 – 441, https://doi.org/10.3102/00346543046003407

Sherman, H. J. & Christian, M. (1999). Mathematics attitude and global self - concept: An investigation of the relationship. College student Journal. Retrieved on March 24th, 2009 from http://findarticles.com/p/a ticles/mi_1_0FCR/is_1_33/ai-62894059/pg

Tobias, S. Overcoming mathematics anxiety, In H. J. Sherman & M. Christian (1999). Mathematics attitude and global self- concept: An investigation of the relationship. College Student Journal. Retrieved on March 24th, 2009. Available: http://findarticles.com/p/ articles/mi1_m0FnCR/is_133/ai- 62894059/pg-.

Uguma, V. U. & Akpama, S. I. (2005). The Influence of Self-concept and Anxiety on Academic Performance of Senior Secondary School Students in Ogoja Local Government Area, Nigeria". International Journal of Education, 2 (1 & 2), 67 – 77.

Yusha'u, M. A. & Musa, M. (2012). Prevalence of learning difficulties and remediating dyscalculia students in junior secondary school students in Sokoto state. Abacus: The Journal of Mathematical Association of Nigeria (MAN), 37(1), 84 – 92.