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Students' Attitude towards Mathematics as a Predictor of their Academic Achievement in the Subject

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Abstract

This study was aimed at investigating the current issues related to the role of affective domain in enhancing effective learning. In particular, the study aimed at investigating whether or not students' attitude towards mathematics can serve as a predictor of their academic achievement in the subject, and whether or not there exist any significant difference between boys and girls in their attitudes towards mathematics. A descriptive correlational design was employed in the study with the population of 114,504 senior secondary school students spread across the 34 local government areas of Katsina state, Nigeria. The subjects were a sample of 383 students from 8 schools, selected using mixed / multistage sampling procedure and the Research Advisors 2006 guideline. The Modified Fennema-Sherman Mathematics Attitude Scale (FSMAS) was the instrument for data collection, and the data collected were analysed using both descriptive and inferential statistics. It was found that there was a significant relationship between students' attitudes towards mathematics and their academic achievement in the subject ($r = .756$, $P = .00$). Similarly, the findings revealed that significant gender difference exist in students' attitudes towards mathematics ($t = 5.736$, $P = .00$) in favour of male students. Based on the research findings, it was concluded that students' attitudes towards mathematics predict their academic achievement in the subject and that students have different attitudes towards mathematics. It was recommended that mathematics teachers in the country should have a means of assessing students' attitudes towards mathematics.

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Students identified with positive attitudes should be encouraged, while those with negative attitudes should be guided appropriately.
Keywords: Students' Attitude; Predictor; Academic Achievement; Mathematics.

INTRODUCTION

It is an undeniable fact that mathematics plays important roles in human existence both at the national, societal, and individual levels. Mathematics has often been termed the "gatekeeper" of success or failure for high school graduation and career success. A lack of sufficient mathematical skill and understanding affects one's ability to make critically important educational, life, and career decisions. Thus, mathematics plays a very vital role in the modernisation of this civilisation. Mathematics is everywhere and it affects the everyday lives of people. Although it is abstract and theoretical knowledge, it emerges from the real world (Sherman, Richardson, & Yard, 2014:1)

Mathematics is said to be the bedrock of all the sciences and the physical world in general. For instance, in our day-to-day activities like buying and selling, we apply some mathematics concepts like addition, subtraction, multiplication, division, ratio and proportion, etc. (Ojo, 1988). According to Brown & Porter (1993), without the mathematics of cryptography, there would not be possible the current level of electronic financial transactions crossing the world, and involving billions of dollars.

Despite these importance and other applications of mathematics in various field of human endeavours, secondary school students' performance in the subject is seriously the issue of concern to many researchers and other stakeholders in education. For instance, in a statistics provided by the West African Examination Council (WAEC) as reported in Daily Post, there has been a steady decline in candidates' performance across subjects, especially in the two vital subjects of English and mathematics. In the 2012 May / June West African Senior School Certificate Examination (WASSCE), *38.81* per cent of the total number of candidates that sat the examination had a minimum of five credit passes including English and Mathematics. This situation got worse in the following year; 2013, as the performance dipped to *36.57* per cent. It further deteriorated in 2014 as only *529,425* candidates out of the total *1,705,976* that took the examination (representing *31.28* per cent) had five credit passes including English and Mathematics(Godwin, 2014).

What could be responsible for this under achievement? Have the materials (mathematics curriculum) been sequential and in

logical order? Is there favourable atmosphere for learning mathematics? Do the students have positive attitude towards mathematics? As noted by Farooq & Shah (2008), students' attitudes towards learning mathematics play a crucial role in the teaching / learning process of mathematics. In fact, it affects their achievement in the subject to the extent that their success or failure in mathematics depends on their attitude towards the subject. Attitudes also influence the learners' rate of participation in the class during lessons, and it was found that positive attitude towards mathematics lead students towards success in mathematics achievement.

It was posited that a healthy attitude towards mathematics on the part of students may result from the teachers' attitude towards the subject. If the (mathematics) teacher dislikes mathematics or feels that the subject consists of rote learning devoid of understanding, he would transmit these feelings to the students. This teacher transmits into the students the feeling that mathematics is difficult. As a result of this, no matter what amount of effort, the students are not likely to make or develop interest in it (Bank, 1962). This idea was also supported by Korau (2006), and Popoola & Olarewaju (2010).

Mathematics phobia has been an academic disease and its virus has not yet been fully detected so as to get its effective treatment in the class. However, the symptoms of this disease are always observed on the faces of students when teaching and learning of mathematics take place in classes. As a result of students' hatred for mathematics, some of them refuse to improve on their interest in mathematics in the secondary school level and this attitude is carried over to tertiary institution. It has been observed that students form the habit of leaving the classroom either before or during the mathematics lesson under the pretence of easing themselves, students refuse to do assignments and this is one of the avenues whereby the teacher can know the students' problems, some do not make out time to practice the subject during the school or after the school hours (Popoola & Olarewaju, 2010).

Similarly, according to Blair (1975), the attitudes of students towards mathematics affect their work and learning, and that a brilliant student may perform poorly in the subject. Alonge (1988) asserted that if a student develops a kind of lukewarm attitude towards mathematics right from primary school, one may say that such student developed negative attitude towards mathematics as a result of poor attitude exhibited by the (mathematics) teacher towards the subject. Similarly, in the words of Blair (1975), if a student has positive attitude to school work, he

/she will experience some success and achieve more within his / her capacity.

Mathematics teachers and other researchers tried to find out relationship of attitude with student's academic achievement in mathematics during the last three or four decades. They came to know that success in teaching / learning process of mathematics depends in part upon the positive attitude towards mathematics (Popoola & Olarewaju, 2010). Therefore, serious efforts should be made to develop and gauge the positive attitude towards mathematics. Student's confidence is another ingredient for education of mathematics. In the opinion of Robson (1996), having a positive attitude towards mathematics means generally enjoying working with mathematics and having confidence in one's own ability to do it, but it does not mean that a student will display this positive attitude towards the whole area of mathematics all the time. Therefore, it is important that educators and researchers have access to instruments that are suitable for assessing students' attitude towards mathematics in all levels of education.

On the issue of gender differences regarding attitude towards mathematics, it was observed by Gutbezahl (1995) that there is a common belief that females are less mathematically capable than males. This belief is fairly constant across populations and classroom studies have shown that this belief is in place by the time children enter the third grade and it is mirrored by students' parents. By the time children enter kindergarten, parents expect girls to do better at verbal tasks and boys to do better at mathematics. This belief continues through elementary school, and on throughout the academic process.

Similarly, as noted by Mata, Monteiro, & Piexoto (2012), gender differences in attitude towards learning are a recurrent theme throughout the literature in academic studies in general and in mathematics studies in particular. Mathematics is often considered to be a domain in which boys are higher achievers, both in terms of attitude and self-concept. But contrary to this notion, findings from other researches show that mathematics achievement and grades do not differ significantly between boys and girls (e.g., Scafidi & Bui, 2010, Lindberg, Hyde, Petersen, & Linn, 2010). This similarity between the performance of males and females is clear in the meta-analysis conducted by Lindberg, Hyde, Petersen, & Linn, (2010). In their study, they gathered data from 242 different studies, totalling 1,286,350 students. The findings indicated that there were no significant gender differences, hence nearly equal male and female variances.

In line with this, Skaalvik & Skaalvik (2004) discovered that girls have lower mathematics self-concept than boys. However, results concerning gender differences in attitude are less consistent than those in self-concept. Some studies (e.g. Ma & Kishor, 1997, Eshun, 2004, Sanchez, Zimmerman, & Ye, 2004, and Asante, 2012) have reported significant differences when comparing girls' and boys' attitude towards mathematics. Nevertheless, there are a number of studies (e.g. Etsey & Snetzler, 1998, Nicolaidou & Philippou, 2003, Georgiou, Stavrinides, & Kalavana, 2007, Kogce, Yildiz, Aydin, & Altindag, 2009, and Mohamed & Waheed, 2011) where these differences are not identified.

In a nutshell, the role of affective domain in enhancing effective learning in any discipline cannot be neglected, hence students' attitude towards mathematics play significant role in enhancing their achievement in the subject as noted by various researchers. In line with this, the need to have an empirical study that will establish whether students' attitude towards mathematics can serve as a predictor of their achievement in the subject was what motivated the researcher to carry out this research, and despite the fact that there were other researches conducted for that purpose, this research is unique as it focused in the north-west part of Nigeria where these researches are very scarce.

STATEMENT OF THE PROBLEM

The main problem of this research was to determine whether or not students' attitude towards mathematics can serve as a predictor of their academic achievement in the subject. Similarly, it was among the problems of this research to find out whether or not there exists any significant gender difference in students' attitude towards mathematics.

OBJECTIVES OF THE STUDY

Based on the statement of the problem stated above, the objectives of this research were to:

1. Determine whether or not students' attitude towards mathematics predicts their academic achievement in the subject.
2. Determine whether or not there exists significant difference between boys and girls in their attitude towards mathematics.

RESEARCH QUESTIONS

Based on the above stated objectives, the following research questions were formulated to guide the study:

1. Is there any significant relationship between students' attitude towards mathematics and their academic achievement in the subject?
2. Is there any significant difference between boys and girls in their attitude towards mathematics?

RESEARCH HYPOTHESES

Based on the above research questions, the following research hypotheses were tested:

Ho1. There is no significant relationship between students' attitude towards mathematics and their academic achievement in the subject.

Ho2. There is no significant difference between boys and girls in their attitude towards mathematics.

METHODOLOGY

RESEARCH DESIGN

The design adopted for this study was a descriptive correlational design. This is because the study investigated whether or not students' attitude can serve as a predictor of their academic achievement in the subject. In other words, the study investigated if there exist any significant relationship between the variables of the study. A Correlational research is a kind of Quantitative research which involves determining relationship among two or more variables. It investigates a range of factors including the nature of the relationship between the variables and the theoretical model that might be developed and tested to explain these resultant correlations (Lomax & Li, 2013). A correlational research is looking for variables that seem to interact with each other so that when you can see one changing, you have an idea of how the other will change (Kowalczyk, 2015).

RESEARCH POPULATION

The target population of this research comprised all the students in all the senior secondary schools in Katsina state Nigeria. At the time of conducting this research, there were a total number of 175 senior secondary schools, with a total enrolment of 114,504 students, spread across all the 34 local government areas (LGAs) of the state. Some of these senior secondary schools were in rural areas while some were in urban areas, and some schools were Day schools and others were Boarding schools. Also, most of the Day

schools were mixed (that is, Boys and Girls) while the Boarding schools were single sex (that is, either Boys only or Girls only).

These 34 LGAs in the state were divided into 7 clusters called Zonal Inspectorates of Education (ZIEs). These ZIEs coordinate and supervise the activities of all the secondary schools under their control. They were located in the headquarters of the old seven LGAs that were in existence when the state was created in 1987. These old LGAs are Daura, Dutsin-ma, Funtua, Kankia, Katsina, Malumfashi, and Mani LGAs, and each ZIE has a certain number of local government areas under its supervision. The number of LGAs under each ZIE, the number of Senior Secondary Schools under each ZIE, as well as the respective number of Senior Secondary School students was as shown in table 1 below:

Table 1: Distribution of the Population by Zonal Inspectorate of Education

S/N	NAME OF Z.I.E.	NUMBER OF LGAs	NO. OF SENIOR SECONDARY SCHOOLS	NUMBER OF STUDENTS		TOTAL
				MALE	FEMALE	
1	Daura	5	21	8,712	2,113	10,825
2	Dutsin-ma	5	21	8,506	3,495	12,001
3	Funtua	6	31	18,265	6,132	24,397
4	Kankia	5	31	8,782	2,451	11,233
5	Katsina	6	29	20,884	12,091	32,975
6	Malumfashi	3	18	9,914	3,295	13,209
7	Mani	4	24	5,967	3,897	9,864
	TOTAL	**34**	**175**	**81,030**	**33,474**	**114,504**

Source: Katsina state Ministry of Education 2012 / 2013 Annual School Census Report

RESEARCH SAMPLE

In this study, each and every senior secondary school student of year two (SS II) stands a chance of being part of the research. The researcher purposefully chose SS II because they were more likely to be stable than the others. This is because at the time of data collection, some new intake (SS I) have not started lessons properly, and so they might not have developed either a positive or a negative attitude towards the school, talk less of any single subject say mathematics. Similarly, the final year students (SS III) were busy making necessary preparations for their final to the instrument.

examinations; as such they might not have enough time to respond honestly Also, because the schools as well as the students were many, the researcher systematically chose the required sample using The Research Advisors (2006) guideline, where the samples selected from each school chosen was proportional to the number of students in that school. Altogether, four out of the seven clusters (ZIEs) were randomly chosen. These were Funtua, Kankia, Katsina, and Malumfashi. Two schools from each cluster (one for Boys and one for Girls) were systematically chosen to participate in the research, making a total number of eight senior secondary schools in all. There were four schools in urban areas and the same number in rural areas. A total number of *383* students were randomly chosen as the research subjects. The table below shows the senior secondary schools chosen in each cluster (ZIE) based on gender and school location, the population of SS II in each school, as well as the proportionate sample size chosen in each school.

Table 2: Distribution of the Samples by ZIE, Schools, Gender, and Location

S/N	SCHOOLS	Z I E	GENDER	LOCATION	NUMBER OF SS II	SAMPLE
1	GSSS Faskari	Funtua	Male	Rural	215	28
2	GGDSS Funtua	Funtua	Female	Urban	1,054	132
3	GDSS Kankia	Kankia	Male	Urban	163	20
4	GGSSS Kaikai	Kankia	Female	Rural	338	42
5	GSSS Batagarawa	Katsina	Male	Rural	264	33
6	GGCK Katsina	Katsina	Female	Urban	668	82
7	GSS	Malumfa	Male	Urban	314	39

	Malumfashi	shi				
8	CGDSS Kafur	Malumfashi	Female	Rural	55	7
	TOTAL				**3,071**	**383**

Source: The Research Advisors Table for Determining Sample Size

SAMPLING TECHNIQUES

In this study, the researcher systematically chose the sample using Mixed or Multistage Random Sampling procedure. Two sampling techniques were used, viz.: Cluster Sampling technique and Simple Random Sampling technique. Cluster sampling technique is a type of sampling method where the researcher divides the population into separate groups called clusters, and a simple random sample of the clusters is then selected (Statistics and Probability Dictionary, 2014, and The Pennsylvania State University, 2014). This method can be used when natural but relatively homogeneous groupings are evident in a statistical population. The required information can be collected from a simple random sample of the elements within each selected group. This may be done for every element in these groups or a subsample of the elements may be selected within each of these groups. It reduces costs and produces more accurate results when most of the variation in the population is within the groups, not between them.

Again, Simple random sampling technique is a basic sampling technique where we select a group of subjects (a sample) for a study from a larger group (a population). Each individual is chosen entirely by chance and each member of the population has an equal chance of being included in the sample, and every possible sample of a given size has the same chance of selection; that is each member of the population is equally likely to be chosen at any stage in the sampling process (Easton & McColl, 2014). Initially, Cluster sampling technique was used in selecting the senior secondary schools to participate in the research, and then simple random sampling technique was used in selecting the required number of students that participated in the study from the participating schools.

DATA COLLECTION INSTRUMENT

The instrument used in collecting the data was the Modified Fennema-Sherman Mathematics Attitude Scale (FSMAS). The instrument was co-developed by Elizabeth Fennema and Julia A. Sherman in the year 1976, in order to study differences between

men and women in their attitudes towards learning mathematics as well as the influence of these attitudes on their performance in the subject. This scale has been the object of extensive studies and it has been translated into various languages and modified for application in different situations (Palacios, Arias, & Arias, 2014). The original version of the FSMAS comprised nine subscales, while the Modified version comprised four out of the nine subscales. Each item was measured on a five-point Likert scale as follows: SA = Strongly Agree, A = Agree, U = Undecided, D = Disagree and SD = Strongly Disagree.

SCORING PROCEDURE

As stated already, the modified FSMAS has four subscales viz. Confidence in learning mathematics, Mathematics as a male domain, Teachers' perception, and Usefulness of mathematics. Also, there is equal number of positive and negative items in each subscale (six items each), so the scoring procedure was that each positive item received the score based on points as follows: SA = 5, A = 4, U = 3, D = 2, and SD = 1. For each negative item the scoring was reversed as follows: SA = 1, A = 2, U = 3, D = 4, and SD = 5. These scores were added to get the total score of a student's attitude in each subscale. The highest possible score for each group of statements is 60 points and the highest overall score is 240 points. Moreover, higher scores indicate positive attitude while lower scores indicate negative attitude towards learning mathematics.

VALIDATION OF THE DATA COLLECTION INSTRUMENT

Initially, Fennema & Sherman (1976) established the factorial validity of the instrument. Later, other researchers (e.g. Elmore, Broadbooks, Pederson, & Bleyer, 1985, and Mulhern & Rae, 1998) supported their findings. For example, Elmore, Broadbooks, Pederson, & Bleyer (1985) administered the scale to 1541 students in the eighth and twelfth grade, and they performed a principal factor analysis on all the 108 items found on the original scale. Based on their analysis, they reported evidence for eight factors. Two of the subscales; Confidence in Learning Mathematics and Mathematics Anxiety were found to load on a single factor. Four items from the Effectance Motivation in Mathematics Scale also loaded on this factor. Correlations between the two scales were .79 for males and .80 for females.

Also, Mulhern & Rae (1998) extracted and rotated six factors of the instrument. This produced pre-rotation eigenvalues ranging from 22.7 to 3.1, accounting collectively for 45.7% of the

variance in participants' response. Earlier on, O'Neal, Ernest, McLean, & Templeton (1988) confirmed the existence of three factors of the Modified FSMAS using Varimax–Rotated Extraction procedure, and recently Liau, Kassim, & Tet Loke (2007) conducted Confirmatory factor analyses to investigate the factor validity of the nine-scale structure of the FSMAS. The nested model comparison methodology was used to compare the nine–factor and six–factor structure.

Again, the authors reported split-half reliabilities for these scales ranging from .86 to .93. Other researchers (e.g. Liau, Kassim, & Tet Loke, 2007, Alkhateeb, 2004, and Tapia & Marsh, 2004) supported these reliability indices in their findings. For example, Alkhateeb (2004) established reliability indices for the Arabic translation of the FSMAS ranging from .72 to .89 and Tapia & Marsh (2004) found the overall reliability of the FSMAS to be .97, and similarly, Liau, Kassim, & Tet Loke (2007) obtained reliability indices for the Malay version of the FSMAS. These alpha values ranged from .65 to .90 in favour of Confidence and Usefulness subscales.

In general, Mulhern & Rae (1998) established the internal consistency reliability for the original version of the FSMAS to be $\alpha = .96$. They also established alpha values for all the nine subscales as follows:

Table 3: Reliability Coefficients of the FSMAS (original version)

S/N	SUBSCALES	Cronbach's alpha (α)
1	Attitude towards Success in Mathematics	.84
2	Mathematics as a Male Domain	.85
3	Confidence in Learning Mathematics	.91
4	Mathematics Anxiety	.90
5	Effectance Motivation	.86
6	Usefulness of Mathematics	.88
7	Mother Perception	.84

8	Father Perception	.91
9	Teacher Perception	.83

Source: (Mulhern & Rae, 1998)

DATA COLLECTION PROCEDURE

The data for the study were collected as follows: First of all, after the researcher identified the required number of the research samples systematically using the techniques stated above, he then went ahead with the administration of the instrument so as to collect the relevant data for the research. With the help of research assistants, the instrument was distributed to the subjects and they were asked to respond to the items honestly.

Since the wordings of the instrument are clear, the researcher briefly informed the subjects what was expected of them objectively, without giving them the direction. They were asked to respond to the items instantly, choose the best options that apply to them, and never mind of what other students were doing. The students were given a duration of forty (40) minutes to finish and in some cases, some were given an extension of not more than ten (10) minutes. When they have finished, the scripts were then collected and arranged orderly and in a systematic way for easy identification and proper documentation. The researcher then consulted the school management to supply him with the students' academic achievements in mathematics during the last End-of-Term Examination. The raw scores were standardised to Z-scores and T-scores.

DATA ANALYSIS PROCEDURE

The data collected were analysed with the help of Statistical Package for Social Sciences (SPSS 16.0) using various statistics, including the descriptive statistics (mean, variance, and standard deviation). This idea was recommended by Bichi (2011) and Yakasai (2011) in order to organise, summarise and interpret the demographic characteristics of various parameters used in a study.

In order to determine whether or not there exist any significant relationship between students' attitude towards learning mathematics and their academic achievement in the subject, the researcher used the Pearson Product Moment Correlation (r). The use of this statistic was recommended by Lawal (2011) as"the most widely used method of measuring the degree of relationship

between two variables. The assumptions behind the use of this procedure are that there is a linear relationship between the two variables, the variables are casually related, and that, large number of independent causes is operating in both variables so as to produce normal distribution" (p. 48).

Finally, the researcher used t-test independent samples statistic in determining whether or not there exist any significant differences between boys and girls in their attitudes towards mathematics. The use of this statistic was also recommended by Lawal (2011), who asserted that "the basis of t-test independent samples is to find out the difference between the means of the two groups and furthermore ascertain whether or not it is significant" (p. 33).

RESULTS AND DISCUSSION

The data collected were analysed using descriptive and inferential statistics. The table below shows the summary / descriptive statistics of the data collected.

Table 4: Group Statistics for Students' Attitude towards Learning Mathematics and their Performance in the Subject

Parameter / Variable	Gender	N	Mean	Standard Deviation	Std. Error Mean
Students' Attitude towards learning Mathematics	Females	264	171.40	18.625	1.146
	Males	119	184.75	25.705	2.356
Students' Performance in Mathematics	Females	264	50.85	9.092	0.560
	Males	119	55.97	10.766	0.987

Source: SPSS Results for Hypotheses Ho1 and Ho2 (Group Statistics pp. 17-18)

From this table, it is clear that students' attitudes towards mathematics vary across gender with male students showing more positive attitudes than their female counterparts. By implication,

this means that male students have confidence in learning mathematics, they perceived mathematics as a useful subject to them, and that their teachers encourage them to study mathematics, and as a result, they have better academic achievement in mathematics than females, as indicated by this table.

HYPOTHESES TESTING

Ho1. There is no significant relationship between students' attitude towards mathematics and their academic achievement in the subject.

To test this research hypothesis, Pearson Product Moment Correlation Coefficient method was applied on the responses of the students. Thus, students' attitudes towards mathematics were correlated against their academic achievement in mathematics using SPSS 16.0. The table below shows the output results:

Table 5: Students' Attitude towards Learning Mathematics and their Performance in the Subject

		Attitude towards Learning Mathematics	Students' Performance in Mathematics
Attitude towards Learning Mathematics	Pearson Correlation	1	.756**
	Sig. (2-tailed)		.000
	N	383	383
Students' Performance in Mathematics	Pearson Correlation	.756**	1
	Sig. (2-tailed)	.000	
	N	383	383

**. Correlation is significant at the 0.01 level (2-tailed). Source: SPSS Results for Hypothesis Ho1 p. 17

Table 5 above indicated that the calculated Pearson Product Moment Correlation Coefficient of the Modified FSMAS was (*r = .756, P = .00).*Since this correlation is significant at 0.01 level of significance and the P-value is less than alpha (generally .05), then the above null hypothesis was rejected and consequently alternate hypothesis was adopted. This is based on the recommendation by Gabrenya (2003) that if the P-value is less than alpha (generally .05), you may reject the null hypothesis. So, the researcher concluded that there exists a significant relationship between

students' attitude towards learning mathematics and their academic performance in the subject.

Ho2. There is no significant difference between boys and girls in their attitude towards mathematics.

To test this research hypothesis, t-test independent samples statistic was used on the responses of the students using SPSS 16.0. Thus, students were grouped based on their gender, viz. males and females. The table below shows the output results:

Table6: t-test Analysis for Differences between Boys and Girls in their Attitude towards Mathematics.

Gender	N	Mean	Std. Deviation	df	t	P
Females	264	171.40	18.62533	381	-5.736	.000
Males	119	184.75	25.70505			

Source: SPSS Results for Hypothesis Ho2 p. 18

Table 6 above indicated that the absolute calculated t-value for the gender differences in students' attitude towards learning mathematics was (t = *5.736, P = .00*). Also, as recommended by Gabrenya (2003), if the P-value is less than alpha (generally .05), you may reject the null hypothesis. Now based on this recommendation, the above null hypothesis was rejected and consequently alternate hypothesis was adopted. So, the researcher concluded that there exists a significant gender difference in students' attitude towards learning mathematics with male students showing more positive attitude than females.

DISCUSSION

The findings from this study show the existence of a significant relationship between students' attitudes towards mathematics and their academic achievement in the subject (*r = .756, P = .00).*This finding agreed with the findings of other researchers (e.g. Nicolaidou & Philippou, 2003, Sanchez, Zimmerman, & Ye, 2004,

Farooq & Shah, 2008, Adediwura, 2011, Lipnevich, MacCann, Krumm, Burrus, & Roberts, 2011, Tshabalala & Ncube, 2012, Wong & Chen, 2012, and Mensah, Okyere, & Kuranchie, 2013). According to all these studies, the performance of students in mathematics is significantly related to the students' attitude towards mathematics. By virtue of this finding, this research has joined the school of thought that relates students' attitude significantly to students' academic achievement.

Also, other findings of this research were that there exists significant difference between boys and girls in their attitudes towards mathematics ($t = 5.736, P = .00$) in favour of male students. Male students show more positive attitude towards mathematics than their female counterpart. This finding supported the assertion of Gutbezahl (1995) and the findings of other researchers (e.g. Hyde, Fennema, Ryan, Frost, & Hopp, 1990, Skaalvik & Skaalvik, 2004, Eshun, 2004, Sanchez, Zimmerman, & Ye, 2004, and Asante, 2012). As explained by Gutbezahl (1995), parents treat boys and girls differently from birth. They are more physically active with boys than with girls and give boys more spatially complex toys and more opportunities to explore their physical worlds. This implies that parents allow boys more chances for active interaction with the physical world, but they talk more to girls. These differences contribute to the well-documented gender differences in spatial ability which is an important component of mathematics skills and facilitates comprehension of abstract mathematical concepts used in (algebra), geometry, trigonometry and calculus.

CONCLUSION AND RECOMMENDATIONS

CONCLUSION

The basic aim of this study was to determine whether or not students' attitude towards mathematics can serve as a predictor of their academic achievement in the subject as well as to determine whether or not there exist any significant difference between boys and girls in their attitude towards mathematics and in their academic achievement in the subject. Based on the findings of this study, the researcher concluded that there exists a significant relationship between students' attitude towards learning mathematics and their academic achievement in the subject, and there exist significant differences between boys and girls in their attitudes towards mathematics. Therefore, students' attitude

towards mathematics is a predictor of their academic achievement in the subject.

RECOMMENDATIONS

Based on the findings of this research, the researcher finally recommended as follows:

1. Mathematics teachers should carefully identify students with more positive attitude towards learning mathematics and encourage them, while those with more negative attitude should be guided appropriately.
2. In case where a student needs more counselling service as a result of extreme negative attitude towards learning mathematics, he/she should be referred to a guidance and counselling master for such a service.
3. Parents at home should encourage their children to learn mathematics, pointing out on the needs to learn mathematics as well as the everyday application of mathematical concepts in solving real life problems.
4. Similarly, parents should give more courage to their daughters that they are capable of and can learn mathematics better than their male counterpart, and give them the necessary support they might require.
5. Government at all levels should try to equip schools with necessary teaching and learning materials. More qualified mathematics teachers should be employed and instructional materials for teaching / learning mathematics should be made available to all schools. This will help students develop more positive attitude towards learning mathematics.
6. Mathematics clubs should be established in all secondary schools and mathematics laboratories should be constructed. This will facilitate easy access to mathematics equipment as well as make mathematics learning more active, and this will enable students develop more positive attitude towards learning mathematics.
7. Finally, students generally should develop more positive attitude towards learning mathematics. This is due to the fact that a

credit pass in mathematics is necessary in order to get admission into tertiary institutions for further studies.

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