Global Educational Research Journal: ISSN-2360-7963, Vol. 3(1): pp 247-257, January, 2015.

Full Length Research Paper

Assessment of students' performance in mathematics at the second cycle schools in the Kassena–Nankana municipality

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Accepted 7th January, 2015

The study was aimed at assessing students' performances in mathematics of some selected senior high schools in the Kassena Nankana municipality in the Upper East Region of Ghana. A total sample of one hundred and forty (140) students from three (3) selected schools in the Municipality was used for the study. The target population for the study was the final years of all the selected schools. The three (3) schools were considered as strata. With the help of some Teachers, the questionnaires were administered by using purposive sampling technique. Statistical Product and Service Solution (SPSS) version 16 was used in generating several outputs for analysis. The Multiple linear regressions were used for some of the analysis. The research findings indicated that, the major factors that cause students' low performance of students included teacher performance and inadequate textbooks. This implies that teacher performance is very necessary for a student to perform well as well as inadequate textbook. Parental factor and extra-curricular activities affect students' performances. The study also revealed that to assess students' performances, the variables must be taking into consideration: attendance of students in class, solving of mathematical problems on their own, engaging themselves in extra classes, students having study group and duration students study outside the classroom.

Keywords: Students' Mathematics, performances, Kassena Nankana municipality, Upper East Region of Ghana

INTRODUCTION

Background of study

The 1987 educational reform comprises the four year middle school and the traditional secondary system into the three year Junior High School (JHS) and four year Senior High School. The average age of JHS is twelve (12). Education is considered as an important index to measure societal development. Every nation develops the system of education to express and promote its unique socio-cultural identity and also to meet the challenges of the times. The role of educational development in mitigating several problems of the human society has been realized at all levels. The importance of quality mathematics education in nation building has also been realized by several nations including developed countries. Thus, improving mathematics and science education has been the priority of the policymaking agenda (Anon,2005). The role of teachers will also be pointed out by the study stating that students' scores on the perception of their mathematics teachers have the strongest correlation with their mathematics anxiety scores. The present investigation is concerning with students performance in mathematics in Navrongo. Formally, student admissions to the second cycle schools were based on the results of the standardized Common Entrance Examination, which was taken during the middle school years. Successful candidate complete a five year secondary school programme and then wrote the WAEC conducted examination for the General Certificate of Education at

the ordinary levels (GCE O-Level) in specialize subject of study. Mathematics is made compulsory for all levels of pre-tertiary institutions and first year universities education.

Problem statement

➢.Passing mathematics is the major criteria for entering into higher institution in Ghana.
➢ Mathematics being an important subject in the academic curriculum, it is then necessary to study the performance of students in mathematics in some selected schools in the Kasse-Nankana municipal.

Objective of the study

The objectives of the study are:
➢To ascertain students' performance in mathematics.
➢To ascertain the relationship between student performance and predictors of their performance.
➢To identify student attitudes towards the study of mathematics.
➢Find out the factors /causes that contribute to their performance.

Hypotheses

H_0: Predictors do not contribute to student performance.
H_1: Predictors contribute to student performance.

Significance of the study

The study of the performance of students will help in decision since a retrogression indicate fall in performance, which requires attention and positive regression indicates improvement in performance. The performance could be an indicative factor to determine whether the standard of Mathematics Education in the country is falling or improving. The study will also help to find out whether the mathematics syllabus is adequately covered by both teachers students. The study will inform students and parents, teachers and policy makers on the performance of students in mathematics.

Limitation of study

The following limitations were encountered:
➢ the sample may lead to certain level of error in study.
➢ unwillingness of institutions in question to deliver data.

LITERATURE REVIEW

Students' attitude towards mathematics

Some authorities regard attitude towards Mathematics as just a like or dislike for Mathematics, while others extend the meaning to embrace beliefs, ability, and usefulness of Mathematics. For Zan and Martino (2007), attitude towards Mathematics is just a positive or negative emotional disposition towards Mathematics. Neale (1969), however, defines attitude towards Mathematics as an aggregated measure of "a liking or disliking of Mathematics, a tendency to engage in or avoid Mathematical activities, a belief that one is good or bad at Mathematics and a belief that Mathematics is useful or useless". Similarly, Hart (1989) considers attitude towards Mathematics from multidimensional perspectives and defined an individual's attitude towards Mathematics as a more complex phenomenon characterized by the emotions that he associates with Mathematics, his beliefs about Mathematics and how he behaves towards Mathematics. A student can develop positive attitude towards Mathematics because he or she learns to associate positive experiences.

In general, the concepts students hold about Mathematics determine how they approach the subject. In many cases, students have been found to approach Mathematics as procedural and rule oriented.

This prevents them from experiencing the richness of Mathematics and the many approaches that could be used to develop competence in the subject. Attitude can also be gender related. There are many who hold the view that boys do better in Mathematics than girls. This belief tends to affect the attitude of girls towards Mathematics. Farooq and Shah (2008) in a study of secondary school students in Pakistan found that there was no significant difference in confidence of male and female students towards Mathematics at secondary school level. They rather found that students' success in Mathematics depended on attitude towards the subject. Researches that have been conducted to determine the relationship between students' attitude towards Mathematics and achievement in Mathematics have yielded contradictory results. Some studies have demonstrated a strong and significant relationship between Mathematics attitude and Mathematics achievement (Minato and Yanase, 1984, Randhawa and Beamer, 1992, Schenkel, 2009). Student beliefs and attitudes were found to have the potential to either facilitate or inhibit learning. Cheung (1998), in his study of 11-13 year olds, also discovered positive correlation between attitude and Mathematics achievement. The correlation showed that the more positive the attitude,

the higher the level of achievement in the student.

Teacher attitude towards mathematics

An understanding of how attitudes are learned should establish a connection between teachers and students' attitudes, and attitudes and performance. Schofield (1981) reports that positive teacher attitude towards Mathematics was significantly related to high achievement in pupils. Bridget, Vemberg, Twemlow Fonag, and Dill (2008) studied how the teachers' attitude contributed to students' academic performance and behaviour. The study unveiled, among other things, that students with more devoted teachers were regarded by their peers as helpful to victims of bullying relative to students with less devoted teachers. The study also disclosed that students with the devoted teachers had the courage and determination to face difficulties in school life. Teachers were recognized as those who provided support, encouraged students and their value for love eradicated unwanted behaviour in students. Unfortunately however, many teachers seldom realize that how they teach, how they behave and how they interact with students can be more paramount than what they teach (Yara, 2009).

Studies confirm that emotional responses toward Mathematics that are found in teachers include like and dislike of Mathematics, anxiety associated with Mathematics and self-confidence in relation to Mathematics (Phillipou and Christou, 1998, Brady and Bowd, 2005, Henderson and Rodrigues, 2008). These emotional factors have been found to have an impact on student performance. The learner draws from the teacher's disposition to form his own attitude which may affect their learning outcomes. Teachers' beliefs about Mathematics such as the usefulness of Mathematics, the way Mathematics should be learned, the difficulty or ease of Mathematics, as well as gender ability and beliefs also affect their attitude towards the subject and impact on students' performance. According to Philippou and Christou (1998), teachers' beliefs about the utility of Mathematics are often found to correlate with either a more positive or negative attitude towards the subject. It is believed that a teacher who sees no usefulness of Mathematics in the real world and believes that Mathematics should be learnt as a set of rules and algorithms will require his students to memorize procedures and rules without meaning. This is a negative outlook that will make his students develop a negative attitude towards the subject. Usually, the way that Mathematics is represented in the classroom and perceived by students, even when teachers believe they are presenting it in authentic and context dependent way stands to alienate many students from Mathematics (Barton, 2000, Furinghelti and Pekhoren, 2002).

Students' performance

Ehiametator (1990) reported that to enhance the learning of students, the presentation of the subject should be followed by assignment. He stated that one thing common with students is that they seem to understand a problem when the teacher is in class teaching a particular subject but when they are left on their own; they find out that solving a similar problem is not easy as it was in class. The assignment also provides assistance to the teacher in determining areas of students' weaknesses.

Ehiametator (1990) and Farrant (1982) reported with a different perspective and said that the learning environment is as important factor in achievement and learning. They said if the environment is conducive, the students are likely to learn effectively. Moore (1998) maintained that, teachers should be enthusiastic in their teaching, because enthusiastic teachers produce higher academic achievers. Farrant (1982) again said that peer teaching is a measure to improve the teaching situation. In peer teaching students supplement the work of the teacher by communicating to the other students those lessons they have been taught by the teacher. He said this is a way of encouraging bright students to exercise their gift of talent. The statement explains the need to create a good environment for learning to take effective course.

The importance of teaching and of how teachers teach in their classrooms is being recognized as key importance in many ways. It is shown in the increased involvement of government in actually trying to determine how teachers teach, either through more prescriptive approaches. Furthermore, the class factors contributing to effective student's outcome were structured sessions, intellectually challenging teaching, a work oriented environment, communication between teachers and pupils, and a limited focus within the sessions. Effective teaching in higher education places students in situations where they are encouraged to develop complex concepts and put them into practice. Experiential learning through simulation requires an individual to become personally involved in the educational experience (Zapalska et al, 2002). All students, regardless of age, race, or religion, have an equal right to effective education, but they also have ethnic and cultural differences that influence learning and achievement (Witkin and Berry, 1975; Witkin and Good enough, 1981; Witkin*et al*., 1977). The most important conclusion that can be drawn from these studies is that students from different subcultures can have different patterns of preferred learning strategies. Culture defines the values, customs, beliefs, communication patterns, and aesthetic standards that are passed from one generation to the next. The

Table 1: Gender of the Respondents

Gender	Frequency	Percent (%)
Male	117	83.6
Female	23	16.4
Total	140	100

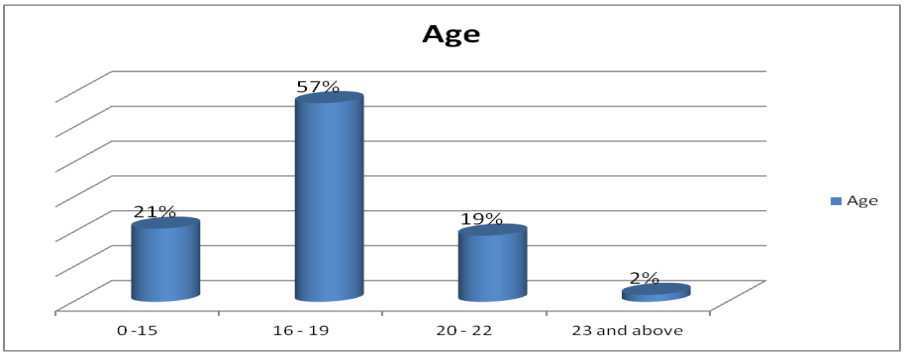

Figure 1: Ages of respondents

particular dimensions which serve as a cohesive cultural force help to define the behaviour of a society.

METHODOLOGY

Research design

The research design used for the study was descriptive design. According to Busha and Harter (1980) cited in Adebi-Caesar (2012) the descriptive research design is capable of collecting background information and hard to find data and that the researcher would not be able to motivate or influence the respondents' responses. Sproul (1995) also recommends the use of the survey technique for research where ideas, comments, attitude and public opinion on a problem or an issue are studied.

Population

The target population for the study comprises 175 students from three different schools in the Kassena - Nankana Municipality in the Upper East Region of Ghana. Simple random sampling without replacement was employed to select the three out of six SHS in the Municipality. There were 78 students from school A, 56 students from school B, 41 students from C. All these three schools are government schools. School A is a mixed school, school B is a girl's school and school B is a boy's school.

Research instruments

The study employed the use of questionnaire. The questionnaires were mainly used to gather information from students of the selected secondary schools. The interview guide was also used to gather information from some teachers where additional data was gathered. The questionnaire was designed by the researcher.

Sample and sampling procedure

The sample consists of 178 students. The sample was selected in such a way that a conclusion or inferences drawn from the study can be generalized for the entire population. Leady (1993) cited in Adebi-Caesar (2012) defines sampling as the process of choosing from a much larger population, a group about which a generalized statement is made, so that the selected parts represent the total group.

Statistical analysis procedure

Data collected for the study was analyzed by using SPSS and multiple linear regressions data presentation, analysis and discussion

Demographic characteristics and information

From the table 1 above, 16.4% of the respondents represent females whiles 83.6% of the respondents represent males. Thus, the majority of students used in this study were males.
Figure 1 shows that majority of the respondents are between the ages of 16 to 19 years indicating the prime ages of the students.
Table 2 shows the distribution of schools used in the study. Majority of the respondents were males. This does not show gender equality.

Table 2: Targeted schools

Name of School	Frequency	Percentage (%)
Navrongo senior high	65	46.4
Notre Dame Seminary	40	28.5
Our Lady Of Lourdes	35	25
Total	140	100

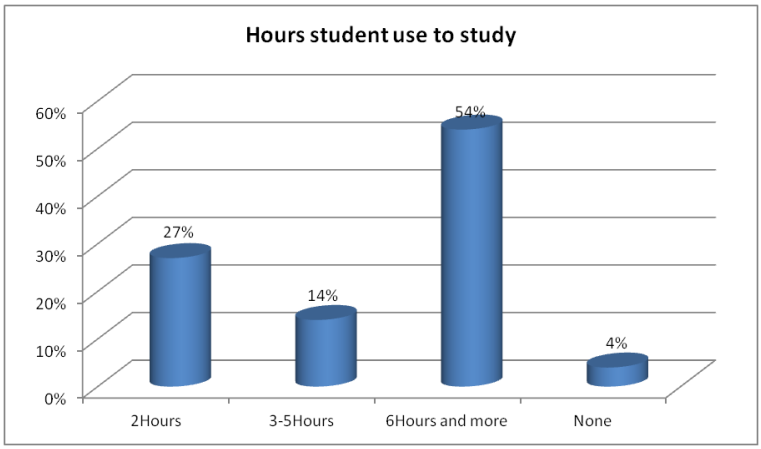

Figure 2: Hours student use to study outside normal school hours

Table 3: Students performance in mathematics

Remarks	Frequency	Percentage	Cumulative Percent
Excellent	25	17.9	17.9
Very Good	40	28.6	46.5
Good	66	47.14	93
Poor	9	7	100
Total	140	100	

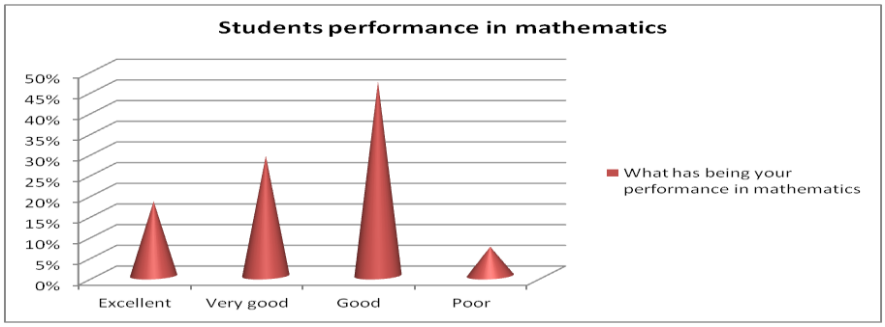

Figure 3: Students performance in mathematics

Assessment of performance of students in mathematics

In order to carry out the study, the researcher asked the respondents questions concerning:

- Study time of student outside the class.
- Student performance.
- Mark of student

Their responses were represented in the figure below. From figure 2, 76 (54.3%) respondents indicating majority of the students study six hours and more. This indicates that students are serious and willing to learn more.

From table 3, 131 respondents representing 93% perform above average. This can be related to more hours students spend to learn (Figure 3).

Table 4: Marks of students in mathematics

Scores	Frequency	Percentage	Cumulative Percent
Below 40	9	6.4	6.4
40 – 49	15	10.7	17.1
50 – 59	51	36.4	53.5
60 – 69	40	28.6	82.1
70 and above	25	17.9	100
Total	140	100	

Table 5: Students' engagement in extra classes.

Responses	Frequency	Percentage	Cumulative Percent
Yes	30	21.4	21.4
No	110	78.6	100
Total	140	140	

Table 6: Factors that affects students' performance

Factors	Frequency	Percentage	Cumulative Percent
Inadequate textbooks	46	32.9	32.9
No textbook	12	8.6	41.5
Teacher Performance	46	32.9	74.4
Co-curriculum activities	22	15.7	90
Parent factor	14	10	100
Totals	140	100	

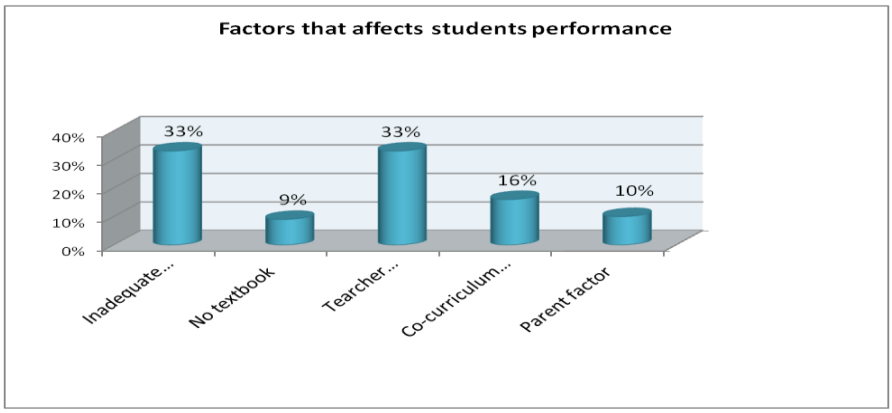

Figure 4: Factors that affects students performance

From Table 4, 139 representing 93% of the respondents scored above pass mark of 40%. This result shows that students' performance in mathematics is encouraging.

The factors that contribute to students' performance

In order to answer this question, the researcher asked the respondent these questions,

- Engage in extra classes,
- Factors that affects student performance.

The researcher answers the question with these responses from the table below.

The Table 5 tells us that a few students engage themselves in extra classes. This could be attributed to the fact that students want to have enough time for their private studies after normal school lessons.

The researcher found out that inadequate textbooks and teacher performance were the highest responses chosen by respondents. Thus, students were of the view that if adequate and requisite textbooks and teachers improve upon their performances, they will excel in mathematics (Table 6 and Figure 4).

Table 7: Class attendance

Responses	Frequency	Percent
Yes	122	87.1
No	18	12.9
Total	140	100

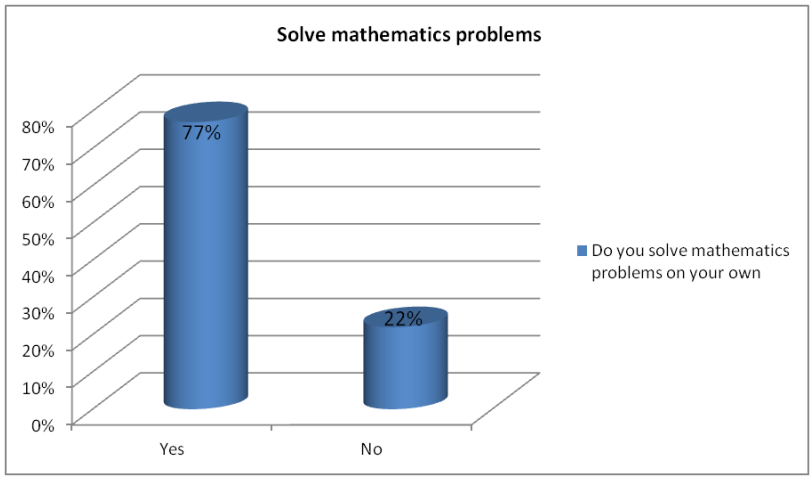

Figure 5: Solve mathematics problem

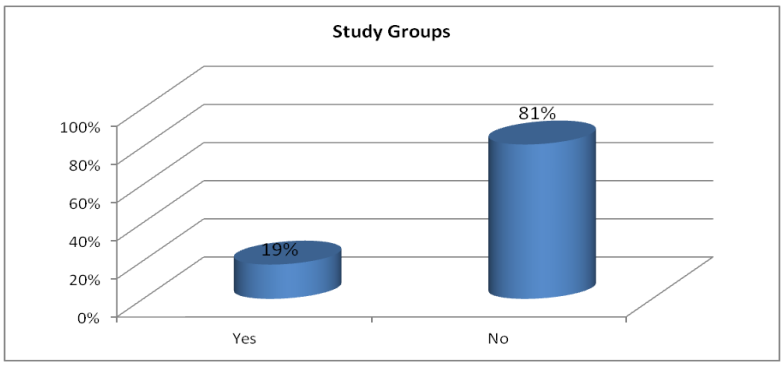

Figure 6: Study groups

Students' attitude towards mathematics

The researcher asked the respondents questions involving:
1. Class attendance. 2. Solve mathematics problem. 3. Study groups.
The responses given by the respondent that "if they do attend mathematics class always" were as shown in the Table 7. 122 students indicating majority of the students attend mathematics class always.
Thus most of the students are not truants and can also be associated with the interest they have in the subject.
Respondents response on either they do solve mathematics problem on their own depicted that 108 representing 77.1% of the respondents indicated Yes indicating their seriousness in learning mathematics (Figure 5).
Figure 6 shows that if respondent do have study groups. 114 out of 140 respondents representing 81.4% had study groups.

Students' preference in both core and elective mathematics

In order to find out from the students' preferences of topics both in core and elective mathematics, the researcher made them to rank them in order of

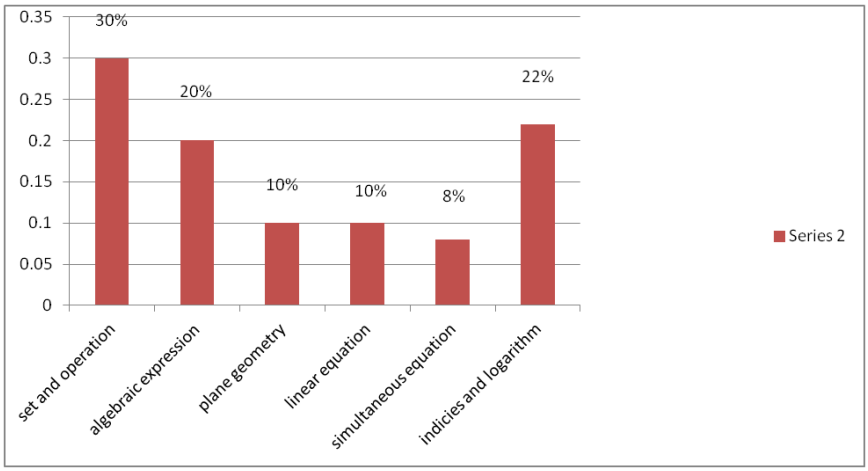

Figure 7: Preference in Core mathematics

Table 8: Elective mathematics topics

Topics	Frequency	Percentage (%)
Algebra	15	10.7
Co-ordinate geometry	5	3.6
Probability	20	14.3
Vector	8	5.7
Trigonometry	30	21.4
Calculus	17	12.1
Statistics	25	17.9
Mechanics	2	1.42
Matrix and linear transformation	15	10.7
Logic	3	2.14
Total	140	100

Table 9: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.634[a]	. 703	.663	1923.161

preference. The researcher also made sure that, those who do not offer elective mathematics ranked only the core.

Figure 7 shows the number of topics student have interest in. It was realized that set operation, indices and logarithms were the ones ranked highest. The students were of the view that they form basis in mathematics and also understand those concepts well.

Table 8 shows respondents responses from arranging those topics in order of interest. Students expressed much interest in trigonometry and statistics. This could be attributed to their applications and the practical manner in which those subjects are taught.

The relationship between students' performance and predictors of their performance

In trying to address this objective, the researcher considered these variables, mark of a student at the end of the academic year as a dependent variable and the constant or the independent variables to be do you attend mathematics class, solve mathematics questions on your own, hours student use to learn outside the class and if a student have student group. The multiple linear regression was used and the results are shown in the table 9.

$Y = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_nX_n + E$

Table 10: Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.	95.0% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	3.181	.746		4.263	.000	1.699	4.662
	Do you attend mathematics class always	43.365	64.442	-.085	-.825	.012	1.242	.513
	Do you solve mathematics problem on your own	56.225	34.462	.609	-.859	.019	.544	.295
	Do you have study group	78.204	543.27	.657	.748	.104	.337	.745
	On average, how many hour per week do you study outside the class	-45.038	561.26	- .843	-.299	.023	-.287	.212
	Do you engage in extra classes in mathematics	76.92	545.43	.659	.379	.034	.291	.575

Table 11: Anova

Model	Sum of Squares	Df	Mean Square	F	Sig.
Regression	4.043	95	.809	5.083	.044[b]
Residual	173.997	94	1.851		
Total	178.040	99			

Table 12: Senior high school A

Year	Number of students	Number of male	Number of female	Overall percentage
2010	706	493	213	88.13
2011	604	498	106	87.90
2012	532	391	141	94.63

Table 12 indicates encouraging performance from 2010 to 2012

Where Y =dependent variables

β_0 = Constant

$\beta_1, \beta_2, \beta_3, \beta_4, \beta_n$ =co-efficient of regression

x_1, x_2, x_3, x_4, x_5 = Independent Variables

Table 10 showing co-efficiencies of the independent variables.

The Model showing the coefficients of the Multiple Linear Regression

$$Y=3.181 + 0.318X_1+0.225X_2+0.204X_3+0.038X_4 +0.092X_.$$

a. Dependent Variable: what was your mark at the end of the academic year in mathematics

b. Predictors: (Constant), do you engage in extra classes in mathematics , do you attend mathematics class always, do you solve mathematics problem on your own, on average, how many hour per week do you study outside the class, do you have study group. Mean Square F Sig.

95 .809 .437 .822b

Hypothesis

Ho: Predictors contribute to student performance.

H1: Predictors do not contribute student's performance.

From Table 11, all the predictors are significant which have an effect on marks of a student. We fail to reject H_o and conclude that predictors contribute to student performance. This implies that, for a student to perform well all these predictors must be considered.

WASSCE results of students' performance in mathematics in the selected schools from 2010 - 2012

We now discuss the WASSCE results of the selected senior high schools as presented in the table 12:

Evaluation of students performance from 2010 – 2012

The following represents the grading system for the WASSCE examination results for the Core Mathematics: A1- Excellent, B2-Very Good, B3-Good, C4-Credit, C5-Credit, C6-Credit, D7-Pass, E8-Pass and

Table 13: Distribution of students grades in mathematics

	A1	B2	B3	C4	C5	C6	D7	E8	F9
2010	3.1	21.2	13.2	35.0	15.2	4.2	2.8	4.0	1.6
2011	4.24	26.5	13.2	33.1	13.2	3.3	0.7	2.3	2.2
2012	13.2	33.8	9.8	5.6	18.4	11.3	6.6	0.4	0.9

Table 14: Senior high school B

Year	Number of students	Overall percentage
2010	486	87.30
2011	502	82.20
2012	492	78.40

Table 15: Distribution of grades in mathematics

	A1	B2	B3	C4	C5	C6	D7	E8	F9
2010	3.1	21.7	11.1	16.3	15.2	12.1	10.2	8.1	2.0
2011	6.0	20.0	16.0	20.3	15.5	14.0	5.0	3.0	1.2
2012	2.1	15.2	18.0	20.0	21.0	11.0	6.1	4.1	3.0

Table 16: Senior high school C

Year	Number of students	Overall percentage (%)
2010	246	68.4
2011	341	76.8
2012	334	84.2

F9-Fail**.**

Table 13 shows students' grades in Core Math over three years (2010-2012).

Percentage of students performance were A1-B2 (i.e., Excellent –Very good) grades. There was generally increase of percentage of students performance from B2 to C4 grades. Majority of the students pass across the years. It was always a few who do not perform well and these people it may due to fear for the subject as difficult and hence making student develop negative attitudes the subject.

In Table 14, the overall performance keeps reducing though it can be described as encouraging.

Table 15 shows students' performance in mathematics in three year interval that is from 2010-2012 which gives understanding that student do well in their mathematics. From the table it was realized that only a few do not do well scoring F but are most are able to between B2-C5 which is encouraging to the student their school as whole.

From the table 16, the overall performance keeps increasing steadily. This could be attributed to positive measures put in place to enhance students' performance.

DISCUSSION OF THE FINDINGS

The response rate of the respondent was encouraging since the respondent answered the questionnaire given. In all the three selected schools, their reports and WASSCE examinations results testify that most students are good in mathematics. The researcher realized that most students do not engage in extra classes after the normal class hours and that most students have study group. It was found by the researcher that textbooks and performance of teachers contribute immensely to their performance. The researcher also found out that most students have positive attitudes towards the subject.

CONCLUSION

The work revealed that there was a significant relationship between the performance of students in mathematics and predictors of their performance. Teacher performance and inadequate textbooks are major contributing factors to student's performance. For

all the three selected schools under review students Performance in mathematics was encouraging.

RECOMMENDATION

Based on the findings, the following recommendations were made:

- Teachers must be encouraged to show increased willingness to address students' academic needs.
- Provision of mathematics books should be made available to students.

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