

Mathematical Activities and Classroom Based Factors That Support Senior High School Students' Mathematical Performance

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Abstract

This paper examined some of the classroom factors that enhance students performance in mathematics in the Senior High School. Some Senior High Schools were selected from Sekondi-Takoradi Municipality for the study. The study was to create awareness of the need to develop student's conceptual understanding as well as their thinking and problem solving skills in mathematics. Two categories of schools less endowed schools and Highly endowed schools were used in this study. Thirty-two teachers and one hundred and forty students were selected for the sample size. Analysis of Variance technique was used to analyze the data. Two hypotheses were tested while the analyses of data were presented using f- test statistic. It was revealed that factors such as: good teachers, good knowledge about the subject matter, good services provided by the teacher during his/her teaching, availability of textbooks and other learning facilities, student's attitude towards mathematics, teacher's motivation skills and the use of teaching and learning materials were the factors that support students' performance in mathematics. The study has implication for policy and practice in educational sector.

Keywords: Mathematical Activities, Classroom based factors, Senior High Schools, Sekondi-Takoradi Municipal, Poor Performance of Mathematics Students

Introduction

Education is the back bone of every nation therefore this study was necessary as a result of poor performances of mathematics students in the Senior High Schools. Monday, April 17, 2002 Daily Graphic published that most candidates perform poorly in Mathematics and the Sciences in examinations conducted by the West African Examinations Council (WAEC). In a statement, the International Final Awards and Examiners Appointment Committee of WAEC emphasized that the situation does not augur well for national development, which calls for immediate steps to reverse the trend. The committee noted that English, Mathematics and the Sciences are the basic disciplines for the planned technological advancement and need urgent attention as envisaged in the Vision 2020 Programme of Ghana. The study of Mathematics and Sciences are major problems facing the whole world. From Mathematics Goodies in the internet, Nick Anderson, Washington post Staffer writer on Wednesday, January 6, 2010 stated that “President Obama will announce a \$250 million public-private effort to improve science and mathematics instruction, aiming to help the nation compete in key fields with global economic rivals. With funding from high-tech businesses, universities and foundations, the initiative seeks to prepare more than 10,000 new math and science schoolteachers over five years and provide on-the-job training for an additional 100,000 in science, technology, engineering and math”. Indeed the assertion that students are not performing well in mathematics may be linked to the fact that prospective mathematics teachers who do not gain conceptual understanding in mathematics during their mathematics education program may have difficulty in teaching mathematics hence fail to provide concrete illustration which engages students in high cognitive activity. Richards and Arends (1998) believed that most teachers operate as generalist rather than subject specialist hence fail to involve the students in more activities during mathematics period which in other way affect their mathematical performance badly. Research conducted by Joanne Guidoccio in United States of America revealed that teaching and learning mathematics can be challenging, exciting and frustrating. A successful mathematics teacher loves the subject and can motivate his students to achieve a high level of performance It has been observed that the under-achievement of mathematics of the students comes as a result of the absence of concrete materials in any mathematical activities. Frequently shifting of mathematics teaching from abstract to concrete approaches was the way to put the students on track, hence the use of concrete materials together with enabling environment provides motivation for learning mathematics and enable students to perform better.

According to Schoefeld (1994), students would developed better mathematical thinking and perform better when the classroom creates an enabling environment in which students would have frequent opportunities to engage in more mathematical activities. Hyrnchlis and Sharef Kin (1993) recognized the effects of poor classroom factors on student’s performance during mathematical activities and wrote this, “ Underestimating the effect of concrete sensory experience is an important reason for the mathematics failure of many students at Senior High School”. The obvious remedy for the students to perform better in mathematics is to make the contents real or decrease its abstractiveness and relate the concept to real life situation. Doyle

(1993) said it is important to structure classroom activities so that appropriate amounts of time are devoted for each mathematical activity where the student would developed the capacity to reason and solve mathematical problems in appropriate and powerful ways.

The paper therefore, investigated prudent mathematical activities and classroom factors that enable the students to perform better in mathematics. It is believed that teachers can use appropriate anecdotes and challenging activities to help students develop a love for mathematics.

Purpose of the study

Mathematics is a compulsory subject for all students, it is therefore imperative that teachers who are skilful and knowledgeable are recruited to teach at various Senior Secondary Schools. The purpose of this study is to identify the ways in which classroom based factors enhanced student's engagement in mathematical activities. The study therefore identifies and describes activities that are associated with high level of mathematical thinking. That is more emphasis must be placed on more classroom activities in any mathematics lesson. The study is expected to raise the level of performance of both teachers and students in view of the important role mathematics plays in our society today.

Furthermore, it was to create awareness that more mathematical activities is a vehicle for building students capacity for good performance. The study therefore aims at finding solutions to the following suggestions:

Research Questions

1. What kind of services must be provided to Mathematics students who are having difficulty in learning mathematics?
2. To what extend are the students willing to solve mathematics questions on their own?
3. Is it essential to recruit only teachers who have specialized in mathematics to teach mathematics at SHS?
4. How do classroom factors and mathematical activities influence students performance?
5. What suggestions can be offered to GES to make the students perform better in Senior High School Certificate Examination (SHSCE).?
6. Is it essential for a mathematics teacher to vary his/her method of teaching?

Materials and Methods

Study area: The researcher in conducting this study used Sekondi – Takoradi Municipality aka - The Twin City in the Western Region of Ghana. Its geographical location are 4° 53' 0" North, 1° 45' 0" West. As at 2005 its population stands at 335,000. Sekondi city currently has several 'secondary' schools, 'colleges', and 'Special' schools, ranging from single to mix sex variation.

These are: [Ghana Secondary Technical School \(GSTS\)](#), [St. John's School](#), [Sekondi College](#), [Ahantaman Secondary School](#), [Fijai Secondary School](#), [Adiembra Secondary School](#), [Archbishop Porter Girls Secondary School](#) and many others. Takoradi has a well-equipped technical training centre ([Takoradi Technical Institute](#)) . Apart from TTI, Takoradi has a polytechnic and other renowned secondary schools including [Ghana Secondary Technical School](#), [St. Mary Secondary School](#), [Bompeh Secondary School](#), [Takoradi Secondary School](#) and many others. It is the third largest city in Ghana, an educational centre with a lot of technical colleges and high schools. It is one of the Municipalities with higher number of both less and highly endowed schools. The capital of the Western Region, Sekondi-Takoradi, is an industrial and commercial centre of Western Ghana. Sekondi-Takoradi is of both historical and cultural importance to Ghana. Life here is very relaxed and easy-going. Educational attainment in the Municipality is very high.



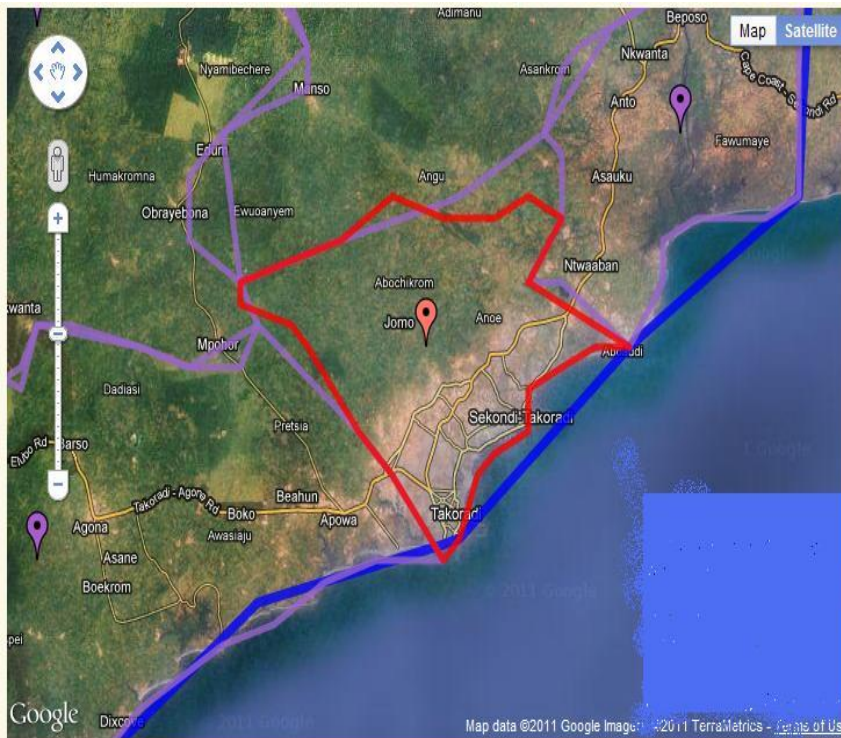


Fig. 1 Map of Ghana showing Sekondi-Takoradi Municipality

Data Collection

The main instruments used to gather information or data for the study were the questionnaire and interviews. The teachers were interviewed whereas the students were given questionnaire to answer. Analysis of variance technique was also employed in this study since we wish to test the significance of the differences existing between highly endowed and less endowed schools.

Sampling:

A simple random sampling technique was used to select the schools, students and teachers. Thirty- two teachers, ten females and twenty-two males were randomly selected from four Senior high schools. Two mixed schools and two single sex schools were randomly selected. The four Senior High Schools under the study are: St John's Boys Senior High School (Day and Boarding), Archbishopporter Girls Senior High School (Day and Boarding), Sekondi Senior High School (Mixed, Day and Boarding), and Takoradi Senior High School (Mixed Day only). One hundred and fifty students comprised of sixty females and ninety males were also randomly selected from Day schools (Mixed), Day/Boarding schools (Mixed), Day/Boarding schools (Boys Only) and Day/Mixed schools (Girls Only) of which equal representative were from both highly endowed and less endowed schools. A simple random sampling technique was used because this work wanted each member of the entire group to have an equal chance of being included in the sample under study.

Research Hypothesis

If μ_1 is the mean condition in highly endowed schools and μ_2 the mean condition in the less endowed schools then we wish to decide between two hypothesis.

1. $H_0 : \mu_1 = \mu_2$, meaning the same conditions are prevailing in the less and highly endowed schools
2. $H_1 : \mu_1 \neq \mu_2$, meaning the conditions in the highly endowed schools are better and help the students to perform better than their colleagues in the less endowed schools.

Descriptive Analysis of the interviews and questionnaire:

The teachers were interviewed on the methods used by the teachers, the kind of assistance offered to the students, number of students in the school, specialization in mathematics, availability of textbooks, teachers attitude etc. Table 1 displays the results of the interview conducted during the research.

Table 1. Interview of teachers about their activities in the classroom (classroom factors) that promote students' mathematical performance.

Classroom Factors (conditions)	Number of teachers from the Highly Endowed Schools	Number of teachers from the less endowed schools
Varieties of methods used By teachers during teaching	28	4
Assistance provided by the teacher to the students who faced difficulty in learning mathematics	19	13
Majority of the students are forced to study mathematics on their own.	27	5
The teachers preferred to teach mathematics if given opportunity	26	6
Number of specialized or experts' mathematics teachers must be increased in various schools.	16	16

Availability of mathematics textbooks in the school	16	16	
The attitudes of mathematics teachers during teaching help students to enjoy the subject.	16	16	
Total	148	76	224
Mean	21.14	10.86	32.0

Table 2. Analysis of variance of the responses from teachers during the interview.

Source of variation	(df)	SS	MS	F _{cal}	F _{table} F _{0.05 (1, 12)}
Between groups	1	370.29	370.29	11.76	4.75
Within groups	12	377.71	31.48		
Total	13	748			

$$SSTR = \frac{(148)^2}{7} - \frac{(224)^2}{7 \times 2}$$

$$= 370.29$$

$$SST = (28)^2 + (19)^2 + (27)^2 + \dots + (16)^2 - \frac{(224)^2}{7 \times 2}$$

$$= 748$$

$$SSE = SST - SSTR$$

$$= 377.71$$

Table 3. Number of responses from the students on the classroom factors considered.

Classroom factors	Response	
	Agree	Disagree
Teaching mathematics with appropriate concrete materials Promotes students' performance in mathematics.	135	15
Available teaching and learning facilities and equipment promote mathematical performance	113	37
Good and experts mathematics teachers must be recruited to teach mathematics	86	60
Varieties of methods must be employed by mathematics		

teachers in the classroom	67	83
Numerous class exercises/assignments ,test must be performed by students	40	50
Teachers effective motivation promotes students' performance in mathematics	75	75
Students willingness to solve mathematical problems	150	0
Prompt marking and discussion of class exercises/assignments and test promote student performance	126	24
Students attitudes towards mathematics	49	78
Extra assistance offered by the teachers to the students after classes hours promotes students performance	95	55
Total	936	477
Mean	93.6	47.7

Table 4. Analysis of variance of responses from the students on classroom factors

Sources of Variation	(df)	SS	MS	F _{cal}	F _{table} F _{0.05(1,18)}
Between Responses	1	10534.08	10534.08	9.76	4.41
Within Responses	18	19436.47	1079.80		
Total	19	29970.55			

RESULTS AND DISCUSSION

From Table 2, the Analysis of Variance (ANOVA) of the responses from the teachers indicated the calculated F ie (F_{cal}) was 11.76 and F table (F_{table}) at [F_{0.05} (1, 12)] was 4.75. The calculated F- statistic is significantly large. That is F_{cal} > F_{table} , We can therefore conclude that there is a significant difference between the highly endowed schools and less endowed schools means.Hence,we reject the null hypothesis that the same conditions are prevailing in the two categories of schools and accept the other. This clearly indicates that the conditions in highly endowed schools are better than the conditions in less endowed schools. It could therefore be inferred from the table that highly endowed schools have enough learning and teaching facilities and equipment. These teaching and learning facilities help the students in the highly endowed schools to perform better in mathematics than their colleagues in less endowed schools. Therefore, we can be convinced that good classroom factors promote students' performance in mathematics.

The results of the responses from the students as shown in Table 4 also focuses on the classroom factors that help students to perform better in mathematics. From the ANOVA table the computed test statistic value F_{cal} falls in the rejection region for 0.05 level of significance, that is F_{cal} > F_{table}, therefore this make it necessary to reject the null and accept the alternative hypothesis that good classroom factors support students mathematical performance

Conclusions

Classroom based factors and mathematical activities that support students' mathematical performance have been studied at Sekondi –Takoradi Municipality.

The work revealed that mathematics learning can be effective if appropriate teaching and learning materials are employed in the teaching process. This was confirmed in Table 2 as majority of the students accepted the fact that appropriate teaching and learning materials would help them to grasp the concept well and be able to solve mathematical problems with ease.

The research demonstrated that teachers who have specialized in mathematics can teach the subject better than their counterparts who have not. With the exception of few, majority of the mathematics teachers were doing quite good. It is therefore essential to recruit teachers who are good at mathematics to teach the subject. Large class size with few mathematics teachers posed major problems for the teachers in the schools. Therefore Ghana Education Service must employ more mathematics teachers to ease the sufferings of few teachers in the classroom.

The students believed that available textbooks and other learning can help them to study mathematics much better. It is therefore essential that schools are equipped with more textbooks and other learning facilities. Enough exercises and assignments also sharpen the minds of the students and enable them to exhibit good performances in the subject.

The research therefore demonstrated that good classroom factors such available textbooks, the use of appropriate teaching and learning materials, good and knowledgeable mathematic teachers help the students to perform better in mathematics.

Recommendations

It is believed that the results from this work will enable:

Ghana Education Service (GES)/Government to recruit competent and knowledgeable mathematics teachers, thus teachers who possess strong mathematical and communication skills to teach mathematics in the various Senior High Schools (SHS).

Ghana Education Service/Government to bridge the gap between highly endowed and less endowed schools by providing equal educational facilities to the two categories of schools that will motivate all the mathematics teachers to work harder.

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