Influence of teachers' coverage of mathematics curriculum materials (MCM) on their schools' performance in mathematics

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Abstract

This study was conducted in the Agona West Municipality, covering a total of nine-nine (99) junior high schools. The objective was to determine the relationship between the proportions of syllabus covered by teachers to their students' performance in the basic education certificate examination (BECE) mathematics. Stratified random sampling technique was employed for the selection of forty (40) out of the 99 schools (representing 40.4% of total schools in the municipal). A survey design was adopted for the study and data was collected using questionnaires and interview guides from fifty (50) teachers in the forty schools sampled for the study. The findings show that only 62% of the mathematics curriculum materials (MCM) were implemented even though teachers admitted in interviews that they conduct extra-classes for the students. This implies about 38% of the content in the MCM are not taught by the majority of the teachers and therefore the omission or skipping of certain topics was common practice in the municipality. A one way ANOVA used to test the null hypothesis that 'there is no significant difference between the school performance categories (high, average and low) with respect to their teachers' coverage of mathematics curriculum' showed the results $F = 22.80$ and $p=0.00$ ($p<0.005$), indicating a significant influence of the teachers' coverage of the content in the MCM on the schools' performance. The implication is that the teachers in the high performing schools cover a great deal of the content of the official curriculum (high mean content coverage = 89.31%). It is recommended that the Ghana Education Service support mathematics teachers in low performing schools to engage in in-service education and training to deal with how to teach difficult topics identified in this study. Also, opportunities should be created for mathematics teachers in high performing junior high schools to share their successes in the implementation of the mathematics curriculum.

Keywords: mathematics curriculum; content coverage; basic schools' performance in mathematics, mathematics curriculum materials

Introduction

Mathematics is described as numbers, quantities and measurement. Situations in life always call for the use of Mathematics because every activity in life calls for the use of numbers, quantities and measurement. Again, Mathematics is a challenging and abstract discipline; its study provides opportunity for a wide spectrum of high level mental activity and sharpens one's ability to reason logically and rigorously. Since mathematics is such that you can learn its rubrics through systematic approach there is a laid down curriculum to define its teaching and learning. Curriculum as defined by Adentwi (2005), as the whole body of courses offered in an educational institution

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or by a department. It is a complete set of courses of a fixed series of a prescribed study at school or college. Mereku (2004), briefly recounted that today's curriculum is perceived as the experiences in which students are expected to engage in at a school and the general order of sequences in which these experiences are to come.

In Ghana, all basic schools are required to work to nationally prescribed teaching programs. The programs are contained in syllabuses which are also spread out in text books, teachers' hand out, etc. They are intended to be carried out in schools throughout the country. That is, they include detailed prescriptions of what is required to be taught each year.

The aims of the basic school mathematics curriculum, are clearly stated in the Junior High School syllabus and have been reviewed over the years (Ministry of Education, 2000, 2007, 2012). According to Mereku (2004), the aims are meant to fully develop the core psychosocial skills required to cope with the mathematical demands of everyday life. That is, to be able to demonstrate cognitive-affective abilities to think critically and creatively, solve problems, make decisions and communicate effectively. For a pupil to acquire these qualities, he/she will require a great deal of support in learning the subject. Mathematics teachers should be conversant with the curriculum materials and hence use methods that will enhance the development of such skills.

However, over the years, performance in mathematics has continued to show a downward spiral. Various researchers have identified factors that are believed to cause poor performance. These include poor teaching methods and an acute shortage of textbooks (Fredua-Kwarteng and Ahia, 2005; Anamuah-Mensah and Mereku, 2005; Anamuah-Mensah, Mereku, and Asabere-Ameyaw, 2004), the difficulty of the subject (Awanta, 2003; Anamuah-Mensah & Mereku, 2005), lack of problem-solving approach in teaching (Anderson, 2005) and utilization of symbols that are unusual and unfamiliar to students (Wasike 2003). In a recent study, 'Effect of Syllabus Coverage on Secondary School Students' Performance in Mathematics in Kenya' (Nakhanu, 2012), it was established that these factors do not directly contribute to poor performance in mathematics. Instead, late or non-coverage of the mathematics syllabus contributes to poor performance.

The Problem

The poor performance of mathematics in Ghana came to light in the TIMSS report of 2003 & 2007 for grade 8 pupils. None of the Ghanaian JHS 2 pupils could reach the Advanced International Benchmark and High International Benchmark in mathematics, (Anamuah-Mensah, Mereku & Ghartey-Ampiah, 2008; Appiah, 2009; Martin, Mullis, Gonzalez & Chrostowski (2004). The downward trends of performance in mathematics in recent years is a source of worry not only to parents but also to me, the teacher and all beneficiaries and stakeholders in education in the country. This poses a challenge to me to find out the factors that influence such poor performance. Therefore, it is in the light of this that I have shown much interest in finding out if the mathematics curriculum is being effectively used or not.

More so, as a mathematics teacher in the Senior High School, I have identified that students perform poorly in mathematics during their first year stay in the Senior High School (SHS). If the sieved Junior High School (JHS) students in the first year of SHS are not doing well then, there is the need to find out what is happening in the JHS. Moreover, Ghana Agency Report (GNA) (2011, October 2) reported that less than half of the total number of candidates who sat for 2011 Basic Education Certificate Examination in Agona West qualified to enter Senior High Schools and technical institutions. It went further to report that, according to the Municipal Director of

Education, out of 2,241 candidates only 980 obtained aggregates from 6 to 30 to gain admission and five schools obtained zero percent (0%) results. In the light of these developments, it can be argued that over the years, performance in mathematics had continued to show a downward spiral. In an attempt to improve performance, teachers have to put in a great deal of effort into the completion of the implementation of the syllabus. Hence, the purpose of the study is to find out if the mathematics curriculum is being effectively implemented at the junior high schools level. Specifically, the objective was to determine whether or not the proportions of content (i.e. syllabus) covered by teachers influenced their students' performance in the basic education certificate examination (BECE) mathematics.

Method

Sample

The municipal had 99 Junior High schools which had been grouped into eight (8) circuits. The 8 circuits were the strata within which five circuits were randomly selected. In each strata are the public and private schools. Seven schools were further sampled from the private schools whiles thirty-three schools were also sampled from the public schools. In all, forty (40) schools were involved in the study. Out of the Forty schools, ten (10) schools had two mathematics teachers each. Therefore, fifty (50) mathematics teachers were involved in this study however; two (2) schools out of the forty did not have JHS 3. The fifty teachers constitute six (6) females and forty-four (44) males. Forty teachers teach JHS 1 to JHS 3 whiles ten teachers teach a combination of the three classes.

Research Design and Instruments

A descriptive survey design was used for this study. Records of syllabus coverage and the corresponding students' performance for a period of three years (the years 2011 to 2013) were accessed for this study. Questionnaire, interview and document analysis guides were the main instruments for data collection. The questionnaire consisted mostly of closed-ended questions and a few open-ended questions. Items in both the questionnaires and interview were mainly concerned with school policy on syllabus coverage and records of work covered. They also sought to find topics in mathematics that were either difficult to be taught or consistently left untaught by most schools. Reliability of the instruments was established by piloting them. The researcher pilot-tested the questionnaire and interview guide in six schools in the Agona West municipal. The six schools were randomly chosen from the circuits which were not part of the sampled circuits for the study. The six schools were chosen because they are of the same characteristics as those sampled for the study.

Data organisation and analysis

The aim of the study was to investigate the influence of teachers' coverage of the contents of mathematics curriculum materials (MCM) on their students' performance. To ascertain this, the grades obtained by students in the sampled schools in the Basic Education Certificate Examination (BECE) in 2011, 2012 and 2013 were examined and the percentages of students getting grades one to five were computed. The grades one to five were considered because, they are the grades for the selection of students into senior high school. The mean mathematics BECE grades for the schools were computed and used to categorise the schools into low, average and high performing schools. Also the topics the teachers' indicated they actually taught were used to compute proxy scores for their content coverage. These scores were further analyzed using one way ANOVA for

difference between the students' performance categories with respect to their schools' coverage of MCM.

Results and Discussion

The overall percentage mean coverage of the schools in the circuits was 62%; meaning about 60% of the mathematics curriculum materials MCM was taught in the previous academic year as requested by the questionnaire. This shows that about 38% of the intended curriculum was not implemented or taught by majority of the teachers. In addition, the findings show that about 50% of the teachers indicated two topics (i.e. 'linear equations and inequality' at JHS 2 and 'enlargement and similarity' at JHS 3) were their most difficult topics. It was also observed that collectively there were at most two contents (topics) in each year's mathematics curriculum that were skipped by about half of the teachers during implementation, These topics are (i) introduction to the use of calculators (JHS 1), (ii) geometric construction (JHS 1), (iii) rates (JHS 2), (iv) probability (JHS 2), and (v) investigations with Numbers (JHS 3).

As indicated above, a One-way ANOVA was used to test the null hypothesis that 'there is no significant difference between the performance categories (high, average and low) with respect to the schools coverage of mathematics curriculum'. Table 1 shows the results of the one-way ANOVA.

Table 1 Results of One-Way ANOVA on Factors Influencing Performance

	Categories Performance	**N**	**Mean**	**Std. Deviation**	**df**	**F**	**Sig**
Content Coverage	Low	32	50.73	18.31	2		
	Average	6	70.22	20.77	47	22.8	.00**
	High	12	89.31	10.69	49		

** $p < 0.05$

The results (Table 1) shows F = 22.80 and p=0.00 (p<0.005) for content coverage, indicating a significant influence of teachers' content coverage on the schools' performance in mathematics. The implication is that the teachers in the high performing schools make good and effective use of the mathematics curriculum and cover a great deal of the content of the official curriculum (high mean content coverage = 89.31%). In order words, it was observed that the schools which cover a great deal of the content of the official curriculum have their students performing better than those who fail to cover much.

The results of this research indicate that about 38% of the content in the MCM are not taught by majority of the teachers. It further showed that about 50% of the teachers had difficulties teaching two topics. This confirms Awanta's (2003) conclusion that most teachers tend to ignore the teaching of some areas in mathematics most weeks as they are likely to face problems in their implementation. The MCM for JHS spreads out the contents to be taught (Intended) in each year for the 3-year JHS duration. The findings show that only 62% of the MCM was implemented even though they teacher admitted in interviews that they conduct extra-classes for the students. This is worrying because Ghanaian teachers have more hours for teaching mathematics which, as pointed

out by Mereku, et. al. (2005), is more than the internationally accepted time to enable them cover all the content in the MCM.

As the mathematics curriculum is a spiral one and gets more complex as the years go by (Mereku, 1995), if at the end of every year some topics are not covered, there will be gaps in students' knowledge and this will definitely affect their performance as noted in the JHS Syllabus. It is clear from the results that the omission or skipping of the content was common practice in most low performing schools in the municipality.

Recommendation

Ghana Education Service should support mathematics teachers in low performing schools to engage in in-service education and training to deal with how to teach difficult topics identified in this study. Also teachers should be motivated to complete the official mathematics curriculum. Opportunities should be created for mathematics teachers in high performing junior high schools to share their successes in the implementation of the mathematics curriculum.

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