Treatment duration of topics in the senior high school elective mathematics syllabus

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ABSTRACT

The research was aimed at investigating whether the intended time of 280 min per week for 92 weeks was adequate for the treatment of Senior High School (SHS) Elective Mathematics. A stratified random sampling method was used to select three sex female, two single sex male and three mixed SHSs in eight sub-metros in the Kumasi Metro of the Ashanti region of Ghana. The study involved 840 students and 36 Elective Mathematics teachers. A questionnaire on estimation of time and three achievement tests in Mathematics were used to collect the data. The data were analysed by mean of simple proportion, t-statistic and One-Way Analysis of Variance (ANOVA). Fisher's procedure was used to make pair-wise comparison among a set of three treatment means. The findings revealed that there is the need to increase treatment duration for elective mathematics as the intended time of 280 min per week for 92 weeks is inadequate. It was also found that teacher experience exhibits differences in treatment duration. Based on the findings, it was recommended that the intended time per week for SHS Elective Mathematics programme should be increased.

Keywords: Treatment, intended time, actual time, mathematics education.

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INTRODUCTION

Background to the study

Closely related to the assignment of instruction personnel is the allocation of time for instruction. Daily schedules are built based on which teachers are available during which times of the day. How the school day is subdivided for instructional purposes typically is a macro-level issue handled by school and educational policies, state guidelines, and contract. Specifically, how do teachers allocate time on a daily basis to particular subjects and particular students? While school teachers cannot be in every classroom for every minute of the day, it is important for them to try to understand how class time is spent and to encourage teachers to allocate it in ways that best promote realization of school goals. Thus, teachers have been assigned duration to teach. A major responsibility of conscientious school teachers must be to monitor the allocation of time in the classroom to determine whether weak students are receiving their fair share of teachers' time.

The performance of students in recent years especially in Elective Mathematics is steadily progressing. The West African Examinations Council (WAEC) report from 2001 to 2005 indicated that 44.97, 60.23, 66.61, 77.67 and 73.92% of the candidate passed at grade E in Elective Mathematics, respectively. However, the percentage pass seemed encouraging; it does not meet societal expectations. Less than 10% of those who passed obtained at least grade C. Many reasons could be attributed to this unfortunate situation. These include:

Some Elective Mathematics teachers teach the subject outside their area of specialization. For instance, a teacher who majored in Agriculture Science teaching Mathematics, the calibre of students offering the subject, students are given programmes by parents and school authorities without taking into account their mathematics background and capabilities, overloaded Elective Mathematics syllabus, large class sizes since teachers need to cope with every student, lack of available textbook, the need to give special attention to students with social and psychological problems among others, negative attitudes that characterize the secondary years, etc.

Without doubt, everyone in education would be aware of serious problems besetting mathematics teaching and learning at the High School level, among which are the poor background of students entering the High School, the chronic low-level performance and negative attitude towards Mathematics. Mathematics teachers at the second cycle can without doubt testify to the deteriorating mathematical abilities of students entering schools. The various governments of Ghana share with the people, the passionate interest in education, the anxiety to bring about constant improvements in its availability and relevance as evidence by the large number of Review Committees, Commissions, etc. on education dates back to colonial times.

Anamuah-Mensah committee was tasked to review the entire education system in the country with the view to making it more responsive to the current challenges. The report of the committee emphasized on the public concern expressed indicating that a number of people wanted an extension of secondary school education to four years due to low achievements. The committee noted that factors that contribute to the low achievements at SHS are multi-faceted. These include: lack of adequate teaching and learning facilities, poor infrastructural facilities, absence of proper guidance and counselling services, lack of well-motivated committed teachers, poor management and supervision, inadequate prepared Junior High School (JHS) leavers and absence of performance standards for each subject (Ministry of Education, Youth and Sports, 2004).

In spite of the problems identified by the various Committees, time, which is a major ingredient in education, could not be identified. One complaint that all educators seem to have in common is 'We do not have time'. There is not enough time to teach all the material of potential value to students. There is not enough time to provide every student with meaningful learning experience. Finally, there is not enough time to address and correct every learning problem. Educators live in a world of scarce resource and time is the dearest of all. Time as it is always said is money. Do teachers and other stakeholders of education make judicious use of time? Has treatment duration been adequately distributed to each subject and for that matter each topic? These questions need answers. There has not been any empirical evidence to determine whether the 3-year duration for SSS programme is adequate by considering the current intended mean time. This could be done if research is done to find out whether the treatment duration for topics in the various subjects is adequate or not.

Statement of the problem

In most stages in the education of the majority, we find an overloaded mathematics curriculum with students hastened along through material which at best is only half learned. Cockroft (1982) suggested that the majority of high school students were following syllabi that were of the difficult and extent, appropriate only to about a quarter of pupils.

There seem to be disagreement on the intended duration for the Senior High School programme. Various organizations, groups and associations such as CHASS, ERRC, and NAGRAT in collaboration with the Ministry of Education have realized that there is the need to increase the intended duration but they have not been able to arrive at the appropriate time. So far, there has not been any study to address this problem empirically to find out whether the intended time of 280 minutes per week for 92 weeks is adequate for SHS Elective Mathematics programme.

The amount of time spent based on mathematics and language is a critical factor in the achievement level of students (Kraft, 1994). Though Kraft (1994) study was focused on primary education, it gives insight into time allocation and time use is our schools. Mathew (1989) affirmed from research that student's level of attainment was directly related to length of time actively spent in learning. Time spent in curriculum development is important. The sufficient and judicious use of time the more effective teaching and learning take place. If educators have a chance, they would have increased the time for teaching and learning of Elective Mathematics topics in the SHS syllabus. Most schools in Ghana have different treatment durations for Elective Mathematics. While some spend 240 min per week, others spend 225 or less. Surprising enough, treatment duration has not been adequately distributed to each subject and to each topic. Other subjects compete for time on the school timetable and this competition calls for judicious use of time. Inexperienced teachers need help to find out how much time they need to teach a particular topic.

According to the chief examiner's reports in 2011, Elective Mathematics students place more emphasis on only a few selected topics to the neglect of others due to inadequate treatment duration. The researcher then finds it necessary to find appropriate duration for Elective Mathematics topics. In Ghana, SHS students spend less time in learning Mathematics while teachers have limited duration to teach many topics. Mathematics instructional time ranges between five and six periods of 40 to 45 min per period. Due to this inadequacy of the treatment duration, it seems the Elective Mathematics syllabus is overloaded in terms of topics and contents. Interruptions (holidays, sporting activities, excursions, etc.) affect teacher-student contact hours. This is clearly depicted, as teachers are unable to complete their syllabus. They then resort to extra classes before and after the normal school hours.

The computer placement for JHS graduates into the SHS has its attendant problems. SHS 1 students are continually admitted into schools while teaching and

learning are in progress. This claim is supported by a caption in the Daily Graphic on 9th December 2010 that SHS 1 admissions were to be continued in the second term. This results in a delay of SHS1 students. The problem therefore is whether these differences in treatment duration, interruptions, and the inability of teachers to give exact time for treating a particular topic in Elective Mathematics hinder judicious use of time on the treatment duration of topics in the Elective Mathematics syllabus. One will also want to know to what extent are teachers well informed about the allotment of time to the topics in the Elective Mathematics syllabus. There is the need therefore to consider the adequacy of treatment duration for topics in the Elective Mathematics syllabus.

Research questions

The study was designed to find answers to the following questions:

1. Is there a significant difference between the intended mean time and the actual mean time for the treatment of SHS Elective Mathematics topics?
2. Is there a significant difference between the intended mean time and the actual mean time for the treatment of SHS 1 Elective Mathematics topics?
3. Is there a significant difference between the intended mean time and the actual mean time for the treatment of SHS 2 Elective Mathematics topics?
4. Is there a significant difference between the intended mean time and the actual mean time for the treatment of SHS 3 Elective Mathematics topics?
5. Is there any statistically significant difference between the estimated times for the treatment of Elective Mathematics topics by teacher experience?

Hypotheses

The following hypotheses were formulated to be tested at 0.05 level of significance:

1. There is no significant difference between intended mean time and actual mean time for teaching the topics in SHS Elective Mathematics.
2. There is no significant difference between the intended mean time and actual mean time used for teaching SHS 1, 2 and 3 Elective Mathematics.
3. There is no statistically significant difference among the times estimated for the Elective Mathematics topics by teacher experience (inexperienced, moderately experienced, and experienced).

Delimitation

The study was restricted to schools in Kumasi Metro education district in the Ashanti Region of Ghana, due to time and financial constraints. The study was focused on 36 the Elective Mathematics teachers in the schools in that academic year. The results of the present study are not expected to be generalized to cover the entire country, not even the Ashanti Region, per se.

Limitation

Certain weakness of the study influenced the results of its generalisability of which the researcher had little or no control. The educational experience of students in the selected schools might be richer than their counterparts in the rural areas. Effects of teachers effectiveness in classroom on the treatment of the selected topics in the school was also not ruled out. Students' motivation was also prime. Topics have different contents.

Assumptions

The following assumptions were made: topics were equally weighted in terms of contents, students in the same form were assumed to have approximately equal mathematics ability and students were equally motivated.

Significance of study

A few studies on similar topic have revealed the need for increase in time in Cape Coast District in Central Region, Ketu and Keta Districts in the Volta Region. Since Kumasi Metro also constitutes an important part in Ghana, it is believed that the study could bring to light whether there is the need for increase in treatment duration of topics in the SHS Elective Mathematics syllabus in the Kumasi metropolis of Ashanti Region of Ghana.

Secondly, this will demystify the efforts being made by educational stakeholders to find possible solution to the problem of requisite treatment duration for individual topics in the subject. Thus, the results of the study may be of great help to the classroom teacher in planning well for the treatment of the topics instead of rushing through the syllabus. Thirdly, the findings may serve as a guide in resolving the seeming controversy that exists among political opponents and other Ghanaian on the duration of the SHS programme.

LITERATURE REVIEW

Theoretical overview of time allotment

Considering first how time is allocated to various subjects, teachers are bound to have preferences for certain areas of the curriculum. When these preferences

result in the neglect of other content areas, the instructional programme and, ultimately, students are bound to be affected. Eisner (cited in Brookes, 1987) in his "null curriculum" contended that what teachers do not teach may be as important as what they do teach. For instance, a history teacher who fails to note the cultural contribution of women may not consciously intend to perpetuate sexual stereotype, but the outcome is likely to be just that. By failing to expose students to examples of female influence, the teacher unwillingly supports the belief that "men make history".

It is generally assumed that students learning are directly related to exposure to instruction. In Washington D.C junior high school students who are working below acceptable levels in mathematics, for example, must take two periods of mathematics everyday as part of a programme called Intensive Junior High School Instruction. The same view is shared by Mathew (1989) that a student's level of attainment was directly related to the length of time actively spent on learning. This opinion was given a further boost by Kraft (1994) that the amount of time spent on the basics of language and mathematics is a critical factor in the achievement level of studies. Besides controlling the time devoted to different areas of curriculum, teachers can exert major influences on students learning by determining how much attention and assistance each student will receive. Ironically, many students who are in the greatest need of teachers' time and assistance least apt to receive it. A major responsibility of conscientious schoolteachers must be to monitor the allocation of time in the classroom to determine whether needy students are receiving their fair share of teachers' time. It is also important that this time largely consists of constructive, rather than punitive, contacts.

Moyles (1997) reported that time, as the modern world perceives it, is a finite, particularly the school day. The concept of time is incompatible for it rarely balances adequately with what we want to achieve. Pernet (cited in Moyles, 1997) suggested that 'in preparing to use our time more effectively, the first things we really need to know are the facts, not the feelings. A record of where our time is really spent is an important first step'. Richardson (cited in Moyles, 1997) suggested two golden rules regarding time that are worth remembering. One can always make more effective use of time and the only person to make better use of your time is you. Richardson suggested that as people mostly underestimate the time needed for tasks, it is necessary to add around 20% to any estimate. Time can be created by recognizing the core component to oneself and the children. Myers, (cited in Moyles, 1997) reported that in relation to learning time, it must be acknowledged that there is a difference between allocated and engaged time. Planning teaching time will not necessarily be equivalent to learning time. It is necessary to be realistic about this. Some teachers structure curriculum time

through the user of topics or projects. Haigh (1990) is of the opinion that where you do what in the time available is crucial to the success of the what and this applies to both timing term and year. According to Pratt (cited in Asare-Inkoom, 2001), greater amount of time is committed not by their own consent but by order of their elders. Bishop (1985) in discussing problem associated with implement of invocation reported that, large changes on that sufficient time for preparation had often proved more harmful than useful. He further asserted according to Asare-Inkoom (2001) that trying to achieve too much too fast could have the opposite results. Quoting Sawada, Greer and Mulhern (cited in Asare-Inkoom, 2001) maintained that the Japanese lowered the pace of their curriculum in order to improve the grasp of concept. Thus, pupils need more learning time for better grasp of concepts. Contributing to time allocation for mathematics, Cockroft (1982) stated that in recent years the proportion of teaching time given to mathematics has decreased in most schools due to the introduction of additional subjects in the curriculum. Schools timetable mathematics is double periods in which five periods were allotted to mathematics. Bennett and Carre (1995) emphasized that teachers have a difficulty in translating awareness of time into good management of time. Balogun et al. (1984) explained management of time as an art or process of tactfully controlling or bringing various elements to work together for some particulars purpose within the given period. They asserted that to manage times means to handle or arrange a number of people, things or situation within the stipulated time to bring about what one desires. Anderson et al. (cited in Kyriacou, 1985) referred to the first construct as active learning time. Thus, the amount of time spent by pupils actively engaged in the learning task and activities designed to bring about the educational outcomes desired. The second construct is the quality of instruction which is the quality of the learning task and activities in terms of their appropriateness and suitability in terms bringing about the educational outcome desired.

Empirical evidence and studies related to time spent on mathematics instructions and achievement

Asare-Inkoom's (2001) study was designed to investigate whether the intended time of 160 min per week for 96 weeks was adequate for the treatment of the Senior Secondary School Core Mathematics in the Cape Coast Education District of the Central Region of Ghana. The data were analyzed by means of simple proportion, t-statistics and one-way analysis of variance. The results showed that the intended time of 160 min per week for 96 weeks for the SHS core mathematics programme was inadequate.

Another research study carried out by Kwetey (1996) to find out whether the intended mean time of 160 min per

week was adequate for the treatment of SHS One Core Mathematics. The topic "Algebraic Expression" was taught in three selected schools in the Keta and Ketu Districts in the Volta Region of Ghana. The mean time spent on the treatment of the topic was compared with the intended mean time. The t-statistics was used. Kwetey concluded that the actual mean time was more than the intended mean time for the treatment of algebraic expression. He was of the view that duration of Senior High School programme be extended from three to four years. Mathew (1989) has said that a pupil's level of attainment was directly related to the length of time actively spent on learning. Kraft (1994) pointed out that, one of the most important things policy makers and researchers turn to in looking for ways to improve a school system is to look at the length of the school day and school year. According to Kraft (1994) it was 1993 that Ghana extended Primary school day from four hours to five hours and the school year from 36 to 40 weeks (Kraft, 1994:76). An inspection of some school teaching times tables in the present school year is 40 weeks for Primary, JHS and SHS.

Carroll (cited in Duke, 1982) maintained that students will master instructional objectives to the extent that they are both permitted and willing to invest the time necessary to learn the content. Therefore, the time it takes each student to learn will vary depending on such factors as prior student achievement and attitudes. The important implication of this model, of course is that given enough time, most students can learn most content. Myers (cited in Moyles, 1997) said, in relating to learning time, it must be acknowledged that there is a difference between allocated and engaged time. To what extent should the teacher determine what is to be taught at a particular time, and who is to determine how long a learning activity should last? (Blege, 1986:145). The teacher is not a slave to syllabus, weekly plans and timetable.

Many studies related to time spent on mathematics instructions and achievements have been carried out. Asare-Inkoom's (2001) study was designed to find out the intended time of 160 min per week for 96 weeks was adequate for the treatment of the SHS core mathematics in Cape Coast Education District. He contended that the treatment duration was inadequate. Kwetey (1996) also carried a study on the same topic in Ketu and Keta Districts for mathematics treatment in SHS 1 core mathematics. He dealt with the topic 'Algebraic Expression' and concluded that the treatment duration was inadequate.

METHODOLOGY

The population of the study was all SHS students and teachers in Ghana. The target population was all Senior High School students and teachers in Ashanti region. However, the accessible population was SHS students and teachers in eight sub-metros of Kumasi Education Metro. The sample consisted of 840 students (400 girls

and 440 boys) and 36 Elective Mathematics teachers drawn from eight Government assisted Senior High Schools. The ages of the students ranged between 13 and 18 years. The experiences of the teachers ranged between less than three year and more than five years and were made up of 28 graduates, 2 post-graduates, and 4 diploma holders. 18 intact classes were purposely selected; three classes each from six of the eight selected schools. Both probability (random) and non-probability sampling methods were used to select the sample. At first, 15 circuits were randomly selected from a sample frame of 22 circuits in the Kumasi Metro. Stratified and simple samplings were used to select the eight out of 19 Senior High Schools in the Kumasi Metro. The schools were classified into single gender (male and female) and mixed schools. There were 840 students (440 boys and 400 girls) involved in the study.

The research design used in the study was the descriptive survey. The descriptive survey design, as pointed out by Gay (1992), involves collecting data in order to test hypothesis or answer questions concerning the current status of the subject of the study. A descriptive survey reports the way things are. The design was considered appropriate since the study described some aspects of the population by selecting a sample of individual performances. Questionnaire and achievement tests were used to gather data for the study. The questionnaire was used to find the teachers' estimation of time allocation for the treatment of the topics in the Senior High School Elective Mathematics Syllabus. It was made up of ten items. The questionnaire was designed for 36 teachers who teach Elective Mathematics. The purpose of the achievement test was to evaluate the schools mathematical programme and to describe student's growth in mathematics problem solving at class level. The objective of achievement test was to produce a fair and representative indication of what the students have learned from the instructions given. Students were assumed to have understood the treated topics if two-thirds of each group obtained a minimum score of 40% in achievement test (Asare-Inkoom, 2001) administered after the treatment. The maximum mark a student could obtain was 40 and the least score was zero.

Content validity was built into the test from the outset. This was followed by experts' examination to indicate whether each item was within the scope of the course content. The items were representative of the topics covered in the SHS syllabus, textbooks and related to the time devoted to each topic as well as the behavioural domains. The comments of two experts in the field of mathematics education and one of the supervisors helped to improve the face validity. In addition, secondary school teachers in mathematics education were selected to examine the instruments. Both sets of people were given the instruments along with supplementary checklists asking them to carefully and critically examine the content to determine the relationship between the test and the defined universe. 20 boys each from school D in SHS1, SHS2, and SHS3 and 20 girls each from school F in SHS1, SHS2 and SHS3 were given the same tasks and both schools were in Kumasi Educational District and were far apart. The students' scripts were scored by two assessors and the internal consistencies of the tests measured through Cronbach (1970) alpha-formula were 0.84, 0.89 and 0.78 for SHS1, SHS 2 and SHS 3 respectively. The final achievement tests were administered after the experimental teachings.

Data analysis

Data were gathered and processed using frequency and percentage, computed t-value, and measures of variability. These statistical processes were computed using SPSS Version 10.05 for Windows software. The One-Way Analysis of Variance (ANOVA) was used to find out whether the estimated times by the teachers differed significantly. T-statistic was used to test the first four

research problems. The mean times for SHS 1, SHS 2 and SHS 3 and the overall mean time were read from SPSS output from the mean times spent on the topics treated for second term (2010/2011) by the 18 teachers in the selected schools. The corresponding standard deviations were also read from the SPSS output. Cronbach (1970) alpha formula was used to calculate the reliability coefficients for SHS 1, SHS 2 and SHS 3 achievement tests. Follow-up tests were conducted to find out which treatment means differ from one another. Thus, Fisher's procedure was used to make pair wise comparisons among a set of three treatment means.

RESULTS AND DISCUSSION

The first item of the questionnaire requested for the gender of teachers. Out of the 34 teachers who responded, there was no female teacher (zero percent). This appears to confirm the claim by the Government of Ghana and other well-meaning educationists that females are woefully under-represented in Mathematics, Science, and Technology. This finding goes to support Asare-Inkoom's research in Core Mathematics where three out of the 32 teachers representing 9% were females. As stated by Anamuah-Mensah (1995), this could be attributed to socio-cultural constraints, societal expectations, and educational practices.

The data collected on the second item depicted that 30 out of the 34 representing 88.2% were graduates. Thus, the Elective Mathematics teachers were academically qualified. The high number of qualified teachers can be attributed to the urban nature of the schools since most professionals and academically qualified teachers want to teach in urban centres. This is due to the improved socio-economic and political situations there. On the question of area of specialization, all the 34 teachers specialized in Mathematics related subjects, 20 majored in Mathematics constituting 58.8% which was inadequate. The situation could be worse in the rural areas where qualified teachers are most needed. There is therefore the need for the Ministry of Education and other private organizations to train more mathematics teachers.

Data collected showed that 10 teachers have taught for less than three years, six between three and five years and 18 for more than five years. From the results above it could be said that a sizeable number of Elective Mathematics teachers were not very experienced. There is therefore the need to lure the University graduates who are teachers to remain in the work. This could be done by making the service attractive and lucrative.

On the criteria for apportioning time for the treatment of the various topics in the Elective Mathematics, most teachers adopt their own ways for apportioning time to the treatment of the various topics in the Elective Mathematics. This may be due to improper monitoring and supervision on the part of school authorities which results in most of the teachers unable to complete the syllabus on schedule which eventually, result into part-

time and extension classes.

Data collected to find which term of the year do Elective Mathematics teachers start the treatment of the subject, majority of the Elective Mathematics teachers are of the view that, the students entering SHS have poor Mathematics background and that, the earlier they got started, the better. Others were of the view that since some SHS1 students have poor Mathematics background, it would be better to teach Core Mathematics for the whole of the first term to give them the basic concepts, principles and skill in lieu of the Elective Mathematics.

Information on the number of periods allocated to elective mathematics per week indicated that most schools are making efforts to increase the number of periods for elective mathematics, many subjects on the school timetable are thwarting their efforts. The maximum number of periods proposed by Educational planners was seven periods of 40 min each.

Data collected on the number of minutes per period, 26 out of the 34 teachers indicated 40 min and the remaining eight teachers indicated 45 min. The total minutes per week ranges between 225 and 240 min. Incidentally, those who indicated six periods a week were the same number who allotted 40 min per period. Those who indicated five periods also spent 45 min per period. The values 225 and 240 were both below 280 min per period stipulated by the curriculum developers. This could be done by reducing the number of core subjects offered in schools. Some subjects could also be combined as one subject and programmes offered in a particular school could also be minimized.

Data collected on the list of topics taught in the first and second terms and their corresponding number of weeks for treatment revealed that in SHS One, topics taught included: Sets, Real Number System, Indices, Surds, logarithm, binary Operation, Mapping and Functions, Quadratics, Partial functions, Polynomial and Coordinate Geometry. The mean treatment duration was 3 weeks. From the data, a few numbers of topics are treated in the first term. This is attributed to late admissions of students to school during first term. On the same questionnaire, the teachers indicated that, the following topics were treated in SHS 2: Binomial theorem, Logarithmic functions, Sequence and Series, Inequalities in two variables, Trigonometry, Calculus, Logic with mean treatment duration of 3.9 weeks. Topics taught in SHS 3 included: Linear transformation, Matrices, Statistics, Vectors, Mechanics, and Probability with mean treatment duration of 4.3 weeks. From the results, the researcher realized that Elective Mathematics teachers teach similar areas for the various class levels but differ in their choices of topics in a term. This could be attributed to the following: teachers' own judgments, directives from heads of departments, the number of weeks in the term, the number of subtopics in the major topic and others. It will be expedient for the Ministry of Education, the

Curriculum Research Development Division (CRDD) and other stakeholders in Education to come out with a unified and sequential topics to be taught at all levels in a term. This will enable students from different schools to share ideas when they meet during vacations. Data collected to find out whether teachers were able to complete the treatment of topics and what efforts if any do they make to treat the unfinished subtopics revealed that majority of the topics were left uncompleted. A few of the topics were treated during part-time classes or extension classes.

On the experimental teaching, the actual mean time for the treatment of Quadratics and Functions in year one was 780 min. That for Trigonometry and Calculus in year two was 960 min. In year three, the actual mean time for the treatment of Vectors and Mechanics was 1080 min per topic.

Information collected on Elective Mathematics topics treated and the time spent on the topics by the 18 teachers for the second term of 2010/2011academic year indicated that:

1. Three topics on the mean were treated in year one with the mean treatment duration of 652 min per topic.
2. Three topics were meanly treated in year two with mean treatment duration of 915 min per topic.
3. Four topics were meanly taught in year three with the mean treatment duration of 92 min per topic.
4. The overall mean topics treated by the 18 teachers in the second term of 2010/2011 academic year were three with the overall mean treatment duration of 830 min per topic.

From the hypotheses, it was found out that, the actual mean time of 942 min for treating SHS Elective Mathematics with t-value 3.648 was significantly different from the intended mean time of 715.5 min. These hypotheses were tested using the student's t-statistic at 5% level of significance. The hypotheses were consistent with both Kwetey (1996) and Asare-Inkoom (2001) study. In both cases the actual mean time was found to be significantly different (more than) from the intended mean time. This implies that teachers have limited time to teach many topics. Furthermore, there was significant difference between the actual mean time (632 min) and the intended mean time (814.5 min) for treating SHS one Elective Mathematics, which was also consistent with both studies of Kwetey and Asare-Inkoom. The actual mean time is less than the intended mean time. Thus, SHS1 teachers have more time to teach few topics.

Also, there was significant difference between the actual time (1100 min) and the intended mean time (814.5 min) for treating SHS 2 Elective Mathematics. This was consistent with the study of Asare-Inkoom (2001). The actual mean time is greater than the intended mean time. Thus, teachers have little time to teach many SHS 2 topics. Again, there was significant difference between

the actual mean time (1095 min) and the intended mean time (560 min) for treating SHS 3 Elective Mathematics. This was also consistent with Asare-Inkoom (2001) study. The actual mean time is greater than the intended mean time. Thus, teachers have limited time to teach SHS 3 topics. Finally, there was significant difference among the estimated times by the three groups of teachers. This implies that the teachers' estimation of time for the treatment of the topics differ by their teaching experiences. This assertion does not agree with that of Asare-Inkoom. This could be attributed to the fact that, teaching requires experience and maturity. Long training in the subject teaching perhaps could make them estimate time well. Another reason could also be that, different schools have different times for a period. Moreover, lack of preparation for lessons such as unprepared lesson notes, lack of teaching and learning materials for lessons and improper monitoring and super-vision on the part of the school authorities could result in differences in estimation of time. Also, most teachers do not prepare termly and weekly forecasts that could help them to estimate time better. Lastly, some of the teachers teach the subject outside their area of specialization and this could lead to differences in time estimation. The one-way analysis of variance was used to analyze the estimated times.

The researcher is of the view that the intended treatment duration between 280 min per week for the SHS Elective Mathematics programme is quiet inadequate. Measures should be taken to increase the intended duration per week for the Elective Mathematics subject by either reducing or combining some core subjects in the syllabus or extend the duration for the SHS programme. Careful planning of lessons, proper monitoring and supervision of teachers could enhance full benefit of the teacher-student contact hours. Though it seems the Elective Mathematics syllabus is overloaded in terms of number of topics and contents, the intended duration given to the subject by the educational planners was inadequate.

The research design had its limitation due to the presence of confounding variables. The data obtained met the statistical assumptions but the sample size was too small that it limited the power of the statistics.

Conclusions

Based on the findings of the study, the following conclusions were made that:

1. The intended treatment duration of 280 min per week for the SHS Elective Mathematics program is inadequate.
2. There is statistically significant difference among the times estimated for the Elective Mathematics topics by teacher experience (inexperienced, moderately experienced, and experienced).

RECOMMENDATIONS

To improve upon the teaching and learning of mathematics and to address the issue of treatment duration of topics in the SHS Elective Mathematics syllabus, the researcher made the following recommendations:

1. More mathematics teachers, especially female mathematics teachers, should be trained at the universities to ameliorate the male dominance and to curb the situations where teachers teach the subject outside their field of specialization.

2. The teaching and learning of Elective Mathematics largely depend on the teacher's, competence, mastery of the subject matter and experience. Teachers should be able to adopt good strategies and techniques in their methodologies, thereby demystifying the development of student mathematics understanding.

3. The Ministry of Education in conjunction with Ghana Education Service and other stakeholders should organize periodic in-service training for Mathematics teachers so that they become abreast with current trends in the treatment of Mathematics. The service should find a way to entice teachers to stay in the work after acquiring experience in teaching. Also, well qualified mathematics teachers should be trained by the government of Ghana, private institutions and agencies to curb situations where some teachers in SSS teach elective Mathematics which is outside their field of specialization due to of shortage of teachers.

4. There should be a common or unified number of periods and treatment duration per week for various subjects in SHS curriculum including Elective Mathematics. This could help to put a stop to the present situation where schools had allotted different times treatment durations for Elective Mathematics on the schools' timetables. Also, the curriculum developers and designers intended to allot 40 min per period for seven periods per week for Elective Mathematics but the competition for time by other subjects on the time table do not permit that. This could be attained if the periods for the Core subjects are reduced and other related subjects are combined.

5. The Heads of departments, teachers, curriculum developers, and designers should take into consideration, the contents in a particular topic, contact hours and the treatment duration of the topics when allocating topics to various levels of the SHS programme.

6. According to Ghana Education Service and the Ministry of Education reports in 2006, school enrolment have increased tremendously because of the capitation grant and school-feeding program introduced to schools by the government of Ghana. This requires more hands in the Education Service. If quality education is required in Ghana, then, the determinants of effective teaching and learning in the schools such as instructional time, textbooks, teachers, motivation, experience and training,

school facilities etc. should not be frowned upon.

7. The agitation for increase in the number of years of the SHS program by a wider section of Ghanaians is in the right direction. Educational authorities should ensure that school hours are put to good use. Steps should also be taken to ensure continuity and cohesion of JHS and SHS programs as done in Nigeria.

Suggestions for further research

The findings of the study suggest further research. Research is needed to find out whether difference in motivation affects treatment duration. There is also the need to determine whether it is appropriate to begin the treatment of Elective Mathematics from SHS 1 or SHS 2. There is the need to research into the assessment of adequacy of the school facilities (classroom space, furniture etc.) the student- teacher ratio, strategies and techniques for teaching Elective Mathematics and teaching load of teachers for effective teaching and learning of mathematics. Though a description survey design was used in the study, the findings cannot be said to be representative of other situations in other localities in Ghana. This calls for replication of the study in other regions in the country. This should include schools in both urban and rural areas to make inter-regional comparisons in order to provide a basis for general conclusion.

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