



DYNAMICS OF TEACHING AND LEARNING OF MATHEMATICS IN GHANAIAN SENIOR HIGH SCHOOLS

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Abstract: This study examined student, teacher and environmental factors that influence mathematics education in Senior High Schools in Ghana. A cross-sectional data was conveniently collected from 305 final (3rd) year students of Ho Technical University who passed mathematics in the West African Senior Secondary Certificate Examination (WASSCE) successfully. With a 76.0% response rate, the questionnaire has a high level of internal consistency of 0.88 among the measured variables at 5% significant level, using SPSS version 22.0. The result which was analysed using the binomial test revealed that 78.8% of the respondents were between the ages of 20 and 25 years and 21.2% were above 25 years. Whilst 70.2% were taught by a maximum of three mathematics teachers, 29.8% were taught by more than three mathematics teachers in the senior high schools. With this, 68.3% of the respondents who were taught by a maximum of three teachers had between grades A1 and C6 whilst 39.3% who were taught by more than three teachers had between grades A1 to C6. As many as 52.0% responded that they did not learn mathematics because they knew of being helped during the examinations, whereas 40.0% and 42.0% said the grades they had at WASSCE and BECE respectively, were not the true reflection of their competencies. The findings indicated that 44.0% were nervous during examination because they did not prepare. However, 41.0% agreed that they had weak mathematical foundation, and 44.0% said they performed well without understanding mathematical concepts. Furthermore, 75.0% of the respondents specified that mathematics syllabi were voluminous to complete and 71.0% reiterated that learning materials were inadequate, thus making learning the subject difficult. In addition, 78.0% and 58.0% of respondents indicated that school management and parents did not support the learning of mathematics respectively. In conclusion, school management, teachers and parents must contribute to the success of students' mathematics learning and students must not have more than three mathematics teachers during their three-year stay in the senior high schools.

1.0 INTRODUCTION

As an indispensable tool for social growth and national development, education open doors to successful economies (Olawoye & Salman, 2008). This is mostly achieved through taught subjects including mathematics (Egbochuku & Alike, 2008). Learning mathematics is one of the primary goals in making students to reach high academic and professional competence (Anwer, 2019) as all disciplines rely on mathematics to solve problems by estimating outcomes (Santos-Trigo, 2020). Again, mathematics is about magnitude of numbers that are very useful in all disciplines to include science, engineering, technology and the humanities from which industrial development takes off (Anigbo, 2016). Mathematics therefore, is a fundamental aspect of human thinking and logic, providing effective ways of building mental discipline that is integral to understanding the world and oneself with reasoning and mental accuracy. Accordingly, mathematics is the foundation of science and technology that is vital in the socio-economic development of human life at different levels (Ayebale, Habaasab & Tweheyo, 2020). Furthermore, it is the queen of science, the language of nature and the bedrock of national development which cannot be overemphasized if a nation is to advance technologically (Alutu & Eraikhuemen, 2004). However, it is the most dreaded subject that learners fear among all subjects that are offered in schools (Akinoso, 2013). Despite its fearful nature, especially at the basic and secondary school levels, it is an important element in school curriculum (Santos-Trigo, 2019), as some programmes at the higher educational institutions require mathematics courses that play critical roles in the intellectual and social development of the students. The factors that contribute to the fearful nature of the subject may include teachers' attitude, content knowledge and pedagogical skills, and students' negative perception due to lack of interest and/or understanding, and government's inability to create the necessary learning environment and so on. Other factors were students' previous mathematics achievement, age especially for adolescents, gender stereotypes, classroom environment among others (Rajoo, Pengiran & Omar, 2013).

These are evident on how the teaching and learning of the subject takes place at all these educational levels including tertiary institutions (Fredua-Kwarteng, 2005; Appiah, 2016). For example, Ghanaian grade eight students participated in the last four Trend in International Mathematics and Science Score (TIMSS) exercise in 2003, 2007, 2011 and 2015 and performed at the lowest level when compared to students from other competing countries (Mullis, 2012). National performance in mathematics by students of basic and secondary schools has become a continuous worry to parents, educators and governments in recent times as this fact came out vividly when the average mathematics pass rate for grades 1-6 in WASSCE and BECE by candidates for the past five years ending 2017 is 30.1% and 72.6% respectively (WAEC, 2019). This notwithstanding, the competency in mathematics is very important to every individual in domestic and business pacts, scientific works,

innovation and creativity, and problem-solving in order to make informed decision in diverse circumstances of life. It is in this view that governments, educators, academic researchers, curriculum designers, parents, and employers are attracted to the debate for an immediate solution. This notwithstanding, the Ghanaian educational system considers mathematics as a core and compulsory subject at all levels especially at the basic and secondary levels of education. This approach is to ensure that all students are mathematically empowered in critical analysis and also to further their education in various programmes of their choice without any impediment (Fletcher, 2005).

In line with these poor performances in mathematics at these levels, the Ministry of Education pledged to collaborate with the African Institute for Mathematical Sciences (AIMS) to make mathematics teaching and learning more practical and lovely. AIMS' contributions to mathematics learning would be strong to empower mathematics teachers to professionally identify the challenges and needs of the students. It is believed that Ghana's socio-economic development will be enhanced if teachers help to demystify the notion that mathematics is difficult and encourage students to appreciate the importance of the subject for national development. Consequently, educators would desire growth interest in the values of mathematics education and how students value mathematics lessons in the midst of all difficulties (Davis, Carr & Ampadu, 2019; Seah & Wong, 2012). Values in mathematics education are related to the socio-cultural context of education (Bishop, 2008) as values across grade levels are strategically positioned due to the important roles it plays among students at various cognitive development levels. Research conducted by Davis, Carr and Ampadu (2019) in the Cape Coast Metropolis of Ghana for 1,256 Primary, JHS and SHS learners on 'What I Find Important' (WIFI), revealed that students value characteristics such as achievement, relevance, fluency, authority, use of ICT, versatility and strategies in learning mathematics (Seah et al., 2017b). It is therefore important to note that at this point, given the students an enabling environment, they will perform creditably in mathematics and its application to real life.

According to the National Teacher Education Curriculum Framework (NTECF), (2018), the main goal of mathematics education in schools is the 'mathematisation of the child's thinking' where clarity of thought and assumptions which lead to logical conclusions is central to mathematics enterprise (Ofori-Birikorang et al., 2020). There are many variations in factors that determine student performance in mathematics where studies have demonstrated strong and significant relationship between attitude towards mathematics and its achievement (Udonsa, 2015). There are other researches in mathematics as "like or dislike for" the subject indicating learners' attitude towards the subject to be positive or negative emotional disposition (Roh, 2003; Erdogan, 2020) where it is indicated that respondents expressed their feelings about the subject. To this end, students' and teachers' attitudes towards the subject and teaching methods and classroom environment were noted as key factors in all 28 articles reviewed on factors affecting the teaching and learning of mathematics (Chand et al., 2021; Naicker, Adeliyi, & Wing, 2020; Sharma, & Sharma, 2022). There seemed to be consistency in this review to the fact that parents can exert positive influence on their children's mathematics learning and performance (Enu, Agyman, & Nkum 2015; Tanveer et al., 2015; Kiwanuka et al., 2022; Sharma, & Sharma, 2022).

The Ghanaian secondary school system starts with the 3-year Junior High School (JHS) and continued with the 3-year Senior High School (SHS). The SHS students selects academic programmes such as General Science, General Arts, Business and Visual Art, according to their capability and achievements. However, the study of mathematics at the JHS and SHS levels is compulsory with the contents in the curriculum at the pre-tertiary level are comparable to those covered in other countries all over the world (Mereku & Mereku, 2000). Whereas, the primary teachers teach all subject including mathematics, the JHS and SHS teachers are specialized in the teaching of the subject. The minimum qualification to teach at the basic and SHS levels is a Diploma in Education and degree in Mathematics Education or Mathematics respectively. Nonetheless, it is common to find teachers without these qualifications, teaching mathematics due to lack of qualified mathematics teachers. Students in SHS study core mathematics with those studying science related programmes, take elective mathematics in addition. Students at these levels take core and/or elective mathematics examination at the end of every term which spans through 12 to 15 weeks. However, the final BECE and WASSCE which include mathematics at the JHS and SHS levels at the end of every three years are organized by the West African Examination Council (WAEC). The WAEC is the regional examination body responsible for the assessment of candidates' academic achievement to transition from the JHS and SHS into the secondary and tertiary educational spaces respectively. Stakeholders are usually keen about the conduct of these examinations with its outcome generating into an academic debate by teachers, parents and government as they all focus on the students passing the examinations. Interestingly, the system which is examination-oriented is highly criticised by the same stakeholders. Teachers also attempts to complete the mathematics syllabus through various instructional strategies to enable students understand the mathematical concepts and its application to everyday life.

1.1 Students Attitudes towards Mathematics

The student is the key person in the learning process; hence a clear understanding of mathematical concepts depends on his/her physical and mental health (Mangal, 2008). According to Piaget (1968), the learner has a basic potential in knowledge, intelligence, understanding, skills acquisition, innate ability and capacity to learn mathematics, so it is important that the teacher acknowledges this fact and guide the student in the learning process (Barrouillet, 2015). It is important also to note that learners have basic interest, aptitude and positive attitude to learning the subject and therefore aspire to achieve success. However, this aspiration must not be too high to cause frustration to the student and must also not be underrated (Mangal, 2008). In addition, learners have goals in life to maintain their philosophies despite the odds that may come their way (Skinner, 1968). Hence, learners of mathematics must have the readiness and will power to learn the subject because no power can make a learner learn except his own. Valero (2007) linked higher achievement in mathematics to positive attitude on the part of the students as earlier mentioned by Olatoye & Agbatogun, (2002).

Students' attitude towards mathematics affects their performance in different studies (Ayebealea, Habaasab & Tweheyob, 2020). A comparative study revealed that students' attitudes towards mathematics is directly proportional to their performance (Emeke & Benedicta, 2015; Öztürk, Akkan, & Kaplan, 2020). Also, the National Research Council (2000) as cited in Akey (2006) indicated that students' beliefs about their expectations and competence for academic success have been directly linked to their levels of engagement, as well as to their emotional states that inhibit their ability to be successful in school. In this instance, students have been found to approach mathematics as a procedural and rule-oriented activity, which prevents them from experiencing the richness of the subject through several approaches that could be used to develop competences (Emeke & Benedicta, 2015; Roh, 2003; Erdogan, 2020). Learners' negative perceptions about mathematics, as well as fear and anxiety, are learner-centred variables that contribute to poor mathematics performance in senior high schools

(Murugan & Rajoo, 2013). Thus, attitudes determine the kind of efforts a student put in to learning the subject. It has therefore become necessary for mathematics teachers to endeavour to sustain positive attitudes towards mathematics learning for the good performance of their students (Hwang & Son, 2021). Gender disparities also affect mathematics achievement where studies revealed that boys perform better in mathematics than girls; thereby, affecting the attitudes of girls towards the subject (Farooq & Shah, 2008). In comparative studies, girls lacked self-confidence due to weakening causal acknowledgement patterns with anxiety that is perceived about mathematics as their male counterpart dominate mathematics lessons (Kiwanuka et al., 2015; Garfield & Kearney, 2019).

Students are averse to mathematics because of the normal ways of teaching where teachers insist on using certain rigid skills which discourage them from trying to invent new ways to do things (Behrstock, & Minsky, 2008). In these regards, concepts and principles are presented abstractly and are later illustrated with examples that may be far away from the students' personal experiences or interests. Consequently, students' achievement in the subject is generally not good especially at secondary level of education in sub-Saharan Africa (Agyeman & Nkum, 2015). This is because their conceptions, attitudes, and expectations regarding the subject have been attributed to factors that underlie their negative experiences and achievements (Emeke & Benedicta, 2015; Kiwanuka et al., 2015; Ochwo, 2013).

The extensive recognition of mathematics as a useful subject build students' cognitive and intuitive ability to solve real-life problems. However, low achievement and interest in the subject among students continue to be a source of concern to academics and policymakers (Naiker et al., 2020; Sharmal et al., 2019). Despite serious attention paid to the study of the subject by stakeholders, students still do not perform well in mathematics examinations, rendering some of them not able to proceed to the next level of their education (Sarfo, Eshun, Elen & Adentwi, 2014). Accordingly, the International Mathematics Union, (2020), state that most African countries have inferior primary and secondary mathematics education, limiting the potential of people who pursue mathematic degrees at the university level.

1.2 Teachers' Attitude towards Mathematics

Effective teaching and learning are based on the competences of available human resource for the impartation of knowledge and enhancement of academic performances (Opore, 2012; Ankomah et al., 2015). Taking into consideration the above assertion, it suffices to note that among multiple factors of education, teachers are the ultimate definers of students' academic achievement (Adegoke, 2003) as there is no powerful influence on students' success than the teacher (Stronge, 2010). Teachers consequently, play important roles in the realization of high academic standard in every school system across the globe (Ayebale, Habaasab & Tweheyo, 2020). Even though there is a consensus about the importance and need of high-quality teachers, stakeholders including practitioners and policy makers are unable to agree on the specific characteristics that make a good teacher. The teaching profession has become greatly complex and the demands placed on teachers are continuously increasing in the ever-changing world. From a qualitative synthesis, the teachers' attitude is strongly mentioned to influence student achievement in mathematics (Ayebale, Habaasab & Tweheyo, 2020). So, learners subsequently take cues from the teachers' temperament to form their personal attitudes which may affect their own attitudes and learning outcomes (Mazana, Montero & Casmir, 2020). In a rapid systematic review, the positive attitude of a teacher towards mathematics was significantly related to high students' academic performance and behaviour (Bharti, 2018; Kele, 2018; Samlesh, Kaylash, Avinesh, & Visha, 2021). Therefore, teachers' beliefs about the usefulness of the subject, how it is to be learnt, its difficulty or ease, as well as the gender factor affect students' attitude towards the subject, thus, impacting on their performances (Sharma, 2018; Onderi, 2015). To this end, the mathematics teacher must manage the learning process and exhibit professionalism by maintaining discipline that is democratic, persuasive and interactive, as an attempt to defuse the negative perception that learners have about the subject. Bolaji (2005) in a study of finding the influence of students' perceptions towards mathematics found out that the teachers' good method of teaching mathematics and their personality greatly account for the students' positive perception towards the subject. Nardi and Steward (2003) opined that students' perceptions towards the learning of mathematics is considered as both an input and outcome variable because their perceptions toward the subject either reinforce higher or lower performance in educational achievement. So, teachers' inability to teach the subject competently and in an interesting way to prepare students for the required task ahead cannot be ruled out. This lack of students' interests which is mostly generated by the way teachers teach the subject also creates the tendency for students to respond to mathematics concepts with little or no self-confidence, negative feelings and worry. Literature has therefore, shown that these underachievement and poor performances by students are characterized by the way mathematics is taught in our schools. Hence, in a study by Schoenfield (2007) involving 850 4th-6th grade pupils and 48 teachers, noted that teachers' perceptions toward mathematics significantly enhances pupils' achievement rate. Another study in Australia involving 5th grade elementary school teachers noted that there was a strong correlation between teachers' perceptions toward mathematics and pupils' achievement with strongest relationship for low achieving pupils (Reeve, 2006).

It is argued that for effective teaching and learning to take place, teachers need to possess some sufficient degree of experience. Mavhundutse (2014) is therefore, of the view that experience is one of the major factors contributing to effective teaching. Most people argue that experience is the best teacher. On the contrary, Department of Education (2012) found that those teachers who had been recently trained and less experienced are more effective than the more experienced ones. It has the idea that newly trained qualified personnel have more to offer since they have new knowledge and skills with experience as compared to those with longer experience. The question that comes in mind is whether teachers employ the gained skills to teaching the subject after a long service. Tshabalala (2014) advances the argument that the quality of teacher training has an impact on teaching methods and improvement of teaching and learning skills. Butts (2010) discovered that the successful achievement of pupils whose teachers had pre-service training was higher in subjects such as Chemistry and Biology but made no difference in student achievement in Mathematics. Although a large number of studies have been carried out, there is little evidence on the direct relationship between teachers' knowledge of mathematics and student learning (Aurbrey (2006); Gay & Airasian, 2003; Ball, Hill & Bass, 2005). This therefore, points to the fact that teacher attitude plays significant role in student learning of the subject. In this connection, knowledge about mathematics teaching includes pedagogy and content, relationship between different aspects of mathematical concepts, the ability to interpret mathematics concepts during lessons, understanding students' thinking about a mathematical concept, and the ability to assess student achievement appropriately (Nicol, 2002). Therefore, effective mathematics teaching requires that the teacher possesses the qualities discussed here and even more to be able to help students to learn mathematics effectively.

1.3 Environmental Factors Affecting Mathematics Teaching and Learning

The poor mathematics performances of students cannot be exclusively attributed to the culture of teaching and learning but also includes the unavailability of material resources, students' socio-economic background and their superficial notion about the subject coupled with parental and societal beliefs (Christmas, Kudzai & Josiah, 2013). Therefore, teacher-centred, learner-centred, school-centred, family-centred, and environmental factors, among others, have impacted on mathematics teaching and learning quality. Guffey (2013) notes that school climate has an impact on teacher effectiveness and student performance in the school. It is argued that the way an individual in an organisation performs is determined by the organisational setting; in this case its climate. In a school where there is a bridge between school leadership and teachers, the climate is said to be conducive for effective teaching and learning. Where there are dialogues among the headteachers, teachers and the pupils, a healthy school climate prevails. Schools where communication is considered as the lifeblood breed give rise to effective teaching and learning environments.

So, environmental factor consists of the socio-economic status of the parents which is informed by their educational levels, income and occupational status and the managers of the schools (Jeynes, 2002) engendering high academic achievement of students (Considine & Zappala, 2002). Parents serve as role models and guides in encouraging their children to pursue high academic achievement by providing the educational resources and creating avenues in the home with particular attitudes and values towards their children's mathematics learning (Pardimin, 20018; Ayebale, Habaasa, & Tweheyo, 2020). In Uganda, it was observed that parents, particularly Parent-Teacher Association (PTA) were instrumental to students' learning and academic achievement (Kiwanuka et al., 2015). However, in a research conducted by Arop et al., (2020), parental support in terms of learning materials such as text books is low with no provision for extra lessons for their children except for a small proportion who guided their children on homework. Chingos and West (2010) are of the view that the level of education and occupational positions of parents are important determinants of pupils' mathematics achievement. Some pupils from lowly educated parents do not perform well at school because they lack motivation and parental support such that even if teachers are very qualified those pupils still do not perform well. Kift (2015) also add that ineffectiveness on the part of pupils is high from families of low socio-economic status, no matter which particular factors are used to measure socio-economic status. This should indicate that inadequate materials such as textbooks within the home background and lowly educated parents have effect on pupils' performance in schools. The diverse individual aptitude of pupils should also be taken into consideration, where a genius may be born within a poor family background. In addition, it is not always the case that performance from low-income families tends to be ineffective as far as academic achievement is concerned. Some children from even rich families may also perform academically poor due to other factors though poor performance among children from well to do families can not be underestimated.

The improvement of quality teaching for the enhancement of academic performance depends on the availability, provision and use of teaching and learning materials (Opore, 2012). Tetteh and Agyei (2022) discovered a positive relationship between the use of recommended textbooks and academic performance. Furthermore, Douglass and Kristin (2000) in an all-inclusive review of activity-based mathematics learning from kindergarten through to grade eight, resolved that using manipulatives produce higher mathematics achievement than those who do not use them. According to them, the long-term use of instructional materials by teachers who know their use improves teaching strategies hence ensures students' progress and attitudes. The teaching methods are therefore key in ensuring that the learners understand the underlying concepts in each lesson (Naiker et al., 2020; Sharma et al., 2018; Mohd et al., 2020; Ayebale, Habaasa, & Tweheyo, 2020). So, the major factors that ignite teacher effectiveness towards teaching in schools, is the availability of instructional materials such as charts, textbooks syllabi among others.

In defining the types of principles and methods for instruction, Mohd et al., 2020, Kearney and Garfield (2019) state that teaching methods depend on the kind of information or skill teachers use to convey concepts. A variety of strategies and methods are therefore, used to ensure that all students have equal opportunities to learn. However, if the teaching method does not favour students' understanding, due to lack of didactical and pedagogical skills and resources, students will achieve little or still fail the course. Available evidence suggests that schools that cultivate particular in-school processes and conditions such as rigorous academic standards, high-quality instruction, and a culture of collective responsibility for students' academic success are best able to meet the needs of students (Goldring, Porter, Murphy, Elliot, & Cravens 2007). In this regard, the school must provide the socio-emotional climate that ensures effective student-teacher, student-student and school-staff relationships. Finally, the availability of appropriate learning material and resources, proper conducive environment, proper seating arrangement, management and control of factors leading to distraction, cooperative and completion group situation, provision of opportunity for creativity and self-expression are factors that guarantee student academic achievement.

2.0 METHODOLOGY

This study examined student, teacher and environmental factors that influence mathematics education in Senior High Schools. So, a cross-sectional data was collected conveniently by administering a questionnaire to 305 final (3rd) year students out of 1103 who were present in the classroom for the second semester of the 2018/2019 academic year. The respondents passed mathematics at the WASSCE with various grades and pursued Higher National Diploma in various programmes from the School of Business, Faculty of Built & Natural Environment and Faculty of Applied Sciences & Technology of Ho Technical University. From the School of Business, 102 students returned the questionnaire, 93 students from the Faculty of Built & Natural Environment and 110 students from the Faculty of Applied Sciences & Technology returned the questionnaire. The researcher who designed the instrument from literature conducted face validity where three mathematics teachers of the university and five national service personnel read through the items and made some adjustments to remove all ambiguous, double-barrelled and leading items. The interviewer consequently, sought permission from the lecturers and distributed the questionnaire to the respondents and supervised its administration and collected same after close to 20 minutes. Those who did not want to participate in the exercise were exempted.

3.0 ANALYSIS OF DATA

Reliability and validity tests were conducted as participants may have divergent views on the items and for the assurance that items completely measure the constructs. (Ravand & Baghaei, 2016). With a 76.0% response rate, the questionnaire has a high level of internal consistency of 0.88 (Cronbach's Alpha coefficient) among the measured variables at 5% significant level, using SPSS version 22.0. The results were consequently, analysed using the binomial test as a parametric test to divide the responses into two classes with each observation belonging

to one or the other. This report is in three sections namely; the teacher, students and environmental factors which contribute to the teaching and learning of mathematics.

3.1 Student Factor

On the student factor, 42.2% of the respondents completed senior high schools between 2012 and 2014 whilst 35.1% completed between 2014 and 2016. Majority (78.8%) of the respondents were between the ages of 20 and 25 years and 21.2% were beyond 25 years. They pursued programmes in General Arts (33.8%), Business (31.2%), Visual Art (20.4%) and General Science (14.6%) in the Senior High Schools. The analysis showed that 70.2% and 29.8% of respondents were taught by a maximum of three (3) mathematics teachers and more than three (3) mathematics teachers respectively before completing school. In this regard, 68.3% of the 70.2% of the respondents had between grades A1 and C6 while 39.3% out of the 29.8% had between grades A1 to C6 in mathematics. The indication here is that students must not be handled by too many teachers in a course. As many as 52.0% responded that they did not learn maths because they knew they would be helped during exams which they have actually experienced during the examinations. The results showed that 40.0% and 42.0% of the respondents said the grade they had at West African Secondary School Certificate Examination (WASSCE) and Basic Education Certificate Examinations (BECE) respectively were not the true reflection of their competencies in the subject. These figures correspond to 44.0% who said they were always nervous during mathematics examinations because they never prepared before the examinations. This may account for the numerous examination malpractices that has bedevilled our institutions. In addition, 44.1% of the respondents indicated that they performed well in mathematics without understanding the concepts with 41.0% agreeing that their poor performance in mathematics was as a result of weak foundation. Remarkably, 57.0% of students said they are not competent to do mathematics without necessarily using the calculators for solving simple mathematical operations whilst 55.4% said that they do not have difficulty playing with figures. However, 52.0% were of the view that they don't like mathematics because they were negatively influenced by their friends and relations. When the participants were asked about the fear of the subject, 54.3% said they learnt the subject because their teachers put some fear in them and 64.2% said they couldn't perform better even if rewards were attached to studying the subject. In another development, 62.0% of the respondents said because their teachers taught them well, they practiced the subject and 52.0% agreed that they take initiative to studying the subject because they have some interest in it. A study conducted in Australia has shown that teachers' method of mathematics teaching and personality greatly account for students' positive academic performance and that without interest and personal effort in learning, students can hardly perform well in the subject (Bolaji, 2005; Koul, Fisher, & Earnest, 2006). So, pupils' perception about mathematics can be influenced by the attitudes of their teachers and their method of teaching. However, 73.0% said they did not have the capacity to develop understanding for mathematical concepts hence they couldn't practice the subject and 74.0% said they are not capable of good mathematical reasoning even if attention and care were directed to activities of their interest. In addition, 76% concluded that teachers did not give them challenging activities during mathematics lessons that would enable them to understand the concepts, however, 58.0% approved that their teachers' method of teaching motivated them to learn the subject, confirming that 66.0% disagreed that the teachers encouraged them just to memorize mathematics formulas and procedures. Many investigations have revealed that competence is nurtured primarily through teaching that engenders specific kinds of cognitive activity and not only by teaching to deliver knowledge (Glaser, 1991). As 52.0% of the respondent did not see the need for learning mathematics as a subject, when the question was posed, 47.0% of them did not see the practical nature or the application of mathematics to real life. By this, students struggle to find mathematics relevant and meaningful to their own lives, and as they see it to be boring and unnecessary (Uyangor, 2012). About 53% had time to learn the subject and 60% completed mathematics assignments on time without any difficulty, whereas 39% always struggled just to pass mathematics examinations and tests.

While 52% responded that they did not learn maths because they knew they would be helped during exams, 40.0% and 42.0% said the grade they had at WASSCE and BECE respectively were not the true reflection of their competencies in the subject. These figures correspond to 44.0% who said they were always nervous during mathematics examinations because they were not prepared before the exams. However, 44.0% of the respondents indicated that they performed well in mathematics without understanding the concepts with 41.0% agreeing that their poor performance in mathematics was as a result of weak foundation. The general perception is that students' performance in examinations depend on how well they prepare themselves towards the examinations in the teaching and learning environment of study (Akaboha & Kwofie, 2016). A plethora of research has shown that standardized test does not predict success for all groups (Cleary, Humphreys, Kendrick, & Wesman, 1975; Melnick, 1975; Nettles, Thoeny, & Gosman, 1986; Sedlacek, 2001) and that this test does not measure what they claim to measure (Benelli et al., 2010; Guinier & Sturm, 2001).

3.2 Instructional Factors

Effective engagement is meaningful to students' lives which aids the development of transferable process skills. The thinking processes and the 21st century competencies that students need to learn mathematics assist them in educational tasks in their daily lives. However, students will not learn these higher-level transferable thinking skills through memorization of mathematical facts, nor will they learn these skills by answering computational questions that have no connection to the real world (Stubbs, 2016). Accordingly, 82.0% of the respondents in this study said that teachers link new topics to previous knowledge whilst 59.0% saying that teachers linked lessons to life and the environment with 49.0% supporting the fact that teachers are competent in teaching the subject. Thus, linking the new learning to the past and correlating the learning in one area to the other has become a panacea to understanding mathematical concepts. Again, where teachers' knowledge is more explicit, better connected and more integrated, they tend to teach the subject more dynamically, represent lessons in more varied ways and encourage the students by responding fully to their comments and questions. In contrast, in the National Education Longitudinal Study of 1988, Fennell & Rowan (2001) found a positive relationship between students' learning gains and teachers' mathematical content knowledge of high school mathematics. While 58.0% of the respondents said that classes were always lively, 74% confirmed that their teachers make teaching very interesting through story telling with 77% claiming that there is no inhibition to the students to demonstrate natural intelligence in the subject. In addition, 56.0% of the students disagreed that teachers insist on a particular method in solving a problem and 74% confirms the statement that their teachers did not encourage them to bring out their own ideas to solve mathematical problems. National Ministry of Education (2001) described the view about mathematics as a kind of human culture and an indispensable tool that plays a unique role in enhancing people's ability to reason, imagine and create new ideas. In the words of Boaler (2008) cited in Guvendir (2016), mathematics as part of culture is a human activity, a social phenomenon, and a set of methods used to help illuminate the world. However, 60.0% disagreed that teachers discouraged their students from inventing new ways to solve mathematics problems. This assertion contradicts the earlier response that 77.0% of the respondents claimed that there is no inhibition to students demonstrating natural intelligence in the

subject. In support to this assertion, 63.0% mentioned that teachers intimidated the students when it is time for questions and answers even though 80.0% stated that teachers gave them feedback on any assignment given to them. Alajmi (2014) supports this result by saying that a good teacher provides feedback that allows students to evaluate the acquisition of new knowledge, reasoning and learning strategies. Following from this, cognitive research and practical experience have led to the improvements in identifying the characteristics of a good problem-solving technique (Skერიene & Juceviciene, 2020). On the issue of being punished for getting a wrong answer, 55.0% said they were not punished, rather, 76.0% of the respondents' indicated teachers didn't give them challenging activities during mathematics lessons to enable them understand mathematical concepts very well as 70.0% of them said group work was not encouraged. The report therefore, states that teachers did not demonstrate fair assessment strategies to enhance learning, as claimed by 75% of the respondents. However, providing students with evaluation rubrics often helps guide the teaching process and underscore the cooperative nature of the learning environment (Dahms & Stenoft, 2008). Furthermore, the results specified that 70.0% of the respondents disagreed that mathematics classes are more of competition than completion. To this end, Mennin (2007) states that groups have two functions: to complete student and curricular tasks and to fulfil group members' social and emotional needs such that learning outcomes and intrinsic motivation are influenced by the group work (Schmidt & Moust, 2000).

3.3 Environmental Factor

A total of 71.0% of the students agreed that teaching and learning materials are inadequate in all their mathematics lessons, hence making the learning environment for the subject not conducive neither attractive. This statement is confirmed by 78.0% of the respondents who said that the role played by the school management team in ensuring good performance in mathematics by the students was not available. In a study conducted in the Eastern Region of Ghana, responses from pupils and circuit supervisors (SISOs) indicated that the support the school and the teachers gave the pupils was inadequate to assist them pass their mathematics examination well. This response again reflected in the pupils' views during a face-to-face interview, where 36.8% of the pupils indicated that relevant teaching learning materials, textbooks and other learning facilities for mathematics are not available (Bawuah, 2013). In the case of parents influencing mathematics performance, 58.0% said their parents did not support or assist them to learn the subject even though the study revealed that most of these parents are literate. This notwithstanding, Akinsanya, Ajayi and Salomi (2014) agreed that parents' occupation could predict students' academic achievement in mathematics, stating that parents with high ranking occupational status might have enough income to provide the needed materials and support for their children in order to arouse their interest in mathematics than their counterparts in low ranking occupation or who do not have any job but whose major obligation is to provide shelter and food for the family. According to Dewey (1938) students thrive in an environment where they are encouraged to experience and interact with the curriculum, independently discovering meaning within the subject area and relating the information discovered to prior experiences, in order to make connections with what is known (Beard, 2018). With regards to the syllabus, 71.0% of the respondents were of the view that the mathematics syllabi were too voluminous to cover with the indication that 69.0% said there was not enough time to complete it. This statement is confirmed by 78.0% who said that the role played by the school management in ensuring students' good performance in mathematics was not available. In the case of parents influencing mathematics performance, 58% of the respondents said their parents did not support or assist them to learn the subject even though the study revealed that most of these parents are literate. The result indicates that literacy levels of parents' support mathematics learning and performance of students such that an average of 72.3% had grades A1 to C6. In the case of parents' occupation, an average of 72.2% of the respondents had grades A1 to C6 because 70% of the parents are well employed.

4.0 Conclusion

The study was carried out to provide a synthesis of the factors affecting students' mathematics achievement in senior high schools and its influence on studying STEM programme at the university. Basing our findings on factors such as, students' and teachers' attitude, instructional strategies, classroom environment, gender stereotypes and parental care, it is widely concluded that these factors influence student achievement in mathematics. Emanating from this study, it is also important to address these factors during the students' career so as to improve their performance in the subject and subsequently have improved student enrolment for mathematics and its related programmes in tertiary institutions. In conclusion, school administrators must contribute to their students' mathematics performance through the provision of learning materials and conducive environment whilst teachers exert positive attitudes towards the teaching of the subject through effective strategies and parents to motivate and supervise their wards in the learning process for an improved performance.

5.0 Recommendation

Teachers must be made to incorporate practical problem-solving techniques in the teaching and learning of the subject, relating same to everyday life of the learners in order to stimulate their interest. This technique, if well-structured and delivered will form part of the solution in producing technological and scientific oriented graduates who will solve the technological problems of the country as more students will enrol in mathematical related programmes in higher educational institutions of learning. Based on some of the conclusions of the study, the teacher must allow the student to explore ways of finding solutions to both theoretical and practical problems as against the teacher forcing his/her methods as the only way in solving the same problem. Thus, the teacher must be a guide to students' learning so as to develop adequate roadmaps for mathematics as a potential lifetime activity. Teachers must therefore, adopt good assessment strategies such as self- and peer assessment that affords the learner to intensify his/her learning skills.

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