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MATH-PHOBIA AND MATHEMATICAL PERFORMANCE CHALLENGES, A LINGUISTIC RAMIFICATION OF COLONIZED NATIONS OF AFRICA: EVIDENCE FROM GHANA

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ABSTRACT

The broad objective of the study was to establish math-phobia and mathematical performance challenges, as a ramification of linguistic of nations within Africa which were once colonized. The convenience sampling technique of data collection was used to select 120 students, in other to obtain the required data for the study. The major instruments that were used included questionnaire and class test on mathematical word problems and mathematics involving basic operators (i.e. plus, minus, division, multiplication, addition signs etc.). The data collected were analyzed using the 'Statistical Product and Service Solution' version 24 (SPSS) together with Microsoft excel. The findings from the research concluded that, the mean score of students in traditional mathematics (mathematics involving basic operators) was higher than that of the mean score of students in mathematical word problems in English at a significant mean difference. It was also established that there was a statistically significant correlation between the two variables, implying that instructional linguistic has an effect on the performance of students in mathematics. It was further established that students found it difficult to interpret and translate mathematical word problems written in English Language. The study finally recognized that students preferred to be taught in English Language but be interpreted to in their home language (Twi). Therefore, it is recommended that teachers who share with students the same home language should teach them in their home language or at least interpret vocabularies and terminologies that are often used for setting mathematics questions to students in their home language.

Keywords: instructional linguistic; Second Language; Colonized Nations; Math-phobia; Academic Performance

1. INTRODUCTION

Language is paramount for interaction between duet or more people specially in the instance where one wants to create the awareness of another person about an issue, knowledge, event, situation or an occurrence as in the episode of teaching and learning. It is worth knowing that there are numerous influences of effective teaching and learning of mathematics, language of tutoring stands out as a crucial factor (Benson, 2016; Espada, 2012). The fact that teaching and learning is often done through communication, means that at least a language would be a prerequisite in the process; this makes language a key factor to academic performance. The

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aspect of teaching which involves communication is only complete when information travels from the sender to the receiver, and is more effective where the receiver is able to decode the message and more especially is able to give a reply without struggling for choice of words.

In every activity or venture there is always a core unit which absence renders the existence of that activity or venture useless. Similarly, Umameh, (2011) cited in Tshabalala and Ncube, (2013) viewed mathematics as bedrock and an indispensable tool for scientific, technological and economic enhancement of any nation. In addition to that Davies and Hersh (2012) saw mathematics as an essential subject not only from point of view of getting an academic qualification at school, but regardless of a work of life a person may choose to be a part of, the subject has the potency of concocting students for the future ahead. Summarizing it in another way, Mefor (2014) posited that everything in the world does relate to mathematics no matter how large or small it is. Umameh (2011) added that mathematics is closely linked-up to routine life and for that matter the life-long planning of everybody. It is for this reason and more especially in line with student academic performance that Ampofo and Osei-Owusu (2015) stated that grades awarded to individuals at the end of an academic study are significant indicators of their ability and productivity when those individuals are affianced in their first jobs.

Considering these importance of mathematics and many other unmentioned ones, it is without doubt that teaching and learning of mathematics in a language that will facilitate the completeness of the process, so that students understand what is taught and are able to apply, is copiously prudent. Sario et al (2014) for instance found in their study that the use of mother tongue makes pupils more energetic, participative, and interactive in class. Launio (2015) recited that using bilingual, which is supporting second language instruction with mother-tongue improved students' performance progressively. Adding to that, the study of Espada (2012) explicitly discovered and opined that mother tongue had a strong influence on students' learning as it aids them to explore, intermingle and devise knowledge thereby enabling them to maximize their full capabilities in especially the area of logic building at the early phase of life. Specifically, for the reason that students who are enrolled into these schools is people who first language or mother tongue is not English (which is the colonial master language) of which their teachers instruct them in.

It is well known that linguistic influences thought formation and that thought formation is the genesis of learning. Therefore, there is the need to extremely study the stimulus of second language on mathematics learning. Teaching and learning of mathematics is like teaching and learning a language in another language. This whole scenario becomes more thought-provoking in multi lingual classes where both the teacher and their pupils do not share the same home language. In Ghana and for that matter the study area, the problem can be unique for a number of reasons: (1) the fact that English language is not the mother tongue of both the students and the teachers at the SHS, (2) there are so many languages in the country, for this reason many teachers and students do have different languages as their mother tongue, (3) there is culture disparities among these languages and hence some signs and sounds have different meanings and interpretations in the different languages. In other words, there is a great variation between Ghanaian culture and that of the British (Colonial master of Ghana), therefore some symbols and

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sounds definitely varies. This therefore makes the interpretation of some mathematical symbols, formulae among others difficult to some teachers. To buttress the above, Israel & Thomas (2013), orated that poor interpretation of mathematical language/symbols and constructions has contributed to the poor performance and bad attitude of students towards the subject. Ball (2014) opined that students who are enrolled in schools where they are taught in a language different from their mother tongue have more probability of dropping out of school or flopping in first grades.

Notwithstanding, a contemporary study executed by Essien & Mccann (2013) posited that although studies have substantiated that mother tongue usage in complementing teaching has proven effective, adopted language have not flopped entirely. This makes decision taking on the issue problematic and hence warrant the execution of this study for evidence based driven conclusion.

In addition, given that core mathematics is a main reason for most students who enroll into remedial classes and the popular re-sit West African Examination Council (WAEC) examination in Ghana implies that the issue has a lot to desire. Hence the recurring poor performance of Basic and SHS students in Mathematics in Ghana, the inconsistent findings in literature, and the paucity of literature and empirical evidence on the dispute in Ghana, are crucial indicators. For these reasons, the study is purported to establish math phobia and mathematical performance challenges as a ramification of using colonial masters' dialect for instruction at the SHS level in the Techiman North district of Ghana.

Research objectives

The general goal of the study was to assess Linguistic as a ramification of math-phobia and mathematical performance challenges in colonized nations of Africa. Specifically, the study concentrated on the following objectives:

i. To ascertain the ramifications of second language on the performance of students in mathematics.
ii. To find out the effect of English proficiency on students' ability to solve mathematical problems.
iii. To establish the preferred instructional mode and language that can positively impact students' mathematical performance.

Research Questions

The research work was grounded on the following research questions;

i. What are the consequences of language on your performance in mathematics?
ii. Does English proficiency affect your ability to comprehend and solve mathematical problems?
iii. Which language or mode of instruction do you prefer to be used for teaching mathematics?

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2. THEORETICAL STANDPOINT

Conceptual Framework

Linguistic is important when it comes to communicating ideas, knowledge, understanding to another person, and so it is, when it comes to teaching and learning where mathematics is not an exception. The fact that Mathematics teaching nowadays must emphasize the process of learning, applications of mathematics to the everyday world and problem solving makes language important (NCCA, 2005). The role of language as a medium of instruction in promoting an effective teaching and learning is an issue that has occupies the minds of many scholars all over the world for many years (Orr 1987a, 1997 as cited by Deyi, et al., 2007). The role of language as a medium of instruction has been a concern mostly in countries where immigrant children are in the minority such as United States and Canada (Krashen, 1981 as citedby Deyi, et al., 2007). In the light of this, one cannot ignore the fact that in countries where there are different languages spoken by its natives the issue of instructional language is a matter of concern. In Ghana the situation is not different, hence attracting a lot of attention.

The fact still remains that teaching of mathematics, however, takes place within a spoken language, such as English (Zevenbergen, 2001). This spoken language is an essential element of the teaching and learning of the subject (Gorgorió & Planas, 2001). In other words, language cannot be excluded in teaching and learning no matter what, and this make its impact so significant. Putting it in another way Prendergast, Faulkner & O' Hara (2015) emphasized that Language plays a significant role in the processing of mathematical text and the interpretation of mathematical questions. The ability of students to understand mathematical text and hence able to interpret them would determine whether they pass or fail test or examination in the subject. Students understand mathematical ideas by making connections between language, symbols, pictures and real life situations (Haylock and Cockburn, 2003).

One of the challenging issues to educational decision makers in many countries especially within Africa is identifying a language instructionally preferable for students' good performance in mathematics and for that reason examination. Some scholars are of the view that the use of mother tongue as an instructional language is appropriate, for others the use of second language (i.e. western languages such as English, French among others) is rather appropriate, and for some other scholars the use of both is appropriate. To throw more light to this, UNESCO (2008) research outcome shows that children first language is the optimal language for literacy and learning throughout primary school. In spite of growing evidence and parent demand, many educational systems around the world rather insist on exclusive use of one or sometimes several privileged languages. This means excluding other languages which are spoken by the children (Arnold, Bartlett, Gowani, & Merali, 2006). Adding to that, Benson & Kosone (2013) and Yiakoumetti (2012) in their research also suggested that engaging marginalized children in school through mother-tongue based, multilingual education is a successful model. However, this research seeks to add to the enlightening of the understanding of people and hence help educational policy makers take decision easily, including identifying a preferable instructional language to be used at the SHS level to help improve the performance of students specifically in mathematics.

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Linguistic Proficiency and Mathematics Achievement

The most fundamental and most asked question in the area of language relating to mathematics is, does bilingualism or multilingualism have any effect on students' mathematics achievement? This question is frequently asked by teachers, policy makers and researchers among others. Several studies have been conducted with the aim of answering the question. Some of these studies cut across various race, ethnicity and social classes (Secada, 1992 cited in Yushau & Omar, 2015), different countries and cultures (Bournot-Trites & Reeder, 2005; Bernardo & Calleja, 2005; Clarkson, 2007; Gerber, Engelbrecht, Harding & Rogan, 2005; MacGregor, Price, 2002) and students' educational levels (Barton & Neville-Barton, 2003; Grant, Cook, Phakiti & Lundberg, 2011; Padilla & Gonzalez, 2001). Furthermore, the studies were conducted using different perspectives and approaches such as comparing the following: monolingual versus bilingual students who studied under the same medium of instruction (Bournot-Trites & Reeder, 2005) students who studied in the medium of a foreign language (English) versus those who studied in their local language, and students who studied in a language switch mode in a medium using both foreign and local languages (Han, 1998 cited in Yushau & Omar, 2015).Other studies investigated the role of the proficiency level of students in their first language as compared to the language of instruction (Dakroub, 2002) and the students' performance in word problems stated in their first language as compared to word problems stated in the students' second language (Bernardo & Calleja, 2005; Clarkson, 2007; Riordain & O'Donoghue, 2009).

Educational researchers' findings in all these studies, though in conclusion, tend to agreed that language proficiency is one of the important factors influencing bilingual students' performance in mathematics (Secada, 1992 cited in Yushau & Omar, 2015). It is good to know that bilingual-ism can be of advantage or disadvantage to student depending on the proficiency level of student in two or more languages (Cummins, 2000). However, the deficit model for bilinguals has since been rejected and is now considered to be outdated by some scholars (Adler, 2001; Barwell, 2009; Clarkson, 2007).

In this section we review some of these studies in their diversity of approach and context. For instance, in the USA, not many researchers have shown interest in following the trend of the effect of language proficiency on mathematics achievement (Tate, 1997 cited in Yushau & Omar, 2015). However, the findings of a number of studies that looked into the issue since then (Abedi & Lord, 2001; Calderon, 2003; Grant, Cook, Phakiti & Lundberg, 2011) indicated that students' language proficiency has an impact on their mathematical performance. In the UK, Philips and Birrell (Phillips & Birrell, 1990 cited in Yushau & Omar, 2015) compared the perfor-mance of students in English medium who are native English speakers with Asians whose English is a second language. The performance of the Asian students in mathematics was far below their native English-speaking peers and also below the national mean. Further analysis of the examination items indicated that language factors were responsible for the low performance of the students.

Another study was conducted in the Wales where the students have different linguistic backgrounds. Some attended Welsh medium schools while others were taught in English (Dowker & Lloyd, 2005). It was reported that students in Welsh-medium schools performed

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better in mathematics than those in English-medium schools. Language factors were reported to contribute to these differences (Dowker & Lloyd, 2005). In a similar study, Roardria (2011) conducted an intensive study in Ireland on students whose local language is Gaelic. The study found that students in the transition from a Gaelic medium primary level education to an English-medium second level mathematics education experienced a disadvantage of 8.7 percent in performance in mathematical word problems. A significant relationship was also found between the students' performance in mathematical word problems through the medium of English and their Gaelic language proficiency. Furthermore, it was found that students with a high level of proficiency in both languages, and those who were predominantly proficient in Gaelic performed mathematically better than their monolingual peers.

In French immersion programs in Canada, Bournot-Trites and Reeder (2005) found that the group with high intensity French instruction outperformed the monolingual groups in mathematics and science. It was noted that by the time the students got into grade 6 they outperformed their monolingual counterparts in all skill areas (Swain, 2005). Therefore, overall, Canadian students have experienced positive benefits from participating in French immersion programs. Some other studies have found that the immersion students performed at a comparable level with English program students (Swain, 2005).

In New Zealand, Barton & Neville-Barton (2003), conducted a series of studies under a sociolinguistics framework with the aim of investigating students who were learning mathematics using English as a second language. The research which outlined the interplay between language proficiency level and the students' performance at the university level found that, due to language difficulty, this class of students experienced a disadvantage of about 10 and 15 percent in mathematics. These researchers also found that students learning mathematics through English medium as a second language encountered greater difficulties with text than anticipated, and as such they wrongly relied more on symbolic modes of working (Barton & Neville-Barton, 2003). Surprisingly, it was found that these second language mathematics learners were unaware of their disadvantage (Barton et al., 2005).

Conclusively, most research dealing with language issues in mathematics education have documented that proficiency in the language of learning and teaching is important for mathematical proficiency (Howie, 2002). The purpose of this research is to find out if instructional linguistic has an impact on the performance of students in mathematics at the SHS level.

Linguistic Proficiency and Ability to Solve Mathematics Problems

The ability to solve word problems in mathematics is an important skill that needs to be developed by students. Through mathematical problem solving, students are able to apply their knowledge and skills to real world situations. However, solving word problems is one of the most difficult tasks that students consider in mathematics (Wiest, 2002). The difficulty comes when students have to apply and assemble thoughts, concepts, and procedures to solve mathematical problems (Heinze, 2005). However, the most basic difficulty students face in solving mathematical problems is their ability to understand the problem structure embedded in

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the word problem (Adams, 2003). This makes the choice of linguistic for instructional purposes important and should be done with care. The fact possibly is that students can easily understand anything including mathematical symbols, concepts and structures in a language they are proficient in. In a study conducted by Cummins et al, (1988) cited in Ong et al., (2009), concluded that language comprehension determines whether students will be able to correctly understand pieces of information and how these pieces of information relate to each other. And hence their choice of solution procedures is dependent on how they understand the elements in a mathematical word problem (Riley & Greeno, 1988 cited in Ong et al., 2009).Various studies have shown that difficulties in mathematical problem solving are associated with difficulties in comprehending the problem especially when it is written in the learner's second language. In the nutshell, 'the language used when phrasing a question poses a major problem for students whose literacy skills is weak, they can therefore not answer a question they are mathematically capable of doing! This is a major issue!'(Cosgrove et al., 2012).

Many students (including those studying at Higher Level) have also expressed difficulties with interpreting word-based problems and with providing written explanations for their solutions to mathematical problems (Jeffes et al., 2013). This clearly indicates the important role proficiency in an instructional linguistic has on the performance of students. It is important to know that students also appear to lack confidence when asked to draw conclusions from a considerable amount of written information (Jeffes et al., 2013), due to the low level of proficiency of them in the linguistic they are instructed in.

Expanding the issue in many ways Nieman (2006) noted that the fact that a learner understands the educator in class and is able to, with ease, read in the language of teaching and learning does not presuppose that such a learner will understand academic texts as easily and write fluently. Earlier research by Cummins (1984) cited in Nieman (2006) had drawn a distinction between basic interpersonal communicative skills and cognitive academic language proficiency. While basic interpersonal communicative skills denote language proficiency in a social situation and characterized by interpersonal interaction, cognitive academic linguistic proficiency positions itself as second level of additional linguistic proficiency. This second level of language proficiency is what is needed if learners are to read and understand scientific reports, tasks or academic assignments in general (Nieman, 2006). The researchers took seriously the recommendation by the Centre for Development Enterprise that all mathematics (and Science) activities be "closed linked with improved language [English] education" (CDE, 2004).

Preferable Instructional Linguistic

Over the years the zeal of stakeholders of education in getting improve mathematics performance has been more serious to be ignored. This makes it important to identify a linguistic in which if students especially those at the SHS are instructed in would lead to improved academic performance. Many scholars have different views to this matter in their research findings within their scope of study. UNESCO has encouraged mother tongue instruction in primary education since 1953 and has highlighted the advantages of mother tongue education right from the start: children are more likely to enrol and succeed in school (Kosonen, 2005); parents are more likely to communicate with teachers and participate in their children's learning (Benson, 2002); girls

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and rural children with less exposure to a dominant language stay in school longer and repeat grades less often (Hovens, 2002; UNESCO Bangkok, 2005); and children in multilingual education tend to develop better thinking skills compared to their monolingual peers (Bialystok, 2001; Cummins, 2000; King & Mackey, 2007).

According to Kioko (2015)**,**in countries where English is not the first language, many parents and communities believe their children will get a head-start in education by going straight for English and bypassing the home language. However as a Professor, Kioko pointed out that, the evidence suggests otherwise. According to the researcher it is better for students to be taught in their own mother tongue where the principles in the subject taught can be understood and be easily applicable**.** To buttress the above, Sario et al. (2014) for instance found in their study that the use of mother tongue made pupils more active, participative, and interactive in class. Adding to that, Espada (2012) in their study found that the influence of mother tongue was strong in students' learning since it enables them to be interact, investigate, invent knowledge, thereby maximizing their full potential in logic building at an early stage. Similarly, many other studies have also revealed that teaching using the mother tongue in the early grades enhances children's ability to learn better compared to the use of a second or foreign language (UNESCO, 2003; Skutnabb-Kangas, 2003 as cited by Rai, et al., 2011). It has also been reported that if children are taught in languages which are different from their home language or mother tongue, they drop out of school, have low academic performance, and repeat classes due to a high failure rate. This state of affairs is persistent in Nepal (Yadava, 2007; Awasthi, 2004 as cited by Rai, et al., 2011) and may not be different in Ghana.

Viewing the matter in slightly a different way; Launio (2015) made mentioned that using bilingual, which is supporting second language in instruction with mother-tongue improved students' performance progressively. Adding to that, Essien & Mccann (2013) posited that although studies have proved that mother tongue usage in complementing teaching has proven effective, adopted language have not failed entirely. The authors stem from the background that most of the instructors in bilingual classes were mostly trained in the adopted language, textbooks written in the adopted/secondary linguistic, and that sometimes teachers struggle to interpret concepts and symbols in the mother tongue.

On the contrary to literatures supporting the use of mother tongue as instructional language, Howie (2003) who conducted a study on "Language and other background factors affecting secondary pupils' performance in Mathematics in South Africa" in that more than 8 000 pupils in 200 schools, where all the items pertaining to English proficiency and linguistic usage and their relationship to mathematics achievement were explored. Her study used partial Least Square analysis to explore the relative contribution of these factors to pupils' achievement together with other background variables from the student, teacher and principal questionnaires, resulting in the presentation of a school level, a classroom-level model, a student-level model and a combined class and school-level model. The author found that pupils' proficiency of English was a strong predictor of their success in mathematics. Though a number of other background variables on student and class-level were found to be significant, home language and class size were amongst those that were not found to have significant effect on achievement, whilst the

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effect of socio-economic status had a lesser effect once certain class-level factors were taken into consideration.

To add to that Kaphesi (2001) conducted a research work on "Effects of Home Language on Pupils' Performance in Mathematics" and saw that teachers and students who have same mother language and were taught by them will not be able to perform well as compared to those students who were taught by teachers who mother tongues differ from theirs. Going further the author noticed that there was interplay between pupils and teachers home language on mathematics learning. However, he concluded that; if mathematics learning was to be improved in his study area, it was recommended that teachers who shared with pupils the same home language teach pupils in their home language. The above statements support the claim of Dickins (2005) as cited by Jabak (2013) that translator training normally focuses on translation into the mother tongue, because higher quality is achieved in that direction than in translating into a foreign language.

Challenges Associated with Teaching and Learning in a Second Language

Second language in the context of this study is any dialect apart from the mother tongue language of an individual. These are languages learned either for their learning sake or are learned to enable the learner communicate with native of that language or to enable the learner further learn other things through that language. Depending on how well an individual is in a linguistic in no doubt determines his understanding of things in that language. The fact that mathematics is taught in a second language in the Ghanaian SHS level and examination questions are set and written in itmakes it a matter of concern. The issue is, whether students are able to decode the meaning of mathematics concepts in the second language or not.

However, many students (including those studying at Higher Level) have expressed difficulties with interpreting word-based problems and also with providing written explanations for their solutions to mathematical problems (Jeffes et al., 2013). Students also appear to lack confidence when asked to draw conclusions from a considerable amount of written information (Jeffes et al., 2013). These are evidence that such students are not too sure of their understanding of words and things in the language in which they are required to provide a written coverage on their answers. In an attempt to draw a relationship between language and mathematics,Setati (2005) talking about the relationship said that, linguistic serves as a medium through which mathematical ideas are expressed and shared. Among the challenges associated with language and academic performance is what is notice by Ball (2014), where she made mentioned that it was hard to grasp all that is at stake: parents not enrolling their children in school at all, children not able to engage successfully in learning tasks, teachers feeling overwhelmed by children's inability to participate, early experiences of school failure, and so on. Some children according to the author do succeed, perhaps through a language transition program that helps them to acquire the language of instruction. And that, there is a risk of negative effects in the case that children fail to become linguistically competent members of their families and communities lose the ability to connect with their cultural heritage.

Linguistic in mathematics has been shown to result in difficulties for all students due to unfamiliarity with contextualized mathematics problems or issues relating to 'miscues' in word

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problems (e.g. 25 would be a common answer to a question such as 'John has now collected 18 tokens. That is 7 *more* than he had last week. How many did he got last week?') (Haylock and Thangata, 2007). Such challenges appear to be amplified for students studying mathematics where English is not their first language, in other to impute the understanding of the questions. The issue becomes better when the first language and second language cultures share similar features the assumptions may contribute to effective learning. However, it worsens off when both cultures differ in so many aspects; learning is at risk (Rhalmi, 2014). The author acknowledges the fact that second Language learners face so many difficulties mainly because of the negative interference of the mother tongue and the cultural differences (Rhalmi, 2014). In that, setting things in one culture may mean the opposite in another culture and if learning is to take place in the language of that culture students automatically would always be completely lost in the class during lessons.

To add to that, children on starting school find themselves in a new physical environment. The classroom is new, most of the classmates are strangers, and the centre of authority (the teacher) is a stranger too. The structured way of learning is also new. If, in addition to these things, there is an abrupt change in the language of interaction, then the situation can get quite complicated. Indeed, it can negatively affect a child's progress. However, by using the learners' home language, schools can help children navigate the new environment and bridge their learning at school with the experience they bring from home.

Consequently, by using the learners' home language, learners are more likely to be engage in the learning process. The interactive learner-centered approach recommended by all educationalists; thrives in an environment where learners are proficient in the language of instruction. It allows learners to make suggestions, ask questions, answer questions, create and communicate new knowledge with enthusiasm (Kioko, 2015). It gives learners confidence and helps to affirm their cultural identity. This in turn has a positive impact on the way learners see the relevance of school to their lives (Kioko, 2015).In summary, the use of learners' home language in classroom promotes a smooth transition between home and school. It means learners get more involved in the learning process and speeds up the development of basic literacy skills. It also enables more flexibility, innovation and creativity in teacher preparation. Using learners' home language is also more likely to get the support of the general community in the teaching/learning process and creates an emotional stability which translates to cognitive stability. In short, it leads to a better educational outcome (Kioko, 2015).

3. METHODS

According to Saunders, Levis, & Thornhill (2000), studies can be grouped into three (3) main categories namely Descriptive, Exploratory and Explanatory. "The primary purpose of exploratory research is to shed light on the nature of a situation and identify any specific objectives or data needs to be addressed through additional research" (Saunders, Lewis, & Thornhill, 2000). Exploratory research design was therefore employed with little descriptive methodology as information on the relationship between instructional linguistic and students' performance in mathematics was not wide spread in the Techiman North district. The research

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design adopted for this work included the use of test and face to face in-depth interviews for respondents (the students and the mathematics teachers in the Krobo SHS in the district), together with the administration of self-constructed structured questionnaire. Generally, data was gathered on how respondents view the consequence of second language as an instructional linguistic on the performance of students in mathematics.

Students of the school were given test made of two sections. The first section was made of mathematical expression for them to solve. The second section was basically the same mathematical expressions worded in English language (second language) in the form of mathematical word problems. The purpose was to establish whether the linguistic of our colonial master (English) has an effect on the understanding and computation of mathematics and whether or not students generally do understand or like the subject.

The Study Population

Bryman et al (2003) defined the population of a study as "the whole group that the research focuses on". The target population of the study included all the students of the school who study core mathematics. Specifically, the study focused on year one students of the study institution and also on teachers who have been teaching mathematics for a long time. The study denoted 203 students and four mathematics teachers in this category.

Sample Size

Sample size stands for the really privilege pieces of a population which after several considerations have been selected to be used to attain a set of objectives. For the purpose of our study one hundred and twenty (120) of the year one students and all the four teachers were considered for the execution of the research.

Sampling Technique

The sampling techniques espoused for the study was convenience sampling technique. Convenience sampling is selecting the research participants on the basis of being accessible and reasonably representative of the population of interest (Baumgartner, Strong and Hensley, 2002). This sampling method is a non-probability sampling technique which was employed by the researchers in that only the first year students in Science and Agricultural classes were deem convenience for the study and hence were selected. This is because the researchers were given some time to test the students and get them answer the research questionnaires.

For the selection of students from the two classes for the study, universal sampling technique was employed in that all the students who were present in the classes were allowed to take part in the test and in responding to the questionnaire.

Data Collection Procedures

On collecting data, every student was assessed on mathematics in English language. On assessing the students, mathematics questions were set in word problems format in that the questions were worded in English language and the same questions kept back in figures form in mathematical expressions for the students to answer. This was to aid the researchers in understanding how language affects performance in mathematics. All the students were given the

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same time for the completion of the questions. While no pressure was put on the students, communication among them and the use of foreign materials was strictly checked and curtailed.

Immediately after assessment, students were interviewed on various issues regarding their perception of the impact of language on their performance in mathematics, challenges bedeviling them as they are taught in a linguistic either than their mother tongue, and eventually on a language they prefer to be instructed in. Teachers too were interviewed on issues of language and classroom learning. The results are discussed in the next session.

Research Instrument

Three main research instruments were employed to source relevant data for analysis and presentation. The first was a test given to respondents; one section purely in mathematical expression and the other section had the same test question in the first section worded in English language in the form of word problems. Following that, was interview schedule which was conducted to gather some specific answers from the sampled mathematics teachers of the school and from the students as well. Another equally important instrument employed in the data collection process was the use of assessment questionnaire on preferable instructional linguistic to students.

Mode of Data Analysis

Data collected was examined by first cross checking, coding, editing and tabulating. Cross checking was done to ensure that collected data was accurate, coding was carried out to have the data in the "Statistical Product and Service Solution" (SPSS) form for execution. Editing was performed to discover and remove errors in the collected and coded data. Tabulation was done to have processed information in a summarized form. Data was analyzed with the research objectives in mind. For the purpose of this research, data collected from the administrators, the teachers and the students of the school was analyzed using descriptive statistics (i.e. frequencies, means and percentages) and inferential statistics (correlation and T-test).

4. RESULTS, DISCUSSION & FINDINGS

Mathematics Learning Ramification & Challenges in a Non-Mother Tongue Linguistic

Table 1; Descriptive Statistics of Survey

Statements on ramification of learning mathematics in English	N	Mean	Std. Error	Std. Deviation
Find it difficult to read mathematical text written in English language	120	3.47	0.11	1.23
Usually don't know what is expected of me when mathematics exam is in English language	120	3.95	0.09	1.07
like mathematics, but often find it	120	3.97	0.09	0.94

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difficult to interpret mathematical words problem in English				
Not familiar with many of the English words used in setting mathematics questions	120	3.89	0.09	0.98
I think mathematics is easy but when it is written in English on the blackboard or textbook, I found it difficult to follow.	120	3.63	0.09	1.07
I understand mathematics better in Twi than in English	120	3.64	0.09	1.03
I will do better if my mathematics exams are interpreted to me in Twi	120	4.03	0.18	1.9
My performance will be better if my mathematics instruction is in Twi	120	4.01	0.11	1.19
It does not matter if mathematics exam is in Twi or English, I do perform well	120	2.54	0.11	1.16

The illustration on table 1 above is made of nine survey statements which were presented to the sampled students to help ascertain their views on how English, a non-mother tongue linguistic which is used for instruction, affect their performance in mathematics. On the overview, except for two statements of which the mean of the responses imply that respondents took a neutral position, they however agreed to the rest of the statements.

The representation in the table above therefore depict that students remained neutral to the statement that it doesn't matter whether they are examined in Twi or English they do perform well and that of the statement "you find it difficult to read mathematical text written in English language". The mean score recorded for the two statements were π =3.4 at a standard deviation of 1.2, mean error of 0.11 and π =2.5 at standard deviation of 1.2 with mean error of 0.1 correspondingly.

On the other side, the students agreed that they usually don't know what is expected of them when mathematics exam is conducted in English, this pop-up with a mean score of π =3.95 at a standard deviation of 1.1 with a minimal standard error of mean 0.09. They further indicated that, they like mathematics, but often find it difficult to interpret mathematical word problems posed in English, which was at a mean score π =3.97, with standard error of mean 0.09 and a deviation of 0.9. This establishment agrees with the finding of Jeffes et al., (2013) who orated that many students have difficulties with interpreting word-based problems and with providing written explanations for their solutions to mathematical problems.

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The respondents also added that they were not familiar with many of the English words used in setting mathematics questions, their average responses ($\pi = 3.89$ with deviation 0.98 and standard error of mean 0.09) depicted that English words prevalently use for setting mathematics questions were not conversant to them.

Furthermore, it was denoted that though students viewed mathematics to be easy, they however found the subject difficult when it is written in English on a blackboard, paper or on a textbook. Majority of the replies (mean score = 4.09, at a standard deviation of 0.80 with standard mean error of 0.10) emphasized that the students did found it difficult to understand mathematics presented in word problems format. To buttress that, the average responses (mean score of 3.6 with standard deviation of 1.02 at mean error of 0.09) opined that students did understood mathematics better when taught in their mother tongue (Twi) than in English.

Exploring the issue further, a good number of the students in their response (mean score = 4.03, at standard deviation of 1.9, with standard error of mean 0.18) also denoted that the students believe that their performance will improve if mathematics examination questions are interpreted to them in Twi. This is in total agreement with Launio (2015) finding where he recited that using bilingual, which is supporting second linguistic for instruction with mother-tongue improved students' performance progressively. It could be inferred that low proficiency in English language is the root of students fear of mathematics and hence the challenges the faced in performing well in the subject.

Consequently, the students were of the view that instruction in their mother tongue (Twi) would lead to improvement in their performance. The students emphatically orated that their poor performance in mathematics was as a result of their low proficiency in English language in which they were instructed in. In that, majority of them in their responses (mean score = 4.01, at standard deviation of 1.2, with standard mean error of 0.10) believed that, they could performance better if instructed in 'Twi', their native language. The discoveries are in congruence with the findings of Yushau & Omar (2015), who established that language proficiency is one of the important factors influencing bilingual students' performance in mathematics.

Respondents' Preferred Instructional Linguistic

Table 2; Mean Distribution on Preferred Instructional Language

Statements on respondents preferred instructional language	N	Mean	Mean Error	Std. Deviation
You prefer to be taught and examined in Twi	120	2.96	0.11	1.21
You prefer to be taught in Twi but examined in English	120	3.71	0.19	2.14
You prefer to be taught and examined in English	120	3.06	0.11	1.23

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Your prefer to be taught in English but be interpreted to in Twi and be examined in English	120	3.92	0.09	1.02

The distribution in table 2 above signpost that the students did not take a clear stand (i.e. neutral at mean score = 2.96, standard deviation 1.12 and at a standard error of mean 0.11) on whether they would prefer to be instructed and as well be examined in 'Twi'. On the other side of they being instructed and as well examined in English, their responses were found to be impartial (at a mean score = 3.06, standard deviation = 1.23 and a standard error of the mean = 0.11). Adding to that, the sampled students were asked, if they would prefer to be tutored in 'Twi' and be examined in English language rather. Their responses were found between neutral and agree but was much closer to agree (mean score = 3.71, standard deviation =2.14 and a standard error of mean 0.19). Inductively, the students seem to prefer this option but were maybe uncertain of how the impact on their performance would be.

Moreover, the average of the students' responses on they being taught and examined in English language but be interpreted to in 'Twi' their native language indicated that the sampled students did subscribed to this alternative (at a mean score=3.92, a standard deviation =1.02, and a standard error of mean =0.09). Eventually it could be inferred that, though the students truly want to be instructed in English language (a second language), for them to have a clear understanding of whatever they are been taught, they would want to be explained to in their native language (Twi). The finding subscribes to the finding of **Kioko (2015), where the professor opined that it is better for students to be taught in their own mother tongue whereby the principles in the subject taught can be understood and be easily applied.**Furthermore, the finding agrees with the findings of Kaphesi (2001) who conducted a research work on "Effects of Home Language on Pupils' Performance in Mathematics" and noticed that there was interplay between pupils and teachers home language on mathematics learning. On that note he concluded that; if mathematics learning was to be improved in his study area, there was the need that teachers who share with pupils the same home language should teach the students in their home language.

Correlation between Proficiency in English and Mathematics Performance:

Table 3; Comparison of Mean Scores

Parameters	**N**	**Mean**	**Mean**	**Std. Deviation**
Score in test involving mathematics basic operators	120	57.34	1.67	18.31

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Score in English worded form of mathematics test	120	21.89	1.56	17.1

The illustration above on table 3 indicates that the average score of the sampled students in mathematics test involving basic operators in the form of algebraic expression was 57.34 at a deviation of 18.31 with a mean error of 1.67 as juxtaposed to the average (mean score = 21.89 subjected to standard deviation of 17.10 at a standard error of mean =1.56) score they had in same test questions which were worded in English language in word problems format on the same test paper at the same time. In fact, the same questions well answered, involving basic mathematical operators in the form of algebraic expression could not even be attempted in the word problems form by many of the students. The researchers' interaction with the students after the test when trying to solve the questions together with the student noticed that most of them have reading problems and some others could read with no understanding. Majority of the students could not identify the question involving mathematical basic operators as the same questions restructured in word problems format.

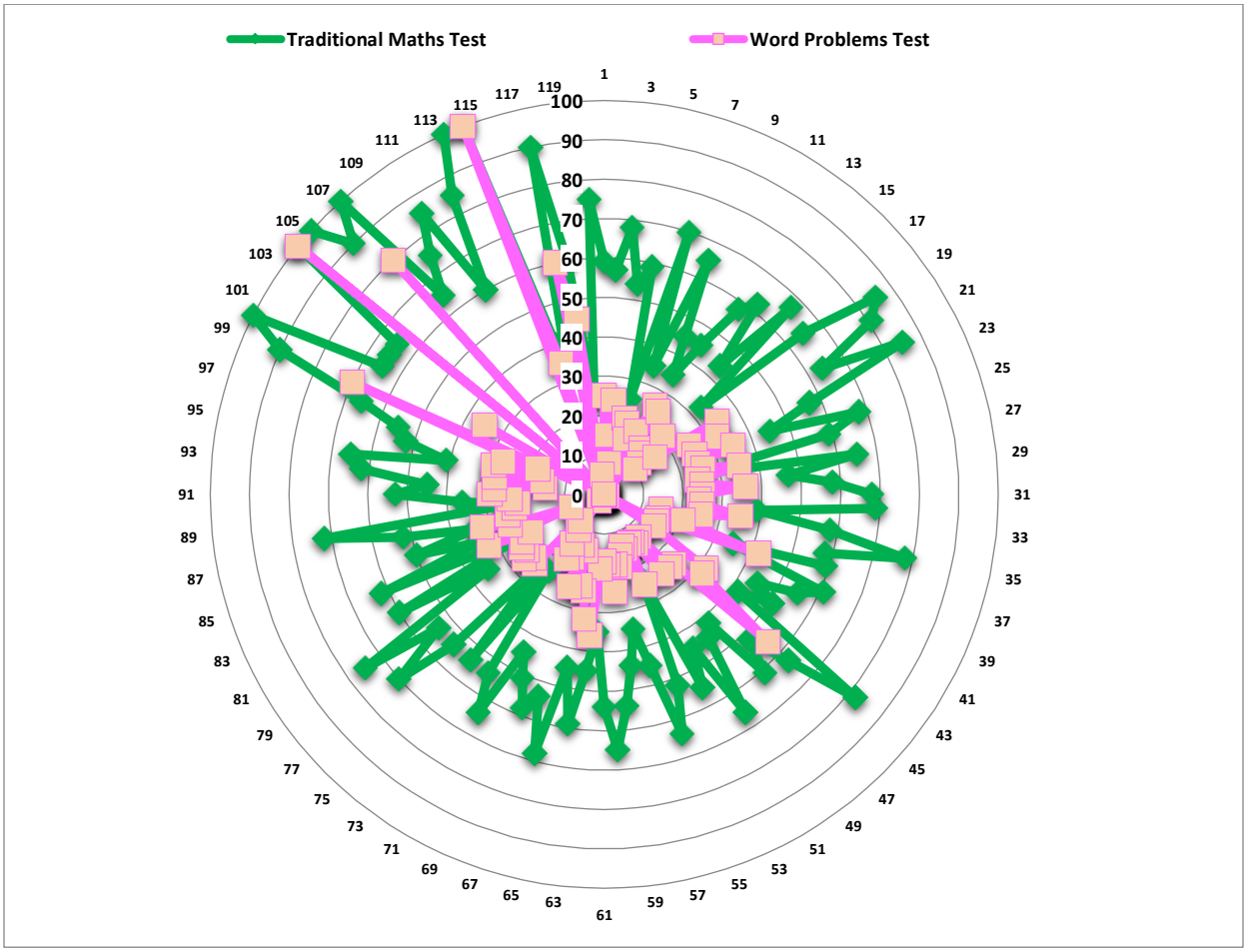

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Fig.1. Illustration of scores of students in algebraic expression & worded form test

Table 4; Correlation of the Variables

Paired Samples Correlations	N	Correlation	Sig.
Score in test involving mathematics basic operators & Score in English worded form of mathematics test	120	0.215	0.018

The correlation between the scores of the sampled students in a test involving basic operators (i.e. +, ×, ≤, ≥, −, ÷ etc.) of mathematics and that of a test in the form of mathematical word problems of the same content as the first test was found to be statically significantly (0.018 >0.05) positive (r = 0.215). This also shows that there is a significant direct relationship between the variables. This implies that an increase in performance of a student in mathematical word problems will automatically imply an increase in the score of the same student in mathematical test involving basic operators. Since word problems questions are the application ofmathematics madeof basic operators. The ability of a student to understand, solve and score high marks in the application aspect depict that such a student has grab the full concept of mathematics involving basic operators and should as well perform better in it.

Table 5; T-Test Comparism of the Variables Means

Paired Samples Test	Paired Differences					Sig
	Mean	Std.	Std. Error Mean	95% Confidence Interval of the Difference		
				Lower	Upper	
Score in test involving mathematics basic operators & Score in English worded form of mathematicstest	35.5	22.2	2.03	31.44	39.46	0.00

The table above entails the significant mean difference between the variables computed. The T-test recorded a significant (0.00 < 0.05) mean difference (mean difference of 35.5) in the students' score in the test involving basic operators of mathematics and that of the scores of the same students in mathematical worded form of test conducted. Implying that the scores for the

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two variables is not the same in the study institution as the mean is within the lower and upper bounds of the 95% confident level of which this study has been subject to, whereby 5% margin of error is acceptable.The finding above is in full congruence with the results of Cosgrove et al. (2012) who in his study stated that 'language used when phrasing a question poses a major problem for students whose literacy skills is weak, they can therefore not answer a question they are mathematically capable of doing! This is a major issue!'

Table 6; Regression Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.215[a]	0.05	0.04	16.77

From table 6 above, an R square value of 0.05 was obtained for the model implying that above 5% of the variation in the results of the students in the English worded form of mathematics test is accounted for by the model. Notwithstanding, the adjusted R square was 4%, which is a measure of the model fit, if the number of the scores of the students in the mathematical test involving basic operators (i.e. independent variable) is to be adjusted.

Table 7; Regression Measurements

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
(Constant)	10.372	5.05		2.05	0.04
Score in test involving mathematics basic operators	0.201	0.08	0.215	2.39	0.02

The linear model for predicting the results of the students' scores in English worded form of mathematics test using the scores of mathematics test involving basic operators (i.e. +, ×, ≤, ≥, −, ÷ etc.) is Y = 10.37 + 0.2X. Where Y is the scores in the English worded form of mathematics test (dependent variable) and X is the average score of all the scores in mathematics test involving basic operators (independent variable). From the linear model, the coefficient of scores in mathematics test involving basic operators in table 7 is 0.2, meaning an increase in a student score in the mathematical test involving basic operators by one would lead to a 0.2 increase in his score in the mathematical word problems test. The regression constant (B =10.37) also shows that if a student score an additional 0% in mathematics test involving basic operators (that is X = 0) his marks in the English word form of mathematics test will be 10.37%.

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Summary of Findings

The goal of the study was to assess math-phobias and mathematical performance challenges as a ramification of instructing students in the linguistic of colonial masters of nations in Africa. Specifically, the study focused on establishing pragmatic evidence on; 1) the ramifications of second language on the performance of students in mathematics, 2) English proficiency on students' ability to solve mathematical problems, and 3) preferred instructional mode and linguistic that can positively impact students' mathematical performance.

In the light of this, the study unearthed the following as challenges which bedeviled students in mathematics as a result of them being instructed in English language which is not their mother tongue. Firstly, the students aired out that whenever mathematics questions were set in English language (mathematical words problems) they often don't know what is expected of them as the found it difficult to interpret the questions. According to the sampled students, as though they like mathematics, this challenge often takes their interest off the subject. Secondly, it was also noticed that many of the students found it difficult to read mathematical questions posed in English Language. Thirdly, the students further indicated that they were not familiar with many of the English language words that were often used in setting mathematics questions. And lastly, the students specified that though they did not perceive mathematics to be a difficult subject, however whenever it is written in English on the blackboard or textbook, they do found it difficult to follow. The evidence was clear as the same questions were put in figures form (e.g. ½ + 3 -1=…) and again put back in mathematical word problems form (e.g. We went for mangoes hunting, on return I had half a mango with me, my brother had three mangoes with him and later noticed that one of them was nowhere to be found, so how many mangoes are there at the present time). Students were able to answer the questions in the figures form and could not even attempt the same questions in the mathematical word problems. This clearly signpost that many of the students' challenges and fear of mathematics is for a reason that they have problem with the non-mother tongue linguistic (English) in which they were instructed.

On the part of preferred instructional linguistic, the sampled students, declared their interest of being taught in 'Twi', or if it was to be carried out in English language, they should be interpreted or explained to in 'Twi' which is their home language. The students emphasized that the concept in mathematics becomes much clearer to them in their own language than in English. An interaction with one of the students by the research team, revealed this "I suppose mathematics is a cheap subject, we know it but the language in which we are instructed in is our problem, our parents who have never being to school understand mathematics as they calculate everything they want to do, be it the quantity of seeds which can cover their farm lands, among others. We grew up with them and are taught all these things including addition, multiplication and subtraction. I don't see why mathematics should be difficult to me, but English language often kills my interest in the subject. So I prefer to be at least interpreted to in 'Twi'."

Lastly, when it came to the issue of the effect of English language proficiency on the ability of students to solve mathematical word problems written in English, though there was a statistically significant correlation between the two, the mean score of students in traditional mathematics (mathematics in figures form) was higher than that of the mean score of students in mathematical

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words problems in English at a significant mean difference ($\pi = 35.5$, $0.00 < 0.05$). Generally, it could be deduced that proficiency in English was a calamitous factor and need to be checked.

5. CONCLUSION

Based on the discoveries coined from the study, it is concluded that instructional language is the ramification of math-phobia and the challenges students' facade in academic performance more especially in mathematics. Henceforth, the stakeholders of education in the country should take desire in training English language teachers with many dynamic skills to be able to help improve the SHS students' proficiency in the language since it is the platform on which mathematics is taught in the country.

6. RECOMMENDATIONS

The study delved into the effect of instructional linguistic on the performance of SHS students in mathematics. It was established that, students like mathematics, but often found it difficult to interpret mathematical word problems posed in English. It is against this background that the study recommends that Mathematics teachers should find the correct translation of mathematical syntax in the home language of their students and explain the syntax first to the students in their home linguistic at every introductory lesson. And as much as possible teachers who share with students the same home language should teach them in their home language or at least interpret vocabularies and terminologies that are frequently used in mathematics to students in their home language.

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