

NYIRAMAFARANGA A.

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**THE RELATIONSHIP BETWEEN LANGUAGE PROFICIENCY AND
PERFORMANCE IN MATHEMATICS: A CASE STUDY OF DISTRICT
SECONDARY SCHOOLS IN KILIFI AND MALINDI DISTRICTS, KILIFI
COUNTY**

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NYIRAMAFARANGA ADIDJA

**A thesis submitted in partial fulfillment of the requirements for the award of
the Degree of Master of Education of Pwani University**

September, 2014

Declaration

This thesis is my Original Work, and has not been presented for a degree or any other award in any other University or College for examination.

..... Date

Adidja Nyiramafaranga
E55/PUC/2039/011

Approval

We confirm that this thesis has been submitted for examination with our approval as University supervisors.

1. Date.....

Prof. Helen Omondi Mondoh (PhD)
Professor
Department of Curriculum Instruction and Educational Technology
(Pwani University)

2. Date.....

Dr. Emily Ayieta Ondondo (PhD)
Lecturer
Department of Linguistics, Languages and Literature
(Jaramogi Oginga Odinga University of Science and Technology)

Dedication

This work is dedicated to my wonderful immediate family, parents, late uncles and sisters who supported me throughout my life unconditionally.

Acknowledgement

I wish to express my sincere gratitude to my supervisors and mentors, Professor Helen Omondi Mondoh and Dr. Emily Ayeta Ondondo for their interest, advise and constructive criticisms that made this thesis what it is. To my beloved husband and children, I am honored by your unconditional love; thanks for your understanding on the days when you could not have my full attention. My colleagues in the Department of Curriculum, Instruction and Educational Technology (CIET), Head Teachers, Teachers in the schools where I collected data deserve praise for the role they played in the completion of this work. To all of you: your love, friendship, assistance and encouragement when it seemed that this was an impossible dream and a lost cause, have meant and still mean so much to me. I thank God.

Abstract

Despite the fact that Mathematics is the backbone of new emerging sciences, the general performance in Mathematics among secondary school students remains poor. Research evidence shows that poor performance in Mathematics not only results from intrinsic conceptual difficulties in the subject but also springs from language considerations. However, Mathematics educationists seem to be in disagreement with respect to the relationship between language proficiency and performance in Mathematics. This study, therefore, set out to find out the relationship between language proficiency and performance in Mathematics. The study was based on Vygotsky's socio-cultural development theory. The study was conducted in Kilifi County. The research design was correlation, and simple random sampling method was used to select students. Data was collected by the use of tests, and descriptive and inferential statistics was used to analyse data collected. The Karl Pearson's coefficient of correlation (r) was employed to measure the degree of the relationship between variables. The findings emerging from this study reveal that there is a significant positive relationship between Language Proficiency and performance in Mathematics. The findings also support strongly the Vygotsky's theory. It is hoped that the findings of this research could help authors, language policy makers, the Ministry of Education as well as the schools management to find solutions to language related problems that hinder performance in Mathematics. Finally the results of this study could also serve as a springboard for further investigation in the same area.

Abbreviations and Acronyms

DoE	Department of Education
KCSE	Kenya Certificate of Secondary Education
KIE	Kenya Institute of Education
KNEC	Kenya National Examination Council
L1	First Language
L2	Second Language
LI	Language of Instruction
LM	Language of Mathematics
MAT	Mathematics Achievement Test
MoE	Ministry of Education
NCST	National Council of Science and Technology
OECD	Organisation for Economic Cooperation and Development
PLI	Proficiency in the Language of Instruction
PLM	Proficiency in the Language of Mathematics
SMASSE	Strengthening Mathematics and Sciences in Secondary Education
STI	Science, Technology and Innovation
ZPD	Zone of Proximal Development

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CHAPTER ONE: INTRODUCTION

1.1 Background to the Study

Mathematics is an important subject, whose usefulness touches on every area of human endeavor. Mathematics is related to other subjects; both in Pure and Applied Sciences as well as the humanities and Social Sciences, where it enhances their understanding. In addition, Mathematics aids economic and technological development of any nation (Aina, 2006). This is the reason why Mathematics is one of the core subjects in all schools worldwide as evidenced by the amount of time devoted to its teaching in schools (Cockcroft, 1982). Mathematics, as a subject, is also the backbone of new emerging sciences including Computer Science, Information Technology, Computer Engineering and related fields (COMSATS, 2012).

The Kenya Government acknowledges the importance of Mathematics in Science, Technology and Innovation (STI); a focus area under the vision 2030. In order to achieve the objectives of Science, Technology and Innovation by 2030, the Kenya Government introduced a pilot project, known as “Strengthening Mathematics and Sciences in Secondary Education” (SMASSE). The aim of the intervention is to strengthen the teaching and learning of Mathematics and Sciences in public schools, through equipping teachers with appropriate teaching skills and

instructional strategies that are necessary to implement the Mathematics curriculum in secondary schools.

Despite the fact that Mathematics is an important subject and that there are mechanisms in place to teach it, the general performance in Mathematics among secondary school students in Kenya remains poor as evidenced by the 2013 Kenya Certificate of Secondary Examinations (KCSE) results (Akwiri, 2014). This could mean that Kenya may not achieve her Science, Technology and Innovation (STI) goal by 2030, for which Mathematical knowledge is necessary.

The problem of poor performance in Mathematics has been given attention by many scholars, among them Secada and Cruzy (2002), Eshiwani (2003), Setati (2003) and Wekesa and Mondoh (2007). The main purpose of most earlier studies was to identify the factors that affect performance in Mathematics and the measures to be taken so as to overcome them. In particular Wekesa and Mondoh (2007) pointed out that many problems faced by secondary schools with regard to instruction in Mathematics may not be attributed to deficiency in curriculum, teaching or assessment, but rather on language. This is in agreement with what Eshiwani (1983) found. According to Eshiwani (1983), learning difficulties in Mathematics spring from language considerations rather than from inherent conceptual difficulties in the subject. None of these studies however, investigated the relationship between language proficiency and performance in Mathematics.

Language is a tool for sharing ideas and a vehicle in the construction of mathematical knowledge (Gorgorio & Planas, 2001). This is in a way reiterated by Durkin and Shire (1991) who declared that Mathematics Education begins in language, it advances and stumbles because of language, and its outcomes are often assessed in language.

The relationship between language and Mathematics has been given attention by educationists such as Pimm (1987), Cockcroft (1982) and Costello (1991). These scholars argue that Mathematics is like a language and learning it is much more than learning a language. According to Macnab and Cummine (1989), Mathematics has a language peculiar to itself, which consists of ordinary language and symbols. Arguably, symbols form another channel of communication, mainly in written form. This written form of the language of Mathematics operates at two levels: the semantic and the syntactic.

In Mathematics, the ordinary language has to illuminate and interpret the symbolic language. However, this can result in conflict of precision. According to Pimm (1987) mathematical English uses ordinary English for Mathematical purposes. Thus, a lot of confusion occurs as a result of differing linguistic interpretations where the teacher, for instance, might be employing terms from what has been loosely called a “mathematical dialect”, with the pupils interpreting everything as ordinary English, thus trying to use non mathematical meanings in a

mathematical context. However, ordinary language can convey its meaning remarkably well despite the possibility of syntactic abuse such as the breaking of grammatical rules or the misspelling of words.

Another aspect of the symbolic language of Mathematics, which separates it from ordinary language, and which can be a source of confusion, is that its syntax can be extended and developed beyond the original domain of application. For example, the definitions of $+$, $-$, $/$ are determined by the desire that the rule $\frac{m}{n} \cdot \frac{n}{m} = 1$ holds for all rational values of m and n . However, such futuristic probabilities of mathematical concept formation can cause confusion amongst students leading to development of negative attitudes towards mathematics. It can also cause some difficulty in conceptualization of mathematical ideas if the occurrence of such probabilities is not carefully handled (Pimm, 1987).

A third cause of language confusion in Mathematics is occasioned by common vocabulary. According to Macnab and Cummine (1989), many words have one meaning in normal English usage but quite different ones in Mathematics. Some of the most transparent English terms which, nevertheless, confound learners when applied strictly in the domain of Mathematics include “*product*”, “*difference*”, “*root*”, “*function*” and “*power*”. Brown (1981) in Gorgorio & Planas, (2001) found instances where children did not understand the apparent simple term *between* when applied in the context of a given mathematical

problem. Brown (1981) explained further that it could be that the phrase *in between* is more easily understood than just the single term *between*, because the phrase has overtones of some physical action which children could more readily relate to. In general, there is an inadequate understanding of both the English language and the language of Mathematics as used in Mathematics instruction (Wekesa & Mondoh, 2007).

1.2 Statement of the Problem

Mathematics educationists appear to be in disagreement with respect to the effects of Language Proficiency on Performance in Mathematics; for example, Tate (1997) and Howie (2003) declare that proficiency in English as a medium of instruction is a strong predictor of success in Mathematics while Kgomotso (2007) asserts that proficiency in the English language does not guarantee success in Mathematics. Most of the studies related to this issue have been carried out in Western countries. Studies carried out in Africa, particularly in South Africa and in Kenya, (Nomlomo, 2007; Benson, 2003) do not clearly point out how language affects the learning of Mathematics, which consequently affects the final performance. There is no study conducted in Kenya, particularly in the Coast region, that has looked at the relationship between proficiency in the Language of Instruction as well as Proficiency in the Language of Mathematics and Performance in Mathematics. It is in this regard that this study sought to assess the relationship between Language Proficiency and Performance in Mathematics.

1.3 Purpose of the Study

The study attempted to find out the relationship between Proficiency in the Language of Instruction and Proficiency in the Language of Mathematics as well as how they are related to Performance in Mathematics.

1.4 Objectives of the Study

The study was based on the following objectives:

1. To study the relationship between Proficiency in the Language of Instruction and Proficiency in the Language of Mathematics.
2. To study the relationship between Proficiency in the Language of Instruction and Performance in Mathematics.
3. To study the relationship between Proficiency in the Language of Mathematics and Performance in Mathematics.

1.5 Research Hypotheses

The study was guided by the following null hypotheses:

H₀₁: There is no relationship between Proficiency in the Language of Instruction and Proficiency in the Language of Mathematics

H₀₂: There is no relationship between Proficiency in the Language of Instruction and performance in Mathematics

Ho3: There is no relationship between Proficiency in the Language of Mathematics and performance in Mathematics.

1.6 Significance of the Study

The results of this study, if consulted could be beneficial to Mathematics textbook writers; they may help them to present the content in a way that overcomes language barriers and therefore facilitate better understanding.

To language policy makers, the Ministry of Education, school management as well as the English and Mathematics teachers, the findings of this study could help them to find out solutions to language related problems that hinder performance in Mathematics.

Finally, the results of this research will contribute in overcoming the language related factors that affect performance in Mathematics, and therefore serve as a springboard for further investigation in the same or related areas, or in different settings.

1.7 Scope and Limitations

1.7.1 Scope of the Study

The study was restricted to girl's district secondary schools in Kilifi and Malindi district, Kilifi County. The researcher only dealt with Form Three Mathematics

students, and was also limited to the relationship between Language Proficiency and Performance in Mathematics.

1.7. 2 Limitations of the Study

In every social research there are errors caused by diverse type of data. There are also inescapably sampling errors. The researcher could not assure ability to control all the confounding factors in the study. It may also be difficult to say that the instruments that were used collected a hundred percent of all the desired data. The fact that this study dealt only with Form Three students from girls' secondary schools in Kilifi and Malindi district and that the results were to be generalised to other settings is a limitation. The students chosen for this study were a small sample of a population and they are from different language background. This small population may be very different from populations in other parts of Kilifi County. Although all teachers are trained on how to teach Mathematics and how to measure performance, the technical that individual instructors use in teaching and testing are different. Testing students from diverse schools taught by different teachers was also a limitation.

1.8 Assumptions of the Study

The study made the following assumptions:

1. The sampled students had similar background of Mathematics knowledge.

2. All respondents were cooperative and provided reliable information.
3. All Form Three students were able to listen, read and understanding.

1.9 Theoretical and Conceptual Framework

1.9.1 Theoretical Framework

This study was based on Vygotsky's (1978) theory of socio-cultural development. Socio-cultural theory postulates that, "all learning is social" and perceives language as a tool for developing thought (Freeman & Freeman, 1994). This theory takes into consideration the role of social interaction in learning and development. Shrum and Glisan, (2000) explain that the socio-cultural theory views learning and development as the cognitive and social processes that occur as a result of interaction between 'experts' (more capable) and 'novices' (less capable).

Vygotsky (1978) says that the life-long process of development is dependent on social interaction and that social learning actually leads to cognitive development. He called this the Zone of Proximal Development (ZPD). He defined the ZPD as the distance between the actual level of development and the level of potential development. When applied to the classroom setting, Vygotsky's (1978) Zone of Proximal Development (ZPD) assumes that the learner brings two levels of development to the learning task: First what the learner can do, or the actual developmental level. Second, what the learner should be able to do in the future or

potential developmental level. As the learner interacts with others (teacher, peers and learning materials), he/she progresses from the actual developmental level to the potential developmental level.

The ZPD or learner's attainment of his/her potential level has implications for the teaching approaches that the teacher employs in the lessons, as well as the kind of interactions that occur in the classroom between the teacher and the learner, between the learner and the learning materials and between the learner and his/her peers. Effectiveness in the ZPD depends on a number of factors such as the expertise of the helper in both the language and the subject, the nature of the task, the goal of the task, and the developmental level of the learner (Ohta, 2000).

For learning to take place, instruction must occur in the learner's ZPD (Freeman and Freeman, 1994). In other words, the learner must be guided by someone who is more knowledgeable than him/her (teacher in this case) to reach his/her potential developmental level. The interaction between the learner and the teacher is scaffolding; in the process of scaffolding, the expert (teacher or more capable peer) supports the learner until he/she reaches a stage when he/she can do the tasks without the teacher's or expert's support.

The most fundamental concept of socio-cultural theory is that the human mind is mediated. Vygotsky (1978) argued that we use symbolic tools, or signs, to mediate and regulate our relationships with others and with ourselves, and thus

change the nature of these relationships. Learners make sense of the world around them by means of certain tools. Such tools include among others, the language used in social interaction, visual materials, learning activities, direct instruction or teacher assistance, (Shrum & Glisan, 2000). Accordingly, these tools mediate between the learner and the world. In simple terms, mediation can be defined as a way of assisting the learner to make sense of what is being learned by making use of various tools.

The ZPD and mediation relate to the transactional view of learning which sees the learner as an explorer. The learner is given the opportunity to construct knowledge by posing problems and raising questions to reflect on new experiences (Freeman & Freeman, 1994). Chamot and O'Malley (1994) mention and explain cognitive and social strategies which mediate learning. Accordingly, cognitive strategies involve the following: - relating new knowledge with existing knowledge, making inferences, linguistic transfer, imagery, deductions and inductions, summarising, among others. These strategies have to do with interacting with materials to be learned. Social strategies, on the other hand, include questioning for clarification, cooperation with teacher or peers and self talk.

Ostensibly, Language is very crucial as a tool of interaction. According to Shrum and Glisan, (2000), language is a cultural tool that enables dialogue with others.

In other words Socio-cultural theory positions school Mathematics as a social practice in which language is a resource for learning. According to Bishop (1985), “the purpose of communication in the Mathematics classroom is to share mathematical meanings. He goes on to say that “meanings” must be exposed in order to be shared and; talk is one important vehicle for such exposure.

Arguably, Language is important in the achievement of the ZPD. If there is a mismatch between the languages of the people or parties involved in interaction, it may be difficult for learners to get into a higher or potential level of development. For instance, if there is no mutual understanding between the teacher and the learner, learning can hardly take place. Thus Freeman and Freeman (1994) and Shrum and Glisan (2000) put forward the importance of language in socio-cultural theory.

Language is also an important tool of mediation as it enables people to organise and control mental processes such as planning, problem solving and learning (Shrum & Glisan, 2000). Through questions and answers, demonstrations and discussions, new knowledge can be mediated with the learners. Collaborative activities such as group work facilitate language learning. Students learn new skills by interacting with each other. That is, more knowledgeable learners can assist others to reach higher levels of understanding through social interaction.

This implies that it is not only the teacher who acts as a mediator; learners who have more capability than others can also mediate learning.

Both strategies (cognitive and social) have implications for language competence. For instance, the learner may be able to make inferences in a text only if she has comprehended the text. Comprehension has to do with the language used in the text (i.e. whether the learner understands the language or not). Likewise, a learner can be confident enough to ask questions if s/he is comfortable enough with the language s/he uses to seek for clarification. Arguably, learners may remain silent without understanding if they do not have sufficient proficiency in the language of interaction.

Vygotsky (1978) does not only emphasise the importance of language and social interaction for learning, he sees the social history of the child as crucial for shaping learners' thinking, which is crucial for learning. That is, cognitive skills and patterns of thinking are not primarily determined by innate factors, but are the products of activities practiced in the social institutions of the culture in which the individual child grows up. Therefore, the history of the society in which a child is reared and the child's personal history is a crucial determinant of the way in which that child thinks. First, through culture, children acquire much of the content of their thinking, that is, their knowledge. Second, the surrounding culture provides a child with the processes or means of their thinking – what Vygotsky

(1978) calls the tools of intellectual adaptation. The implication is that, when learners have mastered the culture of both mathematics and instructional language, they will be able to think and use these languages. Consequently, they will actively participate in the entire process of mathematics teaching and learning.

Culture is also a critical determinant in shaping how learners speak and interpret words. Meanings of words are determined by the uses of the words within a linguistic and cultural setting, and these settings are not the same in any two cultures. For instance, learners who use English as their second language, need to learn words in English, as well as the cultural background that gives words their English meaning. In addition, they must also learn Mathematics language and its culture in order for them to fully participate in the process of teaching and learning of Mathematics. As such, one not only needs to understand the mechanisms, such as the grammar, but also to apply that language across various contexts, audiences, and purposes (Mei-yu, 1998). It is through meaningful interaction with others as well as functional use in daily life that children develop competence, fluency, and creativity in language.

Language development is through input, output and interaction. The kind of output produced by the learner depends on the input s/he receives. The input has implications for effective teaching and learning. If the teacher is not

knowledgeable with regard to both the Language of Instruction and the Language of Mathematics as well as the subject matter, the input will be incomprehensible; it may not result in effective learning. The determining factor in comprehension is usually the language of communication.

1.9.2 Conceptual Framework

Teaching and learning has inputs and outputs (Ellis, 2012). Consequently, in order to obtain a new product which according to this study is performance, there is need to be proficient in languages as they are used in Mathematics teaching and learning process. The language of Instruction explains the Language of Mathematics and they all affect performance in Mathematics. The intervening variables such as: teachers' qualifications, availability of teaching and learning materials and students' knowledge background were controlled through sampling procedures. The interaction between the dependent and independent variables, was presented diagrammatically as a Conceptual Framework in (Figure 1) and represents the relationship between Language Proficiency related variables and Performance in Mathematics.

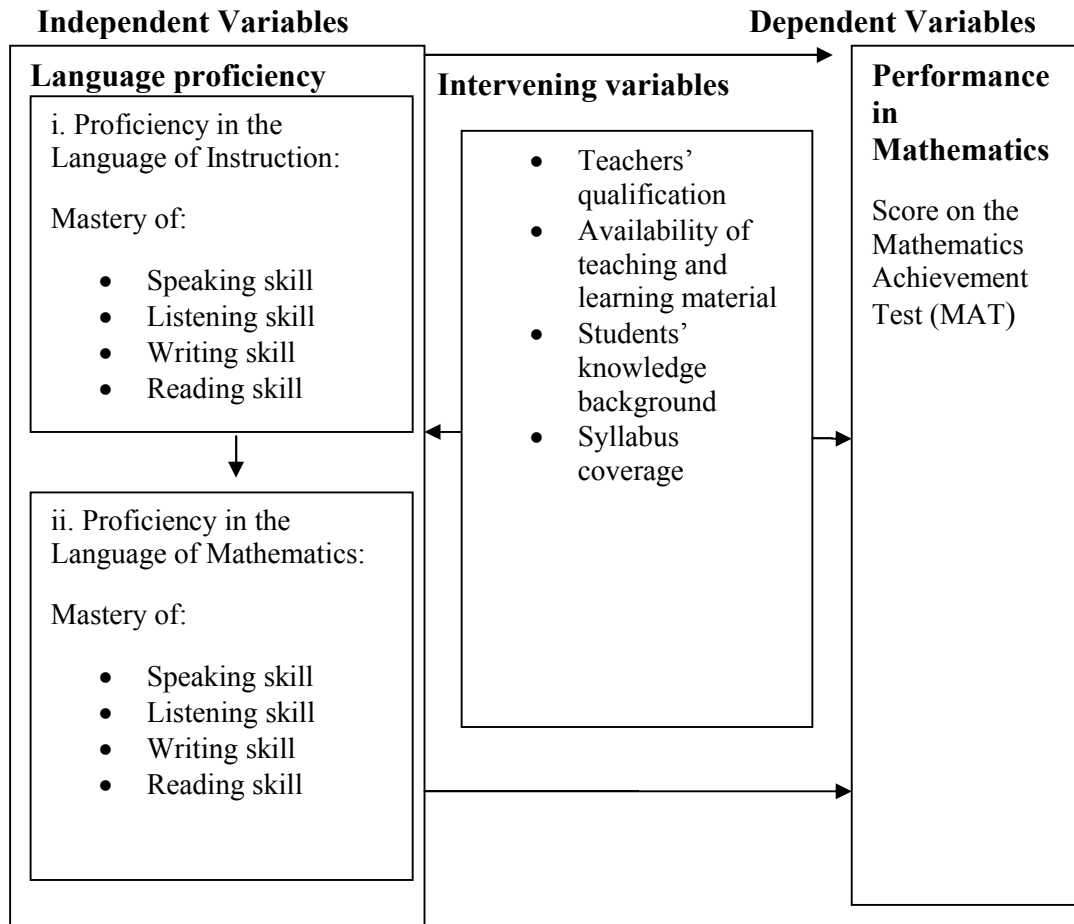


Figure 1: Conceptual Framework

1.10 Operational Definition of Terms

The following meanings were employed for the purpose of this study.

Language proficiency

According to Bailey (2010), language proficiency can be seen as referring to a speaker who, while very skilled in the use of language, uses the language very easily and at a very-advanced level.

In this study, Language Proficiency refers to how well an individual has mastered the Language of Mathematics and the Language of Instruction. This was measured in terms of four domains of language proficiency namely:

Listening: Listening connotes hearing with attention; which can be verified by; appropriateness of response to what is listened to, overall comprehension, accurate retelling of what has been listened to.

Reading: This means reading with comprehension. This can be verified through reader's interpretation of words, sentences, terminologies as well as correctness of answers to questions that follow a comprehension passage.

Speaking: This entails the uttering of words and sentences for communication; verified through appropriateness of speech, flow, pronunciation, clarity, use of vocabulary, pacing of speech and lack of ambiguity.

Writing: This is more than putting words on paper and it is verified in terms of hand writing, writing for communication (presupposes that one has sufficient vocabulary to draw from in terms of words when put together in sentences, phrases or clause, to bring out the intended usage or meaning.), correct spelling, proper use of vocabulary, terminologies, punctuation marks, capitalisation of letters, sentence construction and appropriate use of connectors.

Language of Instruction

According to Muhammad (2009) the Language of Instruction connotes the language used for teaching and learning. According to the Language Policy in Kenya, the language of the catchment (either Mother Tongue, Kiswahili or

English) should be used for instruction in Classes One, Two and Three, while from Class Four onwards English is the Language of Instruction. In addition, from Class One up to Class Three, English or Kiswahili should be used as the Language of Instruction in linguistically heterogeneous communities, while mother tongue should be used in linguistically homogeneous communities (Gathumbi, Bwire and Bunyi, 2008). For the purpose of this study, the Language of Instruction was English.

Language of Mathematics

This refers to the language used in expressing Mathematical ideas. It consists of a substrate of some natural language (for example English), terminologies, symbols and technical terms (Wikipedia, 2013). For the purpose of this study, the Language of Mathematics carried the same meaning.

Performance

For the purpose of this study, performance means scores obtained on the Mathematics Achievement Test.

Teacher Qualification

In this study, teacher qualification means academic qualification; whether diploma or degree with Mathematics as one of the teaching subjects. It also encompassed the teaching experience.

Teaching-Learning Materials

Teaching-learning materials refer to a spectrum of educational materials that teachers use in the classroom to support specific learning objectives (Lewis,

2014). For the purpose of this study, the teaching-learning material carried the same meaning.

Knowledge Background

In this study, knowledge background is taken to mean all the content that has been covered in Mathematics subject from Form One up to Form Four.

CHAPTER TWO: LITERATURE REVIEW

2.0 Introduction

Student's performance in all subjects is mainly measured by achievement tests. An evaluation of scores on such tests leads to the categorisations: poor, good, or excellent. Students' performance can therefore be said to be poor or excellent depending on the evaluation of scores obtained. Nomlomo (2007) in his study concluded that performance in Mathematics, whether poor, good or excellent, can be attributed to factors such as poor teaching methods, lack of instructional materials as well as lack of trained teachers. Arguably, adequacy or inadequacy in these factors would lead to excellent or poor grades in Mathematics. However, there is a possibility that these may not be the only factors.

Eshiwani (1983) asserts that learning difficulties in Mathematics spring from language considerations rather than from inherent conceptual difficulties in the subject. In line with this argument, the Department of Education (DoE, 2003) in Pretoria argues that Mathematics is developed and contested through both language and symbols by social interaction. This argument emphasizes the role of language in the development of Mathematics. It highlights language as a resource for communication and thought in teaching and learning in Mathematics.

However, studies by (Tate, 1999; Buchanan (2002); Setati, 2005; Barwell, 2003; Ishaku, 2005) carried out to study the effects of language on performance in Mathematics have been inconclusive. This chapter reviews literature directly related to language factors affecting performance in Mathematics. The reviewed literature dates back to 1980's and focuses on global, regional and local scenarios.

The chapter is organised as follows: Section 2.1 discusses second language and learning. Section 2.2 looks at proficiency in the Language of Instruction and performance, Section 2.3 looks at proficiency in the Language of Mathematics and performance. Section 2.4 explains proficiency in specific language domains and performance. Finally, section 2.5 provides a summary of the chapter.

2.1 Second Language and learning

Language is important not only for communicating but because it facilitate thinking. Orton (1987) claims that language used for thinking is always likely to be the first language. Thus knowledge communicated in one language might need to be translated into another to allow thinking, and then would need to be translated back in order interact. Errors and misunderstanding might arise at any stage of this two way inner translation process. Cleghorn (2005) explains further and say that this happens when instruction is in a second language and when the concepts being taught lack equivalence in the students' language and culture. Copeland (1984) also supports and says that whatever you say to learners, they

translate it into their own language and forthwith it become something different. However these students have to decode English into their mother tongue and then reinterpret their thought into English. Considerable potential for misinterpretation occurs. Copeland (1984) continues and states that the situation can be worse when weak English proficiency translate into a weak understanding of the subject content which together with poor writing skills can exacerbate the potential to failure. Research done by Keraro, Okere and Mondoh (2004) conclude that language interferes with science learning, especially when English is used as a medium of instruction to second language users. Algarni, Birell and Porter (2012) support and explain that the cognitive load is much higher in the second instance because the brain must work to translate the language while simultaneously trying to understand the new information.

Contrary to the conception that learners who learn in their second language encounter difficulties in their learning, Latu (2005) in his study found that there is enough evidence to support the theory that student who use their mother tongue while learning in English perform better than those who don't. She continues and says that teachers should be aware that code switching is a common practical for the bilingual in these classrooms. This was strongly supported by Antonette (2006) when her study revealed that if a certain level of proficiency is reached in the first language, second language education is not necessarily harmful to academic success. His study provides evidence that bilinguals can transfer

knowledge and skills between the languages they know. This was also evidenced by the research done by Riordain and O'Donoghue (2008), where he revealed that those with high competency in both languages outperformed their monolingual peers, those dominant in one language and those with low competency in both languages. According to him the latter were the weakest mathematically and lagged behind their peers. These results are consistent with the findings of Dawe (1983) and Clarkson (2007). However, Saville –Troike (1991) explains that, when students begin learning a second language, they do not start learning all over again , but interpret meaning in terms of what they already know - not just about language, but about context in which it is being used, and about strategies for social interaction. This means that the process of second language learning is heavily dependent on prior experience and apparently also on the nature and the level of first language development.

2.2 Proficiency in the Language of Instruction and Performance

Language proficiency includes the knowledge of the grammar, vocabulary and the communicative ability of both written and spoken aspects of a language (Chen, 2005). With regard to proficiency in the Language of Instruction and performance, Bradly (1992), cited in Tate (1997), found that the higher the learner's level of proficiency in the English language, the higher the chances of better achievement in Mathematics. Howie (2003) found that pupils that speak the language of the test (i.e. the instructional medium) more frequently, also attain

higher scores on the Mathematics test. His conclusion was that pupils' proficiency in English (as a medium of instruction) was a strong predictor of their success in Mathematics. Jibril (2003), Seyon (2003), Wondimu (2003), Ngome (2003), Subotzky (2003) revealed that the competence in European languages for a good number of African students, leaves a lot to be desired. They concluded that poor level of proficiency in the Language of Instruction is a major factor in the declining quality of education in Africa. Otaala (2003) concurs with this point of view, and further points out that many students have difficulty in English, as the language of instruction since the language is often their second or even third. Consequently, they cannot meet the desired objectives of their studies. In support of the above, Tobin (1995), cited in Wekesa and Mondoh (2007) adds that learners with limited proficiency in the use of English (i.e. the instructional language) face enormous challenges of making sense of the process of instruction, especially while at the same time struggling to build an understanding of novel science concepts. Hill & Miller (2013) have the same opinion which they express by declaring that teaching Mathematics in a language the students are still learning could be problematic to them in particular. They (i.e. Hill & Miller, 2013) continued to assert that students experience difficulties in understanding Mathematics concepts and how they are applied and at the same time do encounter difficulties understanding the language in which aspect of the content are embedded. As a result second language learners do find themselves

performing significantly below their peers; a view starkly expressed by Cummins (2000).

However, Kgomotso (2007) declares that proficiency in the English language does not guarantee success in Mathematics. She argues that the kind of English used in Mathematics is different from the one used in ordinary speech. She proposes that the problem caused by these two language versions should be attended to differently, in order to ensure that the interventions also differ.

2.3 Proficiency in the Language of Mathematics and Performance

With regard to proficiency in the Language of Mathematics and performance, studies in Mathematics Education (Pimm, 1987; Adler, 2001; Setati, 2005) perceive learning to communicate mathematically as a central aspect of learning Mathematics. This is also reflected in the Kenya school curriculum (KIE, 2002).

However, they argued that in order to participate appropriately in any mathematical conversation, learners need to recognise the specific Language of Mathematics expressions needed in certain contexts (i.e. instructional language).

Learners also have to understand the differences between formal and informal Language of Mathematics (Setati, 2005). The assumption is that learning Mathematics involves a shift from everyday language to more precise Language of Mathematics (Barwell 2003), which, according to Lemke (1990) entails the use of abstract generalisations and logical relationships that a learner has to master. In

concurrency, Rollnick, (2000) points out that the difference between everyday language and mathematical terminology leads to acquainting oneself with a totally new language when learning Mathematics. According to Botes and Mji (2010), the learner has to understand a commonly spoken everyday language (Language of Instruction) and a subject-specific Mathematics language in order to master Mathematics. This strongly supports Benson (2003), who reveals that students' performance in Mathematics strongly depends on their understanding of mathematical terminologies. This view is supported by Ishaku (2005), who in his study on the effects of understanding the language of Mathematics on performance in mathematics among secondary school students in Plateau State, explains that secondary school students would, to a large extent, understand the language of Mathematics when taught. He argues that understanding the language of Mathematics has a significant effect on performance in Mathematics. According to him, the findings have implications for Mathematics teaching and learning, one of which is that performance in Mathematics can be improved upon when the subject is taught using its precise language. That is to say, the use of precise language of Mathematics by teachers increases students understanding of this subject thereby boosting the learners' performance.

2.4 Proficiency in Specific Language Domains and Performance

The following literature reveals studies that address the relationship between proficiency in language specific domain and performance. There are four domains of language proficiency: reading, writing, speaking and listening (education .com, 2012).

With regard to speaking, a number of studies (Kotsopoulos, 2007; Chen, 2005; Leibowitz, 2005) have concluded that there is need for students to routinely participate in dialogue and discussion on Mathematics related topics and that learners need to talk in order to learn and that learners could not become proficient in Mathematics if they were unable to participate in Mathematics discussions. Specifically Kranda (2008) found that students who can speak in mathematical terms, with precision, can communicate effectively with the teacher, and that effective communication will be achieved between students only if each knows and understands the terms being used.

A number of studies (Pretorious, 2002; Subotzky, 2003; Gathumbi., Bwire, Bunyi, Maundu, Vikiru, Mujidi & Groenwegen, 2008; Oberholzer, 2005) have focused on the relationship between proficiency in reading and performance in general. These studies found that proficient readers in the Language of Instruction perform better than non-proficient readers. However, there is no study found with

regards to reading proficiency in the language of Mathematics as it relates to performance in Mathematics.

Writing is a key component of language that is important to Mathematics learning, since most learning and assessment tasks are written. Mathematical writing requires cognitive proficiency and academic literacy (Varughese, 2009). Arguably, writing about Mathematics seems to go hand in hand with the understanding of Mathematics. Venne (1989) agrees with this argument and states that students' use of written expression helps in reinforcing Mathematical ideas. Varughese (2009) observes that research findings show that students who are unable to write how to solve problems, using written language, will many times have trouble to fully understand or solve the mathematical problems in the first place. Accordingly, writing in Mathematics can be an integral part of learning, teaching, evaluation, and assessment processes, and makes students aware of their growth in understanding mathematical concepts, as well as in their ability to explain them (Dougherty, 1996).

Research has also shown that students with low reading ability are generally low academic achievers (Stanovich, 2000; Naglieri, 2001). This view has also been supported by Krashen (1993) who points out that children who read effectively have access to numerous sources of written material which, in turn, enables them to increase their general knowledge, their vocabulary and their language skills.

Buchanan (2002) has the same view and points out that learning to read mathematical texts, and writing mathematical ideas in written expressions seems to have a symbiotic relationship with each other. He further ascertains that if a student demonstrates one skill, such ability appears to make the other skill easier and vice-versa. Emphasis is also placed on specific vocabulary, and its importance in performance (Buchanan, 2002). Arguably, the language of instruction has its own vocabulary and so does the language of Mathematics. Macnab and Cummine (1989) and Schleppergrell (2007) support this argument. Accordingly, knowledge of the specific vocabulary of the language of Mathematics is a critical factor in students understanding of Mathematics; a view also supported by Rubenstein, (2007). Washington (2001) notes that strong oral vocabulary skills, both expressive and receptive, are critical for general academic success.

2.5 Summary

The literature presented in the preceding sections suggests that the issue of language and its contribution to performance in Mathematics has not been exhaustively researched on. The related studies presented, although not exhaustive are of great significance as they have filled a critical gap in literature.

With regard to language proficiency and performance in Mathematics, particular attention was paid to issues related to proficiency in the Language of Instruction,

proficiency in the Language of Mathematics, proficiency in the four skills or domains of language and how they affect performance.

There was no study found that particularly dealt with proficiency in reading in the language of Mathematics and its effect on performance. The present study sought to provide information on this.

CHAPTER THREE: RESEARCH METHODOLOGY

3.0 Introduction

This chapter presents an overview of the research methodology. It details the procedures used in the study, location of the study, the research design, variables of the study, population of the study, sampling procedures and sample size, instruments used for data collection and the pilot study. Consideration is also given to issues related to validity and reliability of the instruments, data collection procedures, procedures that were used in data analysis and presentation methods, as well as logistical and ethical considerations, which are crucial features of a research.

3.1 Area of the study

The study was conducted in Kilifi County, Coast province, Kenya. In comparison to other provinces in Kenya, The Coast Province performs poorly in secondary school Mathematics at National examination level (Akwiri, 2014). The study was specifically carried out in two districts of the County; Kilifi and Malindi. The two districts were easily accessible to the researcher and thus eased the data collection exercise. In addition, the two districts provided a representative sample for generalisation since they have enough schools to draw a sample from.

3.2 Research Design

Correlation research design was employed for this study where an independent variable explained a dependent variable. In this study, the main purpose was to explain the relationship between two quantifiable variables (Language Proficiency and Performance in Mathematics). Therefore, this design was considered to be suitable since the study sought to determine whether and to what degree a relationship exists between Language Proficiency and Performance in Mathematics

3.3 Variables of the study

3.3.1 Dependent Variable

The dependent variable for this study was Performance in Mathematics. This was represented by the scores obtained on the Mathematics Achievement Test (MAT).

3.3.2 Independent Variable

The independent variable for this study was Language Proficiency. This is an umbrella term connoting Proficiency in the Language of Instruction and Proficiency in the Language of Mathematics as is defined in section 1.10 of this thesis.

3.3.3 Intervening Variables

The intervening variables in this study were identified as teacher's qualification, availability of teaching-learning materials, level of syllabus coverage and students' knowledge background.

In this study, the effects of the intervening variables was minimised through sampling. In order to minimise the effect of syllabus coverage, only Public secondary were engaged in the study since they follow the 8-4-4 KIE syllabus, and seat for KNEC examinations. The researcher selected schools that only have graduate teachers who have gone through teacher training programs. In addition, the selected schools had almost the same teaching-learning materials. This helped to minimise the effect of knowledge background, availability of teaching-learning materials in schools as well as teachers' qualification.

3.4 Population of the Study

3.4.1 Target Population

The study targeted all girls' from secondary schools in Kilifi County. A comparative study between boys and girls on the same issue is suggested for further study. According to MoE, (2014) there are approximately 14,648 students from 72 registered secondary schools.

3.4.2 Accessible Population

Statistics from the Kilifi County Director of Education's Office (2013) show that Kilifi and Malindi districts had 348 Form Three Mathematics students in four (4) girls' district secondary schools. This provided the accessible population.

This category was selected since performance in Mathematics at this stage is very crucial from the point of view of concept formation and ability development in Mathematics. In addition, compared to other accessible classes (the lower classes in secondary school), Form Three students had comparably covered more content of the Mathematics syllabus and were therefore assumed to be more knowledgeable. Form Four students although assumable more advanced, were not used in order to avoid interference with their preparation for the KCSE examination.

3.5 Sampling Techniques and Sample Size

3.5.1 Sampling Techniques

The schools included in the sample fulfilled the following:

- Were district secondary schools
- Followed 8-4-4 Secondary School Mathematics syllabus
- Had trained Mathematics teachers
- Were adequately equipped with teaching and learning materials.

All four district girls' secondary schools from Kilifi and Malindi districts were included in the sample. Simple random sampling method was used to select students. After defining the population, the researcher wrote each individual's name on a separate slip of paper and placed all the slips in a basket and then selected slips from the basket until the desired number of individuals is selected. In a school where there was more than one stream, one stream was randomly selected by lottery method.

3.5.2 Sample size

Kinoti (1998) recommends a sample of 10% and above as representative of a population. In this study, the sample of students was drawn from the research population of 291 students and 22% of students were included in the sample. Consequently, the total number of students in the sample was 64.

Table 1: Distribution of Students in the Sample per District

Districts	Malindi		Kilifi		Total
Schools	Kakoneni	Ngala Memorial	Uyombo	St Thomas	-
Number of students in the sample	17	24	16	7	64
Total	17	24	16	7	64

3.6 Instrumentation

3.6.1 Research Instruments

Three instruments for data collection were designed by the researcher:

- i. Test on Proficiency in the Language of Mathematics (TPLM) (See Appendix A)
- ii. Test on Proficiency in the Language of Instruction (TPLI) (See Appendix B)
- iii. Mathematics Achievement Test (MAT) (See Appendix C)

The TPLM and the TPLI were used to collect quantitative data. They were organised as a battery of four tests as described in section 3.6.1.1 and 3.6.1.2.

3.6.1.1 The Test on Proficiency in the Language of Mathematics (TPLM)

The test was organised in four parts; each part consisted of a test that measured a specific language skill (Reading, writing, listening or speaking). The choice of topics to be included in the test was guided by the Kenya Secondary School Mathematics Syllabus by KIE (2002). The selection of topics was justified by the amount of mathematical jargon in comparison to others. The distribution and weight of the test items is summarised in Table2.

Table 2: Content Specification

Contents	Reading	Speaking	Writing	Listening	Total
Quadrilaterals			5%		5%
Sequence			7.5%		5%
Algebraic expression	5%	5%	7.5%	10%	30%
Equation and inequality		5%			5%
Sets	5%		5%	5%	10%
Triangles				5%	5%
Angle and plane figures		5%			10%
Statistics	5%			5%	10%
Vectors	5%	5%			10%
Mathematical symbols	5%				5%
Exponents		5%			5%
Total	25%	25%	25%	25%	100%

Part One was the Reading Test. This test consisted of five items selected from different topics of Mathematics (refer to Table 2). The aim of the test was to measure the learner's proficiency in reading and translation of mathematical jargon. Part Two was the Writing Test. The test required the subjects to demonstrate their ability in writing in the Language of Mathematics

Part Three was the Listening Test. It consisted of five (5) Mathematical statements to be listened to and five (5) questions related to the statements. The aim of this test was to measure the learner's ability in listening skills.

Part Four was the Speaking Test and was composed of five (5) written questions with an intention to determine the learner's competence in the speaking skill. The test required subjects to provide oral responses within five minutes.

Each part of the TPLM except the Writing Test was made up of 5 items and each item carried five marks translating to a total of 25 marks. The Writing Test consisted of four items with unequal distribution of marks (refer to appendix A). This part of the test carried a maximum score of 25 marks. The TPLM was manually scored by the researcher in line with the marking scheme (see Appendix D) attached.

3.6.1.2 The Test on Proficiency in the Language of Instruction (TPLI)

The purpose of the Test on Language Proficiency in the Language of Instruction (TPLI) was to measure the learners' ability in four skills of language proficiency (reading, writing, listening and speaking). The test was organised in four parts; each part measured a particular skill.

Part One was the Reading Test, and therefore measured the reading skill. It consisted of a short comprehension passage that was followed by four multiple choice questions based on the passage “*The Ways we Lie*” written by Stephanie Ericsson. It was adopted from the book entitled “*An intermediate reading with comprehension*” (refer to appendix B) authored by Anker (2004). Each question carried a maximum of 5 marks translating to a total of 20 marks for this part of the test.

Part Two was the Writing Test. This part was designed by the researcher. The test required the subjects to write a paragraph of between 200 and 500 words about the disadvantages of mobile phones. The section carried a maximum of 20 marks.

Part Three was the Listening Test, and therefore measures the Listening skill. The Test consisted of a short text followed by eight multiple choice questions based on the text with four preferable answers (refer to appendix B). It was adopted from a book entitled “Intermediate Listening Comprehension” by Dunkel (1986). Each question carried a maximum score of 2.5 marks translating to a total of 20 marks.

Part Four was the Speaking Test and was used to measure the speaking skill. The test was designed by the researcher and required that each respondent in not less than five minutes, talks about his/her favourite subject. The test was designed by

the researcher, as there was no readily available test for the targeted population. This part of the test was marked out of 20. The TPLI was manually scored by the researcher in line with the marking scheme (see Appendix E).

3.6.1.3. Mathematics Achievement Test

The test was designed by the researcher to measure the extent to which planned instruction was achieved. The researcher adapted the MAT from various past KCSE examination papers; since there was no any other test on hand that suit the population involved in the study. The content and construct validity of the test rested on the items, having been sourced from nationally recognised and administered examination papers. The questions covered several topics that were suitable for the level of understanding of Form Three Mathematics students in the study. The objectives of the test were based on Bloom's Taxonomy with an emphasis on the cognitive domain i.e. Knowledge, comprehension, application, analysis, synthesis and evaluation. The content that had more subtopics in the syllabus was represented by larger number of items as compared to other items. Ten (10) items were constructed on the basis of the table of specification from various topics covered from Form one up to form three (refer to Table 3).

Table 3: Table of Content Specification for MAT

Content areas	Instructional Objectives						Total
	K	C	Ap	An	S	E	
Logarithms	-	-	10%	-	-	-	10
Algebraic expressions	3%	-	12%	-	-	-	15%
Linear Equations	-	-	4%	-	-	-	4%
Simultaneous Equations	-	-	12%	5%	-	-	17%
Equation of a straight line	-	-	-	2%	4%	-	6%
Polygons	-	-	10%	-	-	-	10%
Linear motions	-	-	14%	-	4%	-	18%
Trigonometry	-	-	-	10%	-	-	10%
Matrices	-	10%	-	-	-	-	10%
Total	3%	10%	62%	17%	8%	-	100%

Knowledge=K Application=Ap S=Synthesis

Comprehension= C Analysis= An E=Evaluation

All the 10 items were objective type but carried different weights (see Appendix C). The test was manually scored out of 100% by the researcher in line with the marking scheme attached (see Appendix F).

3.6.2 Piloting

A pilot study was conducted in June 2013. This enabled the researcher to determine suitability and relevance of the test for Form Three students. The researcher had to be sure that the tests would neither be, on the one hand too complex for the students nor on the other hand too simple. Furthermore, the test was tested to identify potential problems with the design which, were then rectified before the actual study was carried out in order to enhance cost effectiveness.

After piloting, the researcher discovered that except for the Speaking Test, the time allocated for the tests was insufficient; consequently, the time assigned for the tests was increased from 20 minutes to 30 minutes, for each test during the main study.

In piloting, the researcher used a small sample of the population; 40% of 40 students from a school that did not participate in the final study in line with Brink's recommendations (2006). The pilot data was also used to determine validity and reliability of the tests.

3.6.3 Validity

In order to ensure that tests in this study, measured what they were supposed to measure, content and construct validity were established. For the purpose of this

study, the content and construct validity of the MAT was assured because of the nature of the source from which the test was adapted. It was adapted from a nationally recognised and administered past examination papers. The adaptation of the test was also guided by the secondary school mathematics syllabus. The content and construct validity of the TPLM and TPLI was established by an extensive review and revision of the items by the supervisor, lecturers in the School of Education as well as the committee of Mathematics and English teachers in selected schools. During this process, the content, structure and emphases were compared with accepted curricula and common textbooks.

3.6.4 Reliability

The reliabilities of the various tests were calculated using different methods depending on the type of the test items. Since Kuder–Richardson formula Kr is the suitable method for establishing the internal consistency for dichotomous items, the Kr formula was used for the calculation of reliability of the Reading and Listening Tests given that the test items were designed in a multiple choice format (Refer to appendix B). The test reliability was found to be 0.78 and 0.87 for the Reading and Listening Test respectively and hence the test was judged as reliable.

The formula is indicated as;

$$Kr = \frac{1}{n} \left(\frac{\sum (T_i^2)}{\sum T_i} - \frac{(\sum T_i)^2}{n} \right)$$

\bar{X} = mean of the test

n = the number of test items

In order to ensure internal consistency of the writing test in the Language of Instruction the Cronbach's coefficient alpha formula was used.

$$\alpha = \frac{\sigma^2}{\sigma^2 + \frac{\sum \sigma^2}{n}}$$

σ^2 = variance of the total test

$\sum \sigma^2$ = sum of variance of individual items

The Writing Test in Proficiency in the Language of Instruction was an essay type of test and that Cronbach's coefficient alpha is the appropriate method for the calculation of reliability in essay type of tests. The obtained reliability coefficient of 0.843 showed that the test was reliable.

In order to ensure stability of the PLM, MAT and the speaking test in the Language of Instruction, the test-retest method was employed. The tests were administered twice within an interval of one week to the same subjects under similar conditions. After correction, the correlation between the first set of scores and the second set of scores was determined by the use of Pearson Product

Moment correlation coefficient

$$= \frac{\sum (X - \bar{X})(Y - \bar{Y})}{\sqrt{(\sum (X - \bar{X})^2)(\sum (Y - \bar{Y})^2)}}$$

According to Cohen, Manion and Morrison (2011) a coefficient of stability of 0.8 and above is considered to be acceptable. As such, the obtained coefficient of stability of 0.86 was considered to be acceptable.

3.7 Data Collection Procedures

In order to gain access to schools, the researcher was given an introductory letter by Pwani University to facilitate the acquisition of the research permit from the National Commission for Science, Technology and Innovation NCSTI, allowing her to conduct the research. (Refer to appendix J).

The research tools were administered by the researcher assisted by the subject teachers in the schools (Mathematics/English teacher). All data were collected during the period between May and August 2013. Concerning reading with comprehension as regards to the Language of Instruction, the researcher gave the text and questions to students. Students were in turn required to read, understand the passage and answer questions based on the same text.

In order to collect data on reading in the Language of Mathematics, students were required to read and understand mathematical symbols, chart and statements and then answer questions. The administration of this test took 30 minutes.

With regard to speaking in both the Language of Instruction and the Language of Mathematics, the researcher asked oral questions that required the respondent to give oral answers. Individual learners were given five minutes to speak.

In order to collect data on writing skill, in the Language of Instruction, students were given a topic to write on. On the other hand, in order to collect data on writing in the Language of Mathematics, students were given questions that required to be answered by writing.

The passage on listening in both the Language of Instruction and the Language of Mathematics were read by a fluent speaker (English and Mathematics teachers respectively) to the subjects as they listened. Students (subjects) did not have the text; only the questions related to the passage (LI) and the statements (LM) were availed to them. Except for the listening test, subject answered all the questions on the answer sheet that was provided.

The administration of the tests took two days in every school. The test was administered to the sampled students during free times and lunch times. Using the marking schemes, the student researcher was able to award marks to the respondents.

Data collected for the purpose of hypothesis one (Ho1) consisted of scores on Proficiency in the Language of Instruction test (Listening, Writing, Speaking and Reading tests) and scores on Proficiency in the Language of Mathematics test (Listening, Writing, Speaking and Reading skills). Data for testing hypothesis two (Ho2) consisted of test scores on proficiency in the Language of Instruction (Listening, reading, writing and speaking skills) as well as the MAT scores. In order to test the third hypothesis (Ho3), test scores on Proficiency in the Language of Mathematics and MAT score were used.

3.8 Data Analysis and Presentation Methods

Data collected was analysed using both descriptive and inferential statistics. All data collected were summarised using descriptive statistics. The inferential statistics employed was the Karl Pearson's Coefficient of Correlation (r). The Karl Pearson Coefficient of Correlation is suitable in measuring the degree of relationship between variables (Kothari, 2004).

The researcher correlated the scores obtained on the Test on Proficiency in the Language of Instruction with the scores obtained on the Test on Proficiency in the Language of Mathematics from every group, for the purpose of verifying the Hypothesis One (Ho1). In order to verify Hypothesis Two (Ho2), the researcher also correlated the score on the Mathematics Achievement Test with the scores on the Test on Proficiency in the Language of Instruction in each group. Finally,

scores obtained on the Test on Proficiency in the Language of Mathematics with the scores obtained on the Mathematics Achievement Test (MAT) were used to calculate the Karl Pearson's Coefficient of Correlation (r) for the purpose of verifying the Hypothesis Three (H_03).

Scores were used to calculate Means and Standard Deviations, for the purpose of enabling the calculation of Karl Pearson's coefficient of correlation (r). The hypotheses were tested at $\alpha = 0.05$. Table 3 gives a summary of the methods that were used to test the hypotheses.

Table 4: Analytical Method

Hypothesis	Independent Variable	Dependent Variable	Statistical Test
Ho1: There is no relationship between proficiency in the Language of Instruction and the Language of Mathematics	Proficiency in the Language of Instruction	Proficiency in the Language of Mathematics	Karl Pearson's coefficient of correlation
Ho2: There is no relationship between proficiency in the Language of Instruction and performance in Mathematics	Proficiency in the Language of Instruction	Performance in Mathematics	Karl Pearson's coefficient of correlation
Ho3: There is no relationship between proficiency in the Language of Mathematics and performance in Mathematics	Proficiency in the Language of Mathematics	Performance in Mathematics	Karl Pearson's coefficient of correlation

3.9 Logistical and Ethical Considerations

In order to ensure high ethical standards, strict confidentiality, respect and willingness of respondents on solicitation of the information were assured. The researcher also sought informed consent from the respondent (refer to appendix I). In addition, ethical approval to conduct the research was sought from the Ethics

Review Committee at Pwani University (certificate attached). In order to protect the schools and respondents' identity, all information was assigned a unique code that was only known to the researcher. When the study was completed and the data analysed, any information that could link the respondent to the study were destroyed. Study findings were presented in summary form and the names of the schools or respondents were not used in anywhere in the report.

3.10 Summary

This chapter focused on the research methodology used in this study. A correlation research design was used for the purpose of this study. The research was conducted in Kilifi and Malindi district, Kilifi County. The target population constituted of all girls' from secondary schools in Kilifi County while the accessible population consisted of 348 Form Three Mathematics students from Kilifi and Malindi districts. The sample was selected using simple random sampling method, and data was collected by use of two language proficiency tests (TPLM and TPLI) as well as a Mathematics Achievement Test (MAT) designed by the researcher. Finally, data was analysed using descriptive and inferential statistics. Out of the inferential statistics, Karl Pearson coefficient of correlation was employed in order to measure the relationship between variables.

CHAPTER FOUR: RESULTS, INTERPRETATIONS AND DISCUSSIONS

4.0 Introduction

This chapter presents and interprets the results of the data analysis, and discusses the findings. The data was obtained from a sample of 64 Form Three Mathematics students from Kilifi and Malindi districts through tests administered to the selected respondents. The data obtained was analysed using Pearson's Correlation Coefficient with the aid of Statistical Package for Social Sciences version 20 software. The findings of the study are discussed in relation to the Theoretical Framework of the study and previous relevant empirical researches. The findings of the study are discussed under the headings: - Proficiency in the Language of Instruction and Proficiency in the Language of Mathematics, Proficiency in the Language of Instruction and performance in Mathematics and Proficiency in the Language of Mathematics and performance in Mathematics.

4.1 Results and Interpretations

4.1.1 Proficiency in the Language of Instruction

One of the aims of this study was to establish learners' Proficiency in the Language of Instruction and how it ultimately relates to the respondent's performance in Mathematics. The first task was to obtain the indicators of each of the domains of language. An assessment of Language Proficiency of Form Three Mathematics students in Kilifi County was done on the basis of the

domains of language namely: reading, writing, listening and speaking. The results of the data, as analysed using Pearson's Correlation Coefficient are presented in the following tables.

Table 5: Means for Proficiency in the Language of Instruction

Variable	Mean
Reading	48.47
Writing	47.92
Listening	54.89
Speaking	53.14
PLI	51.19

Table 5, which summarises test results of the respondents' proficiency in the Language of Instruction shows that the respondents Reading Skills registered a higher mean (48.47) compared to their Writing Skills (47.92). However, Listening Skills (54.89), Speaking Skills (53.14) and their overall Performance in the Language of Instruction (51.19) registered a higher mean when compared to their Reading Skills. Further comparison of the mean of the elements showed that the mean (47.92) of the respondents' Writing Skills was lower than that of their Listening Skills (54.89), Speaking Skill (53.14) and overall Performance in the Language of Instruction (51.19). Additionally, the respondents' Listening Skills was found to have a higher mean (54.89) than that of their Speaking Skills (53.14)

as well as their overall Performance in the Language of Instruction (51.19). Similarly, Speaking Skills registered a higher mean relative to the respondents' overall Performance in the Language of Instruction. The extent of association of elements is expressed by the results of Karl Pearson's coefficient of correlation shown in table 6.

Table 6: Correlation for proficiency in language of instruction

Paired variable	Correlation	Sig.
Reading and Writing	0.313	0.012
Reading and Listening	0.305	0.014
Reading and speaking	0.364	0.003
Reading and PLI	0.767	0.000
Writing and Listening	0.265	0.034
Writing and Speaking	0.115	0.366
Writing and PLI	0.517	0.000
Listening and Speaking	0.489	0.000
Listening and PLI	0.765	0.000
Speaking and PLI	0.689	0.000

Table 6, contains analysed test results of the correlation of the elements of the respondents' proficiency in the Language of Instruction. They show that there exists significant positive correlation between the elements of reading and writing ($r=0.313$; $P=0.012$) at 0.05 level of significance. Similarly, there exists a significant positive correlation between the elements of reading and listening ($r=0.305$; $P=0.014$), reading and speaking ($r=0.364$; $P=0.003$), writing and listening ($r=0.265$; $P=0.034$), and listening and speaking ($r=0.489$; $P=0.000$) at

0.05 level of significance. However, the elements of writing and speaking have a positive but insignificant correlation ($r=0.115$; $P=0.366$) at 0.05 level of significance.

Ultimately, therefore, each of the elements: reading, writing, listening and speaking were found to have a significant positive correlation with proficiency in the Language of Instruction with mastery in reading skills having the greatest association ($r=0.767$; $P=0.000$) followed by listening ($r=0.765$; $P=0.000$) then speaking ($r=0.689$; $P=0.000$) and lastly writing ($r=0.517$; $P=0.000$) at 0.05 level of significance. This means that mastery of reading, writing, listening and speaking contributes to proficiency in the Language of Instruction with reading as the greatest contributor followed by listening, then speaking and lastly writing in decreasing order of significance.

4.1.2 Proficiency in the Language of Mathematics

The establishment of learners' Proficiency in the Language of Mathematics, and how it ultimately relates to the respondent's Performance in Mathematics, was also of concern for this study. An assessment of Kilifi County Form Three students' Proficiency in the Language of Mathematics was tested based on the key components of language mastery: reading, writing, listening and speaking. Analyses of the data collected yielded the results summarised in Tables that follow.

Table 7: Means for Proficiency in the Language of Mathematics

Variable	Mean
Reading	25.17
Writing	24.06
Listening	30.34
Speaking	16.19
PLM	24.22

Table 7, which contains analysed test results of the respondents' Proficiency in the Language of Mathematics, shows that the respondents reading skills registered a higher mean (25.17) as compared to their Writing Skills (24.06), Speaking Skills (16.16) and their overall performance in the Language of Mathematics (24.22). Their Listening Skills relative to the Language of Mathematics, however, had a highest mean (30.34) when compared to the other Skills. Further comparison of the mean of the elements shows that the mean (24.06) of the respondents' Writing Skills was lower than that of their Listening Skills (30.34) and overall performance in the Language of Mathematics (24.22) but higher than that of their Speaking Skills (16.19). Additionally, the respondents' Listening Skills was found to have a higher mean rating (30.34) than that of their Speaking Skills (16.19) as well as their overall performance in the Language of

Mathematics (24.22). However, Speaking Skills registered a lower mean rating relative to the respondents' overall performance in the Language of Mathematics. The extent of association of various elements is expressed by the results of Pearson's coefficient of correlation analysis in the table below.

Table 8: Paired Correlation for Proficiency in the Language of Mathematics

Paired variable	Correlation	Sig.
Reading and Writing	0.464	0.000
Reading and Listening	0.244	0.052
Reading and speaking	0.173	0.172
Reading and PLM	0.608	0.000
Writing and Listening	0.414	0.001
Writing and Speaking	0.340	0.006
Writing and PLM	0.737	0.000
Listening and Speaking	0.643	0.000
Listening and PLM	0.808	0.000
Speaking and PLM	0.693	0.000

From Table 8, which contains analysed test results of the correlation of the elements of the respondents' Proficiency in the Language of Mathematics, It can be seen that there exists a significant positive correlation between reading and writing skills ($r=0.464$; $P=0.000$) at 0.05 level of significance. Similarly, there was found to exist a significant positive correlation between writing and listening ($r=0.414$; $P=0.001$), writing and speaking ($r=0.340$; $P=0.006$) and listening and speaking ($r=0.643$; $P=0.000$) at 0.05 level of significance. However, reading and listening ($r=0.244$; $P=0.052$) as well as reading and speaking ($r=0.173$; $P=0.172$)

were found to have positive but insignificant correlation at 0.05 level of significance. Ultimately, therefore, each of the elements: reading, writing, listening and speaking were found to have a significant positive correlation to Proficiency in the Language of Mathematics. Mastery in listening skills has the greatest association ($r=0.808$; $P=0.000$) followed by writing ($r=0.737$; $P=0.000$) then speaking ($r=0.693$; $P=0.000$) and lastly reading ($r=0.608$; $P=0.000$) at 0.05 level of significance.

By examining the strength of the relationship, it can be interpreted students' mastery of Listening is related to their mastery of speaking and that mastery of all the elements (reading, writing, listening and speaking skills) in the Language of Mathematics was linked to the mastery of the Language of Mathematics with listening being the greatest contributor followed by writing, then speaking and lastly reading in decreasing order.

4.1.3 Effects of the Language of Instruction on the Language of Mathematics

Of paramount importance for this study, was the extent of interaction of the elements of the Language of Instruction and the Language of Mathematics. An assessment of this was undertaken and the findings are shown in the subsequent Tables.

Table 9: Paired Means of the Elements of the LI and the LM

Variable	Mean
Reading (LI)	48.47
Reading (LM)	25.17
Writing (LI)	47.92
Writing (LM)	24.06
Listening (LI)	54.89
Listening (LM)	30.34
Speaking (LI)	53.14
Speaking (LM)	16.19
PLI	51.19
PLM	24.22

Table 9 contains analysed test results of interactions of the elements of the Language of Instruction and the Language of Mathematics. The results show that generally, the elements of the Language of Instruction registered higher mean rating (51.19) when compared to their corresponding elements from the Language of Mathematics (24.22). Ultimately, the respondents' performance in the Language of Instruction was better than that of the Language of Mathematics. The extent of association existing between the elements is shown in tables below.

Table 10: Paired Correlation between the LI and the LM

Paired variable	Correlation	Sig.
Reading (LI) and Reading (LM)	0.477	0.000
Writing (LI) and Writing (LM)	0.039	0.762
Listening (LI) and Listening (LM)	0.162	0.202
Speaking (LI) and Speaking (LM)	0.435	0.000
PLI and PLM	0.378	0.003

Table 10 shows that there is a significant positive correlation between the respondents performance in reading skills ($r=0.477$; $P=0.000$) and speaking skills ($r=0.435$; $P=0.000$) at 0.05 level of significance. This means that the mastery of reading and speaking skills in the Language of Instruction is related to reading and speaking in the language of Mathematics with reading having great association. Finally the findings show that there is a positive and significant relationship between performance in the Language of Instruction and performance in the Language of Mathematics ($r=0.378$; $p=0.003$) at 0.05 level of significance. The value of the coefficient of determination r^2 of 0.142 in the case of this study explains that 14% of the dependent variable (Mastery of the Language of Mathematics) is explained by the independent variable (Mastery of the Language of Instruction). This implies that 86% of the Language of Mathematics is explained by other variables not considered in this study. In this case, the null

hypothesis Ho1, which states that there is no relationship between the Language of Instruction and the Language of Mathematics, was rejected.

4.1.4 Effect of the Language of Instruction and the Language of Mathematics on Performance in Mathematics

The last aspect of this study involved investigating the extent of interaction of mastery of the Language of Instruction and the Language of Mathematics with the respondents' Performance in Mathematics. The results of this are given in the subsequent Tables.

Table 11: Means for the LI and the LM and the PM

Variable	Mean
Reading (LI)	48.47
Writing (LI)	47.92
Listening (LI)	54.89
Speaking (LI)	53.14
PLI	51.19
Reading (LM)	25.17
Writing (LM)	24.06
Listening (LM)	30.34
Speaking (LM)	16.19
	15.19
PLM	24.22
PM	15.19

Table 11, contains results comparing the means of the elements of the Language of Instruction and those of the Language of Mathematics with the overall performance in Mathematics shows that all the elements of the Language of Instruction (reading=48.47, writing=47.92, listening=54.89 and speaking=53.14) had comparably higher mean rating to that of the overall performance in Mathematics (15.19). The Language of Instruction also registered a higher mean rating (51.19) compared to the overall performance in Mathematics. Likewise, elements of the Language of Mathematics were found to have higher mean ratings (reading=25.17, writing=24.06, listening=30.34 and speaking=16.19) compared to the overall performance in Mathematics. Similarly, performance in the Language of Mathematics was found to have a higher mean rating (24.22) compared to the overall performance in Mathematics.

Table 12: Paired Correlation between the LI and PM

Paired variable	Correlation	Sig.
Reading (LI) and PM	0.360	0.004
Writing (LI) and PM	0.008	0.949
Listening (LI) and PM	0.392	0.001
Speaking (LI) and PM	0.203	0.108
P LI and PM	0.408	0.000

From Table 12, which contains Pearson's test results on the association of the respondents' performance in the Language of Instruction and performance in

Mathematics, it can be inferred that there was a significant positive correlation between the elements of the Language of Instruction such as reading ($r=0.360$; $P=0.004$) and listening ($r=0.392$; $P=0.001$) and performance in Mathematics at 0.05 level of significance. However, writing ($r=0.008$; $P=0.949$) and speaking ($r=0.203$; $P=0.108$) were found to have an insignificant positive correlation to performance in Mathematics. Consequently, performance in the Language of Instruction was found to have a positive and significant correlation ($r=0.408$; $P=0.000$) to performance in Mathematics at 0.05 level of significance with listening being the greatest contributor followed by reading in decreasing order of effect. The coefficient of determination of r^2 of 0.166 shows that about 17% of performance in Mathematics is attributed to the mastery of the Language of Instruction. This means that 17% of girls' performance in Mathematics can be predicted from the relationship between the language of Instruction and Performance in Mathematics. (Conversely, about 83% of performance in Mathematics cannot be explained by the mastery of the Language of Instruction.). This signifies that 83% of performance in Mathematics is attributed the other variables. Therefore, the null hypothesis H_{02} , which states that there is no relationship between Proficiency in the Language of Instruction and Performance in Mathematics, was rejected.

Table 13 Correlation between the LM and PM

Paired variables	Correlation	Sig
Reading (LM) and PM	0.486	0.000
Writing (LM) and PM	0.559	0.000
Listening (LM) and PM	0.433	0.000
Speaking (LM) and PM	0.326	0.009
P LM and PM	0.717	0.000

Table 13 shows that there exists a positive significant correlation between all the elements of the Language of Mathematics: reading ($r=0.486$; $P=0.000$), writing ($r=0.559$; $P=0.000$), listening ($r=0.433$; $P=0.000$) and speaking ($r=0.326$; $P=0.009$) with performance in Mathematics at 0.05 level of significance. Similarly, there exists a positive significant correlation between the Language of Mathematics and performance in Mathematics ($r=0.717$; $p=0.000$) at 0.05 level of significance with writing being the greatest contributor followed by reading, then listening and lastly speaking in decreasing order of effect. The value of the coefficient of determination of 0.514 explains that 51% of performance in Mathematics is explained by the mastery of the Language of Mathematics and that 49% remaining part is attributed to other variables that this study did not considered. Hence the null hypothesis H_{o3} , which states that there is no relationship between proficiency in the Language of Mathematics and Performance in Mathematics, was rejected.

4.2. Discussion

4.2.1 Proficiency in the Language of Instruction and Proficiency in the Language of Mathematics

In this study the relationships between Proficiency in the Language of Instruction and Proficiency in the Language of Mathematics were examined using Pearson's coefficient of correlation. Findings have demonstrated that there are significant relationships between these variables.

The phenomena, as revealed in the tables of results, are discussed below. Table 5 and 7, containing the respondents' performance in the Language of Instruction and the Language of Mathematics, show that the overall performances in these two critical areas (PLI and PLM) remain low. While the performance in the Language of Instruction seems almost average, that of the Language of Mathematics is significantly low. Generally, the students' mastery of the various elements of the Language of Mathematics was found to be very poor. Based on Pearson's coefficient of correlation analysis, the results show that mastery of reading, writing, listening and speaking skills contribute to mastery of the Language of Mathematics.

The results show that there exists a significant positive relationship between the respondents' performance in the Language of Instruction and performance in the Language of Mathematics at 0.05 level of significance. Vygotsky (1978) social

cultural theory, the theoretical framework adopted in this study, explains the findings. The theory states that the school of Mathematics is a social practice in which language is a source for learning. According to this theory, for learning to take place, incremental change must occur in the learner's ZDP (Freeman & Freeman, 1994). To attain this, the Language of Instruction must help learners in mastering the Language of Mathematics; what this theory calls scaffolding. These findings on the relationship between the Language of Instruction and the language of Mathematics are also supported by previous literature. Botes and Mji (2010) pointed out that in order to master Mathematics a learner has to understand a commonly spoken everyday language: the Language of Instruction and a subject-specific language: the language of Mathematics. The respondents' performance in the Language of Mathematics is affected by their competency in the Language of Instruction. The findings reveal that the greater the level of Proficiency in the Language of Instruction, the stronger the transfer of skills across to the Language of Mathematics. Conversely, the less developed a student's Proficiency in the Language of Instruction is, the more difficult it is to cope with the Language of Mathematics. This argument is also corroborated by Eshiwani (1983) when he asserted that languages in Mathematics are sources of difficulties in Mathematics learning. According to the preceding researchers, Mathematics is developed and contested through both language and symbols by social interaction. These remarks therefore emphasize the role that language plays

in the development of Mathematics by highlighting language as a resource for communication and thinking in Mathematics.

4.2.2 Proficiency in the Language of Instruction and performance in Mathematics

Another aim of this study was to find out the relationship between Proficiency in the Language of Instruction and Performance in Mathematics. The study reveals there exists a significant positive relationship between reading and listening in the Language of Instruction with Performance in Mathematics. This shows that these elements have a significant effect on performance in Mathematics. Ultimately, the results showed that there exists a significant relationship between the respondents overall performance in the Language of Instruction and Performance in Mathematics at 0.05 level of significance. Vygotskys (1978) theory explains these findings by stating that proficiency in the Language of Instruction assist learners to make sense of what is being learned thus affecting their performance. In the context of this study, the findings reveal that the higher the level of learners performance in the Language of Instruction the higher the level of Learners Performance in Mathematics and vice versa. This theory postulates that Learners make sense of the world around them by means of certain tools. Such tools include the language used in social interaction, visual materials, learning activities, direct instruction or teacher assistance, etc. (Shrum & Glisan, 2000).

According to this theory, The Language of Instruction mediates between the learner and Mathematics learning.

The results are also in agreement with the previous studies: Ngome (2003), Setati (2002) indicate that students that are found to be very weak in the Language of Instruction have a tendency towards ill-comprehension as well as poor participation in classroom discourse. Consequently, they cannot meet the desired objectives of the study.

These results further support Bradley's cited in Tate (1997) who claims that, the higher the learner's level of proficiency in the English language (as the Language of Instruction), the higher the chances of achieving well in Mathematics. Howie (2003) concludes that the pupils' proficiency in English (as a medium of instruction) is a strong predictor of their success in Mathematics. Furthermore, there is a common view in much of the scientific literature which claims that, students with a moderate level of proficiency in the Language of Instruction were better able to achieve a basic level of Mathematics performance compared to students classified as low in proficiency in the Language of Instruction (Bradly, 1992 cited in Tate, 1999). Thus, in order to perform better in Mathematics a moderate level of proficiency in the Language of Instruction appeared to matter significantly.

The findings showed that Performance in Mathematics is highly dependent on the mastery of the Language of Instruction and that all the elements in the Language of Instruction contribute to performance in the Language of Instruction. This means that all the elements in the Language of Instruction also contribute to performance in the language of Mathematics. However, reading is the greatest contributor followed by listening, speaking and lastly writing. These research findings are in line with those of Oberholzer, (2005) who claims that in our current education system, much emphasis is placed on the skills of reading and writing. As a result, academic success is largely dependent on literacy skills. Children who experience difficulty with reading or writing are likely to find it harder to reach their academic potential at school.

Research has also shown that students with low reading ability are generally low academic achievers (Stanovich, 2000; Naglieri, 2001). This view has also been supported by Krashen (1993) who points out that children who read effectively have access to numerous sources of written material which, in turn, enables them to increase their general knowledge, their vocabulary and their language skills. With regards to speaking and listening, the results are strongly supported by Washington (2001) who notes that strong oral vocabulary skills, both expressive and receptive, are critical for general academic success.

4.2.3 Proficiency in the Language of Mathematics and Performance in Mathematics

The findings of this study show that there exists a significant positive relationship between the elements of the Language of Mathematics and the overall performance in Mathematics at 0.05 level of significance. The results of this study have also revealed that there is a significant positive relationship between Proficiency in the Language of Mathematics and Performance in Mathematics. This is in line with Vygotskys (1978) theory that claims that learners who have mastered the culture of the language (in this case the Language of Mathematics) will probably be able to think and use this language. Consequently they will actively participate in the entire process of Mathematics teaching and learning. This has been supported by the findings of Pimm (1987); Adler (2001) and Setati (2005) who perceive learning to communicate mathematically as a central aspect of learning Mathematics. This is also strongly supported by Benson (2003) who revealed that student's performance in Mathematics strongly depends on their understanding of mathematical terminologies. Ishaku (2005) also found out that understanding the language of Mathematics has a significant effect on performance in Mathematics.

Pearson's correlation test results on the respondents' mastery of the elements of the Language of Instruction and the Language of Mathematics as well as performance in Mathematics provides insights on the extent of association of each

of the parameters. The results show a significant positive correlation between the mastery of the different domains of language and the mastery of language (Language of Instruction and language of Mathematics). There is also a significant positive correlation between the mastery of the language (Instruction and Mathematics) and Performance in Mathematics.

Further, it can be argued that since each of the domains were found to be positively and significantly related to performance in Mathematics, the poor performance in Mathematics could therefore be attributed to the respondents' poor mastery of the domains of language particularly with regard to the Language of Instruction.

4.3 Summary

From the results, it can be concluded that learner's Proficiency in the Language of Instruction affect their mastery of the Language of Mathematics and ultimately the learners overall performance in Mathematics. Consequently, poor performance in Mathematics could be mostly attributed to poor mastery of the Language of Instruction.

The Pearson's test results on the association of Performance in the Language of Instruction and the Language of Mathematics reveal that there is a significant

positive relationship between both the Language of Instruction and the Language of Mathematics and Performance in Mathematics at 0.05 level of significance.

The descriptive and inferential statistics used to analyse the data provide clear evidence that there is a relationship between Language Proficiency and Performance in Mathematics.

The results were in line with the general literature, in that Proficiency in the Language of Instruction and Proficiency in the Language of Mathematics are related and that both Proficiency in the Language of Instruction and proficiency in the Language of Mathematics are in relationship with Performance in Mathematics.

CHAPTER FIVE: SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

In this chapter, the intention is to provide a summary of the study, to reach conclusions based on the results and to give recommendations for improved practice. Possible areas for further research are also suggested.

5.2 Summary

The purpose of this study was to find out the relationship between language proficiency and performance in Mathematics. More specifically, three null hypotheses were drawn in line with the aims and objectives of the study. These hypotheses are enumerated as below:

Ho1: There is no relationship between Proficiency in the Language of Instruction and Proficiency in the Language of Mathematics.

Ho2: There is no relationship between Proficiency in the Language of Instruction and Performance in Mathematics

Ho3: There is no relationship between Proficiency in the Language of Mathematics and Performance in Mathematics.

These hypotheses were dealt with and the results were presented. The study relied on quantitative data in form of tests namely: Test on Proficiency in the Language

of Mathematics (TPLM), Test on Proficiency in the Language of Instruction (TPLI) and a Mathematics Achievement Test (MAT)

The researcher gathered pertinent insights from tests. The results of this study found that there is a positive and significant relationship between language proficiency and performance in Mathematics and all the three hypotheses were rejected.

5.3 Conclusion

The study set out to find the relationship between language proficiency and performance in Mathematics. The research findings show that languages are source of learning difficulties in Mathematics. When looking at the relationship between performance in Mathematics and language proficiency, proficiency in the language of Instruction was found to be of more significance than competency in the Language of Mathematics. Greater proficiency in the Language of Instruction allows for a stronger transfer of skills across to the Language of Mathematics. Again, proficiency in both the Language of Instruction and the Language of Mathematics correlate with performance in Mathematics. Students with high competency in both languages (LI and LM) perform better. It requires sufficient level of mastery of the Language of Instruction in order to cope with the Language of Mathematics and allow for a strong transfer of mathematical skills across the language of Mathematics and finally succeed in Mathematics.

Research findings show that girls perform better in the Language of Instruction i.e. English (Nalugo, 2014) and that they perform poorly in Mathematics, further research is required to determine the veracity of this.

From the research findings, it can be concluded that both the Language of Instruction and the Language of Mathematics are related and they are both of great importance to performance in Mathematics. To be proficient in the Language of Mathematics, learners need to be proficient in the Language of Instruction. The success in Mathematics depends mostly on learner's proficiency in the Language of Instruction as the key aspect to the learning of Mathematics.

5.4 Recommendations

5.4.1 Policy Recommendations

The language struggle as is implied in the language policy in Kenya is between English, Kiswahili and mother tongue. The policy endorsed in Kenya encompass a bilingual approach, where the child's mother tongue (or the relevant local language) is used as the Language of Instruction in lower primary classes (Class One to Class Three), while English and Kiswahili are taught separate at that level as subjects. Therefore, English takes over from the mother tongue as the language of instruction in the upper classes (Class Four onwards) whereas Kiswahili retains its status as a subject only. However, this study showed that many students do not master the language of instruction very well. Matters are further complicated by

the fact that English, the language of instruction also happens to be the language of examination except for Kiswahili subject. The findings show that proficiency in both the Language of Instruction and the Language of Mathematics and performance in this particular subject (i.e. Mathematics) are very linked. The Language of Instruction as well as the Language of Mathematics are seen as essential components of success in Mathematics. This implies that there is need to master both the Language of Instruction and language of Mathematics in order to succeed in this core subject of the Kenya curriculum. The following is thus recommended and should be implemented to fully achieve this goal:

1. The language policy makers should:
 - i. Employ the language of examination as the Language of Instruction from kindergarten as to enable students to independently understand it.
 - ii. Inform teachers about the importance of mastery of the Language of Instruction for learning, to enable learners to grow with it and embrace it wholly. This will enable learners to acquire skills that are needed to fully participate in the entire Mathematics teaching and learning process.
2. The Ministry of education either directly or through its agents should:
 - i. Enhance learners' English background through provision of more resources to enable schools stock more reading materials.
 - ii. Enhance supervision of schools to help improve the students' general secondary school entry behaviour and particularly their

background in English as it is important in explaining concepts in Mathematics.

3. The school management/administration should:

- i. Expand existing reading and general language learning resources and facilities in schools to help foster improved language literacy.
- ii. Provide for innovative ways to help motivate English teachers like taking them for more capacity building courses and providing them with other incentives so as to empower them to better assist learners in mastering the Language of Instruction.
- iii. Work closely with the teachers and parents in counselling the students to help improve their reading and language literacy efforts.

4. The English and Mathematics teachers should:

- i. Expose their students to more language literacy exercises such as reading, writing, listening and speaking to help improve their language proficiency levels.
- ii. Work in concerted effort to help encourage students to adopt appropriate language literacy practices in all the skills of Language Proficiency.

Mathematics is a very important subject. Fortunately the country's leaders in the area of governance and education recognise this crucial fact given that it has been placed very high in the curriculum. It is well known that failing Mathematics in the national examinations automatically costs any examinee a higher ranking.

Add this to the fact that Mathematics is the backbone of all technological innovations including computer packaging. It is also present in all the pure and applied sciences, not to mention social sciences, humanities and even the arts. Indeed, Kenya's vision 2030 hinges heavily on improved performance in Mathematics as does all the developed countries. This scenario suggests that a country cannot realistically make the big leap in technology development if the country's young do not at the same time perform very well in Mathematics. Unfortunately, for Kenya, this is exactly the case, i.e. the greatest majority of examination takers, have been failing this most important subject year in year out. This is very discouraging given our lofty goal of achieving industrial development status by 2030. Obviously, something must be done in order to salvage the situation, otherwise all is lost.

A suggestion is made here that the Language of Mathematics be taught as a very important course at every important phase of the Kenyan learners' development. Once developed, this course must be taught from kindergarten, through primary school, secondary school all the way to the university where it will be taught to every university student as one of the core communication skills courses. In this way the Mathematics anxiety, which is the real problem, will be dealt a huge blow and as a subject, Mathematics will no longer scare students and performance in it will be greatly improved. The focus could also be on the training of teachers in

colleges and universities as they will be directly involved in the instruction of the subject.

5.4.2 Recommendations for Further Research

This study, While it has achieved its purpose, it has raised a number of other questions that merit further research. Furthermore, the methodology and findings of this research open up several avenues for further research and discussion.

- i. An analysis of learners' poor conception of language domains relative to the language of Mathematics.
- ii. A study of the impact of socio-cultural factors on the Language of Instruction and the Language of Mathematics, and ultimately learners' performance in Mathematics.
- iii. A comparative study between boys and girls on the relationship between Language proficiency and performance in Mathematics.
- iv. A study investigating why girls perform poorer in Mathematics and yet they perform better in English as the Language of Instruction.

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APPENDICES

Appendix A:
TEST ON PROFICIENCY IN THE LANGUAGE OF MATHEMATICS

INTRODUCTION

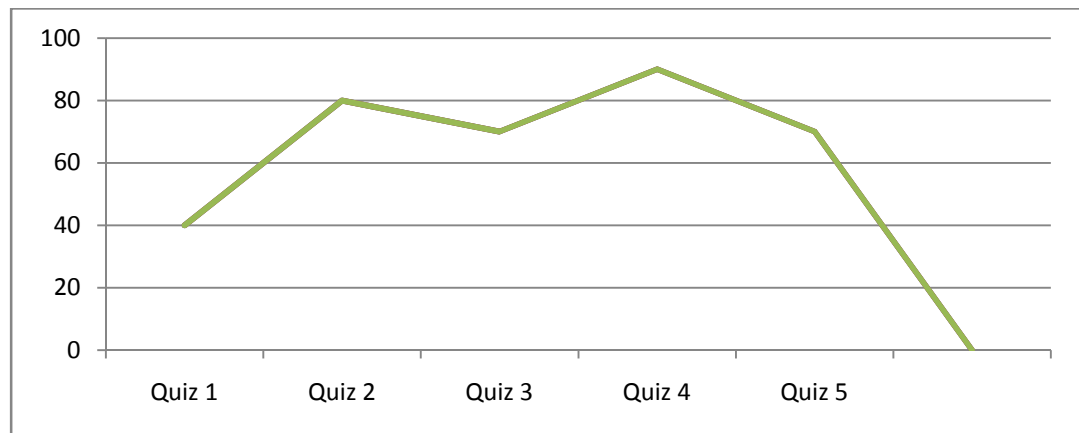
This test is designed to find out the relationship between language proficiency and performance in Mathematics as one of your school subjects. The test is organized in four parts. Please follows instructions carefully and answer all the questions. Your results will be kept strictly confidential and will only be used for the purpose of this study. Your answers will not be used to prejudice you in any way. The researcher will remove any reference to personal information that might allow someone to guess the school name and student's identity.

Student's Index Number:

School:.....

PART ONE**Test One: Reading Test****Maximum Score:** 25 marks**Duration:** 30 minutes**Instruction:** - Answer **ALL** questions on the answer sheet provided.**Question 1**

John's scores in 5 quizzes are graphed in % on the chart



Write down John's grades in each of the quiz.

/5 marks**Question 2**Describe the following set in words $\{x/x \in \mathbb{N} \text{ and } 6 < x \leq 9\}$ **/5marks****Question 3**Read and write the following statement in words $|AB| = |CD|$ **/5marks****Question 4**Read and write in words the following: \geq , \approx , \neq , $|a|$, (x,y) , \sum , $\sin A$, ΔABC **/5marks.**

Question 5

Read and write the following statements in words

/5marks

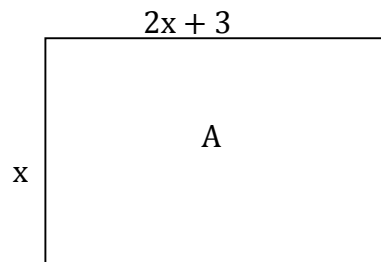
a. $x - 4$

b. $2(x + 7)$

c. $7 + 24$

d. $7(+ 24)$

e. $1/$

PART TWO**Test Two: Writing Test****Maximum Score:** 25 marks**Duration:** 30 minutes**Instruction:** - Answer **ALL** questions on the answer sheet provided.**Question 1**Write a polynomial that represents the area A of the above rectangle.**/5marks****Question 2**If x is the first term of three consecutive natural numbers, write the sum of the three consecutive natural numbers in terms of x . **/7.5marks****Question 3**A and B are the first and second terms of an algebraic expression. Write down the square of the first term, add twice the product of the terms and then add the square of the last term. **/7.5marks**

Question 4

Use Venn diagram to illustrate the relationships among sets U, A and A'

$$U = \{1, 2, 3, 4, 5, 6, 7, 8, 9\}$$

$$A = \{1, 3, 4, 7\}$$

$$A' = \{2, 5, 6, 8, 9\}.$$

/5marks

PART 3**Test Three: Listening Test****Maximum Score:** 25 marks**Duration:** 30 minutes

Instruction: - Listen carefully to the following statements and answer the questions that follow.

Statement 1

A term is a number or the product of numbers and variables raised to powers.

Statement 2

The sum of twice a number x and n is equal to two times a number x increased by n .

Statement 3

The mean is the sum of the data items divided by the number of items.

Statement 4

Two sides of an isosceles triangle have equal length.

Statement 5

Set A and set B are equal if and only if set A and B contain exactly the same elements, regardless of order or possible repetition of elements whereas set A and set B are equivalent if set A and set B contain the same number of elements.

Answer the Following Questions**Questions1**

Write down one example of a term. **/5marks**

Question2

Write down the sum of twice a number and 7. **/5marks**

Question3

What is the mean? **/5marks**

Question4

Draw an isosceles triangle. **/5marks**

Question5

Write down an example of:

a. Two equal sets **/2.5marks**

b. Two equivalent sets **/2.5marks**

PART FOUR**Test Four: Speaking Test****Maximum Score:** 25 marks**Duration:** 5

minutes

Instructions: - Answer orally the following questions.**Question1**

What is a vector AB?

/5marks**Question 2**

Explain how solving a linear inequality is similar to solving a linear equality.

/5marks**Question 3**

What are like terms?

/5marks**Question4**

What is the difference between complementary and supplementary angles?

/5marks**Question 5**Explain the difference between $= -3$ and $= (-3)$ **/5marks**

Appendix B:
**TEST ON PROFICIENCY IN THE LANGUAGE OF
INSTRUCTION**

INTRODUCTION

This test is designed to find out the relationship between language proficiency and performance in Mathematics as one of your school subjects. Please answer all the questions carefully. Your results will be kept strictly confidential and will only be used for the purpose of this study. Your answers will not be used to prejudice you in any way. The researcher will remove any reference to personal information that might allow someone to guess the school name and student's identity.

Student's Index Number:

School:.....

PART ONE**Test one: Reading Test****Maximum Score:** 20 marks**Duration:** 30 minutes

Instructions: - Read carefully the passage before responding to questions; and choose one correct answer by circling around it.

The Ways we Lie

The bank called today, and I told them my deposit was in the mail, even though I hadn't written a check yet. It would be a rough day. The baby I'm pregnant with decided to do aerobics on my lungs for two hours, our three years daughter painted the living room couch with lipstick, the IRS put me on hold for an hour, and I was late to a business meeting because I was tired.

I told my client that the traffic had been bad. When my partner come home, his haggard face told me his day hadn't gone better than mine, so when he asked, "How was your day?" I said, "Oh, fine", knowing that one more straw might break his back. A friend called and wanted to take me to lunch. I said I was busy. Four lies in the cause of the day, none of which I felt the least bit guilty about.

We lie. We all do. We exaggerate, we minimize, we avoid confrontation, we spare people's feelings, we conveniently forget, we keep secrets, we justify lying to the big guy institutions. Like most people, I indulge in small falsehoods and still think of myself as an honest person. Sure I lie, but it doesn't hurt anything. Or does it?

I once tried going a whole week without telling a lie, and it was paralyzing. I discovered that telling the truth all the time is nearly impossible. It means living with some serious consequences: The bank charges me \$60 in overdraft fees, my partner keels over when I tell him about my travails, my client fires me for telling her I didn't feel like being on time, and my friend takes it personally when I say I'm not hungry. There must be some merit to lying.

But if I justify lying, what makes me any different from slick politicians or the corporate robbers who raided the S&L industry? Saying it's OK to lie one way and not another is hedging. I cannot seem to escape the voice inside me that tells me: When someone lies, someone loses.

What far-reaching consequences will I, or others, pay as a result of my lie? Will someone's trust be destroyed? Will someone else pay my penance because I ducked out? We must consider the meaning of our actions. Deceptions, lies, capital crimes, and minor violations of rules all carry meanings.

By Stephanie Ericsson

1. **An alternative title for this passage could be**

- a. Lying Never Hurt Anyone
- b. The Check's in the Mail: The greatest lie of all
- c. Justification for Lying
- d. Lies in Our Lives /5marks

2. **The main idea of this essay is that**

- a. Small lies are Ok because everyone lies.
- b. We should reevaluate the role that lies play in our lives.
- c. Lies told by someone you trust are the worst.
- d. To trust and be trusted, we must refuse to lie. /5marks

3. **What distinction does Ericsson make between telling a functional lie and living a lie?**

- a. Telling a functional lie make someone feels bad, and living a lie cheats big institutions.
- b. Telling a functional lie is relatively harmless, but living a lie can have serious consequences.
- c. Telling a functional lie has no merit, and living a lie is a good idea.

- d. Telling a functional lie is honest, and living a lie is dishonest.

/5marks

4. According to Ericsson, a white lie assumes that

- a. A lie will cause serious consequence.
- b. The truth will cause more damage than a simple harmless untruth.
- c. Lie help in problem solving
- d. It is possible to tell the truth all the time **/5marks**

PART TWO

Test Two: Writing Test

Maximum Score: 20 marks

Duration: 30 minutes

Instructions: - Write on the answer sheet provided and not write less than 200 words. And/or more than 500 words.

Topic: Write a paragraph that shows the disadvantages of mobile phones. Make sure you provide examples for your readers. **/20 marks**

PART THREE**Test Three: Listening Test****Maximum Score:** 20 marks**Duration:** 20 minutes

Instruction: Listen carefully the following passage and answer the questions that follow

Napoleon

Napoleon was a French soldier who becomes emperor of France. He was born in 1769 on the island of Corsica. When he was only ten years old, his father sent him to military school in France. Napoleon was not a very good student in most of his classes, but he excelled in Mathematics and in military science. When he was sixteen years old, he joined the French army. In that year he began the military career that brought him fame, power, riches, and, finally defeat. Napoleon became a general in French army at a young age of twenty four. Several years later he became emperor of the French Empire.

Napoleon was many things. He was first of all, a brilliant military leader. His soldiers were ready to die for him. As a result, Napoleon won many military victories. At one time he controlled most of Europe, but many countries including England, Russia and Austria fought fiercely against Napoleon. His defeat-his end-came when he decided to attack Russia. In this military campaign into Russia, he lost most of his army.

The great French conqueror died alone-deserted by his family and his friends –in 1821. He died in 1821, alone and deserted. Napoleon was only fifty-one years old when he died.

Answer the following questions by choosing only one answer

1. When was Napoleon born?

- a. 1769
- b. 1821
- c. In France
- d. On Corcica

/2.5marks

2. What did Napoleon do when he was ten years old?

- a. He became a general.
- b. He joined the French army.
- c. He started military school.
- d. All of the above.

/2.5marks

3. What kind of student was Napoleon in most of his classes?

- a. Outstanding

- b. Excellent
- c. Good
- d. Poor

/2.5marks

4. What did Napoleon's military career bring him?

- a. Power
- b. Wealth
- c. Defeat
- d. All of the above

/2.5marks

5. How did the speaker describe Napoleon's soldiers?

- a. Fierce
- b. Loyal
- c. Foolish
- d. Brilliant

/2.5marks

6. Which countries tried to stop Napoleon?

- a. Austria
- b. England
- c. Russia
- d. All of the above

/2.5marks

7. When did Napoleon become emperor of the French empire?

- a. When he was fifty one years old.
- b. Just before he defeated England.
- c. After his military campaign into Russia.
- d. Several years after he became a general.

/2.5marks

8. In what year did Napoleon die?

- a. In 1801
- b. In 1820
- c. In 1830
- d. None of the above

/2.5marks

PART FOUR

Test Four: Speaking Test

Maximum Score: 20 marks

Duration: 5minutes

Instructions: - Answer orally the following question.

Topic: Tell us about your favorite subject.

Appendix C:
MATHEMATICS ACHIEVEMENT TEST

Student's Name:

Maximum Score: 100 marks

Duration: 1 hour 20 minutes

Instructions: Answer **ALL** questions on the answer sheet provided.

1. Without using tables, find the value of x in the equation

$$\log_5 x + \log_5 5x = 5 \log 2 - \log (2/5) \quad / 10 \text{ marks}$$

2. Simplify the expression $\frac{2x^2 - 5x + 2}{x^2 - 4} - \frac{x + 1}{x - 2}$, hence solve the equation

$$\frac{2x^2 - 5x + 2}{x^2 - 4} - \frac{x + 1}{x - 2} = - \quad / 8 \text{ marks}$$

3. If $x + y = 29$ and $x - y = 3$

- a. Determine the value of

i. $\frac{x + 2}{y} +$

ii. $\frac{2}{x}$

iii. $\frac{-2}{x} +$

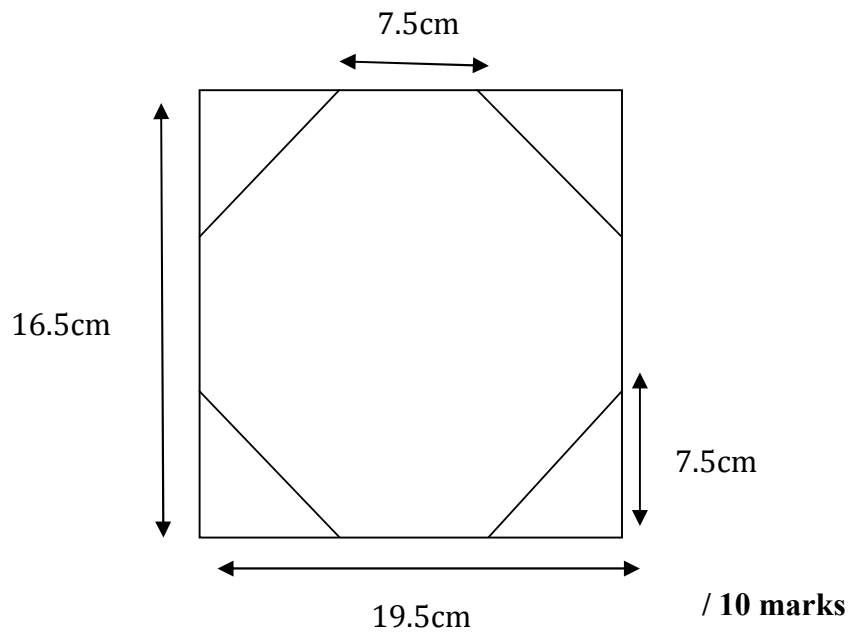
iv. $\frac{-}{y}$

- b. Find the value of x and y /16 marks

4. The equation of a line is $2x + 3y = 6$

- i. Find the gradient of the line
- ii. Find the equation of the line passing through point (1,2) and perpendicular to the given line **/6marks**

5. The figure below shows an octagon obtained by cutting off four congruent triangles from a rectangle measuring 19.5 by 16.5cm.



6. The acceleration a m/s² of a particle moving in a straight line is given by $a = 18t - 4$, where t is the time in seconds. The initial velocity in terms of t is 2m/s.

- a. Find the expression for velocity in terms of t .
- b. Determine the time when the velocity is again 2m/s. **/10 marks**

7. Two sides of a triangle are 5 each and the angle between them is 120° . Calculate the area of the triangle. **/ 10 marks**

8. Given the simultaneous equations

$$5x + 2y = 19$$

$$-x + 3y = 9$$

- a. Write the equation in matrix form.
 - b. Solve the simultaneous equations **/10 marks**
9. A bus travelled at an average speed of 63 km/h left a station at 8.15. A car later left the same station at 9.00 and caught up with the bus at 10.45. Find the average speed of the car. **/8 marks**
10. Olive bought 5 physics books and 6 mathematics books for a total of \$244.00. Ali bought 7 physics books and 9 mathematics books for a total of \$356.00.
- i. Form a matrix equation to represent the above information
 - ii. Use matrix method to find the price of a physics book and that of a mathematics book. **/12 marks**

Appendix D:

MARKING SCHEME OF THE TEST ON PROFICIENCY IN THE LANGUAGE OF MATHEMATICS

A. MARKING SCHEME FOR THE READING TEST

1.

- John got 40% in the 1st quiz. /1mark

- John got 80% in the 2nd quiz. /1 mark

- John got 70% in the 3rd quiz. /1 mark

- John got 90% in the 4th quiz./1mark

- John got 70% in the 5th quiz. /1mark

2. Set P is the set of all elements x such that x is a natural number greater than 6 and less than 9. /5marks

3. The vector AB has same magnitude as vector CD or the length of AB is equal to the length of CD or the distance between point A and B is equal to the distance between C and D. / 5marks

4.

\geq : is greater than or equal to. /0.625 marks

\approx : is approximately equal to. /0.625 marks

\neq : is not equal to. /0.625 marks

$|a|$: absolute value of a. /0.625 marks

(x,y) : ordered pair /0.625 marks

Σ : Sum of /**0.625 marks**

Sin A: sin of angle A /**0.625 marks**

- Δ ABC: Triangle ABC. /**0.625 marks**

5.

a. $\quad - 4$

- A number decreased by 4

- 4 less than a number

- A number minus 4

- The difference between a number and 4 /**1mark**

- $2(\quad + 7)$

b.

- Twice the sum of a number and 7 /**1mark**

- $7\quad + 24$

c.

- Seven times a number increased by 24 /**1mark**

d. $7(\quad + 24)$

- Seven times the sum of a number and 24 /**1mark**

e. $1/$

- Reciprocal of a number or one divided by a number or the quotient of one and a number. /**1mark**

B. MARKING SCHEME FOR THE WRITING TEST

1. To find the area of the rectangle, multiply the length by the width. The formula is $A = l \times w$, where A is the area, l is the length, w is the width. /1

mark

l is the length of the rectangle / **1 mark**

w + 3 is the width of the rectangle / **1 mark**.

The area of a polynomial = $(2l + 3w)$ **1.5 marks.**

= $2lw + 3lw$ / **1.5 marks.**

2. The first term is n / **1.5 marks**

The second term is $n + 1$ / **1.5 marks**

The third term is $n + 2$ / **1.5 marks**

The sum of the three consecutive natural numbers in terms of n is

$n + n + 1 + n + 2$ / **1 mark**

$3n + 3$ / **1.5 marks**

$3(n + 1)$ / **2 marks**

3. $A^2 + 2AB + B^2$ / **5 marks**

4. U

	.2		
1.	.5	A	
	.6		.1
	.8		.3
	.9		.4
			.7

/ 5marks

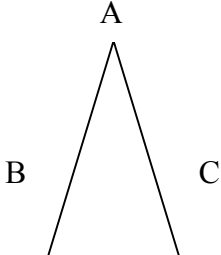
C. MARKING SCHEME FOR THE LISTENING TEST

1. Eg: 2, 6, 7 etc. / **5marks**

2. $2 + 7$ / **5marks**

3. The mean is Σ -

Or $\frac{\Sigma}{n}$ / **5marks**

4.  $AB = AC$ / **5marks**

5. a. $A = \{3, 5, 8, 9\}$ and $B = \{8, 9, 3, 5\}$ are two equal sets / **2.5marks**

b. $\{a, b, c, e\}$ and $\{1, 3, 5, 7\}$ / **2.5marks**

D. MARKING SCHEME FOR THE SPEAKING TEST

1. A vector is a quantity which has both magnitude and direction. The direction is showed by the arrow. Its magnitude is represented by the length of AB. Its magnitude is denoted by $|AB|$.

A is called initial point and b is the terminal point. **5marks**

2. A linear inequality is similar to a linear equation except that the equality symbol is replaced with an inequality symbol and that a linear equation has one answer, while a linear inequality can have more than one solution.

/ 5marks

3. Like terms are terms that have the same variables with the same exponents on the variables.

/ 5marks

4. Supplementary angles has the sum of the two angles that equal to 180° while complementary angles have the sum of 90° between two angles. Complementary angles sum to 90 degrees, like $30^\circ+60^\circ$. Supplementary angles sum to 180° , like $45^\circ+135^\circ$ or two angles are supplementary if the sum of their angles equals to 180° while two angles are complementary if the sum of their angles equals 90° .

/5marks

5. The difference between $= -3$ and $= (-3)$ is that $= -3$, only three is raised to power 3 while $= (-3)$ both the negative sign and 3 are raised to power 3.

/5mark

Appendix E:

MARKING SCHEME OF THE TEST ON PROFICIENCY IN THE LANGUAGE OF INSTRUCTION

A. MARKING SCHEME FOR THE TEST ON READING WITH COMPREHENSION

1. d / **5marks**
2. b / **5marks**
3. b / **5marks**
4. b / **5marks**

B. MARKING SCHEME FOR THE WRITING TEST

Introduction: - Proper use of vocabularies /**1.25 marks**

- Correct spelling /**1.25 marks**
- Use of connectors /**1.25 marks**
- Writing for communication /**1.25 marks**

Body: - Proper use of vocabularies /**2.5 marks**

- Correct spelling /**2.5 marks**
- Use of connectors /**2.5 marks**
- Writing for communication /**2.5 marks**

Conclusion: - Proper use of vocabularies /**1.25 marks**

- Correct spelling /**1.25 marks**

- Use of connectors /**1.25 marks**

- Writing for communication /**1.25 marks**

C. MARKING SCHEME FOR THE LISTENING TEST

1. a /**2.5 marks**

2. c / **2.5 marks**

3. d /**2.5 marks**

4. d /**2.5 marks**

5. b /**2.5 marks**

6. d /**2.5 marks**

7. d /**2.5 marks**

8. d /**2.5 marks**

D. MARKING SCHEME FOR THE SPEAKING TEST

- Introduction / **2marks**

- Appropriate speech flow / **4marks**

- Pronunciation / **2 marks**

- Clarity / **1mark**

- Use of vocabulary / **5marks**
- Speaking at appropriate pace / **1mark**
- Communicative competence / **5marks**

Appendix F:

MATHEMATICS ACHIEVEMENT TEST MARKING SCHEME

1. $(+5) = (2-)$

$$+5 = 2 : \frac{2}{5}$$

$$5 - 80 = 0$$

$$5 = 80$$

$$= 16$$

= 2/10 marks

2. $\frac{-}{-} \frac{-}{-}$,

$$\frac{(-)}{(-)} \frac{(-)}{(-)}$$

$$= \frac{-}{-}$$

$$= \frac{-}{-}$$

$$\frac{-}{-} = \frac{-}{-}$$

$$3 - 12 = 6$$

$$-3x = 12$$

= 4 /8marks

3. $x + y = 3 \Rightarrow (x +) = 9$

a.

i. $+2 + = 9, + = 29$

ii. $2 = 9 - (+)$
 $= 9 - 29$
 $= -20$

iii. $-2 + = 29 + 20$
 $= 49$

$$\text{iv. } (x - y) = -2 \quad + = 49$$

$$x - y = \pm 7$$

b.

$$\text{If } x - y = 7$$

$$x + y = 3 \quad (1)$$

$$x - y = 7 \quad (2)$$

By using the addition method $2x = 10$

$$x = 5$$

$$(1) \Leftrightarrow 5 + y = 3$$

$$\Rightarrow y = -2$$

$$\text{If } x - y = -7$$

$$x + y = 3 \quad (1)$$

$$x - y = -7 \quad (2)$$

By using the addition method $2x = -4$

$$x = -2$$

$$(1) \Leftrightarrow -2 + y = 3$$

$$\Rightarrow y = 5 \quad /16 \text{ marks}$$

$$4. \text{ a. } = - + 2$$

Gradient = -

$$\text{a. } - = -1 \Rightarrow \Rightarrow$$

$$\text{b. Equation } \frac{-}{-} = 5 \quad /6 \text{ marks}$$

$$5. \text{ Area of the rectangle} = 1 \quad \times (19.5 \times 16) = 321.75$$

$$\text{Area of 4 triangles} = 1 \quad \times - \times 6 \times 4.5 \times 4 = 54$$

$$\text{Area of the octagon} = 321.75 \quad - 54 \quad = 267.75 \quad /10 \text{ marks}$$

6.

$$a. \quad = 9 - 4 +$$

$$\text{Initial velocity} = 0 \quad \text{when } v = 2 \text{ms}^{-1}$$

Therefore, $c = 2$

$$. = 2 - 4 + 2$$

$$9 - 4 + 2$$

$$9 - 4 = 0$$

$$(9t - 4) = 0$$

Allow transfer of measures here

$$t = 0 \text{ or } -$$

$$= - /10 \text{marks}$$

7.

$$= - x 5 x \sin 120^\circ$$

$$= - x 5 x 0.866$$

$$= 10.825(10.82) /10 \text{ marks}$$

8.

$$+ = 19$$

$$- + 3 = 9$$

$$a. \quad \begin{array}{cc} 5 & 1 \\ -1 & 3 \end{array} = \frac{19}{9}$$

$$b. \text{ Inverse } \begin{array}{cc} 3 & -1 \\ 1 & 5 \end{array}$$

$$\begin{array}{ccc} - & \begin{array}{cc} 3 & -3 \\ 1 & 5 \end{array} & \begin{array}{cc} 5 & 1 \\ -1 & 3 \end{array} \\ & & = - \begin{array}{ccc} 3 & -1 & 19 \\ 1 & 5 & 9 \end{array} \end{array}$$

$$\begin{array}{cc} 1 & 0 \\ 0 & 1 \end{array} = \begin{array}{cc} 48 \\ 64 \end{array}$$

$$= 3 \quad \neq 10 \text{marks}$$

9.

$$= \frac{635}{1.75} \approx 362.5 \text{m}$$

$$h \frac{157.5}{1.75} =$$

= — /8marks

10.

$$5p + 6m - 2440 = 0$$

$$7p + 9m - 3560 = 0$$

$$\Delta_1 = \begin{vmatrix} 6 & 2440 \\ 9 & 3560 \end{vmatrix}$$

$$\Delta_2 = \begin{vmatrix} 5 & -2440 \\ 7 & 3560 \end{vmatrix}$$

$$\Delta_3 = \begin{vmatrix} 5 & 6 \\ 7 & 9 \end{vmatrix}$$

Cramer's rule $\frac{\begin{vmatrix} 5 & 6 \\ 7 & 9 \end{vmatrix}}{\begin{vmatrix} 5 & 6 \\ 7 & 9 \end{vmatrix}} = \frac{2440}{3560}$

$P = \frac{2440}{3560} = 200$, $m = \frac{3560}{3560} = 240$ /12marks

Appendix G:
LETTER TO THE PRINCIPAL

Adidja Nyiramafaranga

Pwani University

P.O. Box 195

Kilifi

Dear Principal

Re: Permission to conduct research

I am requesting permission to conduct research in your school. I am currently doing my Masters degree in Mathematics Education. As part of my studies, I am doing a research investigating the relationship between language proficiency and performance in Mathematics.

With your permission, data will be collected using tests and records of scores on already administered end term Mathematics achievement test. Tests will be administered by the researcher assisted by the class teacher and only the results of the subjects will be considered.

I intend to protect your school and students' anonymity and confidentiality. Their real names will not be used in the final report. I will remove any reference to

personal information that might allow someone to guess the school's name and students' identity.

Remember that the school is not obliged to participate and may withdraw at any time during the study. If you require any further information about the research, do not hesitate to contact the researcher.

Adidja Nyiramafaranga

.....

Appendix H:
INFORMATION TO PARTICIPANTS

Adidja Nyiramafaranga

Pwani University

P.O. Box 195

Kilifi

INFORMATION FOR PARTICIPANTS

TITLE OF THE PROJECT: The Relationship between Language Proficiency and Performance in Mathematics: A Case Study of District Secondary Schools in Kilifi and Malindi Districts, Kilifi County

PROGRAM OF ENROLLMENT: Masters in Education

NAME OF THE SUPERVISORS: Prof. Helen O. Mondoh and Dr. Emily A. Ondondo

NAME OF THE RESEARCHER: Adidja Nyiramafaranga

Dear Participant:

The purpose of this study is to investigate the relationship between language proficiency and performance in Mathematics. The study seeks to find the relationship between:

- i. Proficiency in the Language of Instruction and Proficiency in the Language of Mathematics
- ii. Proficiency in the Language of Instruction and performance in Mathematics.
- iii. Proficiency in the Language of Mathematics and performance in Mathematics.

This study will take about two to three days. Some instruments will be used for the purpose of this study. The instruments will be tests and records of scores on already administered end term Mathematics achievement test.

As a participant, you are free to discontinue participation in the study and withdraw your consent at any time without giving a reason. It is important to emphasize that any withdrawal from the research will not prejudice the participant's academic progress or future care. This study has been approved by Pwani University College and the National Council of Science and Technology (NCST) and the results of the study may be published.

Any question regarding this study should be directed to Adidja Nyiramafaranga at Pwani University, CIEM Department, telephone number: +254718496444, Email: nyiramafaranga@yahoo.fr.

If you have any complaint or concern about the way you have been treated during the study or if you have any query that the student researcher has not been able to satisfy, you may write to NCST or the Ethics Committee at Pwani University.

Any complaint will be treated in confidence and investigated fully. The participant will also be informed of the outcome. If you agree to participate in this study, you should sign both copies of the consent form and retain one copy for your record and return the other to the student researcher.

Name and signature of the participant

Date

Signature of the student researcher

Date

Appendix I:
CONSENT FORM

TITLE OF THE PROJECT: The Effect of Language Proficiency on Performance in Mathematics: A case of District Secondary Schools from Kilifi and Malindi Districts

PROGRAM OF ENROLLMENT: Masters in Education

NAME OF THE SUPERVISOR: Prof. Helen O. Mondoh and Dr. Emily.A Ondondo

NAME OF THE RESEARCHER: Adidja Nyiramafaranga

I.....understand what this research project is designed to explore. What I will be asked to do has been explained to me. I agree to take part in the project, realizing that I can withdraw at any time without having to give a reason for my decision.

Name and signature of the participant

Date.....

Signature of the student researcher

Appendix J

Appendix k

Raw Data

PLI				PLM				MAT		
R	W	L	S	PLI	R	W	L	S	PLM	MAT
25	40	50	50	41	38	34	0	8	20	26
50	30	63	70	53	16	54	60	8	35	14
50	40	88	75	63	36	56	60	28	45	0
50	80	63	50	60	4	58	56	20	35	1
75	30	50	80	59	26	28	54	16	31	22
25	63	100	60	62	44	18	60	32	39	34.5
100	40	88	80	77	40	30	40	24	34	29
75	35	88	70	77	38	0	56	12	27	31
50	60	50	60	55	54	12	60	28	39	17
75	50	63	60	62	54	26	80	24	46	5
25	30	75	50	45	42	64	80	32	55	54.5
100	40	88	70	74	60	60	40	36	49	20
25	35	75	65	50	24	24	80	16	36	25
75	45	88	70	69	48	56	60	28	48	53
25	40	63	60	47	30	48	20	20	30	26
100	75	85	70	83	38	64	100	56	65	51
50	45	63	60	54	12	8	40	16	19	0
25	65	38	40	42	24	30	22	40	29	11
50	35	38	65	48	6	16	20	32	19	0.5
50	35	50	55	48	30	32	22	24	27	27.5
50	35	38	75	49	6	10	20	16	13	0
25	50	50	70	49	28	24	36	48	34	32.5
12	50	45	63	42	2	32	0	12	12	8.5
25	40	50	80	49	37	6	40	44	32	10
0	10	50	60	30	8	39	60	52	39	12.5
75	45	38	45	51	28	8	20	26	21	3
50	40	0	30	30	4	18	40	24	22	17.5
20	25	35	38	29	24	0	0	20	11	0
50	60	75	80	66	6	4	20	8	9.5	12.5
35	50	0	45	33	22	16	20	24	21	0
40	63	23	50	44	12	28	0	16	14	4.5
45	38	2.5	2.5	22	22	20	40	24	27	2.5

25	45	50	60	45	14	34	68	40	39	24
50	60	30	56	49	14	8	64	32	30	38.5
75	45	25	60	51	10	28	20	8	17	15
0	50	25	30	26	4	4	24	4	9	11
25	65	30	50	43	36	12	24	12	21	0
50	60	88	65	66	24	6	6	8	11	5
100	80	88	65	83	14	4	24	4	12	6
50	30	25	50	39	24	0	4	4	8	6.5
50	40	50	60	50	6	30	44	8	22	18
75	50	75	70	68	16	6	56	24	26	6.5
0	50	50	40	35	4	2	16	4	6.5	0.5
50	40	75	30	49	4	4	0	2	2.5	5.5
0	10	13	20	11	20	0	16	0	9	1.5
50	60	50	40	50	4	0	16	0	5	6.5
25	50	7.5	20	26	26	36	64	12	35	11.5
50	50	75	55	58	22	8	2	0	32	14.5
75	60	63	35	58	40	64	24	16	34	44
100	80	75	50	76	24	24	12	4	16	17.5
50	40	63	45	49	4	16	0	0	5	6.5
75	70	88	60	73	28	16	12	6	16	22
50	35	38	55	44	56	64	32	16	42	46
75	60	25	70	58	32	6	6	0	11	14.5
100	70	88	60	79	28	20	8	8	16	23.5
25	30	63	10	32	16	10	4	0	7.5	5.5
50	40	50	30	43	28	22	6	2	15	12
75	50	25	40	48	64	48	4	0	29	4
50	60	88	70	67	24	8	6	0	9.5	8
0	70	75	60	51	20	16	16	4	14	2.5
50	50	28	20	37	58	36	12	0	27	33
25	40	88	40	48	28	42	8	2	20	26
100	50	63	60	68	54	44	38	2	35	22.5
0	60	75	28	41	2	0	0	0	0.5	0.5

R= Reading W= Writing L=Listening S= Speaking

Appendix L

KILIFI COUNTY

