EFFECTS OF STUDENTS' LANGUAGE INTERPRETATION ON PERFORMANCE IN MATHEMATICS IN SELECTED SECONDARY SCHOOLS IN NAKURU NORTH SUB-COUNTY KENYA

BY

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DECLARATION

DECLARATION BY CANDIDATE

This is my own original work and it has not been presented for the award of an academic degree in any other university. No part of this work should be reproduced without express permission of the author and/or the University of Eldoret.

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This work is dedicated to Dr. Patricia Gathia for inspiring me to pursue this course, and to my parents, my son and my siblings for their love and endless support.

ABSTRACT

This study was set to investigate the effect of students' language interpretation on performance in mathematics. Performance in Mathematics as demonstrated by the Kenya Certificate of Secondary Education results has remained deprived for years. Numerous interventions have been set into place to address this low students' performance in Mathematics in Kenya Certificate of Secondary Education. The Ministry of Education has attempted to boost mathematics teaching in most schools by introducing projects that includes Strengthening Mathematics and Sciences in Secondary Education, in order to boost performance. However, the students' low performance in Mathematics in Kenya Certificate of Secondary Education persists. This prompted the researcher to investigate the effect of students' language interpretation on performance in mathematics. The study was directed by the following four objectives; Firstly was to investigate how students' interpretation of language influenced their performance in mathematics; Secondly was to investigate how representation of word problems in mathematics contributed to poor performance in mathematics; Thirdly was to investigate how students' analysis of mathematical vocabulary influenced performance in mathematics and finally was to investigate if students 'manipulation of mathematics problems influenced their performance. The origin for the study was the constructivist theory by J. Bruner which recommends for teaching learners to build their meanings of mathematical terminologies. The study used Quasi-experimental design. This design was suitable because the students who participated in the study could only be found in intact classes. The target population consisted of all Form 3 students in Nakuru North Sub-County which had a target population of 1926 students in the 35 public schools. Sixteen schools with a population of 731 students formed a sample. Written tests and questionnaire were applied as the data collection instruments. The data was analyzed by use of Statistical Package for Social Sciences version 22. The results indicate that the students performed significantly better after they were taught mathematics' vocabularies than before ($p=0.000$). This study concluded that good performance in mathematics is greatly related to students' understanding of mathematical vocabularies. The findings of this study are beneficial to Mathematics teachers, teacher educators, textbook writers as well as the Kenya Institute of Curriculum Development. The study recommends that mathematics teachers should put more emphasize on definition of mathematical language while presenting content to learners. Students' Mathematics textbooks should have well defined vocabularies to ensure that the students understand them.

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LIST OF ABBREVIATIONS AND ACRONYMS

ANOVA	Analysis of variance
CSEC	Caribbean Secondary Education Certificate
JICA	Japan International Cooperation Agency
KCSE	Kenya Certificate of Secondary Education
KFUPM	King Fahd University of Petroleum and Minerals
KICD	Kenya Institute of Curriculum Development
KIE	Kenya Institute of Education
KNEC	Kenya National Examinations Council
MOEST	Ministry Of Education Science and Technology
MTH 111	A first Year first semester Algebra course for all-Natural Sciences students at the Berbice campus
NACOSTI	National Commission of Science Technology and Innovation
NCTM	National Council of Teachers of Mathematics
QASO	Quality Assurance and Standards Officer
SMASSE	Strengthening of Mathematics and Sciences in Secondary Education
SPSS	Statistical Package for Social Sciences

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CHAPTER ONE

INTRODUCTION OF THE STUDY

1.1 Introduction to the Chapter

This chapter captures details regarding the study background, problem statement, purpose of the study, the study objectives, research questions, justification, Significance of the study, assumptions of the study, Scope of the Study, the study Limitations, theoretical framework and finally the conceptual framework.

1.2 Background of the Study

Mathematics is a compulsory and one of the key subjects at primary as well as secondary school levels in Kenya. Mathematics grades, C+ and above are as well utilized as a fundamental entry necessity into several important courses for example architecture, engineering and medicine among others degree programs. Regardless of the significant function that Mathematics performs in society, many students do not pass in the subject (Jameel & Ali, 2016). Mathematics is the study of numbers. It also entails the study of patterns of numbers and associations between the number and different actions executed on them. It is the science for generating scientific states, coming up with conclusions and solving issues. Mathematics is a powerful means of communication. It may be applied in presenting information in several manners, in figures and letters form and additionally by using charts, tables, diagrams, graphs as well as technical or geometrical drawings. It forms an instrument used to organize and interpret data and a technique of coherent reasoning distinctive to man.

Mathematics forms part of the main significant subjects for schools in the curriculum globally. The subject has direct connection with other subjects, mostly science-based and technical ones. According to Sa’ad, Adamu & Sadiq, (2014), Mathematics is a

compulsory subject in both secondary and primary school. In Nigeria, mathematics is offered every necessary significance in the curriculum as well as each and every policy associated with education, straight from primary to higher learning institutions. In connection to the Federal Republic of Nigeria (FRN, 2004), mathematics is typically stated as part of the central or essential subject for every primary as well as secondary school pupil. Apart from being a compulsory subject, it ought to be highly performed by students at credit level in order to obtained admission in every tertiary institution within Nigeria. With every importance devoted to mathematics in the education system of Nigeria, poor achievement is still noted in the current times in public examinations. This deprived achievement in mathematics forms a single of the main reasons for drop off in technology and science courses as well as development (Sa'ad *et al*, 2014). The study on causes of Poor Performance in Mathematics from Teachers, Student's and Parents' Perspective by Jameel & Ali, (2016) noted that strictness when teaching mathematics is the main source of deprived performance in mathematics. A study carried out by Yusuf & Hammed (2019) to examine the perceived causes of students' poor performance in mathematics revealed that the credible causes of failure in mathematics by students incorporate inadequate number of competent teachers in mathematics, insufficient teaching aids/ inadequate materials used for instruction, persistent relocation of mathematics teachers from one school to a different school, deprived socio-economic student's background as well as deprived methods of teaching.

The major aim of training mathematics at Kenya secondary schools is to generate people who will be systematic, competent, reasonable, precise and accurate in thinking (KNEC Mathematics Syllabus, 2019). Mathematics upholds the routine of precision, reasonable, order and systematic arrangements. It helps to generate power

of reasonable thinking, spatial awareness and precision. The capabilities to utilize logical/reasonable thought, to create a problem in a manner which permits for computation as well as decision, to make subtractions from assumption, to employ superior notions, are generally boosted through a mathematics course. Mathematicians require to apply far bigger effort into spreading mathematical thoughts. They require to give much additional concentration to communicating theorems, definitions, and proofs, as well as their manners of thinking. There is need to realize the importance of diverse thinking ways concerning similar mathematical organization. There is need to aim extreme additional energy on comprehending as well as clarifying the essential mental infrastructure of mathematics. Mathematics equips learners with an exclusively influential set of devices to help in understanding and changing the world. The tools comprise logical/sound reasoning, skills for solving problem, and the aptitude to think in conceptual ways.

Mathematics is useful in many other fields and careers for instance environmental studies, engineering, business, psychology, medicine, as well as in the biological, physical and mathematical sciences. Those who do well in mathematics are in the place to have a broad array of career options. The victory students attain in Mathematics has outcomes for the students' professional and personal lives as well as for nationwide development (Murray, 2013). Mathematics is essential to nationwide success in offering tools to help understand engineering, science, economics and technology. It is crucial in making of public decision and for contribution in the economical knowledge. Knowledge of mathematics also helps students understand calculators and computers and to comprehend ways to work and undertake mathematical actions in the technologies. Therefore, an individual ought to first obtain the fundamental mathematics knowledge. Mathematics must be employed

properly in the recognition of countrywide gains for technology and science and the people in general. Discoveries of inventions and development of innovations have been done through mathematics. The state has been directed by the constitution to uphold scientific research together with technology.

In spite of the vital function of Mathematics, the subject is still poorly performed during countrywide examinations (KNEC Reports, 2017). There remains a public objection on the low mathematics mean scores each time Kenya Certificate of Secondary Education outcomes are out. In Kenya, performance in Mathematics still continues to be deprived as mirrored by the KCSE results for the years, with latest trends confirming that the attainment in mathematics amid students in secondary school is less than average.

Table 1: KCSE Mathematics Mean Scores

Year	**2014**	**2015**	**2016**	**2017**	**2018**
KCSE Mean score (%)	24.02	26.88	20.79	25.48	26.45

Source: KNEC Report 2014– 2018

This efficiently calls for discovery of aspects that should improve the knowledge of concepts of mathematics for advanced accomplishment (Mbugua, Kibet, Muthaa and Nkonke, 2012). Previous studies have looked into factors resulting in poor performance. These comprise insufficient teaching staff, absenteeism of students, underprivileged entry marks, deprived teaching methods (Gitaari, Nyaga, Muthaa and Reche, 2013). The study undertaken by Mbugua *et al*, (2012) established that the factors that contribute to unfortunate performance comprise inadequate staffing,

insufficient learning/ teaching materials, missing motivation as well as negative attitudes by students and teachers, retrogressive practices. Mulwa, (2014) did a study to investigate the extent to which few mathematical terms' meanings are confused and/or understood by learners having English as a second language in Eldoret Municipality, Kenya. He noted that several studies have undoubtedly specified that a learner's English command have a responsibility in his/her mathematics performance.

Constructivist's theory proposes that human beings create knowledge and meaning from their familiarities. It has undeviating relevance to education in that learners may obtain knowledge and learn. In the classroom, the constructivist opinion of learning point to several diverse practices of teaching. Generally, it typically means persuading students to employ energetic methods (real-world problem solving, experiments) to generate additional knowledge and subsequently reflect on and speak concerning things they are undertaking and the way their understanding changes. The teacher ensures she comprehends pre-existing conceptions of students, and directs the action to tackle them and then construct on them (David, 2010). Students have problems understanding and interrelating language and symbols used in Mathematics. There are special symbols and expressions of mathematical language.

The primary function of language in mathematics training is to allow the learner and the learner to speak knowledge of mathematics with accuracy. The specialized languages employed in mathematics need students to understand the meaning of symbols, contextual knowledge and words in a mathematical problem so that they can make rational inferences to solve them, (Mbugua *et al*, 2012). Mathematics is a cumulative subject where formerly learned skills and principles of mathematics are the building blocks on which fresh skills are constructed. If a learner fails to

understand various mathematics skills and principles, they will not understand the new mathematics principles and skills later. The teaching of mathematics depends on those techniques greatly appropriate to encourage the skills acquisition. Learning critical mathematics i.e. subtraction, simple addition, multiplication, and division is crucial for everyday life performance. Several learners disgust the initiative of learning mathematics since it comprises of difficult processes of maneuvering equations as well as variables to attain an answer. For some students, Mathematics has no space for careless mistakes since one mistake may spoil the entire equation solving process. It is essential to note that the required paramount techniques suitable to encourage the attainment of mathematical skills are the methods that are uncomplicated.

Learning language entails ‘learning how to mean’. Mathematical language entails learning ways to create as well as share meanings of mathematics with the use of language that is suitable to the framework. It is beyond identifying and reacting to words in isolation. A momentous understanding of learning mathematics ought to be intended for developing the mathematical connections between dissimilar ideas, comprehend how mathematical thoughts are interconnected to one another thus constructing a comprehensive understanding and utilization of mathematics in contexts out of mathematics (Ramdhani, 2017). This demands the application of proper language (symbols and words) whose level of complexity is appropriate to the cognitive capabilities of the learners concerned. To recognize the objectives of mathematics instruction, textbook authors and teachers require to apply a language with structure, technical vocabulary, symbolism, and meaning that the learners of a specific level of class can understand. Thus, language performs a critical role in deduction and learning of mathematics but teachers downplay its value.

In mathematics instruction, the major role of language is to allow together the learner to speak knowledge of mathematical with precision (Mulwa, 2014). Vocabulary is the understanding of meanings and a word (Stahl, 2005). Vocabularies are words that help label Mathematical concepts which include volume, quotient, dividend and vertex. Learners are required to understand the meaning of Mathematics vocabulary spoken or written so as to understand and speak Mathematics thoughts. Mathematics has a specialized language that consists of both terminologies (vocabulary) and symbols. Unlike English language, Mathematics language is highly symbolized and it mainly uses symbols for communicating ideas. A study by Howie, (2003) on Language and additional background factors influencing mathematics performance of secondary pupils in South Africa found out that there were significant communication and language difficulties with South African pupils who were learning mathematics in a second language. Pupils in all the 3 Grades (7, 8 and 12) demonstrated insufficient understanding of both mathematics queries, and a lack of ability to converse their answers in cases in which they did comprehend the questions. Furthermore, pupils did principally poorly in questions which required a written respond.

The Government of Kenya in collaboration with Japan International Cooperation Agency (JICA) introduced Strengthening of Mathematics and Science in Secondary Education (SMASSE) Programme in 2001, but the poor performance in mathematics at KCSE remains a challenge (KNEC, 2018). According to (KNEC Report, 2017), students did not do well in worded questions. Other students avoided the questions on real life situations as they were wordy. This prompted the researcher to suggest that the students' interpretation of language need to be investigated for a possible

relationship with poor performance. There is an inadequate quantity of research into how language interpretation influences performance in mathematics.

1.3 Statement of the problem

Mathematics performance as shown in the KCSE results has stood deprived for years. Students have not managed to attain a mean mark of 29% which translates to D+ according to KNEC grading system (KNEC Report, 2014-2018). Numerous interventions have been created to tackle this low performance by students in Mathematics. The Ministry of Education Science and Technology (MOEST) in teamwork with JICA has tried to boost mathematics teaching in most schools by introducing projects including Strengthening Mathematics and Sciences in Secondary Education (SMASSE), in order to advance performance. However, the students' low performance in Mathematics in KCSE persists. Most studies have gazed at factors for instances: the teachers' qualification; time used in preparing lesson; teaching techniques; supervision's frequency; teachers' and/or students' attitudes towards mathematics; accessibility and utilization of resources of media; size of class; teaching experiences; as well as in-service training, but are quiet on the function of language in Mathematics training. Few studies have been conducted on the effects of Mathematical vocabulary instructions on students' attainment in Mathematics. There is inadequate research into language factors in education of mathematics and how it affects performance. It is in view of this gap that the study was designed to determine the effects of Mathematical vocabulary or language interpretation on students' performance in Mathematics in public Secondary Schools in Nakuru North Sub-County in Nakuru County Kenya.

1.4 Purpose of the Study

The study explores the association between students' interpretation of mathematics language and their performance in Mathematics.

1.5 Objectives of the study

To investigate the student's interpretation of mathematics language in relation to performance, the study was directed by the subsequent objectives.

i) To find out how students' interpretation of Mathematical language influences their performance in mathematics.

ii) To establish how students understanding of word problems in mathematics influences their performance in mathematics.

iii) To investigate how students' analysis of mathematical vocabulary influences their performance in mathematics

iv) To explore how students' manipulation of mathematics problems influences their performance.

1.6 Research Questions

The study research questions were as follows:

1. How does students' interpretation of language influence their performance in mathematics?
2. How does understanding of word problems in mathematics influence students' performance in mathematics
3. How does students' analysis of mathematical vocabulary influence students' performance.
4. How does students' manipulation of mathematics problems influence their performance in mathematics?

1.7 Justification of the Study

Mathematics is essential to state success in offering instruments for comprehending engineering, science, economics and technology. It is critical in making decision for public and for contribution in the knowledge economy. Therefore, every effort needs to be done to improve its performance levels in schools. Students' language interpretation affects their performance in Mathematics. Good performance in mathematics is extremely connected to students comprehending of mathematical language. Students' poor understanding of mathematics language is one of the reasons why students make mistakes while solving problems in mathematics. The language of mathematics has symbols that are specific to mathematics and can offer a distressing obstacle to the understanding of mathematical models as well as giving students accessibility to assessment substance intended to elicit mathematical understandings.

1.8 Significance of the Study

The research investigated students' interpretation of mathematical language and made necessary recommendations according to the findings. This study findings are significant to mathematics teachers. They emphasize on the meaning of mathematical vocabulary when the content is being presented to students. The study is also significant to curriculum developers to reorganize mathematics curriculum to incorporate mathematical language as component of the content to be educated. It is also significant to the national examiners so that they take into account issues of mathematical language in setting Mathematics items. Finally, it is significant to the MOEST so that it can organize for workshop or in-service to mathematics teachers on addition and significance of mathematics language in coaching mathematics.

1.9 Assumptions of the study

The study was guided by two assumptions namely:

1. That the students' performance does not depend on geographical location.

2. That the sample used is a true representation of the population the researcher wished to study. The researcher randomly selected the schools to take part in the study.

1.10 Scope of the Study

The study limited itself to examinations of students' language interpretation on performance in mathematics. The study was performed in chosen public secondary schools found in Nakuru North Sub-county situated in Nakuru County. Sixteen schools were randomly selected from the 35 public secondary schools to form a sample. A form three class from each selected secondary school was included in the study. The study findings were relevant to all Kenyan schools because the methods and contents of mathematics teaching and learning are similar.

1.11 Limitations of the study

There were some limitations during the study. These are;

Some of the Mathematics teachers were not willing to give the tests citing big workloads and lack of time to mark. However, the researcher overcame this limitation by explaining to them that the researcher would mark together the Post-test and Pre-test.

Some schools also associate tests to performance as they relate to their academic promotion. Therefore, there was a tendency to provide learners who do well in Mathematics tests. The researcher explained to them that the results from the tests

were just for the purposes of the study. They were also guaranteed that the result findings would not be used for the evaluation of their schools.

1.12 Theoretical framework

The origin for this study is the Constructivism theory by (Bruner 1961). This is a learning theory established in psychology which describes how learners may obtain knowledge and learn. It includes the initiative that learning is a vigorous process where learners are in a position to generate fresh ideas established on what their current knowledge is and their past knowledge. Therefore, it applies directly to education. The theory advocates that humans build knowledge together with meaning from their experiences. The constructivist learning opinion in the classroom may direct towards several varying teaching practices. Generally, it normally means promoting students to employ active techniques (real-world problem solving, experiments) to generate extra knowledge and afterward mirror on and converse regarding what they do and how they understand changes. The teacher ensures she comprehends the pre-existing conceptions of students, and directs the activity to tackle them and afterward build on them (David, 2010). Constructivist theory by Bruner proposes teaching of learners to create their mathematical terms' meanings. Based on constructivism, the role of the teacher is not to give the students an answer to their, but shape and build mathematical knowledge to get a mathematical structure (Altaftazani, Rahayu, Kelana, Firdaus & Wardani 2020). Children generate newfangled mathematical knowledge through stunning on their mental and physical events. Ideas are generated to be important when children assimilate them into their present structures of knowledge.

The student's understanding and application of language fluctuates with the participation of the student in the circumstances in which it is applied, and the importance it holds for him. Therefore, it is critical that the student and teacher discuss diverse meanings as well as interpretations of phrases and words in order for everyone to know the meaning of the other and comprehends by specific linguistic types. Mathematical language's understanding and mathematics' performance amongst students in secondary school is beneath average. Performance in Mathematics is greatly connected to students' understanding of the language of Mathematics (Mbugua, 2012).

1.13 Conceptual Framework

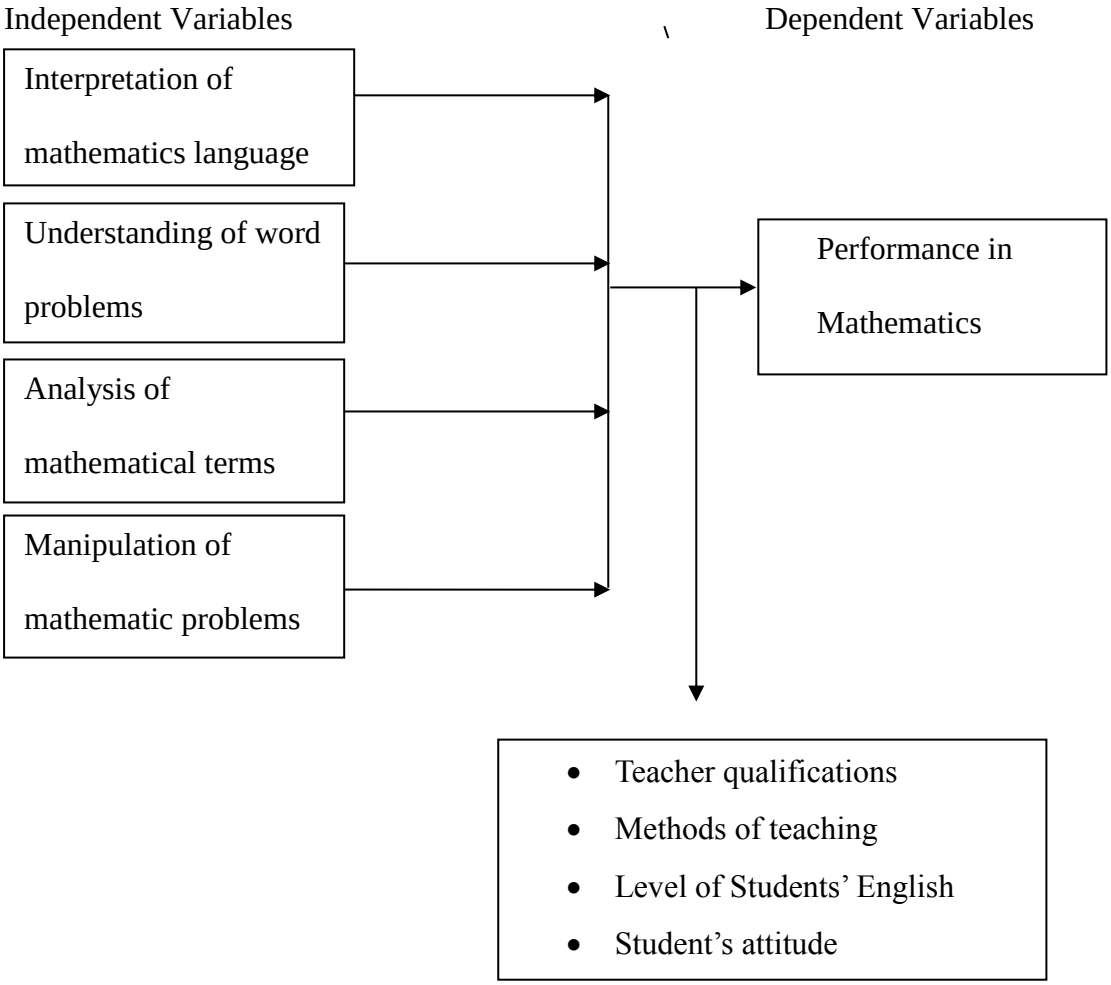


Figure 1.1: Conceptual Framework

Source: Author, 2020

The independent variables were language interpretation, understanding of word problem, students' analysis of mathematical terms and students' Manipulation of mathematic problems. The dependent variable is performance in Mathematics. The dependent variable is directly affected by the independent variables. Good performance in mathematics is extremely associated to understanding of mathematics language by students. The communication level of mathematical ideas and performance is affected by understanding level of mathematical language.

The intervening variables were teacher qualifications, methods of teaching, level of students' English and students' attitude. These intervening variables influence the level of students' Mathematics understanding and eventually their performance in Mathematics. Positive attitude towards Mathematics is related positively to performance.

1.14 Operational Definition of Terms

The following words have been operationalised for the purpose of this study:

Mathematics Concept: A Concept is an abstract idea explaining various relationships within a collection of facts and may be designated by various signs or symbols. It helps to explain the answer that you got, and you can figure out the answers and formulas yourself.

Mathematical Vocabulary: Mathematical vocabulary are the words that help in labeling Mathematical concepts e.g. chord, quotient, area, power among others. In this study, they are phrases and words that students should understand and apply in making excellent progress in Mathematics.

Mathematics performance: It is the ultimate grade comprising of course work assessments and at end of course examination. It is the ability of a pupil or group of students to interpret Mathematical vocabulary in a given task for problem solving.

Good performance in Mathematics: It is where a student is able to score grade C+ and above. Average performance in Mathematic is where a student scoring a grade C.

Poor performance in Mathematics: It is where students score grade D+ and below.

Mathematical language: This is a system used by mathematicians to communicate ideas. It is a communication system with its individual set of special words, symbols, numbers and equations.

Mathematics problem: This is an inquiry beginning from specified conditions to investigate or show a fact or result.

1.15 Chapter Summary

This chapter captured on the problem of the study, that performance in Mathematics has remained poor over the years. The study explored the relationship between students' interpretation of mathematics language and their performance in Mathematics. The objectives, research questions and the hypotheses that guided the study were stated. The assumptions and limitations of the study were also given. Form 3 students from selected Secondary schools participated in the study.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction to the Chapter

This chapter on literature reviews the effect of students' language interpretation on performance in Mathematics. The literature review is based on certain themes derived from the objectives of the study. It covers how mathematics vocabulary influence students' performance, how representation of word problems, analysis of mathematical terms and manipulation of mathematical problems influence performance in mathematics.

2.2 Mathematics Language Interpretation

Mathematical language is a method of communication which have its individual set of convections, symbols or unique words. Mathematics has a globally accepted vocabulary in which words have no similar meaning with common usage. Those words bring confusion in the mind of learner e.g. base, parallels, similarity among others. which have a different meaning in mathematical language. Mathematical vocabulary is a critical element in understanding Mathematics. Since mathematical vocabulary encompasses a number of mathematical concepts, it can be argued that without understanding the terminology employed normally in Mathematics instruction, word-problems and textbooks, students would be handicapped in their attempts to study Mathematics (Marzano, 2011). The main function of language in mathematics instruction is to allow the learner and the teacher to speak mathematical facts with precision. Textbook authors and teachers need to employ a language with meaning, structure, technical vocabulary along with symbolism which is easily

understood by students of a specific class level so as to achieve the objectives of mathematics instruction (Mulwa, 2014).

Despite the nationwide attempts made in creating a curriculum which is appropriate to the Kenya's needs as a nation, mathematics performance has been comparatively deprived. Kenya National Examination Council (KNEC) in its yearly report of 2017 on students' performance in KCSE has continuously indicated that the most poorly performed questions in Mathematics are those that involve word problems. Performance is shoddier for word problems written in additionally difficult language when related to similar problems in extra simple text. Evidence shows that learners have challenges in understanding and interconnecting the symbols as well as particular language structure as applied in mathematics (Wekesa, 2006). There is requirement to advance understanding of mathematics by student. According to Wekesa (2006), perhaps missing understanding of the vocabulary employed regularly in Mathematics textbooks, instruction, and word problems handicap learners in their attempts to learn Mathematics, which is a key factor in low performance of Mathematics in national examinations in Kenya.

Table 2.1: KCSE Mathematics Mean Score, Nakuru North Sub-county

Year	KCSE Mathematics Mean score (%)
2010	21.19
2011	22.0
2012	28.7
2013	29.1
2014	24.76
2015	31.4
2016	20.3
2017	20.7
2018	21.3

Source: QASO Office, Nakuru North Sub-county 2018 Reports

According to Murray (2013), the factors that affects mathematics attainment has been of concern for years to policy makers, researchers, education practitioners, and the public at great due to the distant reaching effects of underachievement in the subject. The victory students gain in Mathematics has outcomes for the students' professional and personal lives as well as for nationwide development. Furthermore, whereas the achievement in mathematics at Caribbean Secondary Education Certificate (CSEC) appeared under the state spotlight, the finishing point of Algebra (MTH 111**)** at the University of Guyana requires to be tackled due to the reality that successful finishing of the course could create an impact on learners' professional and personal lives as well as on the performance of mathematics by secondary school learners because graduates signify a prospective supply of mathematics teachers/trainers to harmonize the depleted labour market.

Language is a communication system encoded or spoken in signed or written form; its fluency assists a person in thinking logically. The distinctive linguistic structure of mathematics put mathematics learning analogous to foreign language learning. Therefore, understanding level of mathematical language influences communication level of mathematical ideas (Mbugua, 2012). The concern of the technical language employ in training mathematics has been quoted as causative to deprived achievement in the subject (Nor, Aziz and Jusoff, 2011). The complex language employed in the mathematics classroom has resulted in poor performance (Wasike, 2003). The researcher reported that word have a varying meaning whenever it is applied in familiar day English language rather than when employed in mathematics exist. Students must comprehend the language of mathematics in an additionally easy form in order to advance performance (Amadalo *et al*, 2012).

According to Padilla (2013), students' language proficiency has an influence on their performance in mathematics. A study by Yushau (2015) revealed that students' expertise levels in English is a factor influencing their mathematical performance. He conducted a study on if the adjustment of instruction language from Arabic to English has any influence on their understanding of mathematics as well as its performance. The official language for operations of Saudi Arabian government is Arabic language which forms the primary students' language, and thus, the language students intermingle with at home, in markets, on the street or in religious gatherings. Students who obtain admission to King Fahd University of Petroleum and Minerals (KFUPM) which is an English medium university having clear scarcity in English language practice and use as they are required to learn Mathematics using English**.** They should go through a single year rigorous English program. The students have the opportunity of learning English and apply the language in learning Mathematics. Even though the students are cautiously chosen, a high number of them experience problems in mathematics due to the students' inadequate mastery of the new instruction language. English language proficiency was established to be amongst the main factors that predicting student performance in mathematics.

According to (Howie, 2003), studies concerning the impacts of language on success in mathematics emerge to show the significance of language in success in general, comprising mathematics and science. There appears to be few verification locally and satisfactory evidence globally to permit the language assessment and its association with mathematics on a large scale in South Africa. The research showed that in South Africa, when pupils' language expertise in English was higher, they have a tendency to score highly in mathematics and when their scores were low in English, they were extra liable to get stumpy scores in mathematics. The study by Mensah, Okyere &

Kuranchie (2013) revealed a significant connection between student and teacher attitude toward Mathematics. It was recorded that optimistic attitude by teachers exuded self-confidence in students therefore making them build up positive attitude towards Mathematics learning. Students' attainment in Mathematics at the Senior High School in Ghana had not been cheering. Candidates are noted to be portraying deprived understanding of Mathematical concepts and hence are incapable to form the suitable Mathematical models that can be addressed with the necessary skills (Chief Examiner's Report, 2007). It was additionally recorded that several students had generated negative attitude towards the learning of Mathematics and consequently led to mass failure of students from the subject. Student, teacher, classroom, and school factors all interrupt on the Mathematics learning. The seriousness connected to the teaching of Mathematics perpetually influences students' achievement in their final examinations.

2.2.1 Reading ability

Good performance in mathematics is greatly connected to understanding of mathematical language by students. According to a study by Beal *et al*, (2010), Mathematics performance rise with English-reading ability. There is a relationship of English-reading skill and math performance where the reading level is related with upgrading in math performance. Students perform mistakes while solving mathematic problems because of insufficient understanding of mathematical language. Familiarity or missing it may dictate the failure or victory in understanding and evaluating word problems. Mathematical language incorporates several words that sounds similar to words with additional meanings (for homophone), and several words with similar spelling as day by day words but then hold varying meanings as mathematical terms (Meiers, 2010).

Table 2.2:Mathematical words and Homophonic Partner

Mathematical Term	Homophonic Partner
Arc	Ark
Chord	Cord
Mode	Moved
Pi	Pie
Plane	Plain
Serial	Cereal
Sum	Some

Source: Adapted from The Digest (2010/2)

Language helps the learners in understanding the word problems. Nevertheless, learners miss the essential expertises in solving word problems (Yonson, 2017). Additional problem is the multiple of diverse words applied in a single operation. Taking subtraction as an illustration, the ordinary words employed comprise take away, minus and subtract. However there are others like difference between, reduce, less, decrease, remove, take off, discount and different other phrases that call for the application of subtraction.

2.2.2 Problem Solving Technique

Problem solving technique is one of the techniques that can motivate the students to learn. Problem solving technique also makes the students have self confidence in learning. Learning through problem solving technique, make the students try to solve the problems until they are able to solve them (Apen, 2016). The first stage of problem-solving process is understanding the problem. Students ought to recognize the story from the information provided as well as the objective of the problem. They then have to obtain the meaning out from the problem in order to make association to

the actual world. Information should be related amid every other so as to envision the problem importantly after which arrangement of the problem-solving is done. Troubles in visual-spatial, language, as well as information skills cause mystification and wrong interpretation of the problem. Many students are reported to be experiencing trouble in obtaining the skills and knowledge required in mathematics (Bryant, 2009). Troubles in studying mathematics are evident in different manners including deprived performance in mathematics, underprivileged appliance in mathematical concept, insufficiency in mathematics expertise and inadequacy in mathematics problem-solving. Insufficient assurance throughout problem solving, limitation in understanding the vocabulary as well as mathematical language, uncertainty in defining mathematical action and inadequate procedural and theoretical expertise in solving problem were the familiar troubles learners came across in mathematics learning. The understanding level of Mathematics language influences the communication level of mathematical ideas. Thus, learners make mistakes when solving mathematic problems because of their deficient understanding of mathematical language.

Problem-solving is classified into;

i) How the problems are presented using words (linguistic) or using graphic or problem based (nonlinguistic)

ii) The illumination of the problem structure-information, action-plan and objective

Problem-solving is a process beginning from the time the student experienced the problem until the last part as the problem is solved. It is a 3 phase problem solving procedure consisting of:-

i) Reading and understanding problem

ii) Organizing stratagem and solving problem

iii) verification of the process and answer

Every phase entailed a varied mixture of mathematical expertise and diverse cognitive abilities. Students have trouble in mathematics mainly in problem-solving as they have trouble in understanding and recovering concepts, procedure, formulas and fact, are unable to envision mathematics concepts and problems, ineffectiveness in logical thinking and insufficiency of the tactical knowledge in problem-solving (Tambychik, Meerah, & Aziz, 2010).

2.2.3 Learning the Language of Mathematics

Language development is vibrant in nature. It is necessary that the teacher and the child must talk about different meanings and interpretations of phrases and words so that everyone is conscious of the meaning of the other and understands through a specific linguistic form. Mathematics language is in the form of new words and some old words with new meanings and symbols. The language of mathematics has its own semantics, syntax and traditions of argumentation and expression. Mathematical language has skills that incorporate the capabilities to read with understanding, to articulate mathematical contemplations comprehensibly, to reason sensibly, and to identify and utilize familiar mathematical thought's patterns. Learners should create an understanding of mathematical terms which they can utilize to effectively share and improve their thoughts. This can be a challenge since students ought to learn new symbols and words which are exclusive to mathematics, and find new math-specific meanings for familiar phrases and words. Numerous words (such as "plus" and "equals") are so familiar and essential that we employ symbols rather than words.

Students must absorb and develop fluency in mathematics language while learning mathematics. The language of mathematics has been overlooked in the classroom. Numerous professional organizations have called for a focus on language in mathematics education (Gray, 2004)

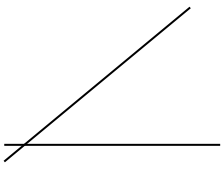
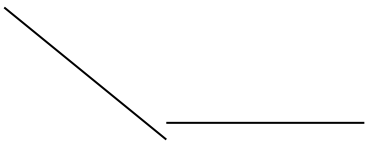
In a booklet entitled *Children Reading Maths* edited by Rothery, it is considered that some technical terms in mathematics can be evaded and substituted by phrases which include ‘top number’ for ‘numerator’ etc. However numerous specific terms have a crucial and correct space in mathematics and it is essential that they be assimilated into the learning and teaching of the subject. The language of mathematics is never taught as a language and often where the teaching of number is concerned, the emphasis is on the written coding only, with a hastily passed over superficial and temporary attachment to meaning. A student can make an error because of the way the problem has been presented. It may be ambiguous.

2.3 Understanding Word Problems

In word problems, important information is offered in the structure of a squat narrative rather than in mathematical note (Verschaffel*et al*., 2000). Several students have severe difficulties in solving word problems. Linguistic as well as numerical complication contributes to the trouble in finding solutions to word problems. Word problems need various linkages between mathematical and linguistic understanding by the incredibly nature of the assignment for symbolizing the diverse problem categories (Daroczy et al., 2015). Students make additional mistakes while solving word problems as opposed to number problems (Didis & Erbas 2015). The complexity of numerical factors, language factors and their interrelation influence word problem difficulty.

Varying learners/students can have a trouble with varying categories of word problems. Students who are weak in language may have problems with word problems with complex language (Daroczy et al, 2015).Word problems depend on students/learners' capability to read and at the same time understand the problem state prior to solving (National Council of Teachers of Mathematics [NCTM], 2000). (Adams, 2003) notes that "doing mathematics is reading mathematics". This is since it is the symbols, words as well as numerals that provide mathematics its framework and substance. These symbols, words as well as numerals should be utilized in communicating the problem condition to students/learners in order for students to employ them in performing procedures, solving problems, and explaining processes. The specialized language utilized in mathematics requires learners to understand the meaning of symbols, words, together with contextual knowledge in a mathematical problem so that they can make logical suggestions to solve them. Example,

a) Jane was given the following question: which of the following angles is a right angle?

i)  ii)  iii) 

She asked, "When it says, 'Which angle is a right angle, does it mean that the wings should go this way, or that way?"

Here, Jane confused the word angle with angel.

b) Billy was asked, what does fifty-six minus forty equal? He gave the answer as 96 hours. He had read it as: What does fifty-six minutes forty equal? And then reasoned: It didn't tell me what to do, so he added and got ninety-six. 56+40=96. Ninety-six is more than sixty, so the answer must be in hours.

Here, he confused the word minus which is to subtract with minutes for time.

Mathematical symbols employed to refer to figures or articulate a mathematics concept moreover create a challenge. Mathematics symbols represent condensed meanings and are also supposed to be a precise language. Symbols make understanding of mathematics hard for students. Can the pupil understand the question, its meaning and specific terms and symbols? An error can occur in understanding the meaning. Mathematics utilizes several words in the language of English that are currently common to learners in their daily lives. Words including 'change' possess a particular mathematical meaning, but in addition have a daily meaning. When used in mathematics classrooms they are often ambiguous. Students require to be educated fresh meanings for the already/existing words (Research digest, 2010). Some other examples are provided in the Table 3.

Table 2.3: Mathematical Words and their Everyday Usage

Mathematical term	Everyday usage
Angle	Point of view
Concrete	Hard substance used in paving
Figure	Shape of an object
Odd	Strange
Order	Place a request
Rational	Same
Volume	Volume level

Source: Adapted from The Digest (2010/2)

There are words that have similar but slightly different meanings in mathematics to the everyday use.

a) Perimeter. It can mean the physical description around a shape in the everyday. In mathematics, we mean the exact length around a shape. E.g. the perimeter of a rectangle is obtained by adding up all the four side-lengths
b) Range. In the everyday, it is usually thought of as from…. to….. In mathematics, it is a single number. Example, the age range of people at the concert was from about 15 to 60 something. The range of heights of the group was 12cm (Skillwise, 2017)

There are also the change questions in which there exist an incident that changes the q uantity value; the type of questions that unite questions relating to stationary circumst ances where there exist 2 amounts; and the questions that are the comparison question s. They entail the comparison of 2 amounts and the disparity among them.

Example 1

Sam leaves to bed at ten minutes to nine. John leaves to bed fifteen minutes later than Sam. What time does John leaves to bed?

A pupil may interpret; John leaves to bed 15 minutes later, giving the answer as 15.

Example 2

A train accelerating at an average speed of seventy-two kilometers-per-hour takes fift een seconds to completely cross an 80 m long bridge.

a) Express seventy-two kilometers/hour in meter/second.

b) Find the length of the train in meters.

The concept of time, distance along with speed trained in upper primary as well as form one was getting tested. Nevertheless, several candidates were incapable to perform the conversion and connect the 3 variables to establish the train length. This shows the learners' insufficient knowledge in elementary methods and their unawareness of uncomplicated processes and algorithms. This indicates learners' incapability to do fundamental processes as division and multiplication is ordinary feature in the work of candidates (KNEC Report, 2017).

2.4 Analysis of Mathematical Vocabulary

Mathematical Vocabulary are words that help labeling Mathematical concepts such as volume, quotient, vertex, hexagon and dividend. Students require to understand the mathematics vocabulary meaning, whether spoken or written so as to comprehend and speak mathematics ideas (Wanjiru, 2015). Students are therefore likely to face difficulties in solving word problems burdened with complex and unusual vocabulary (Solano & Trumbull, 2003). Students encounter difficulties in the learning of Mathematics when they never understand the meanings of mathematical vocabulary employed. Mathematical vocabulary as well as mathematical symbols go together.

Students should learn to identify symbols, link the vocabulary word that names every symbol, consider that the symbol and the word have similar meaning and are stated similarly, and lastly, comprehend the concept following the symbol and the word in order to understand mathematical vocabulary. According to Chow & Ekholm (2019), familiarity of Mathematics vocabulary directly influences performance in arithmetic, specifically problem solving. Perhaps lack of understanding of the vocabulary employed regularly in Mathematics textbooks, instruction, as well as word problems handicap learners in their attempts to learn Mathematics, which is a key factor in low performance of Mathematics in national examinations in Kenya.

According to a study by Wanjiru, (2015), learners are prone to be handicapped in their attempt to study Mathematics if they do not comprehend the vocabulary applied in Mathematics textbooks, assessment and classrooms tests. Students are required to understand mathematical vocabulary meaning so as to communicate after understanding. Even though students may shine in calculation, their capability to utilize their Mathematics expertise will be hampered if they never understand the vocabulary needed to master content or are unable to apply. Mathematics vocabulary directly influences performance in arithmetic, specifically problem solving. Mathematics is a diagrammatical language of numbers and symbols, and is articulated and described by spoken and written words. Therefore, for students to outshine in Mathematics, they should identify, comprehend and employ the mandatory Mathematical vocabulary. From the study by Sila, (2014) on factors having an influence the performance of students in mathematics, the role of the teacher is to give learners formal education in mathematics subject most suitable for their abilities and environmental interests.

2.5 Manipulation of Mathematics Problems

Mathematics learning needs a bottomless comprehension of mathematical concepts, the competence in making linkages among them as well as make valuable solutions to mathematic problems. Many persons remain believing that mathematics is regarding computation. Nevertheless, computation for mathematicians is simply an instrument for understanding structures, patterns, and relationships of mathematical concepts that produce solutions for difficult actual life problems. Students should evaluate and use the mathematical knowledge successfully and resourcefully. Students need to be well-equipped with higher-order mathematical knowledge. Arithmetic ability also influences mathematics performance. Arithmetic ability comprises skills for instance maneuvering mathematical knowledge as well as concepts so as to alter their implications and meaning. Students are able to analyze, interpret, generalize, synthesize, or hypothesize mathematical truth and thoughts. In mathematics, Teachers utilize several representations in mathematics classrooms to assist students discover and build up abstract concepts.

Students are involved in problem solving because they maneuver objects when they look for a solution. Additionally, they can boost their reflective knowledge when airing a scenario problem that are equivalent to the suitable manipulatives. Manipulatives are important to students in their learning of mathematics and also a tool used by teachers to introduce mathematical concepts and to assess their understanding (Larbi & Okyere, 2014). Teachers provide students with a basis of important experiences from which they can discuss comprehension of words from contexts. Students should use mathematical vocabulary to speak mathematics ideas, to clarify, conjecture and protect one’s ideas in writing. They are then able to represent Mathematical concepts graphically through diagrams and by means of Mathematical

notation (symbols). This leads to understanding of Mathematical concepts and hence good performance in Mathematics.

2.6 Knowledge Gap

Performance in Mathematics has remained deprived over the years. Several interventions have been put into place to address this low students' performance in Mathematics. Researchers have studied on deficient syllabus coverage, low entry marks and underprivileged content mastery; the teacher's role, facilities for teaching and the teaching techniques that might be employed to enhance performance. The government of Kenya has tried to solve some of these challenges by training more mathematics teachers, revising the mathematics syllabus and introducing Strengthening of Mathematics and Science in Secondary Education (SMASSE) Program in order to improve performance. However, the students' low performance in Mathematics in KCSE persists.

From the literature reviewed, students are prone to encounter troubles in the learning of Mathematics if they do not comprehend the meanings of mathematical vocabulary used. Secondly, when students are in a position to understand the language of instruction, their comprehension of mathematics content improves. Direct instruction on words that are vital to fresh content enhances understanding in mathematics. Systematic learning of vocabulary of instruction is one of the most important interventions of enhancing understanding of mathematical words. Whenever vocabulary instruction focus on particular words essential to what scholars are learning, performance in mathematics will improve. The understanding level of mathematical language influences the communication level of mathematical ideas and

hence performance. Not much has been done on effect of mathematics language on performance. This generates a knowledge breach which needs to be investigated.

2.7 Summary of the Chapter

This chapter was able to discuss how mathematics vocabulary influences students' performance. This is by looking at English language mastery, problem solving ability and reading ability. The study also discussed learning the language of Mathematics. The study seeks to know how mathematical vocabulary affect students' attitude and performance in mathematics. The literature review in the study is arranged in accordance with some themes originated from the objectives. These are the language interpretation, representation of word problems, analysis of mathematics vocabulary and manipulation of mathematics problems. The next chapter is research methodology.

CHAPTER THREE

RESEARCH DESIGN AND METHODOLOGY

3.1 Introduction to the chapter

This chapter discusses how the research was carried out to obtain information necessary to respond to the objectives of the study. It considers the diverse methods that were utilized to accumulate data and the choice of samples that were employed and the motives for selecting the methods. The chapter was organized into the following subtopics: Research methodology, Research Design, Study Area, Target Population, Sample Size, Sampling Techniques and Sample Size determination. It also introduces the Research instruments and Methods of Collecting Data developed and used in the research objectives' pursuit, and gives an account of the anticipated data analysis schemes.

The chapter also explains how validity and reliability of the research instruments were determined. The chapter ends with a chapter summary.

3.2 Research Methodology

Research methodology is described as an equipped structure within which the data are positioned for their meaning to be clearly observed. Research methodology gives the principles for planning, organizing, designing and accomplishing a high-quality research (Legesse, 2014). In this study, quantitative data was collected from the pre-test and the post-test, as well as from the questionnaire. The quantitative data was then analyzed.

3.3 Research Designs

A research design is the arrangement, framework and approach of investigating the perceived problem in order to obtain possible solutions to research questions. Research design involves the application of procedures and techniques to make observations in a study that is structurally identical to experiments. However, the participant's status and experiences lack various control because the study is missing random task and incorporates a pre-existing factor. The research employed the Quasi-experimental research design. Quasi-experimental study is a kind of evaluation that aims at determining if an intervention or program has the anticipated effect on participants of the study. It is appropriate when whole assemblies of participants are utilized in an experiment rather than allocating participants randomly to experiments treatments. This design is suitable because learning institutions' administrators never permit splitting of the intact classes in order to allow for random tasks (Wanjiru, 2015). Thus, it was convenient to keep these classes intact.

Treatment involved teaching students the content consisting of Mathematic skills, concepts and the various vocabularies in Mathematics language. The variables were manipulated so as to test their effect on the performance in Mathematics. This study compared students' scores in Mathematics tests before and after treatment. According to (Dimitrov and RumrillJr, 2003), Pre-test and Post-test designs are broadly employed in behavioral research. This is for the reason of measuring change or comparing groups' difference from experimental treatments. The researcher selected this design since it permitted comparison of Pre-test and Post-test results of the participating students. This gives an idea of the effect of the treatment.

3.4 Study Area

The study was conducted in Nakuru North Sub-County in Nakuru County Kenya. It occupies an area of 375.4 Km². It lies inside the Great Rift Valley, and borders 5 other sub counties specifically Nyahururu to the North, Mirangi-ine to the North-East, Gilgil to the East, Nakuru to the South, Rongai to the South-West and Subukia to the West. The Sub- County is situated between longitudes 38.28° and 35.36° East and latitudes 0° and 1° South.

This is shown in Appendix XV. The area has moderate climate which makes the region to be a good agricultural area.

This region is cosmopolitan. Students are from all the Kenyan tribes who have settled here doing farming and business activities. Nakuru North Sub-County has 35 public secondary schools and 2 private secondary schools. These are one National school, three Extra County schools, one County school and thirty Sub-county schools making a total of 35 schools.

This is shown by Appendix XII. This area was suitable for the study because it has all the school categories. The schools in this Sub-County have also been posting poor results in Mathematics.

3.5 Target Population

Target population is described as the entire members of the hypothetical or real group of happenings, objects or people from which the researcher wants to oversimplify the research outcomes (Micheni, Njeru, & Wanjiru 2013). It is a set of objects, items or individuals from which samples are drawn. According to Mugenda & Mugenda (2012), target population as the population in which the researcher wants to apply the results of the study. In this study, the target population composed of every Form 3

student drawn from the 35 public secondary schools in Nakuru North Sub-County of Nakuru County Kenya. The Sub-county has a total of 1,923 students enrolled in form three (MOEST, Nakuru North Sub-county).

3.6 Sample size

A sample is component of the target population procedurally chosen as its representative (Kothari, 2011). The study area (Nakuru North sub-county) has a total of 35 public secondary schools. 731 students from sixteen schools were selected from the 35 public schools in the Sub-county to form a sample.

The sample size of the number of schools to participate in this study was calculated using the Nassiuma formula

$$S = \frac{N(C^2)}{C^2 + (N-1)e^2}$$ (Nassiuma, 2000)

Where S = Sample size, N = Population size, C = Coefficient of variation and e = Standard margin of error.

$$s = \frac{35 \times 0.25^2}{0.25^2 + (35-1) \times 0.04^2}$$

$$s = \frac{35 \times 0.0625}{0.0625 + 34 \times 0.0016}$$

$$s = 16$$

(Nassiuma, 2000) advocates a margin error varying from 2%-5% and coefficient of variation that range from 20%-30%. For this study N = 35 schools, C = 25% and e =

4% which provides a sample of sixteen schools. The classes used for the study were intact.

3.7 Administration of Research instrument

The study was done using quasi-experimental design where students did a Pre-test and a Post-test. Tests were administered to all Form 3 students from the 16 selected public secondary schools.

After the pretest, the papers were marked and students given back their scripts (Appendix VI).

The scores were recorded for analysis of the Pre-test.

In the treatment, Mathematics teachers whose schools fell under the study were inducted. The researcher prepared the lesson plans on how to teach the Mathematics language, vocabularies and solving word problems in Mathematics. The lesson plans were given to the respective teachers. The lessons were regularly scheduled for seven lessons per week as stipulated in the syllabus. Each lesson lasted 40 minutes. The researcher hand-picked secondary schools that were 2 streamed. One class formed the control group and the other the experimental group.

Learners were given instructions of every lesson and lead through illustrations on how to interpret Mathematics language, the meaning of the various Mathematics vocabularies, solving word problems and manipulation of Mathematic problems (Appendix X).

During treatment, the teacher let the students manipulate Mathematics problems and to actively explore the Mathematics language concepts. The teacher asked questions and gave assignments to allow students to attempt to answer.

After the completion of the instruction period, the students did a post test (Appendix 8). It was marked and scored recorded for analysis.

3.8 Data Collection Instruments

These are the measurement devices that are planned to acquire data on an area of interest from study subjects. The main data collection tools exploited in this study were tests, (Pre-test and Post-test) and the questionnaire.

3.8.1 Tests

The students did a Pre-test and a Post-test Mathematics test. This was to determine the effects of students' language interpretation on performance in Mathematics. The tests were aimed at determining students' interpretation of Mathematical language through their application of Mathematical language, understanding of Mathematics vocabulary, solving word problems and manipulation of Mathematical problems in responding Mathematical quizzes. It is built with articles obtained from KNEC (2010-2017). Each test consisted of thirteen Mathematics problems. Questions on interpretation of Mathematics language scored 12 marks, understanding of word problems scored 12 marks, questions on analysis of Mathematics vocabularies scored 13 and questions on manipulation of mathematic problems scored 13. All questions in each test totaled to 50 marks. The Mathematics teachers in the selected secondary schools administered the tests. The teaching was carried out outside the planned teaching time so as not to interfere with the syllabus and schools' coverage.

3.8.2 Questionnaire

A questionnaire is an instrument for gathering data and research consisting of a collection of questions in a varied structure of question type that is employed in collecting information from the respondents for the reason of statistical analysis or

survey study (Gillham, 2008). It is a group of written statements or questions to which the subjects of the research are expected to respond in order for the researcher to obtain data relevant to the research topic. The questionnaires also gave the students freedom to express their opinions about the way they understood. The questionnaire method of data collection is quite popular as it can be applied in collecting data quite speedily and all participants are offered a chance to give response (Kothari, 2011).

The questionnaire was used to assemble information about the role of language in Mathematics performance in Nakuru North Sub-county. It was presented to 731 students out of which 723 questionnaires were correctly filled and returned, a return rate of 98.9 %. These rates were considered satisfactory for data analysis because they surpassed 85.0% return rate recommended by (Mugenda, 2012). The respondents were deemed literate and thus, they were in a position to read and understand the questions on the questionnaire. Every respondent was asked similar question in similar order. The questionnaire enclosed 10 items. All students selected the answer reflecting their individual opinion and stand on the statements administered in agreement with the Likert scale. A Likert scale is a psychometric scale normally engaged in research that utilizes questionnaires. A Likert item is purely a statement which the respondent is requested to gauge through offering it a quantitative value on whichever type of objective or subjective dimension, with disagreement/agreement level being the dimension most frequently used. The students answered using a 5-point Scale: 1-Strongly disagree, 2- Disagree, 3- Neither disagree nor agree, 4 -Agree, and 5-Strongly agree.

3.9 Reliability and Validity of Research Instruments

3.9.1 Validity of Research Instruments

Validity is defined as the extent to which a concept is measured precisely in a quantitative study (Heale, 2015). The instrument's validity is the level to which a device can quantify what it is required to measure. Validity is the level at which outcomes acquired from the data analysis truly represent the study variables. Validity is the quality of data collecting tool or procedures that allow the instrument to quantify what is intended to measure (Atkinson, Kumar, Cappelleri & Hass, 2005). In quantitative research, validity is defined as the degree to which a tool measures the item it is anticipated to measure (Thatcher, 2010). It is the extent to which a tool inquires the correct questions in terms of precision. The researcher guaranteed the validity of the research tool by piloting. The insights richly improved the questionnaire and the tests.

3.9.2 Reliability of the Research Instruments

Reliability can be deliberated as consistency. It is the degree to which a research instrument produces consistent outcomes or data after recurrent tryouts. Reliability regards the extent to which a specific measuring process offers alike results over a number of recurrent trials (Orodho, 2004). If a researcher administers an examination to a subject two times and obtains alike score on the 2nd administration as the 1st test, subsequently there exists reliability of the instrument (Mugenda & Mugenda, 2012). Particularly, reliability helps in designing and evaluating some scales, meaning, scales are composed of several individual measurements.

The scale reliability measurement was based on the connections between the individual measurements or items making the scale, comparative to the items'

variances. In this study, the reliability of the tests, Pre-test and Post-test were pre-tested in the pilot school that was not incorporated in the actual study. The scores of test1 and test 2 are correlated to evaluate the stability of the test over time. The retest was conducted after 2 weeks of the first test to similar assemblage of respondents. Throughout the retest, there was an exposure of respondents to the same tests in different order of questions that were used in the 1st test. The results were correlated so as to launch the degree to which the contents in the instruments were consistent in obtaining similar responses each moment the instrument is administered. The Cronbach co-efficient alpha was employed to determine the items' internal consistency. It offers good systems of reliability since maintaining other factors steady, the more analogous the content of the test and situations of administration are, the bigger the interior consistency reliability (Mugenda & Mugenda, 2008). This is as displayed in the table 4.1

Table 3.1:Test for Reliability

Area	**Crobach's value**
Interpretation of Mathematics language	0.7
Understanding of word problems	0.75
Analysis of mathematics vocabulary	0.71
Manipulation of mathematics problems	0.73

Source: Researcher, 2019

The items were thought reliable as they recorded a reliability coefficient of 0.70 and above. The larger the reliability coefficient, the more reliable the test scores are. As a

universal rule, a $\alpha>0.7$ value will be determined dependable enough for every data sets in which α is the element under test for reliability.

The scale utilized in determining how reliable the data sets for every variable are added is as follows;

Table 3.2: Reliability Measures

Cronbach's alpha	Internal consistency
$\alpha \geq 0.9$	Excellent
$0.8 \leq \alpha < 0.9$	Good
$0.7 \leq \alpha < 0.8$	Acceptable
$0.6 \leq \alpha < 0.7$	Questionable
$0.5 \leq \alpha < 0.6$	Poor
$\alpha < 0.5$	Unacceptable

Source: Wikipedia

3.9.3 Piloting

A pilot study is a research study done before the real intended research. The purpose of piloting was to help the researcher to clarify the questions, check on the level of the language used and detect difficulty areas in interpretation which could affect students' responses. It also reduces reading errors, launch the precision of meaning and unambiguousness of every item and determine the time needed to finish. Piloting helps to identify challenges in the design and application of data instruments and collection procedures (Cooper & Schindler, 2014). It aids in identification of possible problems, mistakes and gives an indication of time required for actual data collection. The pilot study was done in a Secondary School in a neighboring Sub-county in Nakuru County, and the piloting was carried out on the form three students. The school used for piloting had alike characteristics with those utilized for the study. The pilot school was never integrated in the final study.

The researcher visited the pilot school with research authorization letters from NACOSTI and County Commissioner Ministry of Education, Nakuru County. During this visit, the purpose of the study was clarified to the research respondents. A Pre-test was administered and after 4 weeks, a post-test was directed to the same students. In

the study, reliability was found using the pilot-test where a few items were dropped or added in the amendment of the instrument. After the amendment, the instruments were also pilot-tested before being deemed for the study.

3.10 Data Collection Procedures

The researcher acquired a letter of introduction from the University of Eldoret. See appendix 5. The letter was attached with other documents including a copy of the research proposal to request a permit from NACOSTI (National Commission of Science Technology and Innovation) which is charged with responsibility of issuing the permits for research in Kenya.

Upon issuance of the permit by the commission (appendix 2), the researcher reported to the County Director of Education, Nakuru County offices before collection of data. The researcher was permitted to collect data in the hand-picked schools in Nakuru North Sub-County of Nakuru County. See appendix 4.

During the survey of the selected schools and actual data collection, the purpose of the research study was explained. The researcher administered the tests and questionnaire with the assistance of mathematics teachers of the respective schools, who were the research assistants enlisted for that purpose.

3.11 Data analysis

Data analysis is the gathering and organization of data systematically for the researcher to draw a conclusion. It permits an individual to answer questions, solve difficulties and gain vital information. After the collection of data, the researcher cleaned the data which involved the detection of unfinished or incorrect answers that were then revised to advance the responses' value. The study produced quantitative data. Coding and placement of quantitative data from the tests into the computer was done for descriptive statistics' calculation.

The data analyzed using Statistical Package for Social Sciences (SPSS version 22) and Microsoft Excel statistical package were utilized to run descriptive statistics including percentages and frequency so as to display the quantitative data in graphs' and tables' form depending on the main research questions. The quantitative data was analyzed using inferential statistics (t-test), to test for the understanding and application of mathematics language in pre-test and post-test. The study findings were then presented in forms of graphs and frequency tables indicating percentage and frequency.

3.12 Ethical Considerations

Research ethics is essential in everyday research events and needs researchers to shield the self-esteem of their respondents and publicize well the information that is researched (Fouka & Mantzorou, 2011). The researcher adhered to the following ethical issues:

a) The researcher sort for permission from the school Principals prior to data collection and produced authorization letters.
b) Informed consent: The researcher did a self-introduction to the respondents and then clarified the study purpose to the respondents. The respondents were fully enlightened concerning the purpose of the study and hence they participated with informed consent. The researcher clarified to the respondents regarding the study and that it is used only for academic purposes.
c) Anonymity: The students were assured that their confidentiality would be guarded by strict anonymity standard. The respondents' identity was concealed. The questionnaire lacked personal identifications numbers or names on it apart from the numbering which was for the purpose of clarification of data throughout data editing. They were also assured that during the reporting of the research findings,

the names of their schools will not be disclosed.

d) The study results were made available to the authorities and to respondents curious in the findings.

3.13 Summary of Chapter Three

This chapter has considered the research design as well as methodology employed in the study. The study area was Nakuru North Sub-county within Nakuru County. The mixed methods research methodology was employed in the study where quasi-experimental design used. Tests (Pre-test and Post-test) and questionnaire were administered to students in the Form 3 class. The sample size comprised of 731 Form three students. The chapter also has details on the sampling and data collection techniques employed in the study and the study area. This chapter has also discussed reliability and validity determination. Ethical issues that were adhered to during the study were discussed.

CHAPTER FOUR

DATA PRESENTATION, ANALYSIS, INTERPRETATION AND DISCUSSION

4.1 Introduction

This chapter displays the data analysis, interpretation and findings' discussion generated from this study and from other related studies. The data analysis was performed with use of descriptive as well as inferential statistics. In descriptive statistics, bar graphs, frequencies, pie charts and percentages were employed to present the study findings.

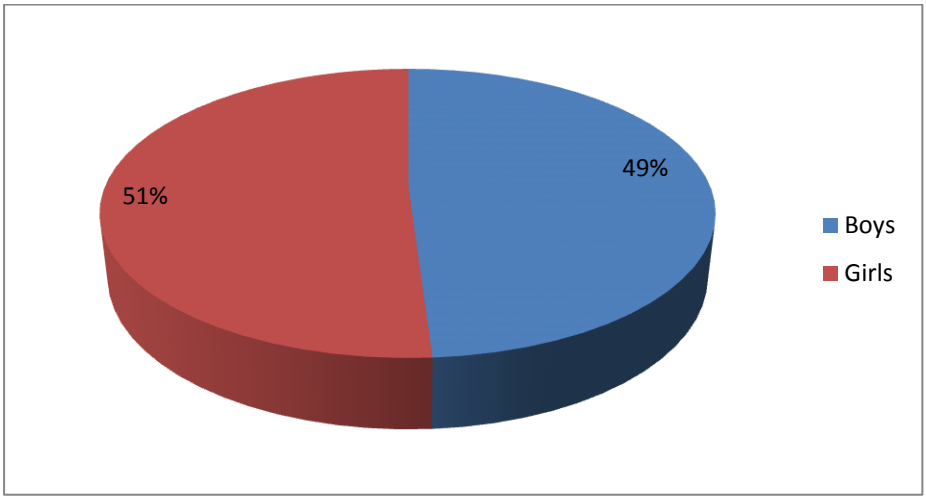
For inferential statistics, independent t-Test samples were utilized in testing hypotheses at α=0.05 level of significance. The findings are based on the stated research objectives. The study was directed by four research questions: How does students' interpretation of language influence their performance in mathematics? How does understanding of word problems in mathematics influence performance in mathematics? How does students' analysis of mathematical vocabulary influence performance in mathematics? How does students' manipulation of mathematics problems influence performance?

The chapter presents the findings in the following order to allow for their systematic presentation:- The degree at which students' interpretation of language influences students' performance in mathematics; How understanding of word problems in mathematics influences performance in mathematics; How students' analysis of mathematical vocabulary influence performance, and how students 'manipulation of mathematics problems influences performance in mathematics; discussion of results and chapter summary.

4.2 Demographic Data of Respondents

The respondents were drawn from County together with Sub-county schools; Single sex boarding schools and mixed day schools. Most day schools were in rural areas and most of the students were from low economic backgrounds. All the students sat for the Kenya Certificate of Primary Education (KCPE) which is the entry exam to secondary schools countrywide. They had 200 to 400 marks out of a maximum of 500. Thus, their entry marks to secondary schools were average. Their ages spanned from 16 to 19 years. In Kenya, students join secondary from the age of 14 years. This shows that they are within the required age bracket for schooling.

Out of the 731 students who took part in the study, 358 (48.97%) were boys while 373 (51.03%) were girls. This was shown in Figure 4.1.



Source: Survey Data, 2019

Figure 4.1: Respondents of the study

4.3 Students' Interpretation of Mathematical Language

The first objective of the study was to investigate how students' interpretation of language influences their performance in mathematics. It sought to answer the

research question: How does students' interpretation of language influences students' performance in mathematics? To test this, some test items testing on students' interpretation of Mathematics language were included in the Pre-test and Post-test. Both tests had 13 test items.

4.3.1 Presentation of Findings

The researcher administered a pre-test to the sample of Form 3 students at the beginning of the research. During marking, it was noted that students were not able to interpret Mathematics language. Only 19% were able to score at least 6 marks out of the 12 marks for the mathematics language interpretation items. 81% could not score the minimum 6 marks.

The areas that were a challenge to students were identified. For instance,

a) In $\frac{\frac{1}{2}\ of\ 3\frac{1}{2}+1\frac{1}{2}\left(2\frac{1}{2}-\frac{2}{3}\right)}{\frac{3}{4}\ of\ 2\frac{1}{2}\div\frac{1}{2}}$, the respondents did not apply BODMAS correctly.

b) Using the table of reciprocals, square roots and squares to find the value of $\frac{8}{\sqrt{0.625}}$ + $(1.64)^{2.}$ Some students did not read or others did not understand that they were required to get the square from the Mathematical table. Thus, those students who got the square from the calculator got it wrong.

c) For $2^{(x-3)} \times 8^{(x+2)} = 128$, the students were expected to write 128 as 2^7 and then solve using the laws of indices.

The students were taught the various Mathematical language and interpretation. In the Post-test, 73.2% were able to answer the questions on language interpretation correctly in the Post-test. However, some 26.8% could still not get minimum 6 marks. Performance of problems on interpretation of Mathematics language improved in Post-test.

4.3.2 Discussion

On students' interpretation of mathematical language, students achieved well in the Post-test than in the Pre-test. This was after treatment was administered. Mathematical language is the way through which mathematical concepts are obtained and presented. It is a communication system which has its individual set of symbols, special words or convections. The ability to interpret Mathematical language is a key component in understanding Mathematics. The main role language plays in mathematics instruction is to facilitate the learner as well as the teacher to speak mathematical knowledge with accuracy. To achieve the purposes of mathematics instruction, textbook authors and teachers require to employ a language with meaning, structure, symbolism and technical vocabulary that is understood by learners of a given class level (Mulwa, 2014). Students possess challenges in understanding and interconnecting the special language structure and symbols as employed in mathematics (Wasike, 2006). There is need to improve students' interpretation of mathematics language. Perhaps inadequate understanding of the language normally used in Mathematics textbooks, instruction, and tests handicap students in their trials to learn Mathematics, which is a key factor in low performance of Mathematics in national examinations in Kenya.

Language is a communication system, either vocalized or encoded in signed or written form; its fluency assists a person in reasonable thinking. The distinctive language structure of mathematics brands mathematics learning equivalent to foreign language learning. Therefore, the understanding level of mathematical language influences the communication level of mathematical concepts (Mbugua, 2012). Underprivileged performance because of the complicated language employed in the

mathematics classroom (Wasike, 2003). Students require to comprehend the mathematical language in a better easy form to boost performance (Amadalo *et al*, 2012). According to Howie (2003), studies concerning language effects on mathematics performance indicated the language importance in Mathematics performance.

4.4 Word problems in Mathematics

The 2nd study objective was to investigate how understanding of word problems in mathematics influences performance in mathematics. It answers the research question, how does understanding of word problems in mathematics influence performance in mathematics. In order to test whether understanding of word problems influences students' performance in mathematics, some test items testing on students' interpretation of word problems were included in the tests.

4.4.1 Presentation of findings

During the marking of the Pre-test, it was realized that students were not able to recognize and understand the various Mathematical words and vocabularies. Only 22.1% were able to score at least 6 marks (50%) out of the 12 marks for the word items, which 78% of the students could not score the minimum 6 marks as shown in figure 4.2

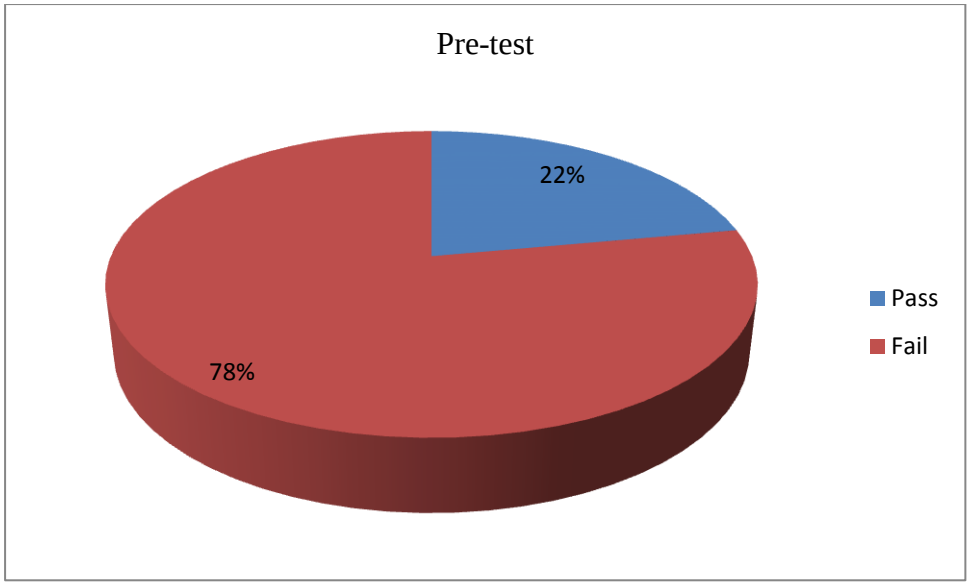


Figure 4.2: Performance of word problems in Pre-test

Source: Researcher, 2019

The words or vocabularies that were a challenge to students were identified. Some of the questions were;

a) How far he walked before the angle of elevation of the top of the pole becomes 80°

   Here, the students did not know what an angle of elevation is. Therefore, they could not apply the trigonometric ratios to find the distance travelled. Other students did not understand the statement 'walking towards the pole'. Thus, they could not find how far he walked before the angle of elevation became 80°. Majority of them got the distance as 2.04m. The question required the student to get the distance, then subtract it from 20m to get how far he walked.

b) A given number of people decided to donate to purchase novels costing sh1200. Five of them withdraw while those who remained had to pay an additional ten shillings each. Their contributions bought novels costing two hundred shillings more than they had initially expected. If the initial number of people was x, how

much did each contribute?

In this question, majority of the students were not able to understand the statement that ‘Five of them pulled out and therefore those who remained had to contribute an extra sh.10 each. Most students did not attempt to answer this question. The question required the students to create an unknown term to represent the initial number of people; Find the initial contribution; Find the new contribution after 5 members pulled out and then work out.

c) A Japanese who travelled to Kenya from France had five thousand Euros. He changed them at the bank to Kenya shilling. When he was in Kenya, he consumed Ksh 289,850 in total, and then changed the outstanding Kenya shillings to Japanese Yen at the bank. Calculate the amount of Japanese Yen which he obtained. Here, the students did not understand the question, that the tourist first converted the money to ksh, spent and converted the balance to Japanese Yen.

The above challenges were noted. The students were taught the meaning of the various Mathematical words and statements. After the learners were taught, they were able to read and understand the items in an exam. 76.4% were able to answer the word questions correctly in the Post-test. However, some 23.6% could still not get minimum 6 marks. Eventually, there was good performance in the Post-test.

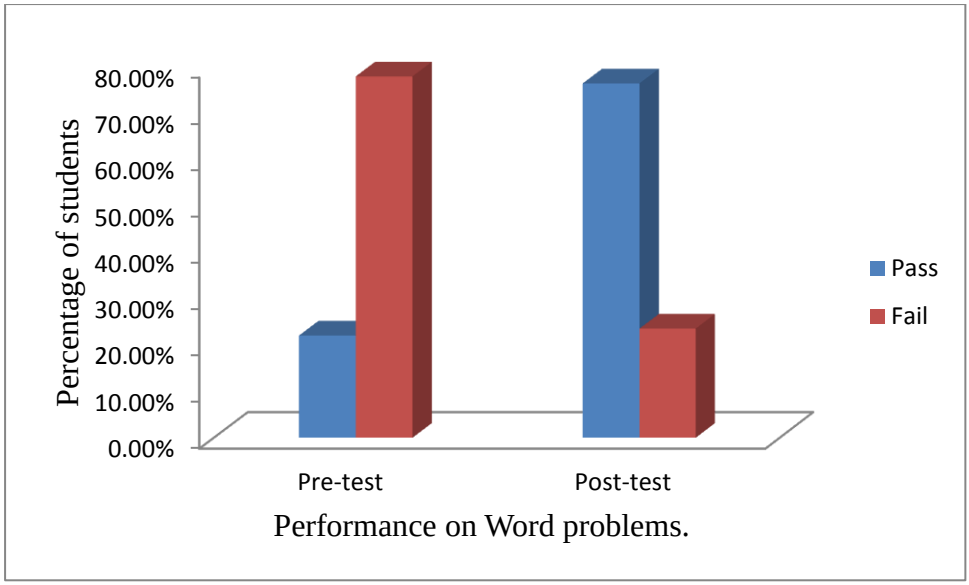


Figure 4.3: Comparison of performance of word problems in Pre-test and Post-test

Source: Researcher, 2019

The study established that there was a significant difference in the understanding of word problems between pre-test and post-test performance in Mathematics. Statistical tests showed that students performed significantly better after they were taught the words (t=-122.74; p=0.000). This was as shown in Table 4.1.

Table 4.1: T- test between pre-test and post-test on understanding of word problems

	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
	16.212	3.571	0.132	-16.471	-15.953	-122.738	730	0.000

4.4.2 Discussion

Findings from the study demonstrated that students achieved significantly well in the Post-test. This agrees with the findings of Mbugua, (2012) where the results of this study displayed that attainment in mathematics is exceedingly associated with understanding of mathematical language by students. He found out that learners create errors while solving mathematics problems because of inadequate understanding of mathematical language. The word problems are presented in a meaningful narration form that is easily understood and mathematically answered depending on former learning practice, and relation to the condition faced by learners in day-to-day life. When resolving word problem, the learners should understand the text to come up with the information missing, find a strategy to solve for it, and make calculations to find it. Mathematical word problem gives students challenges in applying mathematical thinking in several situations. The solving needs incorporation of some intellectual processes in which the learners require to comprehend the language and realistic information in the problem, interpret the problem by utilizing appropriate information to generate the proper mental representation, assemble and monitor problem-solving strategies, and conducting suitable procedural calculations.

Students' reading skills also affect their performance in Mathematics. Many studies have shown that there are high correlations between Mathematics and reading scores (Wanjiru, 2010). The examinations questions are loaded with Mathematical terminologies or words that the students must understand before solving them. The word problem is displayed in a meaningful narration form which can be answered after being understood mathematically depending on former learning practice, as well as linked to the situation faced by learners in day-to-day life. To find solution to word problem, the learners should comprehend the text in order to detect the information missing, acquire a strategy for solving for it, and do calculations to look for it. In mathematics, finding solutions to the word problem is a significant aspect in learning and understanding of mathematics. These solving needs incorporation of some intellectual processes in which the learners/students require to understand the factual information and language in the problem, interpret the problem through the use of appropriate information to generate the proper mental representation, accumulate and monitor plans for solving problem, and undertaking of relevant procedural calculations (Sahendra, Budiarto & Fuad, 2018). Conceptual mathematics understanding forms a knowledge involving full comprehension of fundamental as well as underpinning concepts behind the algorithms done in mathematics. Therefore, it encompasses a state in which students are permitted to make choices and utilize their understanding by vigorous engagement.

Several researchers acclaimed that more weight ought to be accorded on developing students' ability in English after which they could study mathematics efficiently. According to Smith, (2019), the communication method utilized in the classroom of math could be the variance between victory and disappointment for several students. According to (Howie, 2003), there existed significant communication and language

problems with pupils of South Africa studying mathematics in a 2nd language. In all 3 Grades (7,8,12), pupils displayed an insufficient understanding of mathematics queries and an inability to speak their responses in occasions where they understand the queries. Pupils did principally badly in queries which demanded a written answer. Studies about the language effects on mathematics attainment seem to show the significance of language in attainment normally, comprising mathematics. There appears to be satisfactory evidence globally and some evidence in the vicinity to permit the language assessment and its association to mathematics on a huge scale in South Africa.

4.5 Analysis of Mathematical vocabulary

The third objective of the study was to investigate how students' analysis of Mathematical vocabulary influences performance. It tends to answer the research question; How does students' analysis of mathematical vocabulary influence performance. To answer this, questions that required the understanding and analysis of vocabularies were included in the test.

4.5.1 Presentation of Findings

In the pre-test, most students could not analyze mathematical terms in order to correctly answer the questions get the minimum 6 marks out of the 11 as shown in figure 4.4.

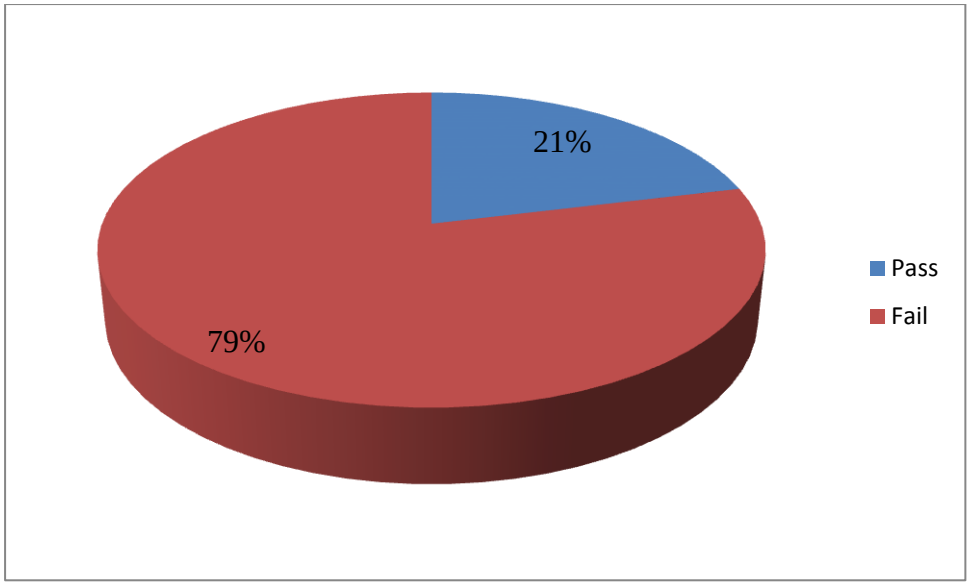


Figure 4.4: Analysis of Mathematics vocabulary in the Pre-test

Source: Researcher, 2019

The areas that were a challenge to students were noted such as;

a) Acute angle

In this question, students did not know what an acute angle is and therefore could not answer the question correctly. Acute angle are the angles that are less than 90°. The students were required to equate Sin (3x-35) = Cos (x+20); Relate that Sine of an angle = Cosine of an angle if they are acute. The angles are said to be complementary. Thus, 3x-35◦+x+20=90 and then solve for x.

The Mathematics teachers took the students through the analysis of the various Mathematical vocabularies. In the Post-test, it was realized that 74.6% of the learners were in a position to analyze them correctly and score the minimum 6 marks. However 25.4% of the students could still not score the 8 marks. Performance of problems involving analysis of Mathematics vocabularies improved greatly in the Post-test as compared to the performance in the Pre-test. This was shown in figure 4.5.

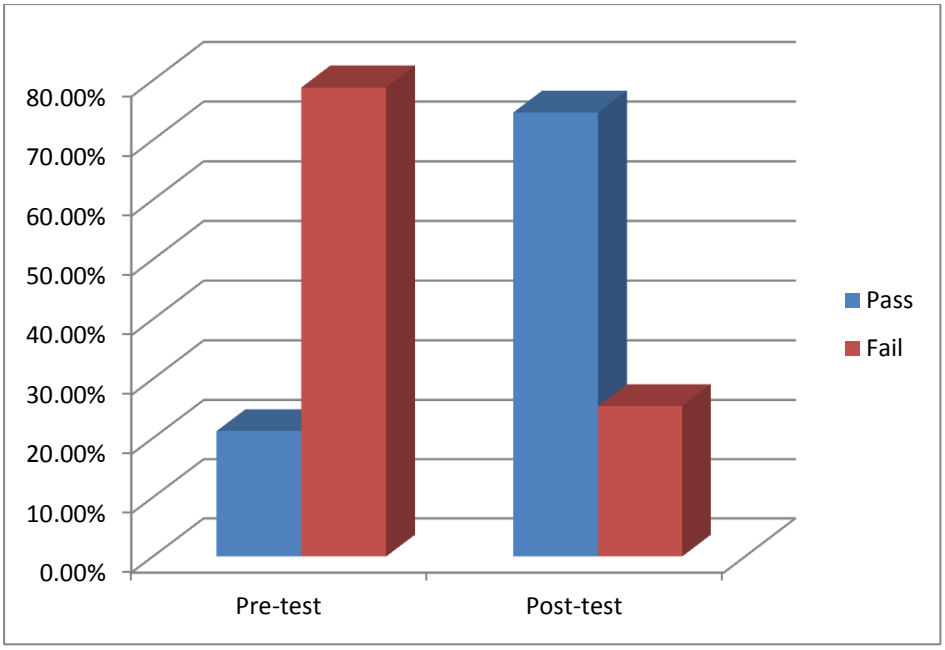


Figure 4 5: Comparison of performance in Analysis of Mathematical vocabulary in Pre-test and Post-test

Source: Researcher, 2019

T- tests showed that students were able to analyze problems significantly better after they were taught (t=12.405; p=0.000). This is shown in Table 4.2.

Table 4.2: T-test between Pre-test and Post-test on the performance in analysis of Mathematics vocabulary

	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
	5.125	11.108	0.413	4.313	5.936	12.405	722	0.000

4.5.2 Discussion

Statistical tests revealed that (p=0.000). There existed a significant difference between pre-test and post-test in students' level of mathematical vocabulary. Students were

able to analyze problems significantly better after they were taught. This agrees with findings obtained by (Njoroge, 2003) who found out that variation of Mathematics performance is accounted for by mathematical vocabulary. Students' performance in mathematics can be accounted for by their understanding of mathematical vocabulary. Since there is a positive relationship between students' level of mathematical vocabulary and level of mathematics performance, Mathematics students should be taught mathematical vocabulary. This approach, students would be in a position to read Mathematics texts better, learn and communicate mathematical concepts, understand comprehension questions in assessment and eventually perform better in Mathematics examination. This would help them achieve the secondary school Mathematics objectives as outlined by KIE (2002). They will be capable to generate a positive attitude to mathematics learning and communicate Mathematical ideas. Ultimately students would become more informed citizens and more of them would join Mathematics and science related careers. This would in turn lead to research and development, innovation and industrialization as envisaged in Kenya's Vision 2030 (Wanjiru, 2010).

Mathematics is a language that one should be capable of using and understanding mathematical vocabulary so as to be fluent in the language. Mathematical vocabulary is a main part in understanding Mathematics. Since mathematical vocabulary encompasses a number of mathematical concepts, it can be argued that without understanding the vocabulary employed normally in Mathematics textbooks, word-problems and instruction, students would be handicapped in their attempts to learn Mathematics (Marzano, 2011). Mathematics is an illustrational language of numbers and symbols. It is expressed and described by spoken and written words. Hence, for learners to outshine in Mathematics, they require to know, understand and use the

mandatory Mathematical vocabulary. Mulwa, (2014) found out that complexities related to learning and application of mathematical terms and the associated concepts may be attributed to either the reality that various terminologies cannot be clearly expressed in common language or student's inadequate hold of the mathematical language. Language-related effects moreover significantly influence students' performance (Mutodi, 2014). Variation of students' performance in mathematics can be accounted for by their understanding of mathematical vocabulary. This confirms the analyses by Githua, (2002) who additionally stated that textbooks quality, students' unenthusiastic attitude to mathematics and inappropriate teaching methods as conscientious factors for miserable performance in Rift Valley and Nairobi provinces.

4.6 Manipulation of Mathematics problems

The fourth study objective was to investigate if students' manipulation of mathematical problems influences performance. It sought to answer the research question; how does students 'manipulation of mathematics problems influences performance in mathematics? To answer this, some questions testing on manipulation of Mathematics problems were included in the test. Most mathematics questions require students to manipulate and apply various formulas and operations to score.

4.6.1 Presentation of Findings

In the Pre-test, only 24.1% of the students were in position to manipulate the Mathematics vocabularies and score the minimum 6 marks of the 12 marks. This was shown in figure 4.6.

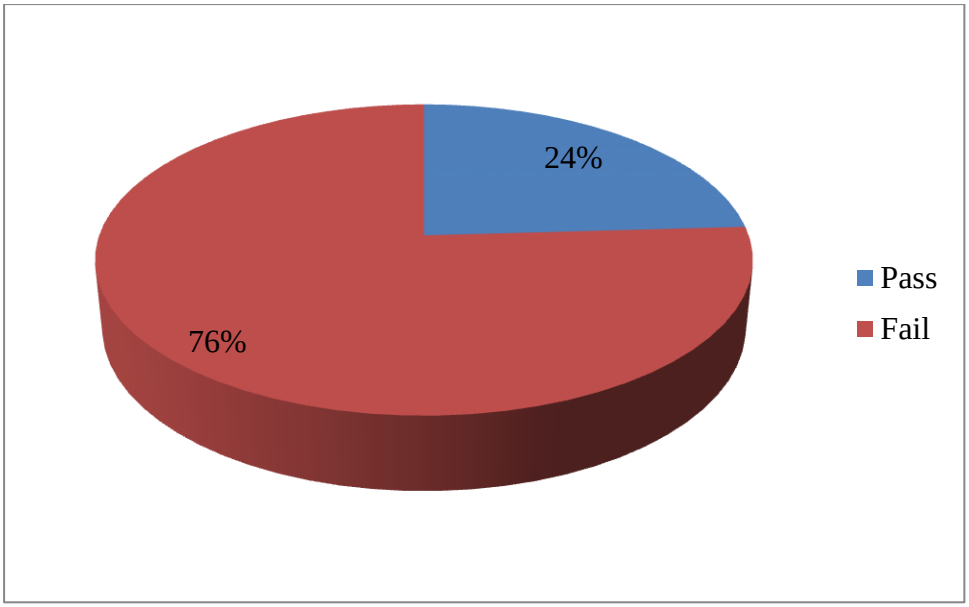


Figure 4.6: Performance in manipulation of Mathematics Problems in Pre-test

Source: Researcher, 2019

In the pre-test, it was noted that students could not manipulate and carry out some operations as expected. These included

a) Jacinta made a profit of 25% by selling a pair of shoes at Ksh. 1500. What profit in percentage would she have achieved if she sold the same shoes at 1600? The students were not able to find the percentage profit. Some students just worked out the profit, 1600-1500=100, and gave the profit as sh100. However, the question required them to compute the percentage profit; $\frac{(1600-1500)}{1500} \times 100\%$.

b) b) A carpenter created a closed wooden box having interior measurements 1.5m long, 0.8m wide and 0.4m high. The wood utilized in making the box was 1.0cm thick and has a density of 0.6g/cm3. Determine the mass, in kilograms, of the wood used in constructing the box. (leave your answer in 1 decimal place)

This question was poorly done in the pre-test. In this question, the students were not able to calculate the external and internal volume so as to find the volume of wood used. They were also required to relate density, mass and volume. Some students only calculated the internal volume. The students were also required to convert density from g/cm^3 to kg/m^3. So, students gave the mass in grams and not in kilograms as required. Others did not give the mass to 1 decimal place.

c) c) Two passengers train A and B with 240 meters away from each other travel at 164 km/h and 88 km/h correspondingly as they move toward one another on a railway line that is straight. Train A is 150 meters long while train B is 100 meters long. Find out the time in seconds that passes before the 2 trains fully pass each other.

In this question, the students were supposed to find the relative speed, the distance and then relate distance, speed and time. Time=$\frac{Distance}{speed}$.They were also required to covert the speed given in km/h to m/s. Some students did not get the correct distance, and the average speed. Others were not able to convert speed.

d) d) Juma spent half of his salary on school fees, one eighth on the farming and two thirds of the remainder on food. Calculate his July salary if he spent sh.3200 on food.

In this question, students were not able to calculate two thirds of the remainder to find the fraction spent on food. Other students got the fraction of two thirds of the remainder which was $\frac{1}{4}$, but were not able to equate it to sh 3200 to get the July salary.

The required response was

$\frac{1}{2}+\frac{1}{8}=\frac{5}{8}$; Rem=$\frac{3}{8}$.

Food=$\frac{2}{3} \times \frac{3}{3} = \frac{1}{4}$; Food=$\frac{1}{4} = 3200$. Salary =sh12800.

After the research assistants took students through these operations, 78.5% of the students were now able to manipulate and answer such questions correctly in the Post-test and score the minimum 8 marks. This was as illustrated in figure 4.7.

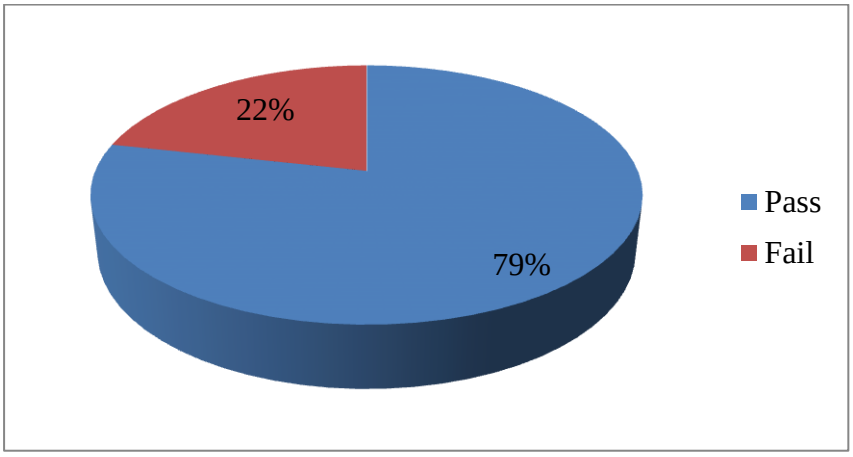


Figure 4.7: Manipulation of mathematics problems in the Post-test

Source: Researcher, 2019

Comparing the results in Pre-test and Post-test, students performed better in the Post-test as was shown in figure 4.8.

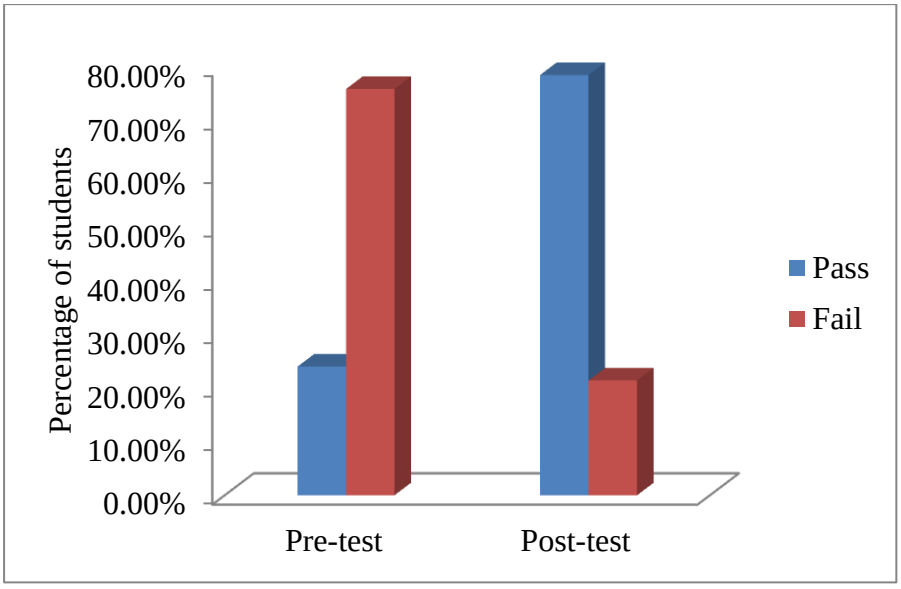


Figure 4.8: Performance in manipulation of Mathematics problems in Pre-test and Post-test

Source: Researcher, 2019

Statistical tests showed that (t=-83.028; p=0.000) which means that students performed significantly better after they were taught how to manipulate the mathematics problems (p=0.000). This implies that manipulation of mathematics problems is a requisite for one to perform well in Mathematics examinations.

Table 4.3: T-test between Pre-test and Post-test on the performance in manipulation of Mathematics problems

	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
	28.078	9.093	0.339	-28.742	-27.414	-83.028	722	.000

Source: Researcher, 2019

4.6.2 Discussion

Manipulation of Mathematics is a problem solving skill which entails greatly more than a plain calculation. For a student to finish a problem-solving assignment effectively, he/she should read and understand the problem condition, appraise what is being asked by the problem, formulate an arrangement for what mathematical procedure(s) should be employed to work out the problem, finish the arrangement, assess the sensibleness of the answer, afterward communicate the outcomes. Poor performance was evident in manipulation questions which tested connections and integration for problem solving skills. One of the Mathematic objectives is that students should perform mathematical actions and manipulations with speed, confidence and precision (KNEC Mathematics Syllabus, 2002). Teachers employ numerous illustrations to assist students discover and build up abstract concepts in mathematics classrooms.

Students are involved in problem solving when they maneuver objects while searching for a solution. In addition, they can improve their deep knowledge while posing a scenario problem that matches to the suitable manipulation. The incorporation of manipulatives in learning and teaching can theoretically help students' acquirement of mathematical language and symbols (Siregar, Rosli, Maat & Capraro 2019). Teachers should be in a position to observe outside noticeable accurate or inaccurate answers into thinking processes of children through trying with tests that permit learners the chance to display what they know (Kelly, 2006). We should teach children and evaluate their knowledge in manners that permits them to demonstrate to us what they actually understand regarding the assignments being tested if we desire them to learn to think profoundly and contemplate actual mathematics and to be in a position to employ in-depth thinking in real life scenarios. According to Mulwa, (2010), students should be revealed as numerous instances of a known term/concept as probable. After learners have comprehended the informal language for a specified concept and how to manipulate it, they can then be introduced to other versions of that concept. Students need to be shown illustrations of 'non-prime numbers', for example, after they understand the 'prime numbers' concept. This method will probably boost students' ability to differentiate between concepts.

4.7 Questionnaire

From the questionnaire, 914 students (63.2%) agreed that language influences performance in Mathematics. However, 532 students (36.8%) did not agree that language influences performance in Mathematics. The researcher also analysed the questionnaire by gender. There were 218 boys (61.1%) who agreed that language

interpretation influences performance in Mathematics. For the girls, 239 of them (65.3%) agreed that language interpretation influence performance in Mathematics. A Comparison of students' responses was as shown in figure 4.9.

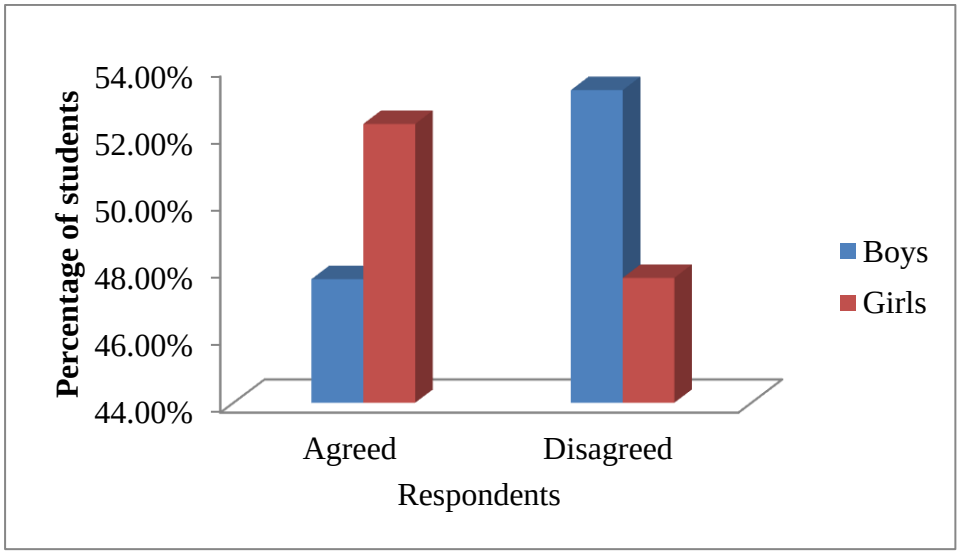


Figure 4.9: Students' response to the questionnaire

Source: Researcher, 2019

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

The chapter discusses the summary of the findings, discussions, conclusion and recommendations drawn from the findings in relation to the effects of students' language interpretation on performance of Mathematics.

5.2 Summary of the Findings

A summary of the findings is therefore as presented below

5.2.1 Students' interpretation of language

The first objective was to investigate how students' interpretation of language influences their performance in Mathematics. In the response to the research question how students' interpretation of language influences performance in mathematics, the research established that understanding of mathematical language and attainment in mathematics by students in Secondary school is pitiable. Mistakes that learners make when solving mathematics problems is partially because of their insufficient understanding of mathematical language. Performance in mathematics is extremely associated to students' understanding of mathematical language. Good performance in mathematics can be boosted by incorporating mathematical terms' definitions in lessons, prepare quizzes requiring definitions of mathematical terms, structures or symbols and grant marks for definitions.

5.2.2 Understanding of word problems

The second objective was to investigate whether understanding of word problems in mathematics influences performance. In response to the research question how does understanding of word problems influences performance in Mathematics, the research established that students performed better after they were taught the meaning of words. They were in a position to read and understand the items in an exam and eventually good performance. This implies that understanding mathematical words and terminologies is a requisite for one to perform well in Mathematics examinations. Students must understand the Mathematical terminologies or words in the questions before solving them. Without understanding the words and terminologies used in Mathematics, Mathematical concepts cannot be understood. This eventually lead to students' poor performance in Mathematics assessments.

5.2.3 Analysis of Mathematical vocabulary

The 3rd objective of the study was to investigate how the analysis of Mathematical vocabulary influences performance in Mathematics. The research found out that students performed better after they were exposed to the mathematics vocabulary. There is a positive relationship between students' level of mathematical vocabulary and level of Mathematics performance. Variation of Mathematics performance is accounted for by mathematical vocabulary. Thus, mathematical terminologies are a requisite for one to perform well in Mathematics examinations.

5.2.4 Manipulation of Mathematics problems

The fourth objective of the study was to investigate if manipulation of mathematics problems influences performance. This was to answer the research question, how does manipulation of mathematics problem influence performance in mathematics. The

research established that manipulation of Mathematics problems is a requisite for one to perform well in Mathematics. Students performed significantly better after they were taught how to manipulate the mathematics problems. Manipulation of mathematics problems is a problem-solving skill that involves much more than simple calculation. The student must make an arrangement for what mathematical procedure(s) to employ in order to solve the problem.

5.3 Conclusion

From the results, the study established that good performance in mathematics is extremely connected to students' mathematical language understanding. It is important to develop classroom practices that facilitate the understanding of concepts. A carefully-created and implemented Mathematics Vocabulary Instruction can successfully boost students' performance in Mathematics. This can also be used to promote students' attitude toward the Mathematics. There is a positive association between words and terminologies used in Mathematics and students' performance in Mathematics.

5.4 Recommendations

Since there is a positive relationship between students' level of mathematical vocabulary and performance in mathematics, the study recommends that;

1. Students should be taught mathematical vocabulary using appropriate strategies. Include mathematical terms' definitions in lessons, set queries that need mathematical phrases' definitions, structures or symbols and reward marks for definitions.
2. Students should be exposed to Mathematics vocabulary. Mathematical terminologies are a requisite for one to perform well in Mathematics
3. Manipulation of mathematics problems is a problem-solving skill that involves

much more than simple calculation. It should be emphasized.

From the study conclusions, the study made some policy recommendations to some chief stakeholders. Further study areas were proposed.

5.4.1. Policy Recommendations

The study made some recommendations to the subsequent stake holders:

a) Mathematics Teachers

i) Mathematics teachers should put more emphasize on definition of mathematical language while giving content to learners.

ii) The mathematics teachers ought to make mathematics notions to be applied practically in order to assist in improving the subject's understanding and henceforth advance on performance. The teacher can obtain an impression concerning language problems of students and suitable counteractive measures engaged.

iii) The Mathematics teachers should be sensitized on the effects of Mathematics vocabulary on students' performance in Mathematics. Simple and appropriate mathematical language should be used in the teaching, learning and assessment of Mathematics. The classroom practices aimed at enhancing Mathematical vocabulary are only done to a small extent or not all. Perhaps if the practices are done the students' poor performance in the subject will be a thing of the past

iv) Mathematics teachers should be encouraged to employ questions and examinations to offer pupils a chance to apply what they have learnt. Regular assignments, exercises, projects and home works assist in developing profound understanding of mathematics concepts and ideas.

v) Teachers should enhance skills to allow learners to communicate and work

collaboratively with each other

vi) The Ministry of Education should organize in-service courses or frequent workshops for teachers on teaching of Mathematics language

b) Mathematics Textbook Writers

Mathematics textbook writers control the commercial curriculum. They ought to be sensitized on the influences of Mathematics vocabulary on students learning of Mathematics. They do not consider the Mathematical Vocabulary proficiency of the readers. The textbooks treats vocabulary casually and do not spare time to give them thorough definitions. Thus, they must lay importance on the mathematical vocabulary description in their textbooks before using them in mathematical questions and text. They should explain the vocabularies that students would meet in each part of their textbook. This would boost learners' understanding of Mathematics.

c) The Kenya Institute of Curriculum Development (KICD)

The Kenya Institute of Curriculum of Development is the body charged with curriculum development in Kenya. It must plan Mathematics materials with simplified appropriate language to enhance learner readability that will lead to improved students' Mathematics performance. The KICD should pilot the developed prototype lesson for mathematical vocabulary instruction in a number of schools in different counties and thereafter it could be adopted in all schools. The syllabus of Mathematics need to emphasize on language of mathematic as component of the content to be learned, therefore restructuring of mathematics textbooks to incorporate language of mathematics as component of the content to be trained (Mbugua, 2012).

f) Mathematics Teachers' Educators

The educators of Mathematics teachers ought to be moreover alerted on the necessity to train Mathematics teachers on the tactics that can be employed to enhance students' mastery of Mathematics vocabulary instruction. This will help ensure there is bottomless understanding of the mathematical vocabulary and understanding of mathematical concepts. Pre-service teachers should be completely prepared to be teachers of mathematics reading. To offer a complete training needs more than only providing the requisite pedagogical content knowledge; it moreover necessitates that teacher educators apply fresh beliefs and attitudes concerning their function as mathematics reading teachers.

5.4.2. Recommendations for Further Research

The study recommends a further research on the impacts of students' entry behavior on Mathematics performance.

REFERENCES

Adams, T. L. (2003). Reading mathematics: More than words can say. *The Reading Teacher*, *56*(8), 786-795.

Adino, A. (2015). Factors influencing students performance in mathematics in Kenya certificate of secondary education in public secondary schools in Butere sub county, Kenya (Doctoral dissertation, University of Nairobi).

Aduda, D. (2003). Kenya Certificate of Secondary Education, Examination Results Released by Minister of Education. *Daily Nation, Nairobi: Nation Media Group Ltd*.

Ali, H. H., & Jameel, H. T. (2016). Causes of poor performance in mathematics from teachers, parents and student's perspective. *American Scientific Research Journal for Engineering, Technology, and Sciences (ASRJETS)*, *15*(1), 122-136.

Altaftazani, D. H., Rahayu, G. D. S., Kelana, J. B., Firdaus, A. R., & Wardani, D. S. (2020, October). Application of the constructivism approach to improve students' understanding of multiplication material. In *Journal of Physics: Conference Series* (Vol. 1657, No. 1, p. 012007). IOP Publishing.

Amadalo, M. M., Sulungai, M. W., & Toili, W. W. (2012). Teacher Related Factors influencing integration of ICT in Teaching of Mathematics in Secondary schools in Kenya. *African Journal of Education and Technology*, 1-14.

Amin, M. E. (2005). *Social science research: Conception, methodology and analysis*. Makerere University.

Anwar, R. B., &Rahmawati, D. (2017). The Use of Mathematical Module Based on Constructivism Approach as Media to Implant the Concept of Algebra Operation. *International Electronic Journal of Mathematics Education*, *12*(3), 579-583.

Apen, R. (2016). The applicative use of problem solving technique in teaching grammar. *Proceedings of ISELT FBS Universitas Negeri Padang*, *4*(2), 180-187.

Asante, K. O. (2012). Secondary students' attitudes towards mathematics. *IFE Psychologia: An International Journal*, *20*(1), 121-133.

Atkinson, M. J., Kumar, R., Cappelleri, J. C., & Hass, S. L. (2005). Hierarchical construct validity of the treatment satisfaction questionnaire for medication (TSQM version II) among outpatient pharmacy consumers.

Barbu, O. C., & Beal, C. R. (2010). Effects of linguistic complexity and math difficulty on word problem solving by English learners. *International Journal of Education*, *2*(2), 1.

Beal, C. R., Adams, N. M., & Cohen, P. R. (2010). Reading proficiency and mathematics problem solving by high school English language learners. *Urban Education*, *45*(1), 58-74.

Bell, R., & Bell, L. (2002). A bibliography of articles on technology in science education. *Contemporary Issues in Technology and Teacher Education*, *2*(4), 426-446.

Best, P. J., Lennon, R., Gersh, B. J., Ting, H. H., Rihal, C. S., Bell, M. R., ... & Berger, P. B. (2003). Safety of abciximab in patients with chronic renal insufficiency who are undergoing percutaneous coronary interventions. *American heart journal*, *146*(2), 345-350.

Boonen, A. J., van Wesel, F., Jolles, J., & van der Schoot, M. (2014). The role of visual representation type, spatial ability, and reading comprehension in word problem solving: An item-level analysis in elementary school children. *International Journal of Educational Research*, *68*, 15-26

Bryant, D. P. (2009). Working with your child's teacher to identify and address math disabilities. *LD online*, 197-228.

Chow, J. C., & Ekholm, E. (2019). Language domains differentially predict mathematics performance in young children. *Early Childhood Research Quarterly*, *46*, 179-186.

Cooper, D., & Schindler, S. (2014). Business Research Methods. New York: McGraw-Hill Irwin

Cooper, D. R., Schindler, P. S., & Sun, J. (2006). Business research methods (Vol. 9). New York: McGraw-Hill Irwin.

Creswell, J. W., & Creswell, J. D. (2017). *Research design: Qualitative, quantitative, and mixed methods approaches*. Sage publications.

Creswell, J. W., & Clark, V. L. P. (2017). *Designing and conducting mixed methods research*. Sage publications.

Daroczy, G., Wolska, M., Meurers, W. D., & Nuerk, H. C. (2015). Word problems: a review of linguistic and numerical factors contributing to their difficulty. *Frontiers in psychology*, *6*, 348.

Didis, M. G., & Erbas, A. K. (2015). Performance and Difficulties of Students in Formulating and Solving Quadratic Equations with One Unknown. *Educational Sciences: Theory and Practice*, *15*(4), 1137-1150.

Dimitrov, D. M., &Rumrill Jr, P. D. (2003). Pretest-posttest designs and measurement of change. *Work*, *20*(2), 159-165.

Fitzmaurice, O., Cronin, A., Fhloinn, E. N., O'Sullivan, C., & Walsh, R. (2016). Preparing tutors for mathematics learning support. *MSOR Connections*, *14*(3), 14-21.

Fouka, G., &Mantzorou, M. (2011). What are the major ethical issues in conducting research? Is there a conflict between the research ethics and the nature of nursing?. *Health Science Journal*, *5*(1).

Frey, N., Fisher, D., & Smith, D. (2019). *All learning is social and emotional: Helping students develop essential skills for the classroom and beyond*. ASCD.

Gichuru, L. M., &Ongus, R. W. (2016). Effect of teacher quality on student performance in mathematics in Primary 6 National Examination: A survey of private primary schools in Gasabo District, Kigali City, Rwanda. *International Journal of Education and Research*, *4*(2), 237-259.

Gillham, B. (2008). *Developing a questionnaire*. A&C Black.

Gitaari, E. M. E., Nyaga, G., Muthaa, G., &Reche, G. (2013). Factors contributing to students poor performance in mathematics in public secondary schools in Tharaka South District, Kenya.

Githua, B. N. (2002). Factors related to the motivation to learn Mathematics among Secondary School Students in Kenya's Nairobi Province and Three Districts of Rift Valley Province'. *Unpublished Phd. Thesis, Egerton University, Njoro*.

Goodenough, A., & Waite, S. (2012). Real world research: a resource for users of social research methods in applied settings

Goodrum, D., Rennie, L. J., & Hackling, M. W. (2001). *The status and quality of teaching and learning of science in Australian schools: A research report*. Canberra: Department of Education, Training and Youth Affairs.

Grace, D. N., &Irungu, M. N. (2013). Determinants of Academic Performance in Kenya Certificate of Secondary Education in Public Secondary Schools in Kiambu County, Kenya. *Journal of Education and Practice 4 (12).*

Gray, V. (2004). The language of mathematics: a functional definition and the development of an instrument of measure teacher perceived self-efficacy.

Heale, R., & Twycross, A. (2015). Validity and reliability in quantitative studies. *Evidence-based nursing*, *18*(3), 66-67.

Howie, S. J. (2003). Language and other background factors affecting secondary pupils' performance in Mathematics in South Africa. *African Journal of Research in Mathematics, Science and Technology Education*, *7*(1), 1-20.

Howie, S. (2004). A national assessment in mathematics within an international comparative assessment. *Perspectives in education*, *22*(2), 149-162.

Jameel, H. T., & Ali, H. H. (2016). Causes of poor performance in mathematics from the perspective of students, teachers and parents. *American Scientific Research Journal for Engineering, Technology, and Sciences*, *15*(1), 122-136.

Kelly, C. A. (2006). Using manipulatives in mathematical problem solving: A performance-based analysis. *The mathematics enthusiast*, *3*(2), 184-193.

Kombo, D. K., & Tromp, D. L. (2006). Proposal and thesis writing: An introduction. *Nairobi: Paulines Publications Africa*, *5*, 814-30.

Kosgei, A., Mise, J. K., Odera, O., &Ayugi, M. E. (2013). Influence of teacher characteristics on students' academic achievement among secondary schools. *Journal of Education and Practice*, *4*(3), 76-82.

Kothari, C. R. (2008). Research Methodology, Methods and Techniques (2nd ed., pp. 109-110). New Delhi: New Age Inter- national (P) Limited

Kothari, C. (2017). Research methodology methods and techniques by CR Kothari. *Published by New Age International (P) Ltd., Publishers*, *91*.

Larbi, E., & Okyere, M. (2014). Algebra tiles manipulative and gender differences in learning and achievement in mathematics: A case of Sunyani West Municipality. *differences*, *5*(38).

Laverde, A. C., Cifuentes, Y. S., & Rodriguez, H. Y. R. (2007). Toward an instructional design model based on learning objects. *Educational Technology Research and Development*, *55*(6), 671-681.

Legesse, B. (2014). Research Methods in Agribusiness and Value Chains. *School of Agricultural Economics and Agribusiness, Haramaya University*.

Manoah, S. A., Indoshi, F. C., &Othuon, L. O. (2011). Influence of attitude on performance of students in mathematics curriculum. *Educational research*, *2*(3), 965-981.

Marzano, R. J. (2011). *Formative assessment & standards-based grading*. Solution Tree Press

Mbugua, Z. K., Kibet, K., Muthaa, G. M., & Nkonke, G. R. (2012). Factors contributing to students' poor performance in mathematics at Kenya certificate of secondary education in Kenya: A case of Baringo county, Kenya.

Mbugua, Z. K. (2012). Influence of Mathematical Language on Achievement in Mathematics by Secondary School Students in Kenya.

Meiers, M., &Trevitt, J. (2010). The digest edition 2010/2: Language in the mathematics classroom.

Mensah, J. K., Okyere, M., & Kuranchie, A. (2013). Student attitude towards mathematics and performance: Does the teacher attitude matter. *Journal of education and practice*, *4*(3), 132-139.

Micheni, M. K., Njeru, A. W., & Wanjiru, B. (2013). Influence of television advertisements on telecommunication companies' consumer psychological buying behavior in Kenya. *International Journal of Social Sciences and Entrepreneurship*, *1*(5), 728-741.

Monoranjan, B. (2015). Constructivism Approach in Mathematics Teaching and Assessment of Mathematical Understanding. Basic Research Journal of Education Research

Morapeli, M. A., &Luneta, K. Difficulties Encountered by Grade 11 Mathematical Literacy Learners When Solving Problems of the Surface Area Of Rectangular Prisms. *for Mathematics Education of South Africa*, 242.

Mugenda, O. M., & Mugenda, A. G. (2012). Research Methods: Quantitative and Qualitative Approaches. Nairobi: Acts Press.

Mulwa, E. C. (2014). A Review of Students' Understanding of Mathematical Concepts of Arithmetic Operations in Eldoret Municipality, Kenya. *Research Journal in Organizational Psychology and Educational Studies (RJOPES)*, *3*(2), 67.

Murray, J. (2013). The factors that influence mathematics achievement at the Berbice campus. *International journal of business and social science*, *4*(10).

Musasia, A. M., Nakhanu, S. B., &Wekesa, W. D. (2012). Investigation of factors that influence syllabus coverage in secondary school mathematics in Kenya.

Mutodi, P., &Ngirande, H. (2014). The Influence of StudentsPerceptions on Mathematics Performance. A Case of a Selected High School in South Africa. *Mediterranean Journal of Social Sciences*, *5*(3), 431.

Nalianya, R. S. (2011). *Factors influencing career choices by students in tertiary institutions in Kenya; a case of Youth polytechnics in Bungoma County* (Doctoral dissertation, University of Nairobi, Kenya).

Nassiuma, D. K. (2000). Survey sampling. *Theory and methods*, *10*(1), 59-63

National Council of Teachers of Mathematics (Ed.). (2000). *Principles and standards for school mathematics* (Vol. 1). National Council of Teachers of.

Nicol, D. (2010). From monologue to dialogue: improving written feedback processes in mass higher education. *Assessment & Evaluation in Higher Education*, *35*(5), 501-517.

Njoroge, P. M., &Nyabuto, A. N. (2014). Discipline as a factor in academic performance in Kenya. *Journal of Educational and Social Research*, *4*(1), 289.

Nor, F. M., Aziz, M. A., & Jusoff, K. (2011). Should English for teaching mathematics and science (ETeMS) in Malaysia be abolished. *World applied sciences journal*, *12*(Special Issue on Creating a Knowledge Based society), 36-40.

Ogula, P. A. (2005). Research methods.

Ongong'a, J. J., &Akaranga, S. I. (2013). Work ethics for lecturers: an example of Nairobi and Kenyatta Universities.

Orodho, J. A. (2005). Techniques of writing research proposals and reports. *Education and Social Sciences*.

Orodho, A. (2004). Techniques and Social Science Research Methods Nairobi.

Otieno, K. O. (2010). Teaching/learning resources and academic performance in mathematics in secondary schools in Bondo District of Kenya. *Asian Social Science*, *6*(12), 126.

Padilla, A. M., Fan, L., Xu, X., & Silva, D. (2013). A Mandarin/English two- way immersion program: Language proficiency and academic achievement. *Foreign Language Annals*, *46*(4), 661-679.

Papanastatsiou, C. (2010). Linkage of attitudes and performance of Mathematics among students in middle level schools. *International Journal of Education*, *102*, 34-39.

Ramdhani, M. R., Usodo, B., & Subanti, S. (2017, November). Student's mathematical understanding ability based on self-efficacy. In *Journal of Physics: Conference Series* (Vol. 909, No. 1, p. 012065). IOP Publishing.

Rosli, R., Goldsby, D., & Capraro, M. M. (2013). Assessing students' mathematical problem-solving and problem-posing skills. *Asian social science*, *9*(16), 54-60.

Rubenstein, R. N., & Thompson, D. R. (2002). Understanding and supporting children's mathematical vocabulary development. *Teaching Children Mathematics*, *9*(2), 107-112.

Sa'ad, T. U., Adamu, A., & Sadiq, A. M. (2014). The causes of poor performance in mathematics among public senior secondary school students in Azare metropolis of Bauchi State, Nigeria. *Journal of Research & Method in Education*, *4*(6), 32.

Sahendra, A., Budiarto, M. T., & Fuad, Y. (2018). Students' representation in mathematical word problem-solving: exploring students' self-efficacy. In *Journal of Physics: Conference Series* (Vol. 947, No. 1, p. 012059). IOP Publishing.

Samuelsson, M., & Samuelsson, J. (2016). Gender differences in boys' and girls' perception of teaching and learning mathematics. *Open Review of Educational Research*, *3*(1), 18-34.

Sila, M. P. (2014). *Factors influencing students' performance in mathematics in Kenya certificate of secondary education (KCSE); A case of Kathonzweni District in Makueni County, Kenya* (Doctoral dissertation).

Siregar, N. C., Rosli, R., Maat, S. M., & Capraro, M. M. (2019). The effect of science, technology, engineering and mathematics (STEM) program on students' achievement in mathematics: A meta-analysis. *International Electronic Journal of Mathematics Education*, *15*(1), em0549.

Solano-Flores, G., & Trumbull, E. (2003). Examining language in context: The need for new research and practice paradigms in the testing of English-language learners. *Educational Researcher*, *32*(2), 3-13.

Stahl, S. A. (2005). Four problems with teaching word meanings. *Teaching and learning vocabulary: Bringing research to practice*, *95*.

Suleiman, Y., & Hammed, A. (2019). Perceived Causes of Students' Failure in Mathematics in Kwara State Junior Secondary Schools: Implication for Educational Managers. *International Journal of Educational Studies in Mathematics*, *6*(1), 19-33.

Tambychik, T., Meerah, T. S. M., & Aziz, Z. (2010). Mathematics skills difficulties: A mixture of intricacies. *Procedia-Social and Behavioral Sciences*, *7*, 171-180.

Thatcher,R.W.(2010).Validity and reliability of quantitative electroencephalography. *Journal of Neurotherapy*, *14*(2), 122-152.

Verschaffel, L., Van Dooren, W., Greer, B., & Mukhopadhyay, S. (2010). Reconceptualising word problems as exercises in mathematical modelling. *Journal für Mathematik-Didaktik*, *31*(1), 9-29.

Wachira, C. N. (2016). *Causes of poor performance in mathematics in secondary schools: a case of Nyandarua north sub county, Kenya* (Doctoral dissertation, Karatina University).

Wanjiru, B. N. (2015). *Effects of mathematical vocabulary instruction on students' achievement in mathematics in secondary schools of Murang'a County, Kenya* (Doctoral dissertation, Kenyatta University).

Wasike, D. W. (2003). Effect of Socialized Mathematical Language Module on Students' Understanding of Mathematics and Their Perception of the Learning Environment: A Case of Form Two Students of Bungoma District, Kenya. *Unpublished Thesis, Egerton University*.

Wekesa, D. W. (2006). Effectiveness of a Language Based Program in School Mathematics on Students Understanding of Statistics. *Eurasia journal of Mathematics, science and technology education*, *2*(3), 79-87.

Yonson, D. L. Solving word problems performance of students in L1 (Mother Tongue) and L2 (English language).

Yushau, B., & Omar, M. H. (2015). Mathematics performance and its relation to English language proficiency level of bilingual Arab university students. *Indian Journal of Science and Technology*, *8*(13), 1-15.

Zakaria, E., Chin, L. C., &Daud, M. Y. (2010). The effects of cooperative learning on students' mathematics achievement and attitude towards mathematics. *Journal of social sciences*, *6*(2), 272-275.

APPENDICES

APPENDIX I: INTRODUCTORY LETTER

DORCAS WANJIRU RUTHIGA
P.O BOX 17603
NAKURU

Dear Sir/Madam,

RE: AUTHORITY TO CONDUCT A FIELD RESEARCH

I am currently undertaking a Masters degree in Education at the University of Eldoret. As part of my degree program, it is a requirement to undertake a research study on an area of my study specialization in partial fulfillment of the degree. In this regard, I have chosen to undertake a research on the topic; **Effects of students' language interpretation on performance in Mathematics in selected public secondary schools in Nakuru North Sub-County.**

This research is purely academic and any information provided shall be treated with confidentiality. I hereby wish to ask for authority to engage Form 3 students and teachers in Mathematics department in your school. During the study, I will administer a questionnaire and tests to Form Three students. A copy of the questionnaire is attached to this letter for your perusal. The findings from this study will be used to enhance good performance in Mathematics in secondary schools in Kenya.

I am optimistic that your good office will be critical in facilitating this research study and I do look forward to a favorable response from your office.

Yours faithfully,

DORCAS WANJIRU RUTHIGA

APPENDIX II: NACOSTI RESEARCH PERMIT

THIS IS TO CERTIFY THAT:
MISS. DORCAS WANJIRU RUTHIGA
of UNIVERSITY OF ELDORET, 0-20100
NAKURU,has been permitted to conduct
research in *Nakuru County*

on the topic: *EFFECTS OF STUDENTS LANGUAGE INTERPRETATION ON PERFORMANCE IN MATHEMATICS IN SELECTED SECONDARY SCHOOLS IN NAKURU NORTH SUB- COUNTY NAKURU COUNTY KENYA*

for the period ending:
12th March,2020

Permit No : NACOSTI/P/19/28964/28545
Date Of Issue : 12th March,2019
Fee Recieved :Ksh 1000

.....
Applicant's Signature

.....
Director General
National Commission for Science, Technology & Innovation

THE SCIENCE, TECHNOLOGY AND INNOVATION ACT, 2013

The Grant of Research Licenses is guided by the Science, Technology and Innovation (Research Licensing) Regulations, 2014.

CONDITIONS

1. The License is valid for the proposed research, location and specified period.
2. The License and any rights thereunder are non-transferable.
3. The Licensee shall inform the County Governor before commencement of the research.
4. Excavation, filming and collection of specimens are subject to further necessary clearance from relevant Government Agencies.
5. The License does not give authority to transfer research materials.
6. NACOSTI may monitor and evaluate the licensed research project.
7. The Licensee shall submit one hard copy and upload a soft copy of their final report within one year of completion of the research.
8. NACOSTI reserves the right to modify the conditions of the License including cancellation without prior notice.

National Commission for Science, Technology and innovation
P.O. Box 30623 - 00100, Nairobi, Kenya
TEL: 020 400 7000, 0713 788787, 0735 404245
Email: dg@nacosti.go.ke, registry@nacosti.go.ke
Website: www.nacosti.go.ke

REPUBLIC OF KENYA

National Commission for Science, Technology and Innovation

RESEARCH LICENSE

Serial No.A 23555

CONDITIONS: see back page

APPENDIX III: LETTER OF RESEARCH AUTHORIZATION NACOSTI

NATIONAL COMMISSION FORSCIENCE, TECHNOLOGY ANDINNOVATION

Telephone:+254-20-2213471,
2241349,3310571,2219420
Fax: +254-20-318245,318249
Email: dg@nacosti.go.ke
Website: www.nacosti.go.ke
When replying please quote

9th Floor, Utalii House
Uhuru Highway
P.O. Box 30623-00100
NAIROBI-KENYA

Ref: No. **NACOSTI/P/19/28964/28545**

Date: **12th March, 2019**

Dorcas Wanjiru Ruthiga
University of Eldoret
P.O. Box 1125- 30100
ELDORET.

RE: RESEARCH AUTHORIZATION

Following your application for authority to carry out research on ***"Effects of students' language interpretation on performance in Mathematics in selected Secondary Schools in Nakuru North Sub- County, Nakuru County, Kenya"*** I am pleased to inform you that you have been authorized to undertake research in **Nakuru County** for the period ending **12th March, 2020.**

You are advised to report to **the County Commissioner and the County Director of Nakuru County** before embarking on the research project.

Kindly note that, as an applicant who has been licensed under the Science, Technology and Innovation Act, 2013 to conduct research in Kenya, you shall deposit **a copy** of the final research report to the Commission within **one year** of completion. The soft copy of the same should be submitted through the Online Research Information System.

GODFREY P. KALERWA MSc., MBA, MKIM
FOR: DIRECTOR-GENERAL/CEO

Copy to:

The County Commissioner
Nakuru County.

The County Directors of Education
Nakuru County.

APPENDIX IV: LETTER FROM COUNTY DIRECTOR OF EDUCATION

MINISTRY OF EDUCATION

STATE DEPARTMENT OF EARLY LEARNING OF BASIC EDUCATION

Telegrams: "**EDUCATION**",
Telephone: **051-2216917**
When replying please quote
Email:cdenakurucounty@gmail.com
Ref.CDE/NKU/GEN/4/1/21 VOL.VIX/69

COUNTY DIRECTOR OF EDUCATION
NAKURU COUNTY
P. O. BOX 259,
NAKURU.

14th May,2019

TO WHOM IT MAY CONCERN

RE: RESEARCH AUTHORIZATION – DORCAS WANJIRU RUTHIGA
PERMIT NO. NACOSTI/P/19/28964/28545

Reference is made to letter NACOSTI/P/**19/28964/28545**
Dated 12th March, 2019.

Authority is hereby granted to the above named to carry out research on "***Effects of students; language interpretation on performance in selected Secondary Schools in Nakuru North Sub-County, Nakuru County, Kenya***" for a period ending ***12th March, 2020***

Kindly accord her the necessary assistance.

For' COUNTY DIRECTOR OF EDUCATION
NAKURU COUNTY

JOYCE SANKOK
FOR: COUNTY DIRECTOR OF EDUCATION
NAKURU

Copy to:

University of Eldoret
P.O Box 1125 – 30-30100
ELDORET

APPENDIX V: INTRODUCTION LETTER FROM THE UNIVERSITY

University of Eldoret
flame of knowledge and innovation

P.O. Box 1125-30100, ELDORET, Kenya
Tel: 053-2063111 Ext. 242
Fax No. 20-2141257
Email: soe@uoeld.co.ke
www.uoeld.ac.ke

UNIVERSITY OF ELDORET
SCHOOL OF EDUCATION
CENTRE FOR TEACHER EDUCATION

REF: UOE/B/CTE/PGS/033/Vol.1

DATE: Monday, 18th February, 2018

The Executive Secretary
National Council for Science Technology & Innovation
P.O Box 30623- 00100
NAIROBI, Kenya.

Dear Sir /Madam

RE: RESEARCH PERMIT AND AUTHORIZATION LETTER FOR: DORCAS WANJIRU RUTHNGO - EDU/PGSE/015/14

This is to confirm that Dorcas Wanjiru Ruthiga **Reg. No.:** EDU/PGSE/015/14 has successfully presented her Masters of Science thesis research proposal and is ready to proceed for data collection.

The research is on *"Effects of Student's Language Interpretation on Performance in Mathematics in Selected Secondary Schools in Nakuru North Sub-County Nakuru, Kenya."*

Kindly accord her the necessary assistance.

Yours faithfully,

HEAD
Centre for Teacher Educ
UNIVERSITY OF ELDO
MAIN CAMPUS

R. M. AMINGA
HEAD, CENTRE FOR TEACHER EDUCATION

c. c. Post Graduate Coordinator, School of Education, University of Eldoret.

APPENDIX VI: PRE-TEST

Answer the following questions. Show your working

1.Evaluate without using a calculator (4mks)

$$\frac{\frac{1}{2}\ of\ 3\frac{1}{2}+1\frac{1}{2}\left(2\frac{1}{2}-\frac{2}{3}\right)}{\frac{3}{4}\ of\ 2\frac{1}{2}\div\frac{1}{2}}$$

2. Use tables of squares, square roots and reciprocals to evaluate to 3 decimal places the question below

$\frac{8}{\sqrt{0.625}}+(1.64)^2$(4marks)

3. Solve the equation Find the value of x. (4mks)

$2^{(x-3)} \times 8^{(x+2)} = 128$

4. Given that $\sin (3x-35)^o - \cos (x+20)^o = 0$ and x is an acute angle, find its value (4mks)

5a) Express 1764 as product of its prime factor (2mks)

(b) Using the expression in (a) above find $\sqrt{1764}$ in power form (2mks)

6. Jacinta made a profit of 25% by selling a pair of shoes at Ksh. 1500. What percentage profit would she have made if she sold the same shoes at 1600? (3mks)

7. A carpenter constructed a closed wooden box with internal measurements 1.5m long, 0.8m wide and 0.4m high. The wood used in constructing the box was 1.0cm thick and has a density of 0.6g/cm3. Determine the mass, in kilograms, of the wood used in constructing the box. (leave your answer in 1 decimal place (4mks)

8. A straight line L_1 is perpendicular to another line L_2 whose equation is $3y + 4x = 12$. If the two lines meet at point P which lies on the x-axis, find

(i) The co-ordinates of point P. (1mk)

(ii) The equation of L_1 in the form ax + by = c. (3mks)

9. A man standing 20 meters away from the foot of a vertical pole observes the top of the pole at an angle of elevation of 300. He begins to walk along a straight line on the level ground towards the pole. Calculate how far he walked before the angle of elevation of the top of the pole becomes 800. Give your answer to two significant figures (4mks)

10. A certain number of people agreed to contribute to buy novels worth sh1200. Five of them pulled out while those who remained had to contribute an extra sh.10 each. Their contributions bought novels worth sh.200 more than they had originally expected. If the original number of people was x, how much did each contribute? (4mks)

11. Two passengers train A and B which are 240 meters a part are travelling at 164 km/h and 88 km/h respectively as they approach one another on a straight railway line. Train A is 150 meters long and train B is 100 meters long Determine the time in seconds that elapses before the two trains completely pass each other (4mks).

12. A Kenyan bank buys and sells foreign currencies as shown below.

	Buying (ksh)	Selling (Ksh)
1 Euro	84.15	84.26
100 Japanese Yen	65.37	65.45

A Japanese travelling from France to Kenya had 5000 Euros. He converted all the 5000 Euros to Kenya shilling at the bank. While in Kenya, he spent a total of Ksh289,850 and then converted the remaining Kenya shillings to Japanese Yen at the bank. Calculate the amount of Japanese Yen that he received. (4mks)

13.Juma spent half of his salary on school fees, one eighth on the farming and two thirds of the remainder on food. Calculate his July salary if he spent sh.3200 on food. (4mks)

APPENDIX VII: PRE-TEST MARKING SCHEME

Q.1

$\frac{\frac{1}{2}\times\frac{7}{2}+\frac{3}{2}\left(\frac{5}{2}-\frac{2}{3}\right)}{\frac{3}{4}\times\frac{5}{2}\div\frac{1}{2}}$;

$$\frac{\frac{7}{4}+\frac{3}{2}\left(\frac{15-4}{6}\right)}{\frac{3}{4}\times\frac{5}{2}\times\frac{2}{1}}$$

$$\frac{\frac{7}{4}+\left(\frac{3}{2}\times\frac{11}{6}\right)}{\frac{3}{4}\times 5}$$

$\frac{\frac{7}{4}+\frac{11}{4}}{\frac{15}{4}}$; $= \frac{18}{4}\times\frac{4}{15}$

$$= \frac{18}{15} = 1\frac{1}{5}$$

Q.2

$$\frac{8}{\sqrt{62.5\times 10^{-2}}} + 1.64^2$$

$$8\times\frac{1}{7.906\times 10^{-1}} + 1.64^2$$

$$(8\times 0.1267\times 10^{1}) + 2.69$$

$$10.136 + 2.69$$

$$= 12.826$$

Q.3

$$2^{x-3}\times 2^{3(x+2)} = 2^7$$

$$x - 3 + 3(x+2) = 7$$

$x - 3 + 3x + 6$=7

$$4x + 3 = 7$$

$$4x = 4$$

x=1

Q.4

$$sin(3x - 35°) = cosx + 20°$$

$$sin\theta = cos \propto if\ \theta + \alpha = 90°$$

$$3x - 35° + x + 20° = 90°$$

$$4x - 15° = 90°$$

$$4x = 105°$$

$$x = 26.25°$$

Q.5

$$1764 = 2\times 2\times 3\times 3\times 7\times 7$$

$$= 2^2\times 3^2\times 7^2$$

$$\sqrt{2^2\times 3^2\times 7^2}$$

$$2\times 3\times 7$$

Q.6

$$\frac{100}{125}\times 1500 = sh1200$$

$$B.P = sh300\times 4 = sh1200$$

$$Profit = sh1600 - sh1200$$

$$= sh400$$

$$\%\ profit = \frac{400}{1200}\times 100\%$$

$$\%\ profit = 33\frac{1}{3}\%$$

Q.7

$$Eternal\ volume$$

$$= (152cm \times 82cm \times 42cm)$$

$$= 523{,}488cm^3$$

$$Internl\ voume$$

$$= 150cm \times 80cm \times 40cm$$

$$= 480{,}000cm^3$$

$$Volume\ of\ wood$$

$$= 523{,}488cm^3 - 480{,}000cm^3$$

$$= 43{,}488cm^3$$

$$Mass = Density \times Volume$$

$$= 0.6g/cm^3 \times 43{,}488cm^3$$

$$= 26{,}092.8g = 26.0928kg$$

$$= 26.1kg$$

Q.8

$$At\ the\ x\ axis\ y = 0$$

$$In\ 3y + 4x = 12, x = 3$$

$$Point\ P = (3,0)$$

$$3y = -4x + 12.\ SO\ y = \frac{-4}{3} + 4$$

$$G = \frac{-4}{3}$$

$$If\ lines\ are\ perpendicular, G_1 \times G_2$$

$$= -1$$

$$\frac{-4}{3} \times G_2 = -1;\ G_2 = \frac{3}{4}$$

$$\frac{3}{4} = \frac{y-0}{x-3}$$

$$3x - 9 = 4y.$$

$$y = \frac{3x}{4} - \frac{9}{4}$$

Q.9

$$Tan\ 30° = \frac{h}{20}$$

$$h = 20 \tan 30° = 11.55cm$$

$$tan\ 80° = \frac{11.55cm}{x}$$

$$x = 2.04cm.$$

$$20cm - 2.04cm = 17.96cm$$

$$= 18cm.$$

Q.10

$$\frac{1200}{x} + 10 = \frac{1400}{x-5}$$

$$\left(\frac{1200}{x}\right)x(x-5) + 10x(x-5)$$

$$= \frac{1400}{x-5}x(x-5)$$

$$1200(x-5) + 10x^2 - 50x = 1400x$$

$$1200x - 6000 + 10x^2 - 50x$$

$$= 1400x$$

$$10x^2 - 250x - 6000 = 0;$$

$$x^2 - 25 - 600 = 0$$

$$x = 40\ .$$

$$Each\ contributed\ \frac{sh1400}{35} = sh\ 40$$

Q.11

$$Relative\ speed = \frac{(164 + 88)km}{hr}$$

$$= 252km/hr$$

$$speed = \frac{5}{18} \times \frac{252km}{hr} = 70m/s$$

$$Distance = (240 + 150 + 100)m$$

$$= 490m$$

$$Time = \frac{Distance}{Speed} = \frac{490m}{70m/s}$$

$$= 7\ Seconds.$$

Q.12

$$Conversion\ to\ Ksh;$$

$$5000 \times sh84.26 = sh421{,}300$$

$$Spent\ sh\ 289850.$$

$$Balance = sh421{,}300 - sh289{,}850$$

$$= sh131{,}450$$

$$Conversion\ back\ to\ Japanese\ yen$$

$$\frac{sh131{,}450}{65.45} = 2{,}008\ Japanese\ yen$$

Q. 13

$$Fees\ and\ farming = \frac{1}{2} + \frac{1}{8} = \frac{4+1}{8}$$

$$= \frac{5}{8}$$

$$Rem = \frac{3}{8}$$

$$Food = \frac{2}{3} \times \frac{3}{8} = \frac{1}{4}$$

$$Salary = sh3200 \times 4 = sh12{,}800$$

APPENDIX VIII: POST-TEST

1. Answer the following questions. Show your working.

Evaluate without using a calculator.

(4marks)

$$\frac{\left(-\frac{1}{2}\right) \div \left(\frac{2}{3}\right) of\ 8 - \left(-4\frac{1}{2}\right)}{\frac{3}{4} - \left(-2\frac{3}{4}\right) \div \frac{11}{8}}$$

2. Use tables of reciprocal and squares to evaluate, to 4 significant figures,

$$0.4346^2 + \frac{1}{27.46}$$ (4 marks)

3. Solve form in the equation below.

(4marks)

$3^{4(m+1)} + 3^{4m} = 243$

4. Given that x is an acute angle and sin $(x - 20)° = \cos(3x - 50)°$ find the value of x in degrees. (3 marks)

5. Use prime factorization method to find the GCD and LCM of 126, 84 and 441

(4 marks)

6. A business woman bought 300 oranges at Sh. 10 for every twelve oranges. Twelve of them got bad but she sold the remaining at Ksh. 20 for every 18 oranges. Calculate the percentage profit. (3 marks)

7. A solid block in the shape of a cylinder has a height of 14cm and weighs 22kg. If it is made of a material of density 5g/cm^3, find the diameter of the cylinder. Take $\pi = \frac{22}{7}$ (4mks)

8. The line $2y + 3x - 5 = 0$ meet another line L at point where $y = -2$, Find the equation of L in the form $y = mx + c$ if the two lines are perpendicular to each other. (4marks)

9. The angle of elevation of the top of a flag-post from point A is 40^o. A boy walked towards the flag post on a level ground. Calculate the distance he should walk so that the angle of elevation of the top of the flag-post becomes 60^o given that the height of the flag-post is 5.3m. (4mks)

10. Madam Beatrice used to buy a certain number of bottles of soda for her class during bashes for Ksh. 3000. However when the prices of each bottle of soda went up by Ksh.10 she had to add money for ten more bottles on top of their usual budget. Find

a) the price of a bottle of soda before the increase in price (3marks).

b) the number of students in Madam Beatrice's class given that each learner was entitled to two bottles of soda during the bash. (1 marks)

11. A truck left Nairobi at 8am for Nakuru at an average speed of 60km/h. At 9 am a bus left Nakuru for Nairobi at an average speed at 120km/h. How far from Nairobi did the vehicles meet if Nairobi is 160 km from Nakuru. (4 marks)

12.A Kenyan bank buys and sells foreign currencies at the exchange rates shown below.

Currency	Buying (Ksh)	Selling (Ksh)
1 Euro	147.56	148.00
1 US Dollar	94.22	94.50

A tourist arrived in Kenya with 11,255 Euros. He converted all the Euros to Kenyan Shillings at the bank. He spent Ksh 1,130,300.50 while in Kenya and converted the remaining Kenya Shillings into US Dollars at the bank. Find the amount in dollars that he received correct to 2 decimal places.

(4marks)

13. King'oo spends one-third of his salary on food, one quarter on rent, three fifths of the remainder on transport and saves the rest. If he spends Kshs.1800 on transport, find how much money he saves. (4mks)

APPENDIX IX: POST-TEST MARKING SCHEME

Q.1

$$\frac{\frac{-1}{2}\times\frac{3}{16}+\frac{9}{2}}{\frac{3}{4}+\left(\frac{11}{4}\times\frac{8}{11}\right)}$$

$$\frac{\frac{-3}{32}+\frac{9}{2}}{\frac{3}{4}+2}$$

$$\frac{-3+144}{32}\div\frac{3+8}{4}$$

$$\frac{141}{32}\times\frac{4}{11}=\frac{141}{88}$$

$$1\frac{53}{88}$$

Q.2

$$0.4346^2=(4.346\times10^{-1})^2$$

$$=18.888\times10^{-2}=0.18888$$

$$\frac{1}{27.46}=\frac{1}{2.746\times10^{1}}$$

$$=0.3658\times10^{-1}=0.03658$$

$$0.18888+0.03658=0.22546$$

$$0.2255$$

Q.3

$$3^{4(m+1)}+3^{4m}=3^5$$

$$4(m+1)+4m=5$$

$$4m+4+4m=5$$

$$8m=1$$

$$m=\frac{1}{8}$$

Q.4

$$Sin\ A=Cos\ B\ if\ A+B=90°$$

$$(x-20°)+(3x-50°)=90°$$

$$x-20°+3x-50°=90°$$

$$4x-70°=90°;\ 4x=160°$$

$$x=40°$$

Q.5

$$126=2\times3\times3\times7$$

$$84=2\times2\times3\times7$$

$$441=3\times3\times7\times7$$

$$GCD=3\times7$$

$$LCM=2\times2\times3\times3\times7\times7$$

$$=2^2\times3^2\times7^2$$

Q.6

$$Buying\ price$$

$$=\frac{300}{12}\times sh10=sh250$$

$$300-12=288\ oranges$$

$$Selling\ price=\frac{288\times sh20}{18}$$

$$=sh320$$

$$\%\ Profit=\frac{sh320-sh250}{sh250}\times100\%$$

$$=\frac{70}{250}\times100\%=28\%$$

Q.7

$$Volume = \frac{mass}{density}$$

$$= \frac{22 \times 1000g}{5g/cm^3} = 4400cm^3$$

$$4400cm^3 = \frac{22}{7} \times r^2 \times 14$$

$$4400 = 44r^2$$

$$r^2 = 100.\ r = 10cm$$

$$Diameter = 10cm \times 2 = 20cm$$

Q.8

$$2y = -3x + 5$$

$$y = \frac{-3}{2}x + \frac{5}{2}$$

$$Gradient = \frac{-3}{2} \quad G_1 \times G_2 = -1$$

$$G_{2=\frac{2}{3}}$$

$$\frac{y+2}{x+3} = \frac{2}{3}$$

$$3y + 6 = 2x + 6$$

$$3y = 2x;$$

$$y = \frac{2}{3}x$$

Q.9

$$Tan40° = \frac{5.3}{x}$$

$$x = \frac{5.3}{tan\ 40°} = 6.32cm$$

$$\tan 60° = \frac{5.3}{y}$$

$$y = \frac{5.3}{\tan 60°} = 3.06cm$$

$$6.32cm - 3.06cm$$

$$3.26cm$$

Q.10

$$\left(\frac{3000}{x} + 10\right)(x - 10) = 3000$$

$$x^2 - 10x - 3000 = 0$$

$$(x - 60)(x + 50) = 0$$

$$x = 60. No\ of\ people = 60.$$

$$price\ of\ soda = \frac{3000}{60} = sh50$$

$$sh50\ per\ bottle$$

Q.11

$$At\ 9am,$$

$$the\ truck\ had\ covered\ 1 \times 60km$$

$$= 60km$$

$$Distance\ between\ them$$

$$= 160km - 60km = 100km$$

$$Relative\ speed$$

$$= \frac{120km}{hr} - \frac{60km}{hr} = 60km/hr$$

$$Time \frac{Distance}{Speed} = \frac{100km}{60km/hr}$$

$$\frac{10}{6} = 1hr\ 40\ min$$

$$Distance = \frac{10}{6} \times 60 = 100km$$

Q.12

$$11{,}255 \times 148 = sh1{,}665{,}740$$

$$Spent\ sh\ 1{,}130{,}300.50$$

$$Balance = sh1665740$$

$$-\ 1130300.50$$

$$= sh535439.50$$

$$\frac{sh535{,}439.50}{94.5} = 5{,}666.026$$

$$5{,}666.03\ dollars$$

Q.13

$$Food\ and\ rent = \frac{1}{3} + \frac{1}{4} = \frac{7}{12}$$

$$Remainder = \frac{5}{12}$$

$$\frac{3}{5} \times \frac{5}{12} = \frac{1}{4}$$

$$\frac{1}{4}x = sh1{,}800$$

$$x = sh7{,}200.$$

$$Saving$$

$$= \frac{7}{12} + \frac{1}{4} = \frac{7+3}{12} = \frac{10}{12}$$

$$\frac{12}{12} - \frac{10}{12} = \frac{2}{12}$$

$$= \frac{2}{12} \times sh7200 = sh120$$

APPENDIX X:LESSON PLANS

LESSON 1

TOPIC: FRACTIONS

Subtopic: Simplifying fractions

Objectives: By the end of the lesson the learner should be able to simplify fractions using BODMAS

INTRODUCTION **5 MINUTES**

The teacher to lead the students to define a fraction and give examples of fractions Proper fractions, Improper fractions and Mixed fractions.

LESSON DEVELOPMENT **30 MINUTES**

a) The teacher to lead the class to simplify fractions involving more than one operation using BODMAS

b) Give examples and work out

Give a class exercise.

c) Marking.

CONCLUSION **5 MINUTES**

The teacher to summarizes the lesson and give assignment.

Self Evaluation

LESSON 2

TOPIC: SQUARES, SQUAREROOTS AND RECIPROCALS

Subtopic: Finding the squares

Objectives: By the end of the lesson the learner should be able to:

i. Find the square of numbers from square tables

INTRODUCTION **5 MINUTES**

The teacher introduces the lesson by asking learners to find the squares of numbers by multiplication.

LESSON DEVELOPMENT **30 MINUTES**

a) The teacher to illustrate to the learners how to find square of numbers from the square tables. These are numbers between 1 and 10.

b) The teacher to help the learners to find the squares of numbers less than 1 and greater than 10. First write the numbers in standard form.

c) Give a class exercise and mark.

CONCLUSION **5MINUTES**

Teacher summarizes the lesson and gives the assignments.

Self Evaluation

LESSON 3

TOPIC: SQUARES, SQUAREROOTS AND RECIPROCALS

Subtopic: Square roots from tables

Objectives: By the end of the lesson,the learners should be able to find the square root of numbers from the Square root tables.

INTRODUCTION **5MINUTES**

The teacher to review the previous lesson on square of numbers

LESSON DEVELOPMENT **30MINUTES**

a) The teacher to lead the learners in finding the square root of numbers from the table of square roots. Give examples.

b) Illustrate how to find square root of numbers less than 1 and greater than 10. First write the numbers in standard form.

c) Give a class exercise. Marking.

CONCLUSION **5MINUTES**

The teacher summarizes the lesson and gives the assignment.

LESSON 4

TOPIC: TRIGONOMETRIC RATIOS

Subtopic: Sine and Cosine of Acute angles

Objectives: By the end of the lesson, the learners should be able to relate and find the trigonometric ratios of acute angles.

INTRODUCTION **5MINUTES**

The teacher to define an acute angle. Ask learners to give examples.

LESSON DEVELOPMENT **30MINUTES**

a) The teacher to lead the learners in finding the Sine and Cosine of acute angles

b) Lead class to identify complementary angles from the trigonometric ratios.

c) Give a class exercise. Marking.

CONCLUSION **5MINUTES**

The teacher summarizes the lesson and gives the assignment.

LESSON 5

TOPIC: COMMERCIAL ARITHMETIC

Subtopic: Profit

Objectives: By the end of the lesson, the learners should be able to calculate profit.

INTRODUCTION **5MINUTES**

The teacher to ask students to define a profit

LESSON DEVELOPMENT **30MINUTES**

a) The teacher to lead the learners to calculate profit

b) Lead class to calculate percentage profit.

c) Give a class exercise. Marking

CONCLUSION **5MINUTES**

The teacher summarizes the lesson and gives the assignment.

LESSON 6

TOPIC: DENSITY, MASS AND VOLUME

Subtopic: Density, Mass and Volume

Objectives: By the end of the lesson, the learners should be able to relate and find density, mass and volume.

INTRODUCTION **5MINUTES**

The teacher to ask learners to define Mass and give units of mass

LESSON DEVELOPMENT **30MINUTES**

a) The teacher to lead the learners in find volume of an object

b) Lead class to find the density of an object given its mass and volume.

c) Give a class exercise. Marking.

CONCLUSION **5MINUTES**

The teacher summarizes the lesson and gives the assignment.

LESSON 7

TOPIC: EQUATION OF A STRAIGHT LINE

Subtopic: Parallel and Perpendicular lines

Objectives: By the end of the lesson, the learners should be able to find the equation of parallel and perpendicular lines.

INTRODUCTION **5MINUTES**

The teacher asks te learners to give the general equation of a straight line.

LESSON DEVELOPMENT **30MINUTES**

a) The teacher to lead the learners to find the equation of parallel lines given the gradient and a point. Parallel lines have the same gradient.

b) Lead class to find the equation of perpendicular lines given the gradient and a point. The product of gradients of perpendicular lines is equal to -1.

c) Give a class exercise. Marking.

CONCLUSION **5MINUTES**

The teacher summarizes the lesson and gives the assignment.

LESSON 8

TOPIC: FORMING EQUATIONS

Subtopic: Solving Equations

Objectives: By the end of the lesson, the learners should be able to form and solve equations.

INTRODUCTION **5MINUTES**

The teacher to read through a given statement and ask the learners to form an equation

LESSON DEVELOPMENT **30MINUTES**

a) The teacher to lead the learners in form and solve equations from given statements.

b) Lead class to solve the equations formed.

c) Give a class exercise. Marking.

CONCLUSION **5MINUTES**

The teacher summarizes the lesson and give the assignment**.**

LESSON 9

TOPIC: SPEED

Subtopic: Relative speed

Objectives: By the end of the lesson, the learners should be able find relative speed.

INTRODUCTION **5MINUTES**

The teacher to ask learners to illustrate how to find the speed of an object.

LESSON DEVELOPMENT **30MINUTES**

a) The teacher to lead the learners in finding relative speed when vehicles are coming from the same direction.

b) Lead class to find relative speed when vehicle are moving in the same direction.

c) Give a class exercise. Marking.

CONCLUSION **5MINUTES**

The teacher summarizes the lesson and give the assignment.

LESSON 10

TOPIC: COMMERCIAL ARITHMETIC

Subtopic: Foreign Exchange

Objectives: By the end of the lesson, the learners should be able to convert local and foreign currency.

INTRODUCTION **5MINUTES**

The teacher to define currency

LESSON DEVELOPMENT **30MINUTES**

a) The teacher to lead the learners to convert local currency to foreign currency and vice versa.

b) Give a class exercise. Marking

CONCLUSION **5MINUTES**

The teacher summarizes the lesson and gives the assignment.

APPENDIX XI: QUESTIONNAIRE

To what extent do you agree on the following statement regarding the role of language in Mathematics performance in Nakuru North Sub-County?

Key: 5: Strongly Agree; 4: Agree; 3: Undecided; 2: Disagree and 1: Strongly Disagree

No.	**Statement**	**5**	**4**	**3**	**2**	**1**
1	Mathematics vocabulary influence students performance in Mathematics					
2	Mathematical knowledge and understanding is important for day to day application					
3	Low performance in Mathematics can be attributed to lack of understanding of Mathematics vocabulary among students.					
4	Understanding abstract concepts and ideas in Mathematics is a challenge to students.					
5	The level of understanding mathematics language affect the level of communication of mathematic ideas					
6	Students have problems understanding and interrelating language and symbols used in mathematics					
7	Some words in mathematics confuse learners minds as they have different meaning in English					
8	Symbols make comprehension of mathematics difficult for students					
9	Mathematics textbooks should be in simple English that is understood by learners					

10	Teachers should pay close attention to mathematical vocabulary so that students are familiar with basic terms such as solve, simplify and factorize.					

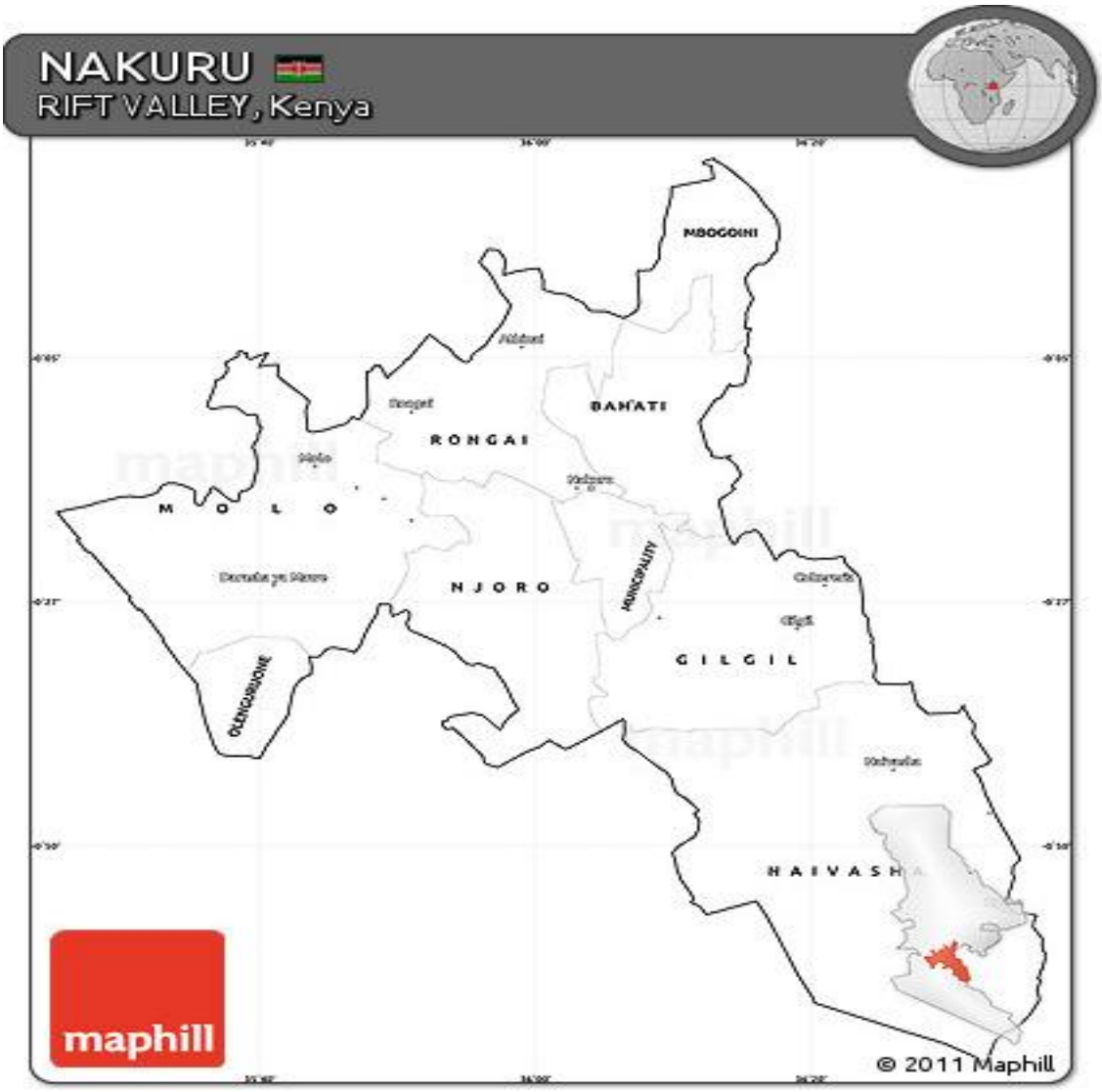
APPENDIX XII: LIST OF SCHOOLS IN NAKURU NORTH SUB-COUNTY

	SCHOOL	**CATEGORY**
1	MOI FORCES LANET	NATIONAL
2	BAHATI GIRS HIGH SCHOOL	EXTRA COUNTY
3	JOMO KENYATTA GIRLS	EXTRA COUNTY
4	JOMO KENYATTA BOYS	EXTRA COUNTY
5	BAHATI PCEA GIRLS SECONDARY SCHOOL	COUNTY
6	BAVUNI SECONDARY	SUB COUNTY
7	J.M KARIUKI MEMORIAL SECONDARY SCHOOL	SUB COUNTY
8	KIAMAINA SECONDARY SCHOOL	SUB-COUNTY
9	ST ANTONY ENGOSHURA	SUB COUNTY
10	RIGOGO	SUB COUNTY
11	RURII	SUB COUNTY
12	ST JOHNS BAHATI	SUB COUNTY
13	DUNDORI SECONDARY SCHOOL	SUB COUNTY
14	HEROES SECONDARY	SUB COUNTY
15	ST JOSEPH KIRIMA	SUB COUNTY
16	ST JOSEPH KARI LANET	SUB COUNTY
17	MURUNYU HIGH SCHOOL	SUB COUNTY
18	MWIRUTI	SUB COUNTY
19	MENENGAI HILL SECONDARY	SUB COUNTY
20	NDUNGIRI	SUB COUNTY
21	WANYORORO SECONDARY	SUB COUNTY
22	HESHIMA SECONDARY SCHOOL	SUB COUNTY

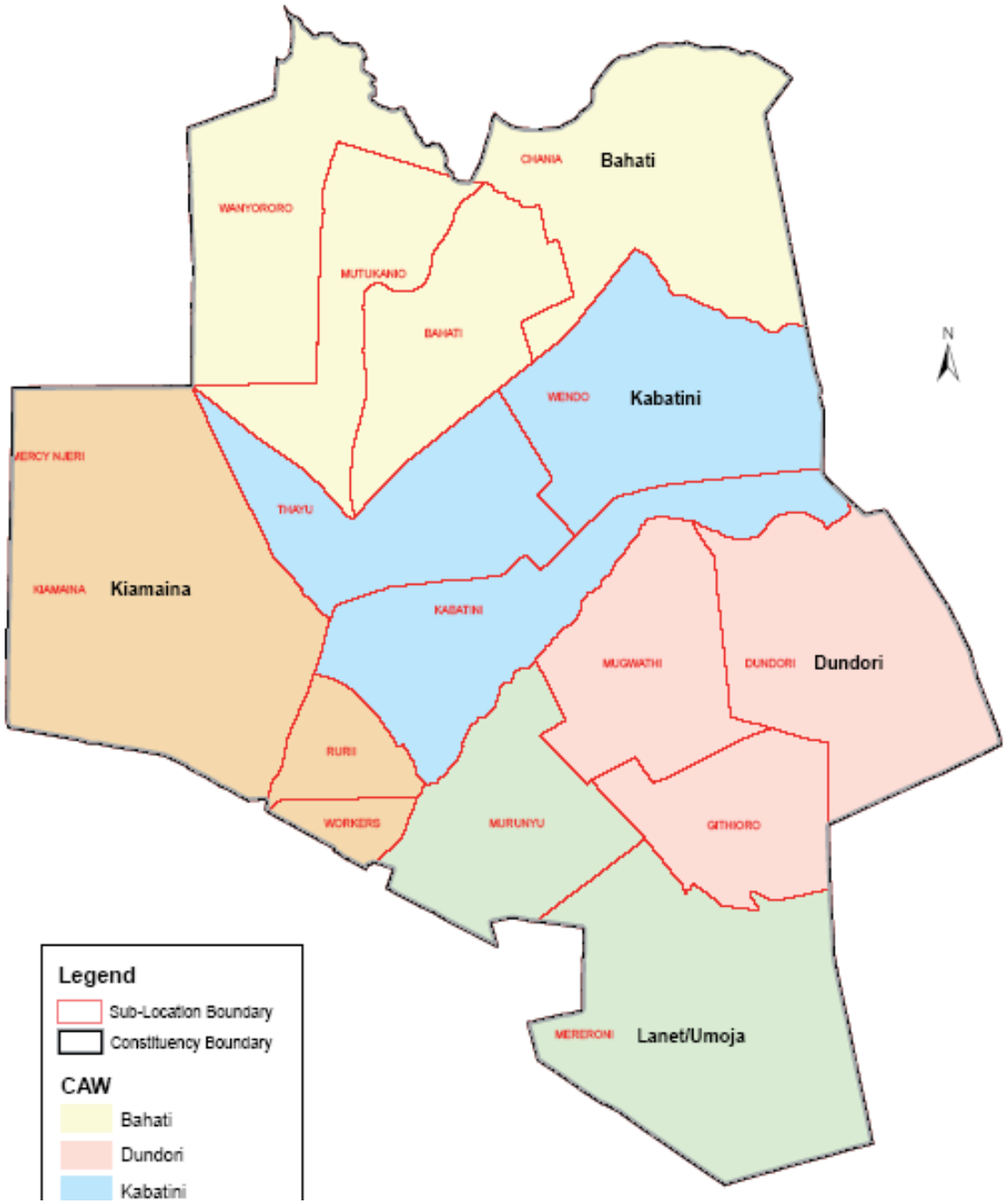
23	MIKEU SECONDARY SCHOOL	SUB COUNTY
24	KING DAVID	SUB COUNTY
25	ST MARKS ELDONIO	SUB COUNTY
26	BISHOP EDWARD DONOVAN	SUB COUNTY
27	MURUNGARU	SUB COUNTY
28	LIMUKO	SUB COUNTY
29	WORKERS HIGH SCHOOL	SUB COUNTY
30	ST FRANCIS BAHATI	SUB COUNTY
31	OLBONATA	SUB COUNTY
32	ST GERALD HIGH SCHOOL	SUB COUNTY
33	MILIMANI	SUB COUNTY
34	OUR LADY O FATIMA	SUB COUNTY
35	SOLAI BOYS	COUNTY

APPENDIX XIII: MAP OF KENYA SHOWING NAKURU COUNTY

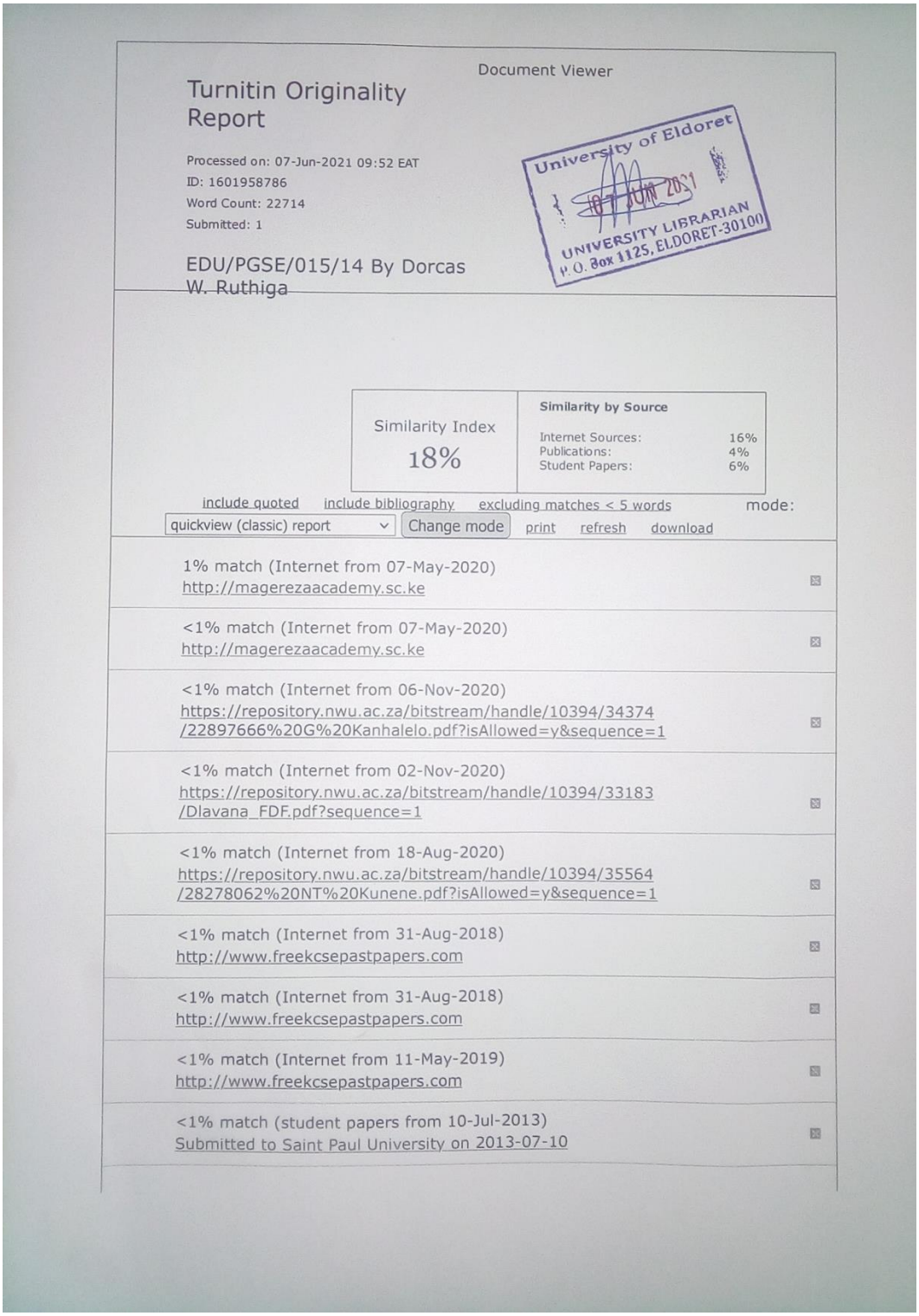
APPENDIX XIV: MAP SHOWING NAKURU COUNTY



APPENDIX XV: NAKURU- NORTH SUB-COUNTY MAP



APPENDIX XVI: SIMILARITY REPORT



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