AN INVESTIGATION INTO THE DETERMINANTS OF PERFORMANCE OF STUDENTS IN MATHEMATICS IN SELECTED SECONDARY SCHOOLS IN KINANGO DISTRICT, KENYA

BY

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A RESEARCH PROJECT REPORT SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF A POST GRADUATE DIPLOMA IN EDUCATION OF THE UNIVERSITY OF NAIROBI

2012

DECLARATION

I hereby declare that this research project is the result of my own original work and that no part has been presented for another dissertation in this university or elsewhere for the purpose of examination or otherwise.

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DEDICATION

The researcher, whole heartedly dedicates this entire work to his dear mum, Susan Kamula, without whose continued belief in him, this work might never have seen the light of the day and to her grandchildren Adam Kamula and Susan Kusunkwa Mwikali for their innocence.

ACKNOWLEDGEMENTS

The researcher wish to thank the following; the supervisor, Mr. Johnbosco Kisimbii, for the priceless intellectual input given, Mangawani secondary school interim Board of Governors and by extension education officers at Kwale District for the encouragement and patience, University of Nairobi for availing a platform, well-tested, respected and shared by great academic giants. The researcher would also wish to extend deep gratitude to Mr. Justus Makau, for sharing his academic experiences, his trust and above all for being among the finest human beings. Failure to mention the input into this study of Mr. George Kihoro, the principal Kinango secondary school, would be a great disservice to the entire work. Mr. Kihoro provided an entire package of stimulus necessary for the research, including one on one motivational talk, group advisory sessions, exposure to a staffroom with a considerable number of complete/ on going second degree programs, hardware/software facilities for internet research and typesetting/printing tasks. The list is endless, so thank you Mwalimu. My dear wife Cecilia Mkombozi, for the odd hours she had to put up with while this work was going on accept deepest gratitude. Least but not last, the researcher thanks brothers and sisters for their moral, spiritual and even material support. Finally much gratitude to Ms. Bintomar Said Mwatasa for odious task of typesetting and printing the original research proposal at Fadhili Enterprises Kwale

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ABREVIATIONS AND ACRONYMS

KCSE	Kenya Certificate of Secondary Education
DEO	District Education Officer
NCTM	National Council of Teachers of Mathematics
KDDP	Kinango District Development Plan
CDF	Constituency Development Fund
FPE	Free Primary Education
FSE	Free Secondary Education
O – LEVEL	Ordinary Level of Education

ABSTRACT.

Mathematics plays a central role development. In particular, technological development of a country depends heavily on availability of the appropriate technology in the human resource of the country. Educational technology has therefore been identified as an essential tool in the process of preparing the student for technological and industrial advancement. That is why, in 2002 in Kenya, where mathematics is compulsory in primary and secondary schools; educational technology was introduced in the form of the scientific calculator in the teaching and learning of the subject in secondary schools. This was intended to avoid wastage of time in solving mathematical problems and improving student's performance (Indoshi and Ochanda 2011). However the influence of the calculator on student's performance has not been fully established especially in the marginalized areas. The purpose of this study was to investigate the effect of the calculator on the student's performance in Kinango District. The study sought to determine whether there is an improvement in performance of the subject of mathematics when students used calculators. The researcher also identified other factors influencing performance of students in mathematical examinations. The study employed descriptive survey research design. The research was carried out in eight secondary schools in Kinango District. The schools were in existence before and after the introduction of calculators in the curriculum. The study population was the group of students who sat for their K.C.S.E examinations just before and after the introduction of the calculator.

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

One of the challenges facing the current generation is the achievement of academic excellence. A popular yardstick for academic excellence is academic performance. Answers.com defines academic performance as the ability to study and remember facts and being able to communicate your knowledge verbally or down on paper. But academic performance is a function of myriad factors including teaching and learning resources and materials, attitudes, teaching methods, discipline issues and certainly emerging technological trends among others.

The current technological revolution calls for its inclusion in achievement of even better results. One of the most applicable areas of technology in education is in the teaching and learning of mathematics. Electronic technologies are essential tools for teaching, learning and doing mathematics. Students can learn more with the appropriate use of technology, National council of Teachers of Mathematics, (NCTM, 2000).

The introduction of technology more or less coincided with advent of technological revolution more than three decades ago. This technology was basically in form of computers and calculators. And for almost as long research has been conducted to assess the effect of the calculator or computer on students learning. Starting in the late 1970's groups of studies were gathered and analyzed to determine the effect of calculator use in classrooms (Barion, 2010). For example Suydan (1976, 1980) located 75 studies from the late 1960's through the 1970's relating to the effect of calculator use on mathematics education (Barion, 2010). The studies addressed the areas of achievement in traditional instruction, achievement within special curriculum and student's attitude towards mathematics.

According to the paper by Barion, (2010) some of the studies yielded more than one finding prompting over 95 comparisons, 47 of whom no significant difference was found. The treatment group (with calculators) scored higher on test scores than the control group (no calculators) in 43 of the comparisons, while the control group scored higher than the treatment group in only five of the comparisons. Suydan findings suggest the use of calculator do not adversely affect student achievement and can actually result in higher achievement than with non calculator usage.

Further studies from Humbree and Dessert (1986) which dealt with over 70 studies with quantitative data comparing calculator-based instruction to traditional instruction found that average ability students who used calculators performed significantly better than the non calculator group in computation and problem solving. Smith (1996) also reviewed over 30 studies from 1984 to 1995 and found significantly higher achievement for students who used calculators for problem solving, computation and conceptual understanding compared to those who did not use calculators. Related studies such as those of Stick (1997), Rodiol (2000) and Acelajado (2001), among others, also share the same findings that students who used calculators in their mathematics class had better achievement and more favorable attitude to the subject than those who did not use calculator.

According to Ministry of Education Hand book on teachers proficiency course prepared by Directorate of Quality Assurance and Standards performance may be gauged by the following means; Value Added Progress, Measures of central tendency, uses of standard score and carrying item analysis.

At macroeconomic level Sessional Paper number 1 of 2005, (SP 1, 2005), notes that good performance in education and training sector contributes to national development through production of an appropriate human resource that help to spur productivity and eliminate poverty, disease and ignorance; the three enemies of development. But performance, especially in education is a function of myriad factors: economic, social and at times political. That is why after identifying the three enemies of development the government has consistently addressed challenges facing the education sector through Commissions, Committees, and Task Forces among others, (SP 1, 2005).

Okwatsa N.E. (2003) points out that the general mandate of these Commissions, Committees and Task Forces is to;

'Examine, Review, Determine, Identify and Recommend Objectives and Policies that would form the basis and guide the Development and Management of Education in Kenya'.

All these policy initiatives have focused on attainment of Education for All (EFA) and in particular, Universal Primary Education (UPE). Key indicator of the success of the initiatives is academic performance of the student. Mathematics is seen by society as the wheels and foundation of scientific and technological knowledge that is vital in social economic development of any nation (Mbugua, Muthomi, and Okere, 2011). As such, student's performance in mathematics is of great concern to education stake holders (KNEC 2001). At the university mathematics is used as filter of students into science and other related prestigious courses such as Medicine, Architecture and Engineering among Others (Eshiwani 1984).

Significance of mathematics notwithstanding, for the last ten years performance in National Examination indicates that National Examination Mean Grade for Mathematics has been E (Ouko 2004). A report from the KNEC Newsletter found out that the greatest challenge the learners face in the process of examination was time management. Candidates were not able to complete the mathematics papers within the allocated time. To address this problem there was need to introduce new technology in mathematics that could aid learners in time management in their examinations (Indoshi and Ochanda, 2011). Much of the technology commonly in use then including Visual Aids, Audio Aids and Audio-Visual Aids only solved the problem of concept understanding of facts but not aid in time management. The aspects of time management was initially addressed by the introduction of Slide Rules and Mathematical Tables, but were soon found not to give sufficient accuracy (KNEC 1981).

A new and sufficiently accurate technology was introduced in the syllabus implemented by Ministry of Education, Science and Technology (Republic of Kenya, 2002), in year 2002. The syllabus approved use of Scientific Calculators in mathematics in all Secondary Schools (Indoshi and Ochanda, 2011). According to Mbugua, Muthomi, and Okere (2011) calculators are powerful learning tools that allow students to experience the richness and value of mathematics by greatly reducing the need to execute Paper-And-Pencil Computations and Algebraic Manipulations. Since calculators were essentially introduced to solve the problem of time management in mathematics examinations, confirmation/proof of improved examination performance is central to the success of the calculator as a Teaching Aid.

1.1.1 Profile of Kinango District

Kinango District is one of the 13 Districts that constitute Coast Province. According to Kinango District Development Plan (KDDP) 2008-2012, of June 2009, the District is divided into 4 Administrative Divisions and 28 Sub Locations, and it falls within Kwale County. Major towns in the district include Kinango, Samburu, Mazeras, Taru and Mackinon Road.

The District has one topographical feature, the Nyika Plateau, also referred to as the Hinterland, which rises gradually from 180m to 300m above sea level. The region is underlain by basement rock system and overlain by poor soils hence has low agricultural potential. The main rivers are Marere and Mwaluganje which have been harnessed to provide domestic piped water to Kwale, Kinango and Mombasa towns. There is high potential for underground water which is mostly saline. The climate is Monsoon type, hot and dry from January to April while June to August is cold. The district experiences two rainy seasons. Short Rains in October to December while Long Rains in March/April to July. Total precipitation varies from 500mm to 600mm per annum in the hinterland. Average temperature ranges from 24.6^{0}c to 27.5^{0}c with Humidity of around 60%. The main economic activity in Kinango district is livestock rearing and commercial activities in urban centers. The district is sparsely populated with some pockets of very Low Density, (KDDP, 2008-2012).

According to data from Education office Kinango District, see Table 1.1, for the last five years, the eight selected schools have had a Mean Score of 3.6, which is much lower compared to Kwale District's mean score of 4.6 for the same period.

In year 2010 total of 26 out of a possible 818 students attained Quality Grades (C+ and above) in Mathematics. This was a drop of 1.78% when compared to 34 students out of 685 students who had similar qualification in the previous year. See Tables 1.2 and1.3.

In the two years, 2009 and 2010, out of a student population of 1503 only 5 students managed Grade 'A' in mathematics. In the same period 823 students scored Grade 'E' in mathematics.

In summary main challenges in Kinango District include High Poverty Levels, Harsh Geographical Conditions, High Rates of Unemployment, Human-Wild Life Conflict, Poor Infrastructure, Low Literacy Levels, High Population Growth, Unexploited Mineral

Resources, Environmental Degradation, Low Education Enrolment, inadequate Water Sources, Inadequate and Unreliable Electricity. Other Challenges include inadequate Critical Facilities/Services such as Judicial Services, Information Communication Technology (ICT) Infrastructure. A number of cross Cutting Challenges are also prevalent; HIV/AIDS, Lack of Disaster Management System. (KDDP, 2008-2012)

Table 1.1: *Mean scores of KCSE examination, year and entry (Ent) of student*

	Sch	**Ent**	**2007**	**Ent**	**2008**	**Ent**	**2009**	**Ent**	**2010**	**Ent**	**2011**
1	**KNG**	92	5.293	98	3.979	124	3.590	131	3.588	195	3.385
2	**NDV**	47	3.530	48	3.530	44	2.818	---	3.000	44	2.841
3	**SMB**	77	4.831	95	4.221	100	4.720	95	4.537	96	4.417
4	**MVB**	94	2.780	105	2.415	127	2.790	140	3.142	157	3.764
5	**MZ,B**	54	5.210	73	4.217	64	4.076	93	4.613	160	3.481
6	**MZ,G**	63	3.694	63	2.617	55	2.745	---	2.679	149	2.866
7	**TRU**	81	4.821	90	3.371	115	3.521	111	4.252	115	4.209
8	**MNZ**	31	2.700	66	2.864	56	3.035	76	3.487	101	3.851
MS/ TTL		544	4.1	638	3.1	685	3.4		3.7	1017	3.6

Source: District Education Office, Kinango, 2012.

Key: Ent – Entry, Sch – School, KNG – Kinango, NDV – Ndavaya, SMB – Samburu, MVB – Mwavumbo, MZ,B – Mazeras Boys, MZ,B – Mazeras Girls, TRU – Taru, MNZ – Mnyenzeni secondary schools.

Table1.2: *KCSE Mathematics analysis for 2010*

	ENT	A	A-	B+	B	B-	C+	C	C-	D+	D	D-	E	MS
SMB	95	2	1	1	3	1	1	1	9	3	17	24	32	2.96
MZ,B	93	0	0	0	1	1	4	4	4	5	6	24	46	2.15
TRU	111	0	0	0	3	1	2	2	8	5	13	29	47	2.50
KNG	131	0	0	0	0	0	3	3	6	6	15	22	67	1.82
MVB	140	0	0	0	0	0	3	3	2	2	16	29	86	1.75
MZ,G	78	0	0	0	0	0	0	0	0	0	3	11	64	1.22
MNZ	76	0	0	0	0	0	1	1	2	3	11	25	33	1.99
NDV	38	0	0	0	1	0	0	0	1	1	0	5	30	1.53
MK,N	55	0	0	0	0	0	2	1	1	0	3	11	36	1.47
TTL	818	2	1	5	8	3	7	15	33	25	84	180	441	1.93

Source: District Education Office, Kinango (2012)

Table 1.3: *KCSE Mathematics analysis for 2009*

	ENT	A	A-	B+	B	B-	C+	C	C-	D+	D	D-	E	MS
SMB	100	2	1	1	3	5	4	5	6	11	14	20	28	3.54
MZ,B	64	1	0	0	0	2	0	2	3	3	11	11	31	2.40
KNG	124	0	0	0	0	4	2	4	4	2	18	30	59	2.21
TRU	115	0	0	0	0	1	2	1	3	2	11	29	66	1.81
MVB	127	0	0	0	0	1	3	0	2	1	14	26	79	1.79
MNZ	56	0	0	0	0	0	2	0	0	2	4	12	36	1.68
NDV	44	0	0	0	0	0	0	0	0	2	1	4	37	1.27
MZ,G	55	0	0	0	0	0	0	0	0	0	4	5	46	1.24
TTL/MS	685	3	1	1	3	13	13	12	17	23	67	137	382	1.99

Source: *District Education Office, Kinango (2012)*

1.2 Statement of the Problem

Ouko (2004), Adada (2005) and Kituku (2004) have all noted that National Examination Mean Grade for Mathematics has been E for the last ten years. This poor performance is also reflected at the local level though not as bad. According to data from Education Office, Kinango District, The District recorded a Mean Score of 3.56 for the Years 2007 to 2011in KCSE Examination.

All Schools analyzed in the District have not collectively registered a score higher than they collectively registered in 2007 when they had a Mean Score of 4.1, this is despite a 46.7% increase in Enrolment from 544 Students to 1017 in 2011. Kwale District, whose Student Enrolment Surpassed Kinango's by 62.37%, outperformed Kinango District In 2011 KCSE achieving a Mean Grade of C-.

Percentage of overall Quality Mean Grades, (C+ and above), in the district for boys, though low, stood at 9.83% in the year 2010. This was at least four times better than girl's percentage which was 2.15% in the same period. In Mathematics, Quality Grades, as low as they were in 2009, still managed to drop further from 5.11% to 3.18% in 2010. In the same period the number of students scoring D- and below was steady at 76%.

This Poor Performance in Mathematics has been attributed to many factors ranging from inadequate Teaching-Learning Resources/ Materials, To Negative Attitudes towards School, the Subject and the Subject Teacher, (Mbugua, Muthomi And Okere 2011).

Recently there has been revolution of technological advancement like use of calculator in teaching and learning of mathematics in secondary schools, (Mbugua, Muthomi and Okere 2011). The influence of calculator on student's performance had not been fully investigated, especially in Kinango District. Hence this study investigated, among other factors, the influence of calculators on student's performance in KCSE in selected schools in Kinango District.

1.3 Purpose of the Study

The purpose of this study was to determine the factors influencing the performance of students in mathematics exams.

1.4 Objectives of the Study

The study had following objectives:

1. To determine whether the use of calculators influence the performance of students in mathematics.

2. To examine whether the attitude of learners towards mathematics influence the performance of students in mathematics.

3. To assess whether the availability of teaching and learning resources influence the performance of students in mathematics.

4. To ascertain whether teaching methods influence the performance of students in mathematics.

1.5 Research Questions

1. Does the use of calculator in teaching and learning of mathematics influence performance in the subject?

2. Does the availability of teaching and learning resources influence performance of students in mathematics?

3. Does the attitude of learners towards mathematics influence the performance of students in mathematics?

4 Does different methods of teaching mathematics influence the performance of students in the subject?

1.6 Research Hypothesis

H_O: There is no significant relationship between the use of calculator and learner's performance in mathematics.

H_1: There is a significant relationship between the use of calculator and learners performance in mathematics.

1.7 Significance of the study

If this study is accomplished it will significantly be beneficial to a number of people;

To Students: since performance is better they have proven the advantage they have over those who never used a calculator in Secondary Schools and hence strive to obtain and fervently use the calculator for maximum benefits, especially in one of the core and compulsory subjects in Kenyan Secondary School Curricular; Mathematics.

To Teachers: They certainly experienced an overwhelming sense of relief since the calculator was proved to have positively influenced the students performance in a subject who's results have perennially been below everybody's expectation.

To Education Officials And Policy Makers: They are expected encourage Optimum Use of the Calculators and hopefully entrench them deeper into the Education System, in particular, targeting Upper Kenyan Primary School Students.

To Parents: They have realized the usefulness of calculators as one of the motivating factors in their sons and daughters education and will thus endeavor to supply their children with the appropriate calculators for their studies.

To the Community at Large: They are expected to enjoy the skills and experiences of confident people who harbor no phobia for electronic gadgets as they were introduced early in their studies.

To Technologically Conscious 21st Century: Overall performance in mathematics and other sciences will significantly improve and hopefully cease to be among the most dreaded subjects hence more science-oriented learners will graduate from schools into the techno world.

1.8 Scope of the Study

The study was carried out in Kinango District of Kwale county, Coast region. The researcher sought performance data for all the eight Secondary Schools in existence during the calculator switch-over period (years 2004, 2005, 2007 and 2009) so as to establish any effect due to use of calculator in mathematics. To determine the effect of other factors on performance of students in mathematics, the Researcher used Questionnaires to collect Data from five (representing over 30% of total number schools in Kinango District) randomly selected schools.

1.9 Limitations of the Study

1.9.1 Financial Constrain

As in many other studies, scarcity of funds was an obvious impediment while carrying out the research. To cut down on cost, the researcher personally visited the DEO's offices in Kinango and Kwale Districts to obtain the performance data. The researcher also had to make trips the selected schools to administer the questionnaires personally.

1.9.2 Time Constrain

The researcher having wasted a considerable amount of time while waiting for opportune moment to continue with the study could not afford to fall a victim of time wastage and there fore was acutely aware the fast receding time lines he had personally set.

1.10 Definition of Significant Terms

Unless otherwise specifically stated the terms enumerated will have the meaning specified below in the study;

Calculator: A Scientific Calculator of the Model Casio Fx 82-ms

Student: An individual admitted in a Secondary School for the Purpose of attaining Ordinary – Level Educational Qualification.

Performance: Ability to study and remember facts and being able to communicate the knowledge verbally or down on paper. In this study a student will be said to have performed when he/she attains a score of 40%, (C-), and above. See table. 1.4.

Table 1.4 *Table showing percentages (%), grade and corresponding points.*

%	0-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75-100
Grade	E	D-	D	D+	C-	C	C+	B-	B	B+	A-	A
Points	1	2	3	4	5	6	7	8	9	10	11	12

1.11 Organization of the Study

This study consists of chapter one to five. Preliminary pages consist of Declaration, Dedication, Acknowledgements, Table of Contents, List of Figures, Acronyms and Abbreviations and Abstract. The Appendices are listed at the end of the Documents and include the Relevant Authorities given for the Study to be conducted and Questionnaires used for Data Collection.

Chapter one consists of the Background to the Study, Statement of The Problem, Purpose and Objectives of the Study based on four identified Independent Variables. The Chapter also contains Research Questions, Research Hypothesis, Significance of the Study, Scope and Limitation of the Study. The chapter concludes with Definition of Significant Terms.

Chapter two reviews literature related to factors affecting performance of students in Mathematics examinations. The review is done Internationally, Nationally and Locally within Kinango District.

The Research Methodology used in the Study is covered in Chapter Three. In particular the Chapter outlines the Research Design, Target Population, Sample Size and Sampling Procedure used in the Study. Data Collection Methods and Procedure is also covered. The Chapter deals with issues of Reliability and Validity of Data Collection Instruments, Ethical Consideration and Concludes with Data Analysis Technique.

Data Analysis, Presentation and Interpretation are covered in Chapter Four. The findings are presented according to the Objectives outlined in Chapter One.

Chapter Five presents a Summary of the Findings, Conclusions and Recommendations. The Chapter also suggests areas for Further Research.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

A thorough Literature Study is an indispensable component of all research, Kriel, (2009). It familiarizes the researcher with both researches which has already been done in his field as well as with current research, (Kriel, 2009). He goes on to suggest that a Literature Study makes the researcher aware of what the current train of thought is, as well as the focus of existing and acceptable thought regarding a specific topic. Literature helps the reviewer demarcate the boundaries of his research theme. When doing this, he finds ideas for his own research theme and for possibly processing his data.

In this study the researcher gave the international, national and local perspectives of performance in mathematics. In doing so, the researcher highlighted several factors which influence performance in mathematics. In particular the study brought out clearly the link between performance and availability of the scientific calculator.

Other factors which influence performance in mathematics were also addressed. Such factors included; attitudes and believes of students and sometimes teachers, towards the subject of mathematics, towards the calculator, towards subject teachers of mathematics. The issue of availability of teaching and learning resources including textbooks, qualified teachers, syllabus coverage, resource persons, and well equipped classrooms was also discussed. Conceptual framework, a research tool (Guba and Lincoln, 1989), defined as a set of broad ideas and principles taken from relevant fields of enquiry and used to structure a subsequent presentation (Reichel and Ramsey, 1987) was also included as part of this chapter.

2.2 International Perspective

2.2.1 The Use of Calculator and Performance in Mathematics

In Curriculum and Evaluation Standards for school mathematics (1989) and principles and standards for school mathematics (2000), the National council of Teachers of Mathematics (NCTM) stated;

Integrating calculators and computers into school mathematics programs is critical in meeting the goals of a redefined curriculum,

All students will have a calculator with functions consistent with the tasks envisioned in this curriculum,

Scientific calculators with graphing capabilities will be available to all students at all times,

Technology is an essential tool for teaching and learning math. It influences mathematical content as well as the way teachers teach mathematics,

Technology enhances student learning,

The council, founded in 1920 and with close to 100000 members in USA and Canada (WIKIPEDIA the Free Encyclopedia), has long advocated the use of calculators at all levels of mathematics instruction, as indicated by the position statements above. After nearly three decades of availability, calculators have gained a foothold in classrooms across the country (Futch& Stephens, 1997; Porter, 1991; Spath, 1990; Tan, 1995). Spurred by recommendations of national organizations like NCTM, by increased acceptance on standardized tests such as the SAT and AP Calculus exams, and by issues of price, portability, and ease of use, hand-held devices are now more prevalent than other forms of technology in mathematics education. A recent study by Burke (1996) indicates the difference: 19% of Alabama secondary teachers surveyed use microcomputers in mathematics instruction while 83% use calculators. Despite the prevalence of calculators, however, their role in mathematics instruction has not reached the level of NCTM's goals stated above.

Research provides strong empirical evidence to support the *Standards* view that hand-held technology can and should play an important role in mathematics instruction (Dunham & Dick, 1994; Heid, 1997; Hembree & Dessart, 1986, 1992; Smith, 1997). Why, then, have calculators yet to reach their full potential in education? Studies point to a host of reasons: shortages of calculators and curricular materials, lack of training and in-service opportunities, little planning time, few incentives, and limited administrative support (Hope, 1997; Johnson, 1991; Porter, 1991; Schmidt & Callaghan, 1992; Spath, 1990). Such lists beg the question, though. Why haven't teachers and parents, with research results and national recommendations in hand, demanded that school districts correct the deficiencies? Part of the answer is that parents and classroom teachers often are not aware of research supporting the benefits of calculator-based instruction (Fine &Fleener, 1994); but the most important reason is that a complex web of beliefs about the nature of mathematics and the goals of mathematics education works against the full inclusion of technology (Fleener, 1995; Graber, 1993; Schmidt & Callaghan, 1992; Terranova, 1990). Teacher fears that students will lose computational skills and use calculators as crutches, and not master basic concepts, play an important role in limiting calculator usage (Payne, 1996; Simonsen & Dick, 1997; Smith, 1996; Zand & Crowe, 1997), despite evidence to the contrary.

A number of studies, however, Army (1991) and Tolias (1993), found that the use of this instructional tool did not make any significant difference in the mathematical performance of the experimental and control groups. A persistent theme in surveys of teachers', parents', and students' attitudes is the fear that calculator use will adversely affect computational skills (Fleener, 1995; Futch& Stephens, 1997; Johnson, 1991; Payne, 1996; Schmidt & Callaghan, 1992; Simonsen& Dick, 1997; Smith, 1996; Zand& Crowe, 1997). Yet, the research evidence is to the contrary. Students who learn paper-and-pencil skills in conjunction with technology-based instruction (from simple four-function calculators to the most sophisticated CAS software) and are tested *without* calculators perform as well or better than students who do not use technology in instruction (Heid, 1997; Hollar, 1997; Kinney, 1997; Liu, 1994; Wilkins, 1995). A number of teachers believe that calculators should be withheld until students have mastered basic skills (Fleener, 1995; Johnson, 1991; Spiker, 1991), despite evidence that concept learning can take place before skills are mastered or even taught (Heid, 1988, 1997). Research indicates that teachers' beliefs about mathematics affect their beliefs about calculator use (Simmt, 1995); those who support "mastery first" often view mathematics merely as computation rather than a process for patterning, reasoning, and problem-solving (Fleener, 1994, 1995). Teachers with a rule-based view of mathematics are more likely to believe that calculators will hinder rather than enhance learning (Futch& Stephens, 1997; Tharp *et al.*, 1997).

Although research supports the claim that calculator use improves student performance in computation, concept development, and problem-solving (Giamati 1991), (Day 1996) (Green 1999), (Kissane 1999), (Almaqdadi 1997) (Rodil 2000), (Acelajado 2000), a growing number of studies show that there may be a class of errors and misconceptions that are induced by calculators. Tuska (1993) identifies eight types of errors made by students using graphing calculators, such as considering every number as rational, assuming "solve" means "find zeros," and thinking of the domain as a subset of the range. Students' difficulties with scale (Goldenberg, 1988) are compounded by the different type of scale required when using different window settings on graphing calculators (Dunham & Osborne, 1991). Recent studies mention continued difficulties with scaling and with domain and range concepts (Adams, 1994; Kaplan & Herrera, 1995; Ward, 1997; Wilson and Krapfl, 1994); however, a solution is suggested by Steele (1995) who reports that adding units on scale issues in the curriculum can alleviate scale misconceptions for calculator users.

As the body of research on hand-held technology grows, we begin to see clusters of studies pointing to positive benefits for groups of students who traditionally do less well than the general population. In effect, calculators level the playing field (Dunham, 1995) so that the special groups perform as well or better than the main group. The "leveling" effect of calculator use is evident for a variety of groups traditionally disadvantaged because of different cognitive styles, learning disabilities, or special circumstances. Studies show that calculator use benefits non-visualizers (Galindo-Morales, 1995), low-ability and at-risk students (Ferraro, 1997; Hembree & Dessart, 1986, 1992; Owens, 1995); non-traditional college students (Austin, 1997; Zand & Crowe, 1997), students with learning disabilities (Glover, 1992), and those with low mathematical confidence (Dunham, 1995). One cluster of studies indicates gender differences in the effects of using calculators; there is evidence that with calculators female students perform as well as or better than males (Dunham, 1995). That is, in some instances, women and girls made greater gains with calculators than males did, and females who performed at lower levels than males without calculators reversed the pattern when calculators were in use (Austin, 1997; Bitter & Hatfield, 1993; Bosche, 1998; Nimmons, 1998; Ruthven, 1990; Jones & Boers, 1993; Wilkins, 1995). Christmann and Badgett (1997) report that, in a study of statistics achievement, males outperform females using computers, but the pattern reverses in favor of females when calculators are used. Explanatory factors may include reduction of anxiety and increased confidence for female students (Bitter & Hatfield, 1993; Dunham, 1995; Ruthven, 1990). Some studies show improvement in spatial visualization skills when instruction is calculator-based (Nimmons, 1998; Shoaf-Grubbs, 1993; Vazquez, 1991), and spatial ability is sometimes a significant predictor for mathematics achievement in women.

2.2.2 The Influence of Attitude on Performance in Mathematics

Most of the studies mentioned in this article have been descriptive, telling us *what* happens when calculators are in use. For research to effectively guide curriculum development and instruction there is need to find out *why* calculators make a difference. As Bright and Williams (1994) note, there is use for more true educational research that attempts to explain relationships among variables, as opposed to evaluative studies which only evaluate the use and success of calculators. There is need for studies that document the way calculators are used by individual students, studies that identifies users of calculators; how often and when are they used and on what kinds of tasks; whether there are ethnic, gender, or social differences in calculator uses, and whether calculators evoke different effects among these various groups. Chief among such effects is attitude.

The encyclopedia Americana volume 2, 1985 defines attitude as 'a predisposition to respond in a certain way to a person, object, situation, and event or idea'. The encyclopedia goes further to assert that the response may come without conscious reflection, and a person normally reacts to his/her conception of that thing rather than to its actual state. Attitude is differentiated from mood as attitude is more permanent and enduring than mood. Although attitude are closely related opinions a subtle distinction is made in that a person can state his/her opinions in words but may not be able to express his/her attitudes in the same way. This is done by actions and only indirectly by contents of the statements made.

According to the encyclopedia Americana volume 2, attitudes are formed as a result of some kind of learning experience. These experiences can be in homes, schools, churches, media and so on. Thus attitudes can influence the way one behaves in certain situations. Psychologists and sociologist are concerned with how attitudes develop, how they affect behaviors and how they can be changed, Encyclopedia Americana vol. One way attitudes may be studied is by use of measuring scales developed by social scientist. In some of these scales a respondent is required to read a number of statements ranging from strongly favorable to strongly unfavorable about a topic. The respondent then picks a statement he most fully agrees with. For example a scale to assess attitudes about calculators might include statements ranging from 'all students should have calculators' to 'all calculators should be abolished'

Attitude is identified by Stuart, 2000, as one of the non-cognitive factors affecting performance. He asserts that the motivation to learn and perform better in mathematics is affected by several factors including the learning procedure, the instructional materials technology used and a number of non-cognitive factors such as attitudes and anxiety. He asserted that innovations in the methods of teaching and use of teaching aids may improve student's feelings of success and may help them develop confidence in mathematics. Bert, (1978) and Tobias, (1980) asserted that most student feel anxious and tense when manipulating numbers and solving mathematical problems. Mathematical anxiety is a psychological state engendered when a student experiences or expects to loose self esteem in confronting a mathematical situation. It has been found that negative feelings and attitudes towards mathematics intruded on the development of formal reasoning.

Ward (1989), and Trichett (1997), emphasized that there times when anxiety caused excitement, energy, more creativity, more creativity, more productive thinking, more expansive original solutions, higher performance in particular intellectual tasks. However, too much anxiety, limits constricts and paralyses one's mind, interfering with new learning and performance in school. Sundarajan, (1995), asserted that extremely high uncontrolled anxiety levels affect student's ability to perform in school, resulting in poor academic progress and high drop out rates.

Some teaching approaches and anxiety reduction programs that have been tried to reduce mathematical anxiety are group counseling and behavior modification procedures by Crouch, (1971) integration strategy by Hendel and Davis (1978), use of calculators by Martin (1980), rational emotive therapy by Puerto (1980), and co-operative learning approach by Macatangay (1999).

2.3 National Perspective

2.3.1 Impact of Educational Technology on National Economy

Vision 2030 places education and training ahead of all other social indicators including Health, Water and Sanitation, Youth Sports and Culture, Equity and Poverty Reduction among others. The implementation tool towards the building of a just and cohesive society is, according to the vision, an all round adoption of Science, Technology and Innovation (ST&I). The recently appointed task force on education, while presenting its report, also notes in its opening statement;

'Vision 2030 singles out education and training as the vehicle that will drive Kenya into becoming a middle-income economy.' (Daily Nation, March 30, 2012)

The importance of education, and in particular, educational technology, cannot be over emphasized. According to Mbugua, Muthomi and Okere (2011), mathematics is a crucial skill in the information age. Further, maintenance of economic leadership is a function of improved mathematics performance. While technology advances at high speed, a poor mathematics performance in school shortchanges the student's future and endangers prosperity and security (Mbugua, Muthomi and Okere 2011).

2.3.2 The Influence of Calculators on Performance of Students in Mathematics

As noted earlier, calculator has been identified as part of the new technology introduced into the teaching and learning process of mathematics. The integration of the calculator was expected to impact positively on the teaching and learning process by reducing drudgery of applying arithmetic and algebraic procedures and improving manipulative skills (Indoshi and Ochanda 2011). In their study which sought the benefits from the use calculator in mathematics Indohi and Ochanda (2011) found that calculators have great potential as instructional aids for the development of mathematics concepts and understanding especially when the learners are proficient in their use. Specifically, Indohi and Ochanda (2011) noted that learners were able increase the volume of calculations in a given time because calculators make computation faster.

Whereas study by Indoshi and Ochanda (2011) looked at the challenges and benefits of using scientific calculators in the learning and teaching of mathematics in secondary schools in Emuhaya District, this study looked at factors influencing the performance of students in mathematics and specifically whether the calculator causes improved examination performance.

As in Indoshi and Ochanda (2011) who used questionnaires and interview schedule in collecting data for their study, this study used similar instruments on selected schools in Kinango District as well as employing document analysis. A further comparison between the two studies is the group of students used in each case. Indoshi and Ochanda (2011) use form four students drawn 24 secondary schools in Emuhaya District, this study used data of all students who have already sat for their K.C.S.E exams in 8 selected secondary schools in Kinango District during the transition period, for document analysis.

2.3.3 The Influence of Different Attitudes on Performance of Students in Mathematics

Farrant (1980) notes that educational change, whether caused by curriculum development, increased investment or adoption of innovative practices, almost always places the teacher in some new role. The adoption of the calculator in the teaching and learning process of mathematics compels the teacher to assume new roles. These include assisting the student to learn how to use the calculator, as well as instilling the right attitude in the student towards the calculator among others, for the student to achieve the expected results; improved performance. But a study by Ouko (2004) on teacher's attitude towards teaching and learning of mathematics in secondary schools in Kisumu District established that teachers had negative attitude towards teaching mathematics and science.

Otieno Alego (1988), while discussing importance of instructional materials in teaching and specifically the use of calculator in mathematics class acknowledges that technological advances have resulted in process of such aids like calculators and pocket computers being readily available to aid in problem solving situation. He goes on to declare rightly 'in developing countries such as Kenya *these electronic aids* (italics mine) are not readily accessible to our pupils'. The inaccessibility notwithstanding, he further drowns any hopes harbored by ambitious pupil by pointing out the real issue bedeviling the embracement of technology in Kenyan classrooms. He says even if the calculators were readily accessible locally, they will have to contend with the major battle that has always raged among mathematics teachers; whether such computational aids should be allowed within our classes.

The mindset attitude which greets new technology, however promising, is its greatest threat. Most people would rather retain the status quo than chart a new course in unknown waters. This is demonstrated by Otieno Alego (1988), who after agreeing that the calculator opens up possibility of pupils tackling more ambitious problems than they could using traditional methods, notes rather uncollaboratively that children who are exposed to the use of calculators sometimes ends up demonstrating very low competence in computation'. He concludes by discouraging the use of calculators until pupils have built a strong foundation in mathematics leaning.

Atieno Alego's sentiments might be compared to the findings of a study done by Indoshi F. C and Ochanda J.P (2011), who found that 65.47% of the respondents were unable to use calculators effectively. This was attributed to failure by learners to access calculators during the teaching and learning process, leading to lack of hands-on training opportunities. The study found that this was caused by teacher's level of preparedness. This concurs with a study by Kituku (2004), on lesson planning by teachers in secondary schools. The study found out that lack of teacher's preparedness leads to ineffective content delivery, which may in turn lead to in-effective teaching and learning process.

Above study contradicts the one by Mbugua, Muthomi and Okere (2011), which notes that the availability of calculators motivates the students to do more computations in less time. Such students are bound to have a positive attitude towards a calculator which increases the chances of achieving a higher score in mathematics. Consequently their teachers are likely to have a positive attitude to, not only the calculator but by extension, the teaching and learning of mathematics and science. The study by Ouko (2004) although related to the one by

Mbugua, Muthomi and Okere (2011), used systematic random sampling in determining the study sample of teachers where as by Mbugua, Muthomi and Okere (2011) used a combination of simple random sampling and saturated sampling to select students and teachers respectively. This study also employed saturated sampling as well as simple random sampling to obtain study population.

2.3.4 Impact of Teaching and Learning Resources on Performance of Students in Mathematics

A baseline survey by SMASSE (1998) revealed that lack of enough teaching and learning resources like laboratories and text books made it difficult for the teacher to complete the syllabus on time and for those who did, students were not well prepared in knowledge and creativity. This meant that learners could not perform in the National examinations. The study is relevant in that it looked at accessibility to various learning resources by the learners, while this study looked at specifically the effect of one teaching aid, the calculator, on the student's performance in national examinations.

Technology is recognized as an essential component of the instructional process; consequently the advent of calculator technology has influenced the teaching and learning in a profound way (Dunham and Dick1994; Demana and Waits, 1990; Fey and Good, 1985). Ambuka (2008) agrees and notes that greater benefits can be achieved from the use of multimedia approach to learning since all the senses are involved. Ambuka further notes that these teaching and learning resources and their advantages in classroom instruction have necessitated the integration of such media in the teaching and learning process. Where as study by Ambuka (2008) looked at selection and use of media in teaching and learning of

Kiswahili in secondary schools in Emuhaya District, this study looked at the influence of the availability various determinants of performance of students in mathematics.

2.3.5 The Influence of Different Teaching Methods on Student's Performance in Mathematics

According to Secondary Mathematics Form One Teacher's Guide, 3rd edition, 2008, (SM, TG, 2008), there are several factors which govern the choice of the appropriate method of teaching mathematics. Some of these factors include; teacher, topic to be covered, age of student, aptitude of learners, the size of the class and facilities available. The most common methods of teaching Mathematics are lecture method, discussion method, class activity, class experiment and project work.

Lecture method is a teaching method in which the teacher talks in pre-planned structured schemes, expecting the student to listen and write relevant notes, (SM, TG, 2008). This method is appropriate when introducing a topic/subtopic, and when summarizing/synthesizing important information. When applying the method, the teacher is to consider; the simplicity and precision of the language used, the appropriateness of the content being taught and the instructional objectives to be achieved.

Discussions are verbal interactions between learners on a given topic with teacher acting as facilitator, Ministry of Education Secondary Geography Teacher's Handbook, 2006, (MoE, SG TH, 2006). Discussion is a purposeful conversation proceeding towards a certain goal, (SM, TG, 2008). For this method to be effective, the students and teacher need sufficient information to know what they are talking about and facts to base their arguments on. This is to facilitate the learners to ask/answer questions and the teacher to clear areas of disagreements, so as to achieve the particular objectives the discussion was set to achieve, (SM, TG, 2008).

In class activities, learners are supposed to work individually or in groups where student is given a chance to handle the apparatus and take data, (SM, TG, 2008). Just as in afore - mentioned methods class activities are aimed at achieving certain specific objectives through the availability of full activity details and apparatus. The teacher is also supposed to furnish the leaner with specific time to operate and precautions to take during the activity.

2.4 Local Perspective – Kinango District

Kinango became a district in 2008 after being curved from the larger Kwale District. It borders Taita District to the North West, Kilifi to the North, Kwale to the South East and Msambweni to the South, (KDDP, 2009) and see Maps 1and 2 in the appendix. Kinango is subdivided into four divisions namely Samburu, Kasemeni, Kinango and Ndavaya, see Map 3. Kinango District lies between latitudes 4^0 2' and 3^0 31' South and longitudes 38^0 45' and 38^0 40 East (KDDP, 2009). The district covers an area of 4007.5 Km^2, more three times bigger than Kwale District. See Appendix III; Location of Kinango district in Kenya , Location of Kinango District in Coast Province, and Kinango district administrative boundaries.

According to 2009 Kenya Population Housing Census (KPHC), volume 1A, August 2010, Kinango district has the lowest population density of 52 persons per square kilometer, compared to 147 and 89 of Kwale and Msambweni districts respectively. Total population in the district is 209,560 persons, which is average compared to151, 979 and 288,393 of Kwale and Msambweni districts respectively. The main ethnic communities are the Duruma and Digo with other ethnic groups such as Shirazi (Wakifundi), Kambas and Masai also featuring in small numbers. Communities which practice pastrolism have settled in Kilibasi in Samburu division and Nyango areas of Kinango division. They are also in Ndavaya division where most of the land is occupied by group ranches while those engaged in agriculture are in Kasemeni, Samburu, and some parts of Ndavaya and Kinango divisions, (KDDP, 2009). Poverty levels in the district stand at 75% which is high compared to Kwale's 53%. Kinango's poverty level contributes 8.8% to the provincial poverty level while Kwale's level contributes only 4.4% to the provincial poverty level, (KDDP, 2009).

In 1999, the age group of 14-17 (secondary school age) had 11,464 children which are 9.45% of the population in the district. It was projected to reach 18,178 persons in 2008. Currently the secondary school enrolment is 5,580 students, which is 34% of the population in this age group. This translates to low literacy levels of 58% compounded by low transition rate of 27.78%, dropout rate of 2%, this is according to district fact sheet in KDDP, 2009. In terms of educational facilities the district has over 11 secondary schools serving over 111 primary schools. Although teacher/pupil ratio is 1:23 which is well within the recommended rate of 1:40, the average years of secondary school attendance is 3 years. This again adds to the problem of illiteracy in the district. Even for those who remain in school their performance is affected by inadequate education facilities, inadequate staffing especially in primary school where the teacher/pupil ratio is 1:59, retrogressive cultural practices.

2.5 Conceptual Framework

A conceptual framework can be defined as a set of broad ideas and principals taken from relevant fields of enquiry and used to structure a subsequent presentation (Reichel and Ramey, 1987).

Conceptual Framework

Independent Variables **Dependent Variable**

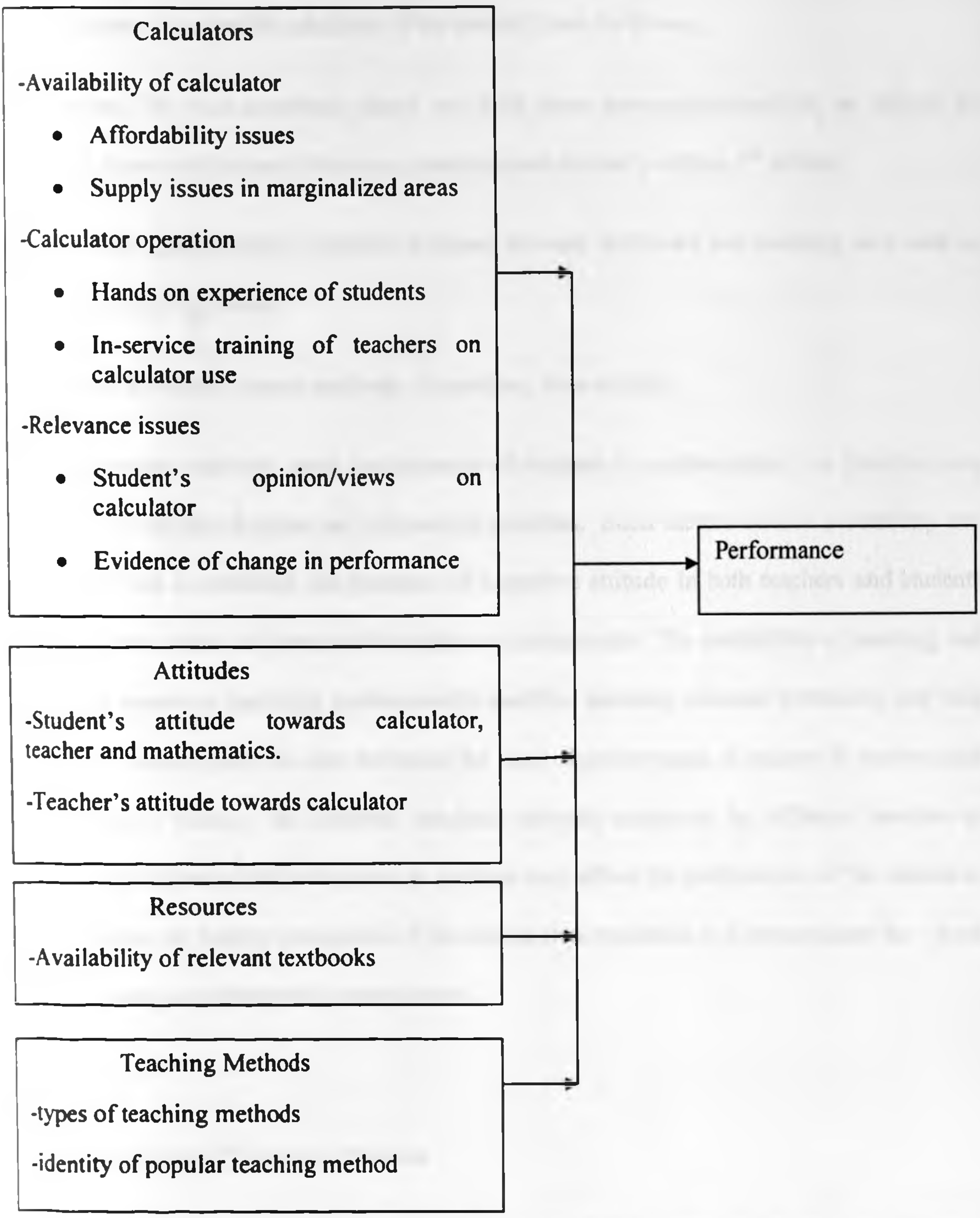

Figure1. A conceptual frame work on the factors influencing performance of students in mathematical examinations

Performance: A score of 40% and above will be treated as an acceptable performance. A score below 40% will be treated as a failure.

Calculator: A scientific calculator of the model; Casio Fx 82-ms,

Attitudes: The way somebody thinks and feels about somebody/something, as defined by Oxford Advanced learners Dictionary, international student's edition, 7^{th} edition.

Resources: professionally qualified teachers, relevant textbooks and teaching aids such as calculators among others.

Teaching methods: lecture methods, discussions, class activity.

The dependent variable, good performance of students in mathematics, is a function of a number of factors identified as independent variables. Such factors include availability and ability to use a calculator, the presence of a positive attitude in both teachers and students towards each other and towards the subject of mathematics. The availability of teaching and learning resources including professionally qualified teachers, relevant textbooks, and well equipped school plant can also influence the level of performance of student in mathematics examination. Finally, the different teaching methods employed by different teachers in delivering mathematical instructions to students may affect the performance of the student in examination. A healthy interaction of the independent variables is a pre-requisite for good performance in mathematical examinations.

2.6 Summary of Literature Review

In this chapter, literature was reviewed on studies that focused on factors that influence performance of students in mathematics. The studies revealed that the scientific calculator play an important role in mathematics instructions, leveling the playing field so that special groups perform as well or better than the main group. It was also shown that attitude, as one of the non-cognitive factors, can actually affect performance in mathematics. Innovations in the methods of teaching and use of teaching aids were shown to improve student's feeling of success and helped them to develop confidence in mathematics greatly increasing their chances of performing better in mathematical examinations. The literature also revealed the central role played by education and training in achievement of Kenya's vision 2030 and consequently driving Kenya into becoming a middle-level economy. Different teaching methods were also reviewed in the study. Main methods of teaching were identified as discussion, lecture and class activity among others. Finally the literature gave overview of Kinango District in terms of locations, size, population, ethnicity and different rates including school enrolment levels, poverty levels and literacy levels.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

According to Mmuya 2007, *Methodology* entails the defining of the conceptual and theoretical frame of reference that will guide the research. Generally, the methodological approaches form part and parcel of the entire research process. This section identified and justified the choice of the research design used. The target population where the sample size came from was also included in the discussion. Data collection methods and procedure were identified and discussed.

Other aspects of the study that were tackled under research methodology were reliability and validity of data collection instruments, ethical considerations and finally data analysis technique.

3.2 Research Design

The study was descriptive survey design as it was concerned with the conditions or relationship that already exists. The design involved obtaining data through questionnaires, among others. Descriptive survey design was appropriate since upon collection of data, the data was used in testing for hypothesis as well as answer questions concerning the current status of the subjects in the study, Kimutai G, (2008).

3.3 Target Population

The first set population was constituted all the eight secondary schools in existence in Kinango District before the year 2008. The study chose those students because they fell into two groups; 2004-2005 groups did not use the calculator in KCSE exams and 2006-2009 group which used calculator in the final exam. Table 3.1, 3.2, 3.3, 3.4 and 3.5: were used to collect the data on performance of students in mathematics for the said years.

The second set of population consisted of 75 form four students from five sampled schools out of a total population of 15 schools. The study chose form four students because this is the class where the independent variables (use of calculators, development of attitudes, utilization of resources among others) have already occurred. Table 3.6 was used as a guide to collect data on attitudes, availability of teaching and resources, among others.

Table 3.1: *Mathematics Analysis 2004*

Sch.	Ent.	A	A-	B+	B	B-	C+	C	C-	D+	D	D-	E	MS
KNG	83	0	0	0	3	1	3	1	1	5	10	10	49	**2.241**
MZ,B	62	0	0	0	0	0	0	1	3	1	6	20	30	**2.180**
SMB	53	0	0	0	0	1	1	1	2	5	1	11	27	**2.170**
TR	98	0	1	0	0	1	0	3	1	2	11	21	58	**1.867**
MNZ	32	0	0	0	0	1	0	0	2	0	0	12	17	**1.843**
MVB	41	0	0	0	0	0	0	0	1	2	2	6	30	**1.488**
NDV	23	0	0	0	0	0	0	0	1	1	1	1	19	**1.435**
MZ,G	47	0	0	0	0	0	0	0	0	1	2	4	40	**1.234**
OVERAL MS/TTL	439	0	1	0	3	4	4	6	11	17	33	85	270	**1.807**

Source: DEO's office Kwale

Use the key in Table 1.1

Table 3.2: *Mathematics Analysis 2005*

Sch	Ent	A	A-	B+	B	B-	C+	C	C-	D+	D	D-	E	MS
KNG	87	0	0	1	1	1	0	3	3	5	9	11	53	2.094
MZ,B	93	0	0	1	1	0	0	0	0	3	5	15	68	1.548
SMB	40	0	0	1	0	0	0	1	1	1	3	5	28	1.800
TR	73	0	0	0	0	0	0	0	0	1	3	17	52	1.356
MNZ	41	0	0	0	0	0	0	1	0	3	5	12	20	1.878
MVB	51	0	0	0	0	1	0	0	0	2	5	8	33	1.780
NDV	17	0	0	0	0	0	0	0	0	0	0	2	15	1.118
MZ,G	72	0	0	0	0	0	0	0	0	0	2	8	62	1.167
OVERAL MS/TTL	474	0	0	3	2	2	0	5	4	15	32	78	331	1.593

Source: DEO's office Kwale

Table 3.3: *Mathematics Analysis 2007*

Sch	Ent	A	A-	B+	B	B-	C+	C	C-	D+	D	D-	E	MS
KNG	93	0	0	1	0	2	2	1	2	5	14	23	43	**2.140**
MZ,B	58	0	0	0	0	2	1	1	1	4	3	12	27	**2.259**
SMB	77	1	2	11	0	1	2	2	3	5	19	16	24	**3.065**
TR	81	0	0	0	0	0	1	1	5	4	3	2	55	**1.753**
MNZ	53	0	0	0	0	0	0	1	0	0	1	6	26	**1.343**
MVB	94	1	0	0	0	0	1	0	1	3	2	19	67	**1.436**
NDV	47	0	0	0	0	0	0	0	0	1	2	7	37	**1.298**
MZ,G	63	0	0	0	0	0	0	0	1	2	2	8	50	**1.349**
OVERAL MS/TTL	566	2	2	12	0	5	7	6	13	24	46	93	329	**1.836**

Source: DEO's office Kwale

Table 3.4: *Mathematics Analysis 2009*

Sch	Ent	A	A-	B+	B	B-	C+	C	C-	D+	D	D-	E	MS
KNG	124	0	0	0	0	4	2	4	4	2	18	30	59	**2.211**
MZ,B	64	1	0	0	0	2	0	2	3	3	11	11	31	**2.398**
SMB	100	2	1	1	3	5	4	5	6	11	14	20	28	**3.540**
TR	115	0	0	0	0	1	2	1	3	2	11	29	66	**1.809**
MNZ	56	0	0	0	0	0	2	0	0	2	4	12	36	**1.679**
MVB	127	0	0	0	0	1	3	0	2	1	14	26	79	**1.790**
NDV	44	0	0	0	0	0	0	0	0	2	1	4	37	**1.273**
MZ,G	55	0	0	0	0	0	0	0	0	0	4	5	46	**1.236**
OVERAL MS/TTL	685	3	1	1	3	13	13	12	18	23	77	137	382	**1.992**

Source: DEO's office Kwale

Table 3.5: *Summary KCSE mean scores for Mathematics for different years and selected schools in Kinango District*

	Sch	Ent	2004	Ent	2005	Ent	2007	Ent	2009
1	**KNG**	83	2.241	87	2.094	93	2.140	124	2.211
2	**NDV**	23	1.435	17	1.118	47	1.298	44	1.273
3	**SMB**	53	2.170	40	1.800	77	3.065	100	3.540
4	**MVB**	41	1.488	51	1.780	94	1.436	127	1.790
5	**MZ,B**	62	2.180	93	1.548	58	2.259	64	2.398
6	**MZ,G**	47	1.234	72	1.167	63	1.349	55	1.236
7	**TRU**	98	1.867	73	1.356	81	1.753	115	1.809
8	**MNZ**	32	1.843	41	1.878	35	1.343	56	1.679
	Ms/ttl	439	1.807	474	1.593	566	1.83	685	1.992

Overall mean score for years 2004-2005: 1.70. Students did not use calculator.

Overall mean score for years 2007-2009: 1.91. Students used calculator.

Table 3.6: *Sample Frame*

School	No. of f4 students	Sample	%
Vigurungani	57	15	26.3
Moyeni	46	15	32.6
Ndavaya	50	15	30.0
Kinango	78	15	19.2
Bofu	38	15	39.5
Total / % average	269	75	29.5

3.4 Sample Size and Sampling Procedure

For the testing of the stated hypothesis, saturated sampling was used to select eight schools which presented candidates for KCSE exams in years 2004 – 2009. Saturated sampling is a non-probability sampling procedure in which all the members of the target population are selected because they are too few to make a sample out them, (Borg and Gall, 1996). While simple random sampling was used to select five schools representing 30% of the total schools in the district currently. Simple random sampling was further used to select 15 form four students from each of the sampled school as respondents to the questionnaire aimed at achieving all the research study objectives. Simple random sampling was chosen as it eliminates chances of biases in selecting study sample.

3.5 Data Collection Methods

The researcher used questionnaires to gather information. According to Karugu (2007), questionnaire is an instrument that is widely used in educational research to gather data from a population or a sample. Questions are given to individuals or groups of individuals with the objective of obtaining data related to some problem under investigation. He further goes on to classify the questionnaires into structured and unstructured questionnaires. In the former, the researcher provides choices for the respondents to respond to by ticking, circling or unveiling the preferred choice. While in the later, the questions have no clues and the respondent can use his/her own words when responding.

The researcher used the structured questionnaires in the study. A variation of Likert-type scale was used.

3.6 Data Collection Procedure

A copy of the permission to collect data was availed to the DEO's offices Kinango and Kwale Districts. Kinango District being relatively new did not contain data covering the period before the year 2006. The researcher then contacted principals of selected schools in writing to inform them of the intention to visit their schools for data collection. The researcher visited the schools to administer questionnaires to respective respondents and collected them the same day.

3.7 Reliability of Data Collection Instruments

Reliability measures the degree to which a particular measuring procedure gives similar results over a number of repeated trials (Orodho, 2004). For reliability of instruments of research to be achieved, a pilot study was conducted in two schools. The schools were not part of the final study. The inadequacies, inconsistence and weaknesses in the instruments were corrected before they were used in the field.

3.8 Validity of Data Collection Instruments

According to Mugenda and Mugenda (1999) validity is the degree to which the empirical or several measures of concepts accurately measure the concepts. For validity of the instruments to be ensured expert advice was sought from the office of the Resident Lecturer, University of Nairobi, Mombasa Campus. Improvements were made according to the recommendations suggested before the instruments were used in the field.

3.9 Ethical Considerations

Ethics has been defined as that branch of philosophy which deals with one's conduct and serves as guide to ones behavior (Mugenda and Mugenda, 1999). The researcher, fully aware of the implications of breaching the trust bestowed on him by virtue of current undertaking aspired to avoid issues of plagiarism, fraud, causation of psychological harm to any subjects, or misuse of privileges among others. Having encountered difficulties in getting compiled data from some relevant offices, the researcher intends disseminate part if not all of the findings to the appropriate offices as a token of appreciation and goodwill.

3.10 Data Analysis Technique

The quantitative data which was collected using the questionnaires was analyzed according to the research questions by the use of descriptive statistics. This involved coding of data, for the responses to the close-ended questions and analyzing the data using Statistical Package for Social Sciences (SPSS) program to yield frequencies, means, and percentages (Thomas and Nelson, 1996).

CHAPTER FOUR

4.1 Introduction

This study investigated the factors influencing performance of students in mathematics examination in selected schools in Kinango District. The study was prompted by the continued poor performance in mathematics despite the improvement of school plant through CDF, introduction of FPE and partial FSE, introduction of educational technology as teaching aids among others.

This section presents the research findings in line with the objectives that guided the study. A total of 75 students from 5 secondary schools responded to the questionnaire. Out of this 26 were girls while 49 were boys. The hypothesis sought to check if there was any significant relation between the use of calculator and performance of students in KCSE Mathematics examination. The independent variables were use of calculators, availability of teaching and learning resources, attitude of learners towards Mathematics and finally Teaching Methods. The dependent variable was student's performance in mathematics examinations. The sampled students were given the questionnaire to fill in their views. The responses given were used by researcher to obtain information on availability of teaching and learning resources, student's attitude, and the different teaching methods employed by teachers when delivering mathematical instructions. The researcher visited District Education Offices (DEO) in Kinango and Kwale District to collect information on student's KCSE performance and used it to test the stated hypothesis. The information from DEO's offices and questionnaires was categorized into various groups based on similarity and relevance to the research questions.

4.2 Response Rate

Response rate of 100% was realized as shown by table 4.1. The exceptionally high response rate was attributed to the fact that the researcher personally administered the questionnaires to the respondents who filled them in his presence before collecting the questionnaires back. The researcher was satisfied that this response rate would produce reliable results.

Table 4.1: *Response Rate of sampled students*

School	Number of questionnaires		Percentage
	Issued	Returned	Responce
Vigurungani	15	15	100
Moyeni	15	15	100
Ndavaya	15	15	100
Kinango	15	15	100
Bofu	15	15	100
Total	75	75	100

4.3 Demographic Characteristic of Respondents

The demographic characteristics of the sampled students are shown on table 4.2 which gives a summary of the relevant available characteristics.

Table 4.2 *Summary Demographic Profile of the Respondents*

		Sampled Students
Response Rate (%)		100
Average Age (years)		19
Gender (%)	Male	65.4
	Female	34.6
Education Level		Form Four students

As can be seen from table 4.2, the response rate was 100% since the researcher personally supervised the filling of the questionnaires in all the schools sampled. Since the respondents were drawn from secondary schools there was minimal variation in ages and no variation at all level of education. The researcher sought to fulfill the one third rule as envisioned in the constitution when handling gender related issue since the population presented no obstacle. Hence the percentage of male students was 65.4% compared to girl's 34.6%.

4.4 Data Analysis

4.4.1 Influence of Calculators on Performance of Students in Mathematics Examinations.

The first objective of this study was to determine whether the use of calculator influence the performance in mathematics. The researcher therefore sought KCSE mathematics performance data for two groups of students from DEO's office. The first group of students did their exams without the use of calculator in the years 2004 – 2005 while the second group did their exams using the calculator using the calculator in the years 2007 – 2009. Table 4.3 gives a summary of performance for the said years.

Table 4.3: *Summary of KCSE Mathematics Performance for the Years 2004 – 2009*

Performance of Group 1

YR	ENT	Grades Obtained												M/S
		A	A-	B+	B	B-	C+	C	C-	D+	D	D-	E	
2004	439	0	1	0	3	4	4	6	11	17	33	85	270	1.807
2005	474	0	0	3	2	2	0	5	4	15	32	78	331	1.593
TTL M/S	913	0	1	3	5	6	4	11	15	32	65	163	601	1.70
		Performance of Group 2 Grades Obtained												
2007	566	2	2	12	0	5	7	6	13	24	46	93	329	1.830
2009	685	3	1	1	3	13	13	12	18	23	77	137	382	1.992
TTL M/S	1251	5	3	13	3	18	20	18	31	47	253	556	711	1.91

Source: DEO office Kwale

Data for the years 2006 and 2008 was not readily available.

The results in table 4.3 clearly indicate an increase in overall average mean score for the two groups from 1.70 to 1.91. This indicates an increase of 11%. The data obtained shows not a single grade A obtained for the years 2004 to 2005 in all the schools. Five Grade A scores were obtained in the years 2007 and 2009. Despite a minimal increase (17.3%) in the number students undertaking exams in the two groups, there was a big increase in number of Quality Grades (C+ and above) from 19 to 62, indicating an increase of 80.6%. For the 913 students in group 1, a total of 601students, representing 65.8%, obtained Grade E in mathematical exams which was 9% higher than the number of students who got the same grade in group 2.

Using the data obtained, the researcher tested the hypothesis;

H_0: That there is no significant relationship between the use of calculator and learner's performance in mathematics.

H_1: There is a significant relationship between the use of calculator and learner's performance in mathematics.

The test results yielded $X^2(1) = 14.5$, $p = <0.05$ at seven degrees of freedom revealing a significant relationship between the use of calculator and performance of student in mathematics exams. Based on these results, the null hypothesis was rejected. In order to determine the degree of relationship between the two variables the Cramer's V Contingency Coefficient was calculated. The result obtained was 0.17 indicating a moderate relationship. This meant that only 17% of the change in performance may be attributed to the introduction of the calculator in teaching and learning of mathematics.

Generally above results imply use of calculator makes the student perform better in mathematical examinations. This conclusion agrees with student's response to the question on whether calculators can improve performance in examination. 35% of the students strongly agreed, 52% agreed, while only 7% indicated negatively.

4.4.2 Attitude of Student towards Mathematics, Calculator, Mathematics Teacher.

When the students were asked whether calculators make the learning of mathematics easier, 72% strongly agreed, while only 4% disagreed. The findings of the study concur with the findings of a study by Dunhum (1995), who noted that scientific calculator use results in more positive feelings and better attitudes about mathematics for both teachers and learners. Similar findings were noted by smith (1977). In his study test results of students using calculators were compared to those of students not using calculators. The study showed that calculator had a positive effect on increasing conceptual knowledge at all levels. When the students were asked whether they work out more problems with calculators, over 78% were positive. See table 4.4.

Table 4.4: *Student's responses on whether calculators enable them to do more sums within a shorter time*

	Frequency	%
Strongly agree	41	54.6
Agree	18	24
Undecided	8	10.6
Disagree	5	6.6
Strongly disagree	3	4
Total	75	~100

The result comply with findings of Suydam (1985) that the calculator enables students to practice more problems since it gives immediate feedback and also Pomerantz (1997) that the calculator enables students to solve more problems and it stretches the student's interest and increase motivation. The result also agrees with a study by Mbugua, Muthomi and Okere (2011) which showed that calculators make student to finish their work faster. McClauliff (2004) also found that considerable amount of time is saved when the students use calculators.

To evaluate student's attitude towards the subject of Mathematics, their reaction was sought in response to the statement 'Mathematics is beautiful'. 38% of the students strongly agreed, while only 5% strongly disagreed. A total of 67 % of the students can be said to have a positive attitude towards Mathematics against 33% who portrayed a negative attitude. In response to the statement 'My best teacher is the mathematics teacher', a statement tailored so as to gauge the popularity of the mathematics teacher and hence the attitude of the student towards the mathematics teacher, 60% of the students responded positively. Even though a minority of the students did not agree with the statement, the number of students, over a third of the total sampled, indicates existence of attitude issues between the student and the teacher. Generally the mathematics teacher may not be the most popular teacher in schools.

4.4.3 Availability of Teaching and Learning Resources.

The researcher sought to find out whether the student had the calculator and reasons for failing to have one. 63% of the students own a calculator, while 37% don't own a calculator. 40% of the students said they could afford the calculator while only 5% thought the calculator as unnecessary. As a computing machine, the availability and use of calculator may rightly or wrong be thought to inhibit logical thinking on the part of the student. To establish the true effect of the calculator, the students were asked whether the calculator makes them not to think when doing mathematical sums. 15% of the students strongly disagreed, while only 3% strongly agreed. In general most students, 75% felt that calculators do not inhibit logical thought. These findings are not in consistent with the conclusion of Rey and Arbaugh (2001) who claimed that calculators inhibit logical reasoning of the students. The findings of this study agree with Pomerantz (1997) that the calculator does not replace mental ability to solve problems but it provides multiple solution techniques and also calculators do not think for students and sometimes it is faster to compute mentally.

Availability of core and reference mathematics text books was also determined. 55% of the students had the core Mathematics textbook. This translated to Student: Book ratio of 2:1 which according to Ministry of Education requirements is below the acceptable ratio of 1:1. Only 13% of the sampled students had a supplementary Mathematics textbook

4.4.4 Teaching Methods in Mathematics.

Table 4.5 shows responses on the different teaching methods applied when delivering mathematical content. 64% of the student identified Discussion Method as the most popular method of teaching mathematics, while lecture method was the least popular. A substantial number of students, 19%, confirmed the practice of all the methods while receiving mathematical instructions.

Table 4.5: *Students response on different teaching methods in practice*

	Frequency	%
Discussion method	48	64
Lecture Method	4	5.3
Class activity	4	5.3
Others	19	25.3

Most of the students, 89% liked the way their mathematics teacher taught them. The calculator being one of the new teaching aids recently introduced in school curriculum appears mysterious to students leading to time wastage during exams as the students try to locate and identify different keys and their functions. So when the researcher sought to know whether the student had been taught how to use the calculator, over 94% of the students responded positively highlighting a step in the implementation process of this new aid. The findings of this study disagree with a study by Indoshi and Ochanda (2011) who found that learners were unable to use scientific calculators effectively because they lacked hands-on training opportunities when it came to calculator use in mathematics.

CHAPTER FIVE

SUMMARY OF FINDINGS, DISCUSSIONS, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter summarizes the findings of the study based on the four stated objectives. In each case, the researcher briefly states the findings and their general implication towards performance of students in mathematical examinations in Kinango district. The chapter also includes recommendations based on the findings of the study. Finally the chapter concludes by identifying areas that could be explored as a basis for future research.

5.2 Summary of Findings

This study was an investigation into the determinants of performance of students in mathematics in selected secondary schools in Kinango district, Kwale County. Four factors were identified as possible determinants of performance of students in mathematical examinations. These were use of calculator, attitudes of students towards the subject of mathematics and towards teaching and learning resources, availability of teaching and learning resources and lastly different teaching methods in practice.

On the availability and use of calculator, the chi-square results revealed a significant relationship between the use of calculator and performance of students in mathematical examinations. This result agreed with the feeling of a big majority (87%) of the students who thought that calculators can improve performance in examinations.

The availability of teaching and learning resources was explored especially the availability of calculators and relevant textbooks. Although most respondents' attitude towards calculator was positive and felt it was an important teaching aid, more than a third of them did not own a calculator. The most common reason cited by majority of the students was the prohibitive cost of the calculator. The student: textbook ratio was found to be 2:1 indicating shortage of text books necessary to a student awaiting exams. The most popular method of teaching mathematics identified by students was discussion method.

5.3 Discussion of Key Findings

The first objective was to determine whether the use of calculator influence the performance in mathematics. The researcher sought to establish this by comparing performance data of students in mathematical exams done prior to and after the introduction of calculators in the teaching and learning of mathematics in Kenyan secondary schools. In particular data from selected secondary schools in Kinango district was analyzed and revealed an improvement in performance of students after the introduction of the scientific calculator in schools. Also data obtained from questionnaire indicated that calculators can assist the student to do more sums within a shorter time. This, to an extent, solves the element of time constrain experienced by candidates when undertaking final exams thereby increasing their chances of performing better in such exams. Since the study was done in one of the areas declared as Arid and Semi Arid Land (ASAL) in Kenya, that is Kinango district, issues of availability of the calculator were central to the sampled students. Most students pointed to the calculator's price tag when asked why they do not own a calculator. The cost of buying the calculator was, in some places in the district, double what others incur since the calculator was not stocked in the local shops. Therefore the students had to incur huge travel costs compounding an already difficult situation.

The second objective was examine whether the attitude of learners towards mathematics influence the performance of students in mathematics. This objective was expanded to include student's attitude towards the calculator and also the mathematics teacher. In certain cases the attitude of the teacher, especially towards the calculator, was covered. Mathematics as a subject was not the most popular subject since slightly more than half of those sampled displayed a positive attitude to the subject. Similar levels of apathy were shown towards the mathematics teacher. From the data collected the attitude of the students towards the calculator may be said to be positive as a big majority of the respondents answered positively when dealing with questions on calculator efficiency and importance. Teachers' attitude towards adoption of the calculator as a teaching aid was evaluated. Most mathematics teachers were found to have discarded the traditional paper-and-pencil method and embraced technology based instruction. This was confirmed by students who confirmed that their teachers have actually taught them how to use the calculator as a teaching aid.

The third objective was to assess whether the availability of teaching and learning resources influence the performance of students in mathematics. The resources evaluated included textbooks and calculators. About half the respondents lacked a single relevant mathematical textbook and an eighth had core as well as supplementary textbooks. This showed a serious shortage of very critical input in the process of education and indicated that the perennial poor performance in mathematics in the region may to a large extent be attributed to lack of very basic requirements such as textbooks.

The fourth and final objective was to ascertain whether teaching methods influence the performance of students in mathematics. From the responses collected the study found that the teaching and learning methods employed by mathematics teachers are the officially recommended teaching methods. However quite a number of the sampled students were able to identify with one particular method more than others. This was the discussion method of teaching.

5.4 Conclusion

The study concluded that; the use of calculator in teaching and learning mathematics positively influences the performance of the student in examinations. The students believe that they perform better in mathematics and work out more problems when they have calculators. According to the students mathematics is very interesting and enjoyable with calculators. The availability of the calculator does not inhibit the student to think, it actually encourages them to think.

The study also concluded that there exist a large number of students who for a variety of reasons do not own a calculator despite appreciating its importance in teaching and learning of mathematics. The level of preparedness of the teacher was found satisfactory when the study concluded that a substantial number of students had been taught how to use the calculator. The study found that a number of students lacked other essential resources like textbooks. The most common method of teaching mathematics was discussion method.

Finally, the study found that the attitudes between the student and mathematics teacher and/the subject of mathematics was fairly conducive to better performance of the student in examinations.

5.5 Recommendations

Based on the findings and conclusions made in the study, it is recommended that use of calculators be adopted for mathematics instruction at lower levels by evaluation of education goals of mathematics and restructuring the curriculum to incorporate the use of calculators at form one level. Mathematics teachers should inform students, parents, administrators and any other stake holder of the research results that document the advantage of including the calculator as one of the several tools for learning and teaching mathematics.

Mathematics educators should promote appropriate use of the calculator to enhance instruction by; modeling calculator applications, using calculators in instructional setting, integrating calculator use in assessment and education, remaining current with the state of art calculator technology and by considering new applications of calculators to enhance the study and leaning of mathematics. Curriculum developers should give order and treatment of most topics that need to be aligned to new technologies like use of calculators.

The Government should source funds from development partners and donors in education sector to be able to purchase calculators for every learner as well formulating a policy on provision of scientific calculators to the learners to ensure equitable accessibility to calculators by the learners hence achieve a calculator-student ratio of 1:1.

The Ministry of Education should organize seminars on calculator use for mathematics teachers to equip the small number of teachers who are yet to embrace the full benefits of the calculator and consequently pass over the learned skills to their students. This can be achieved through an already existing program called Strengthening Mathematics and Science Subjects in Education (SMASSE).

Generally the Ministry of Education and by extension the Government should be prepared to deal with enormous challenges in mathematics education, like use of calculator, to forge ahead because holding onto old and familiar ways would mean putting students at a disadvantage in a world that is fast embracing technology.

5.6 Suggestions for Further Research

Following the findings of this research, the researcher suggests the following areas that could be explored as possible areas for future related research. Since then scope of this study was constrained by time and financial elements leading to coverage of a very small population of students in Kenya, the researcher suggests the need for a similar study that will encompass a bigger population preferably that of a county, which could be said to be more representative of the general student population in Kenya.

The study was confined to a marginalized area whose characteristics may differ greatly with those of a non marginalized area. The researcher therefore suggests the carrying out of a similar research in a more homogenous area.

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APPENDICES

APPENDIX 1

TRANSMITTAL LETTER

Kennedy K. Ndwiga,

Kinango Secondary School,

Po Box 9, Kinango.

25^{TH} July 11, 2012

TO WHOM IT MAY CONCERN.

RE: TRANSMITTAL LETTER

This is to introduce a Research Project being carried out by NDWIGA K.K, Reg No. L40/P/8191/2006, a PGDE student at the University of Nairobi.

The purpose of the study is to determine the factors influencing the performance of students in mathematics examinations in selected secondary schools in Kinango district. In particular the study will determine, among others, if the introduction of calculators in secondary school curricular has had any significant influence on the performance of students in Mathematics examination. Other factors to be investigated are attitudes of students and teachers towards each other and towards the subject of mathematics, availability of teaching and learning resources, and lastly the different Methods of Teaching Mathematics will also be investigated. If this study is accomplished it will significantly be beneficial to students, teachers, policy makers, parents and so forth.

If the calculator is found to have positively influenced performance, students will realize the advantage they have over those who never used the gadget in their O-Levels and strive to maximize the benefits accruing. Policy makers and parents will also realize the importance of availing the calculator to learners and hopefully entrench deeper into the education system, in particular, targeting upper Kenyan Primary school students.

To accomplish the study, data will be collected and treated with utmost confidentiality. The questionnaire attached will assist in data collection and will be administered and collected on same day from the respondents.

Any assistance extended will be highly appreciated.

Regards,

....

Kennedy K. Ndwiga.

CC. The Research Project supervisor,

JOHNBOSCO M. KISIMBII,

RESIDENT LECTURER,

EXTRA-MURAL CENTRE (EMC) MOMBASA AND ITS ENVIRONS

APPENDIX II

QUESTIONNAIRE

Instructions to students;

A list of statements and questions are given to you and each statement /question is so constructed that it might reflect ones thinking or feeling about the use of calculator among other issues.

Please answer the questions by choosing the answer which you think clearly expresses your own feelings about the use of calculators. Put a tick mark (√) against the chosen response.

Thank you in advance.

1. Calculators make learning mathematics easier

(a)Strongly agree, (SA)........ (b)Agree, (A).......... (c)Undecided, (U).........
(d) Disagree, (D)............ (e) Strongly disagree, (SD)..........

2. Calculators can improve student's performance in mathematics.

(a)Strongly agree, (SA)........ (b)Agree, (A).......... (c)Undecided, (U).........
(d) Disagree, (D)............ (e) Strongly disagree, (SD)..........

3. Calculators are important in teaching and learning of mathematics.

(a)Strongly agree, (SA)........ (b)Agree, (A).......... (c)Undecided, (U).........
(d) Disagree, (D)............ (e) Strongly disagree, (SD)..........

4. Does the calculator enable you to do more mathematical sums within a short time?

(a)Strongly agree, (SA)........ (b)Agree, (A).......... (c)Undecided, (U).........
(d) Disagree, (D)............ (e) Strongly disagree, (SD)..........

5. I do not think much when doing mathematical sums using calculators.

(a)Strongly agree, (SA)........ (b)Agree, (A).......... (c)Undecided, (U).........
(d) Disagree, (D)............ (e) Strongly disagree, (SD)..........

6. Most of the recommended calculators are affordable?

(a)Strongly agree, (SA)........ (b)Agree, (A).......... (c)Undecided, (U).........
(d) Disagree, (D)............ (e) Strongly disagree, (SD)..........

7. Do you own a calculator?

(a) Yes............. (b) No..............

8. If the answer question 7 above is 'No', why?

(a). Cannot afford ....(b). Misplaced .... (c). It is not necessary ....

(d). Other reasons (specify) ....

9. My teacher has taught me how to use a calculator.

(a) Yes.............. (b) No...........

10. Do you have the core Mathematics text book?

(a) Yes.............. (b) No..............

11. Do you have a Supplementary/ Reference Mathematics text book?

(a) Yes.............. (b) No..............

12. 'Mathematics is beautiful.'

(a)Strongly agree, (SA)........ (b)Agree, (A).......... (c)Undecided, (U).........
(d) Disagree, (D)........... (e) Strongly disagree, (SD)..........

13. My best teacher is the mathematics teacher.

(a)Strongly agree, (SA)........ (b)Agree, (A).......... (c)Undecided, (U).........
(d) Disagree, (D)........... (e) Strongly disagree, (SD)..........

14. Do you like the way your mathematics teacher teaches the subject?

(a). YES............ (b). NO............

15 During mathematics lesson, the teacher:

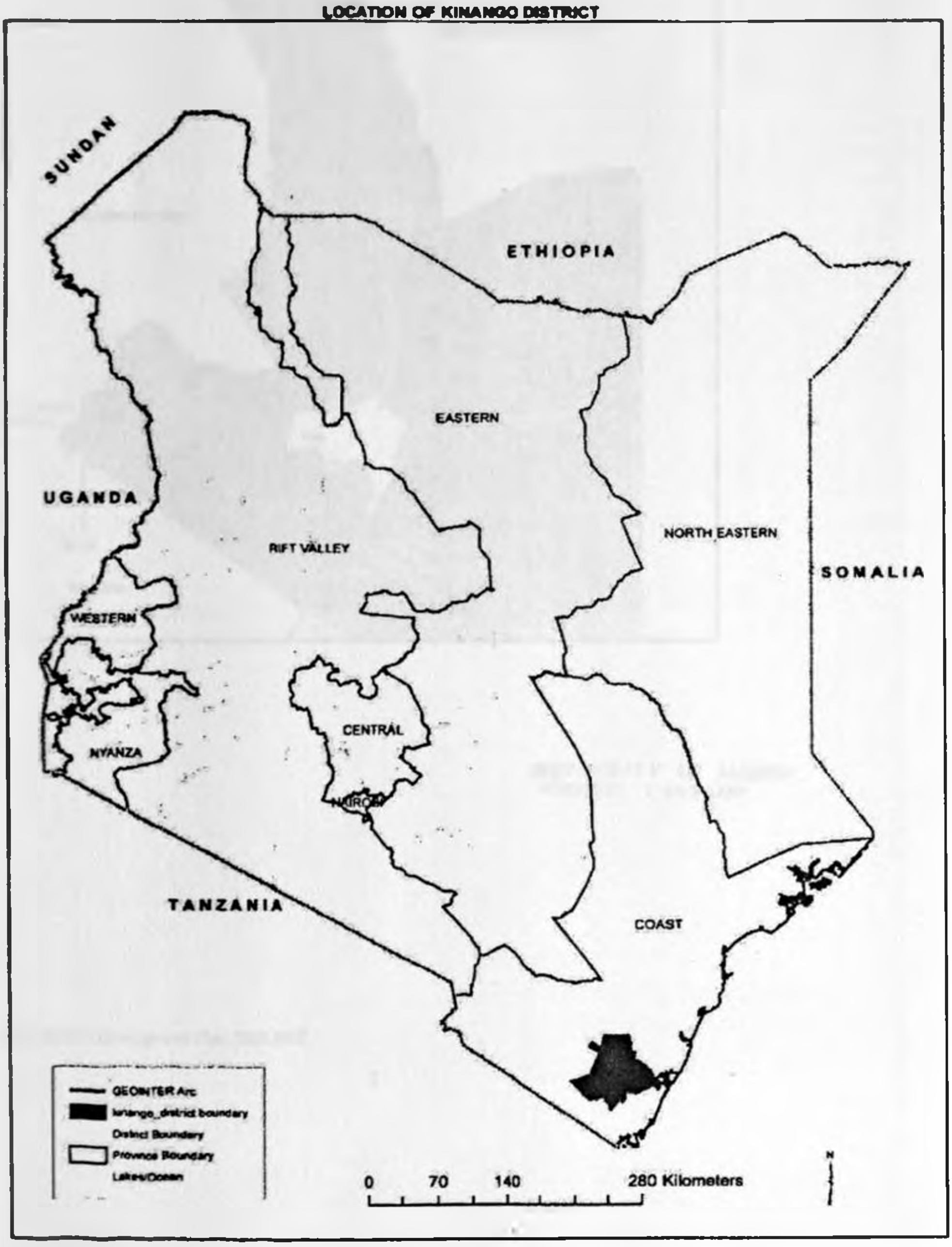
(a) Discusses the sums with us – Discussion method of teaching,

(b) Talks and we listen as we take notes – Lecture method of teaching,

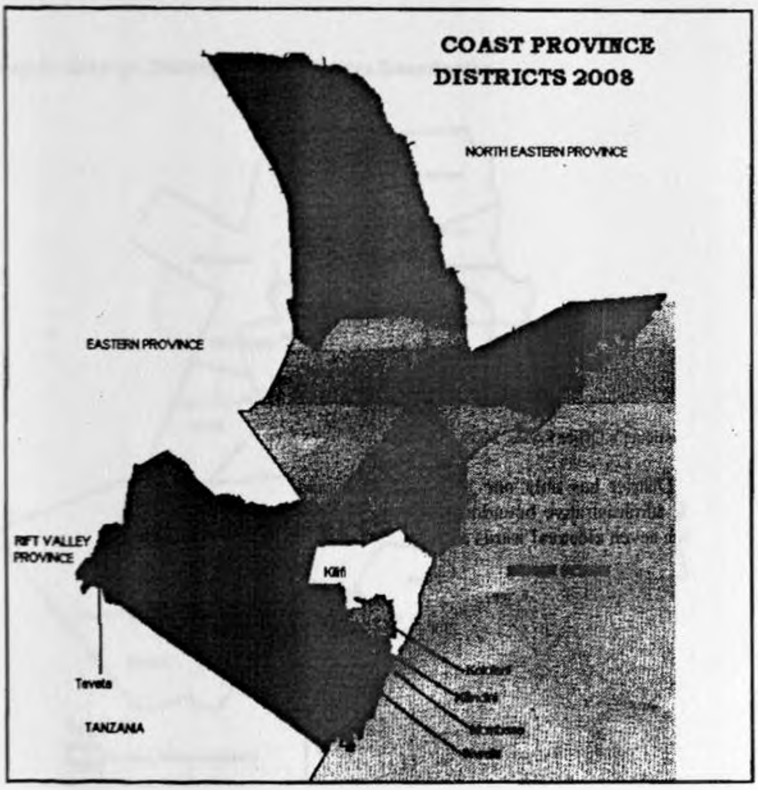
(c) Provides apparatus and we carry out some activities – Class activity method of teaching,

(d) Uses all of the methods mentioned above when teaching mathematics.

Map 1: Location of the District in Kenya



Map 2: Position of Kwale District in Coast Province



Map 2: Kinango District Administrative Boundaries

Kinango District Development Plan, 2008-2012

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