STUDENTS' ATTITUDES TOWARDS THE USE OF INSTRUCTIONAL RESOURCES IN THE LEARNING OF MATHEMATICS IN SELECTED SECONDARY SCHOOLS OF BARINGO-CENTRAL DISTRICT, KENYA.

BY

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EDU/PGCM/1011/08

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MOI UNIVERSITY.

DECLARATION

Declaration by the Candidate

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DEDICATION

This thesis is dedicated to my beloved family members; Grandmother Rispa, parents the late Mr. and Mrs. Ong'ou, Aunts; Anne, Grace, Martha, Wife Ruphine. For they have been an inspiration and mentors in my life. Dedication also goes to my son Robin with a prayer that he will diligently follow my footsteps in pursuit for knowledge that will transform the livelihoods of many generations after him.

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ABSTRACT

This study investigated attitudes of secondary school students towards the use of learning resources during the teaching and learning of Mathematics in Secondary schools of Baringo central district. The study adopted Piaget's theory of cognitive development which suggest that teaching methods and materials should be consistent with the learner's level of cognitive development. This study adopted a descriptive survey design. Stratified random sampling was used to categorize schools into Boys, Girls, private and mixed schools. Simple random sampling technique was applied to come up with two Boy schools, three Girl schools, two private schools and four mixed schools. At school level, systematic random sampling was applied to come out with a proportional number according to the population of the form four students of each sampled school and the same procedure replicated for mathematics teachers. A total of 180 students' and 17 teachers comprised the respondents group. The study used Secondary School Student's Questionnaires (SSSQ) and Secondary School Mathematics Teacher's Questionnaires (SSMTQ) to collect data on the students' attitudes on the use of learning resources. Descriptive and inferential statistics (the chi square) was used to analyze the data collected. Descriptive statistics involves comparison of means, Cross tabulation, use of tables, pie charts and bar graphs. The chi-square (X^2) test was used to measure the differences between the independent variable and the dependant variables. The study found out that students have negative attitude towards expository learning materials used by the teachers but favor learning materials that they are in co-operated into and those that they can manipulate. Mathematics teachers should work hard to use available learning materials even if it means improvising to instill positive attitude on students towards the use of learning resources during Mathematics instruction. The study recommends the adoption of Information and Learning Technologies (ILT) such as Computer Assisted Learning and Computer Managed Learning because they motivate and arouse interest of the students.

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LIST OF ABBREVIATIONS AND ACRONYMS

C.L.E: Constructivist- Learning Environments

I.C.T: Information and Communication Technology

IT: Information Technology

K.I.E: Kenya Institute of Education

K.L.B: Kenya Literature Bureau.

MOE: Ministry of Education.

NAEP: National Assessment of Educational Progress.

NCTM: National Council of Teachers of Mathematics.

PBL: Project-Based Learning.

P.I: Performance Index.

QUASO: Quality Assurance and Standards Office.

SMASSE: Strengthening Mathematics and Sciences in Secondary Education.

SSMTQ: Secondary School Mathematics Teachers Questionnaire.

SSSM: Secondary School Students of Mathematics.

SSSQ: Secondary School Students Questionnaire.

US: United States.

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CHAPTER ONE

INTRODUCTION TO THE STUDY

1.0 Introduction to the Chapter

This chapter will look at the background of the study, statement of the problem, purpose of the study, objectives of the study, research questions, research hypothesis, significance of the study, scope of the study, limitations of the study, assumptions of the study, Theoretical and conceptual framework.

1.1 Background of the Study

Mathematics is one of the compulsory subjects in the secondary school curriculum in Kenya. Its importance is not only for the national purpose but also for the individual development. In their book, Reece & Walker (2004) noted "…It is generally accepted that mathematics is a curriculum subject, which must be taught and learned in schools…." Reece & Walker (2004) continue to assert "…there is little doubt that it would be difficult to transact the normal business of the day without some mathematics, however elementary it could be, in most parts of the world…."

Mutunga & Breakell (2003: 15) also noted that:

> *Mathematics is regarded by most people as essential; clearly it is useful, in many ways more precisely useful than other subjects of the school curriculum. Arithmetic skills which have been learnt, can be applied effectively and easily in the home, at work and in leisure pursuits. A great deal of mental computing and calculation together with estimation will take place for example, in playing most sports. Obviously, too, mathematics has a formidable input to make to*

scientific development, and there is increasing use of Mathematics techniques as a tool in commerce and industry.

During the colonial period in Kenya mathematics was compartmentalized into arithmetic, algebra and geometry. It was meant to provide basic skills which could be applied in clerical jobs but this has long time changed to the current 8-4-4 mathematics curriculum offered today, which requires practical orientation, emphasis on discovery learning method and problem solving approach. (Tum, 2003: 2).

Bell (1980:146) in his book also observed that:

Discovery learning takes place as a result of children exploring, manipulating and transforming information so that they find new information or arrive at the conclusions. The essential element in discovery learning is that children take an active part in formulating and attaining new knowledge. A child who is told by the teacher that multiplication of natural numbers is commutative has not discovered the commutative property of multiplication. However, the child who through explorations and observations finds that the roles of multiplier and multiplicand can be interchanged in a multiplication problem has discovered the commutative property.

However, it seems this might not be the case during learning of mathematics in most of the secondary schools of Baringo district. A close analysis of the previous results at both the national and district levels attest to this.

Table 1.1 illustrates the mean scores and standard deviations for the years 2004 to 2008 in mathematics at the national level.

Table 1.1:

Mean /Standard Deviation in Math, KNEC results from 2004 to 2008

Year	Candidature	Mean Score	Standard Deviation
2004	221,295	18.86	17.92
2005	295,280	15.96	15.50
2006	238,504	17.50	17.52
2007	273,504	19.73	19.91
2008	287,545	21.29	21.16

Source: KNEC Report, 2008

It is clear that the performance in the subject at the national level has not been satisfactory. It is evident from the Kenya National Examination Council (K.N.E.C) reports that the results from 2004 to 2008 for the whole country show that mean scores for four consecutive years were below 20% save for the year 2008 where there was an improvement of 21.29% . A close analysis of the results also reveals that the least score by some candidates was a zero percent (0%) see table 1.1. In his study on the Availability and Use of Media resources in mathematics instruction, Too (1996) also noted this unsatisfactory performance in the subject at the Secondary school level. He reported "...performance in mathematics has been relatively poor despite national efforts made in developing a curriculum that was appropriate to the needs of the country and the attainment levels has been very low…."

Table 1.2 illustrates the mean grades and the percentages of students' performance in each category for the years 2004 to 2008 in mathematics at the Baring Central District level.

Table 1.2:

2004-2008 K.C.S.E Performances of students in Mathematics in Baringo District

Year	Entry	A to A$^-$ (%)	B$^+$ to B$^-$ (%)	C$^+$ to C$^-$ (%)	D$^+$ to D$^-$ (%)	E (%)	Mean Grade
2004	2037	3.92	8.39	16.54	45.36	25.57	D$^+$
2005	2381	2.72	6.13	13.19	47.59	30.07	D
2006	2316	3.76	7.21	14.08	54.58	20.68	D$^+$
2007	2493	3.45	6.42	13.20	47.65	28.12	D
2008	1843	10.09	12.70	17.41	38.31	20.89	C$^-$

Source: KNEC Report 2007-2008.

The unsatisfactory performance in mathematics at the national level has persisted and Baringo central district has not been an exception. Data from KNEC reporst for the results of Baringo central district schools for the years from 2004 to 2008 shows that the district has been performing very unsatisfactorily in mathematics with a mean grade of D or D+. What the results in table 1.2 imply is that the low achievement level in Mathematics has been recorded in the Kenya Certificate of Secondary Education (K.C.S.E) Examinations for long in the district. Strengthening of Mathematics and Sciences in Secondary Education (SMASSE) report of 2007 for Baringo central District inset noted that:

> *For the last seven years, candidates in Baringo district have been scoring low grades of D$^+$ to E in Mathematics, the percentage varying between "67.4% -*

77.66%". Those candidates scoring qualities grades of A to B⁺ have been varying between "4.45% - 8.9%". Over the years there has been little improvement in candidates scoring grade D⁺ and below, save for the year 2008, when there was a slight comparative improvement.

According to annual reports by K.N.E.C for five consecutive years from 2004 to 2008, candidates failed to score in items that required learning through the use of discovery learning method and instructional media resources and that could have contributed to the poor performance mentioned earlier. In most of these KNEC reports, recommendations were made to secondary school mathematics teachers to enhance learning by use of instructional media resources to make it easier for the learners to discover the mathematical concepts and principles being learnt by the students. To mention a few of the examples in the K.N.E.C report of 2006 for the K.C.S.E of 2005 there were various recommendations for teachers about different questions involving the use of instructional materials during teaching and learning of mathematics, Question number 4 was as follows:

"...The diagram below is part of a figure which has a rotational symmetry of order 4 about 0.

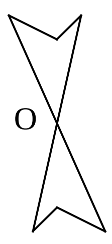

Figure 1.1: Question 4 from KNEC Report 2006

I. *Complete the figure.*

II. *Draw all the lines of symmetry of the completed figure*

The report noted that the question tested candidate knowledge on rotational symmetry and that most candidates could not complete the diagram successfully since several candidates were unable to identify correct lines of symmetry. The report recommended that teachers should use real life objects to help learners identify rotational symmetries of different symmetrical objects.

Another recommendation in the same report of KNEC of 2006 was on Question 15 as stated below;

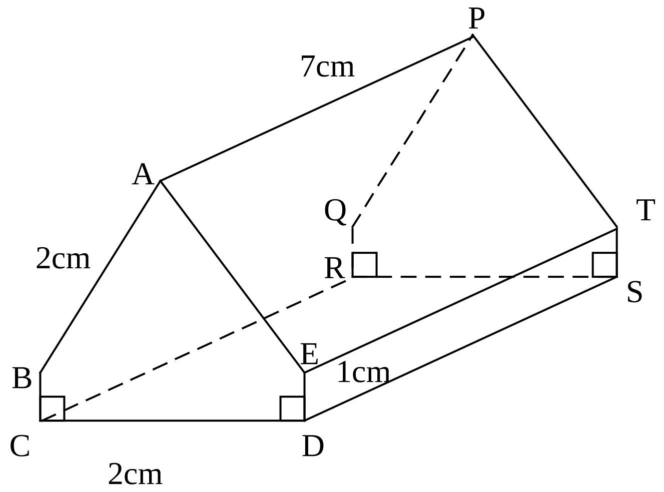

Figure 1.2: Question 15 from KNEC Report 2006

"...The figure above represents a prism of length 7 cm. AB = AE = CD =2 cm and BC = ED = 1cm. Draw the net of the prism…."

The report noted that the question tested candidates' knowledge on drawing of nets from solids. Candidates were required to draw a net of the given prism. The report recommended that teachers should use models of prisms or any solid for that matter to make nets of such solids in the teaching/ learning sessions. In another Report by (KNEC 2008: 43) for the examination year 2007, they gave nearly the same recommendations as were in the Report of KNEC 2007. For example in mathematics paper 2 of the year 2007 question 24 was as follows:

"…Two bags A and B contain identical balls except for the colours. Bag A contains 4 Red balls and 2 yellow balls. Bag B contains 2 red balls and 3 yellow balls.

a) If a ball is drawn at random from each bag, find the probability that both balls are of the same colour.

b) If two balls are drawn at random from each bag, one ball at a time without replacement , find the probability that;

i) the two balls drawn from bag A or bag B are red,

ii) all the four balls drawn are red…."

The report noted that many candidates were unable to establish the required probability space. Many students failed to address the issue of drawing one ball at a time without replacement. Teachers were given advise to give pupils practice in real life probability questions.

"…Instructional media resources are essential ingredients in learning and teaching of the mathematics. When they are carefully selected and used by the teacher, students learn with a lot of ease and this leads to improved results…."

(Woodhall, 1998 & Kawoya, 1988 cited in Rotumoi, 2006).

Bennars et al (1994) have emphasized that:

> *"…Some of the mathematics teachers had been accused of never using teaching aids because their older colleagues do not use them. Many teachers are too boring to listen to. Some teachers enjoy talking and even punishing students who doze when they are teaching. Some tell students to run around the school, and others are told to stand up in class for the rest of the lesson just because they are dozing. Teachers should not rely only*

on words to explain facts and concepts. The use of teaching aids make teaching both lively and interesting to students….”

Mukwa (1993) also observed that

> *”…Lack of materials can hinder any program from operating with desired efficiency…….Availability of necessary and relevant resources that are tools, facilities, equipment, personnel, finances and time are crucial in the successful implementation of any innovation. An innovation without supportive materials is linked to a farmer who goes to dig without relevant tools….”*

According to encyclopedia, an attitude is a hypothetical construct that represents an individual’s degree of like, dislike for something or somebody, and usually reflected in a person’s behavior. In a study that examined the perceptions of secondary school students on improvised science learning materials prepared during teaching practice by teacher trainees, Ndiragu (2000) cited in Esokom (2006) found out that inadequate learning resources had seriously affected students’ attitudes and performance in science subjects. He further noted that:

> *“…Serious lack of science teaching materials had led teachers to the use of theoretical approaches, hence contributing to negative perceptions by learners that science subjects are difficult and strenuous to learn. In conclusion, the researcher noted that improvised teaching practice instructional materials enhanced learner motivation, made conceptualization easier and improved attitudes towards learning of the subjects….” (Ndiragu, 2000 cited in Esokom, 2006:3)*

However, the study done by Esokom (2006) only looked at science subjects and did not consider mathematics, it could be that the same scenario is what is happening in mathematics and that the poor performance could be due to the attitude held by the students towards the instructional materials used. Research study done by a group of economists showed that positive attitude towards the use of instructional materials can yield to good performance (Glock 1971). This study was purposively carried out to ascertain the attitudes of students on the use of instructional materials during mathematics in secondary schools of Baringo central district. As has been mentioned, majority of teachers are assumed to be always using instructional resources during mathematics. This is because they are trained and qualified and with the Strengthening of Mathematics and Science in Education (SMASE) Inset (in service training) they attend yearly that recommends the use of learning materials yet students still fail to score in questions that require use of teaching and learning materials like models. Knowing the attitudes of students towards the instructional media resources used will help teachers to use appropriate learning resources for appropriate students in class.

1.2 Statement of the Problem

There is a general dissatisfaction expressed by educationists, potential employers, the mass media and ordinary Kenyan citizens that most of the secondary school learners and even university graduates, are not fully equipped with the basic skills of mathematics. Studies carried out in Uganda, Kenya and Tanzania reported that accessibility of learning resources is positively correlated to achievement (Husen, 1967). Another survey carried out in Uganda indicated that textbooks availability is positively related to achievement. Research study done by Too (1996) found out that all teachers generally have a high regard for instructional media and recognize them as important vehicles of learning. In addition, Too (1996) study further asserts that the qualification, training and teaching experience were found to have a positive relationship with the use of instructional media. Too (1996) study continued to note that trained and experienced teachers are adept and more disposed to using instructional media.

As pointed out in the background of the problem, the use of instructional materials in mathematics instruction has not yielded good scores in topics like 3- dimensional geometry, transformations, geometric constructions and statistics. The questions that this study will try to answer is that if teachers are trained to use instructional materials and that they are qualified and experienced to handle instructional resources or learning objects then why does KNEC reports recommend to mathematics teachers to use teaching resources to enhance learning?. It is documented that teachers are properly using instructional media resources. This was supported by a study done by Omwono (1990), which investigated the availability and use of instructional media in the teaching and learning of primary mathematics in Kuja division in the former South Nyanza District. The study found out that there was acute shortage of teachers and students resources for teaching mathematics. Omwono (1990) study further found out that teachers were generally innovative, they improvised teaching aids and were willing to use the meager resources available. This is the gap the study was set to answer and to find out. Do the students, who have different perceptions on the instructional materials used, have the right attitude towards the use of learning media during mathematics instruction. This study therefore sought to ascertain the attitudes of Secondary school students of Baringo Central district on the use of instructional materials in the learning of Mathematics. The study emphasized most on the nonprojected media category like the models, textbooks, manila cut-outs, supplementary textbooks and graphics and design during mathematics instruction.

1.3 Purpose of the Study

The purpose of the study was to investigate the attitude of students towards the use of learning resources in mathematics instruction in selected secondary schools of Baringo district, Kenya.

1.4 Objectives of the Study

The objectives of the study were to:

1. Find out students attitudes towards the use of instructional resources in the learning of mathematics.
2. Find out whether there is a significant difference in attitudes of students towards the use of instructional resources between male and female students.
3. Find out whether there is a significant difference in students' attitudes towards the use of instructional resources among those in public provincial and public district schools.
4. Find out whether there is a significant difference in students' attitudes towards the use of instructional resources among those in public and private schools.
5. Find out the influence of mathematics teachers' academic qualification on attitudes of students towards the use of instructional resources.
6. Find out the influence of mathematics teachers' experience on attitudes of students towards the use of instructional resources.

1.5 Research Questions

The following were the specific research questions used to guide the study:

1. What are the students' attitudes towards the use of instructional resources in the learning of mathematics?
2. Is there a significant difference in attitudes towards the use of instructional resources between male and female students?
3. Is there a significant difference in attitudes of students towards the use of instructional resources among those studying in public provincial and public district schools?
4. Is there a significant difference in attitude of students towards the use of instructional resources among those studying in public and private schools?
5. Are there influences of mathematics teachers' academic qualifications on attitudes of students towards the use of instructional resources?
6. Are there influences of mathematics teachers' experience on attitudes of students towards the use of instructional resources?

1.6 Research Hypotheses

The following research hypotheses, stated in null form, as derived from the research questions, were tested using chi-square test at an alpha level of 0.05 (95% level of confidence)

1. There is no significant difference in attitudes towards the use of instructional resources between male and female students.
2. There is no significant difference in attitudes of students towards the use of instructional resources among those in public provincial and public district schools.
3. There is no significant difference in attitudes of students towards the use of instructional resources between those students in public and private schools.

4. There is no significant difference in attitudes of students towards the use of instructional resources between those students taught by teachers with diploma certificate holders and those taught by degree certificate holders.
5. There is no significant difference in attitudes of student's towards the use of instructional resources between those students taught by teachers with less than 5 years experience, and those taught by over five years experience.

1.7 Significance of the Study

The research study would help teachers to facilitate instruction and hence improve the overall learning outcome, in that the study will give recommendations to teachers on how to deal with students different attitudes towards teaching/learning resources and on the best combination to motivate and arouse interest of the students. The study will contribute valuable knowledge to the field of pedagogical content; teachers will no longer spend their time passing along pre-interpreted information or supervising lockstep drills. This will enhance learner motivation, make conceptualization easier and improve attitude towards learning of mathematics.

The findings of the study will be useful to the Quality Assurance Office (QUASO) of the Ministry of Education (MOE) who is responsible for curriculum interpretation and implementation. Through Strengthening of Mathematics and Sciences in Education (SMASE) inset, the QUASO will be able to identify, judge and select suitable instructional media resources for use in secondary schools. The Kenya Institute of Education (KIE) which produces and provides guidance on the use of instructional resources for secondary schools will also benefit from the findings of this study.

The study will also provide information about the appropriate instructional resources for use in secondary schools to commercial book publishers like The Kenya Literature of Bureau (KLB), Oxford, Moran (formerly Macmillan) et cetera. This will encourage them to produce the best instructional resources for teaching and learning of mathematics.

1.8 Scope of the Study

The study was carried out in selected secondary schools of Baringo Central district in Kenya. It focused only on students in form four, who were present during the time of study. Form four students were purposively sampled because of their maturity and long experience in learning mathematics. Data were collected from students and mathematics teachers of secondary schools.

1.9 Limitations of the Study

The instruments (questionnaire and interview schedule) used to collect data might have brought some limitations. To start with there was low rate of return of the duly filled in questionnaires with some being lost in the process. Bias due to no response was also experienced during the feeding in of the data. Another limitation that came due to the research tool used was the ambiguous replies or omission of replies altogether to some items which made interpretation of these omissions a bit difficult.

The study was carried out in mathematics classes in Baringo central district, Kenya. Thus, the results might not be generalized, as they are not representative of all Kenyan secondary schools. The results would be adequate only for descriptive purposes.

Time and financial constraints also did not allow all the secondary schools in Baringo central district to be included in the study. The research study was specific to instructional resources which can be improvised if not available in schools for example Non- projected media like models, playing cards, printed media i.e. textbooks, encyclopedia, magazines, newspapers and sets of mathematics instruments. This is because they were easily available for the teachers in the study area.

1.10 Assumptions of the study

The study based its assumptions that secondary school mathematics teachers have been exposed to various methods of teaching the subject during their training and during the insets offered by SMASE (Strengthening of Mathematics and Sciences in Education). Teachers are familiar with and are using various available instructional resources for teaching and learning mathematics. In scenarios where the learning materials were not available teachers should be able to improvise or make locally some instructional resources. Secondary school teachers and students responses on the questionnaires would represent a true state of the students' attitudes on the use of instructional resources in the learning of mathematics.

1.11 Theoretical and Conceptual Framework

Theoretical Framework

This study adopted Piaget's (1964) theory of cognitive development. Piaget's (1964) theory asserts that children's mental constructs develops through their experiences in their environment. The theory holds that, the cognitive structure develops valiantly or sequentially and interactively forms the concrete to the more abstract one. In his theory, he specified four major stages of development:

- The sensory motor stage (birth – 2 years)
- Pre- operational stage (2 years – 7 years)
- Concrete – operational stage (7 years – 11 years)

- Formal operational stage (12 years onwards)

This study based its assumptions on the formal operational stage because most learners in secondary schools fall in this stage.

Formal Operational Stage

Here, the child can use reasoning based on logic. He can formulate theories. The child is able to relate, differentiate, combine mentally and logically various ideas through symbols. Maximum ability at this stage is usually achieved through adulthood. Piaget's theory implies that the child is not simply a passive organism that responds to any stimuli that occurs, but is an active organism. The theory further implies that the activity of the child to learn more of the subject matter present will increase as he progresses through the different stages of cognitive development. Therefore when a teacher decides to use teaching and learning resources, he has to take into account the learners stages of cognitive development.

The theory suggests that teaching methods and materials should be consistent with the children's level of conceptual development. Regarding school experience and cognitive development, Piaget (1964: 4) wrote that:

> *"…Experience is always necessary for intellectual development. However, I feel that we may get into illusion of being submitted to an experience that is sufficient for the subject to disengage the structure involved, but more than required. The subject must be active, must transform things and find out the structure at his own actions on the objects…."*

According to Piaget's (1964), it is the responsibility of the teacher to organize the learning process to be more meaningful to the learner. Wadsworth (1984) espoused that:

> *"…Most Piagetians believe that school experiences can have an impact on children's acquisition of knowledge if teaching practices are brought in line with children's ways of learning. ….most Piagetians agree that the teacher can help facilitate cognitive development, but most argue for an enrichment approach that permits children's to solidify and generalize the knowledge they have…."*

This observation calls upon the teacher to use among other instructional multi-media materials to enable the learner make meaning out of the concepts he /she learns. A teacher who conceptualizes intelligence as developing may be motivated to help the poor performers by use of instructional resources. How teachers conceptualize learning will influence their actions. Teachers expectations are communicated to students and these affect their achievement. How teachers conceptualize learning and how each organizes the instructional process, has a lot to do with how much is learned and who learns in their classrooms. Therefore, students' perception on learning resources will depend on their attitude held.

Piaget (1964) emphasizes throughout his work that cognitive and intellectual changes are the result of development and coherent processes of successive qualitative changes of cognitive structure (schemata). Each structure and its non-combatant charge derive logically and inevitably from the preceding one. The learning starts at birth through primary education, where experiences are made vivid by use of concrete experiences, and when they join secondary schools the process of learning should be made continuous as Piaget (1964) argues. In order for learning process to be

continuous, the use of instructional resources, even for adults or adolescents students in secondary schools, is essential. The use of instructional resources makes learning interesting, motivating and a fulfilling experience, especially when they are selected wisely and used as they bring reality into the classroom. In their research, Sankey & Nooriafshar (2005) noted that presenting instructional content using various learning media elements creates access of information for different types of learners. Sankey & Nooriafshar (2005) continued to note that instructional resources also gives learners opportunity to interact with the content and make meaning of the information for themselves. Ayot & Wanga (1987) in their book titled *Teaching Practice the teacher as a tool of learning* stated that teaching resources are used to increase learning to generate more interest and create a situation where the students would fully engage in the classroom activities. When teaching aids are applied adequately, they give students practical experience, which can help them develop skills and concepts easily.
Hence, teachers should therefore ensure that the child is given the benefit of mathematically stimulating environments. This will enable the child to develop the correct meaning of concepts as used in classroom by the teacher. However, Piaget did not say how or under what specific conditions development can be advanced. He was only concerned with how concepts develop and not how to develop them. The theory was mainly concerned with learners and did not consider behavioral aspect of the learners. It is in this ground that the researcher brought in the functionalist theory of attitudes. This account for the learners perceptions on the learning resources used during mathematics instruction.

1.12 Definition of Unusual Significant Terms

Attitude: A disposition to think or act in a particular way in relation to oneself, other individuals, objects or groups in society or settled ways of thinking or feeling about something or somebody usually reflected in a person's behaviour.

Baringo District: After the Implementation of the Kenyan new constitution of 2010 this geographical area is now known as Baringo Central Sub-county of Baringo County.

Experience: A teacher who has gained knowledge of teaching mathematics for several years and has taught this subject across all the four classes in secondary school.

Gender: Refers to social-cultural classification of human beings into two basic grouping comprising women and girls on one hand and men and boys on the other hand.

Instructional Materials: This is a broad and all-inclusive term that is serviceable when referring to all kinds of resources / materials which aid attainment of instructional objectives.

Media: Any material, equipment, resource, instrument that facilitates the transfer of information.

Multimedia: Using more than one learning technology or use of multiple ways to present information.

Special board: Refers to either a ruled lined or square lined chalkboard.

1.13 Summary of the Chapter

This research study was to investigate the attitudes of students on the use of instructional materials during learning of mathematics in secondary schools of Baringo district. As was mentioned, researchers have shown that majority of teachers use instructional resources during the teaching and learning of mathematics. This is because they are trained and with the Strengthening of Mathematics and Science in Education (SMASE) inset which they attend yearly that recommends for the use of learning materials nevertheless students still fail to score in questions (three dimensional geometry, trigonometry and geometrical constructions) that require use of learning materials like models and a set of geometrical instruments. Coming up with findings on the attitudes of students towards the instructional learning resources used during mathematics will help teachers to use appropriate learning resources for appropriate students in class.

CHARTER TWO

LITERATURE REVIEW

2.0 Introduction to the Chapter

This section looked at review of related literature in different parts. The first part reviewed literature related to students attitude towards the use of instructional media, gender and students' attitude towards the use of instructional media resources, school type and students' attitude towards the use of instructional media resources, teachers experience and students' attitude towards the use of instructional media resources and teachers qualification and students' attitude towards the use of instructional media resources. Lastly review of literature related to instructional media in general, specific instructional media and instructional media resources for teaching mathematics.

2.1 Students' Attitudes towards the Use of Learning Resources.

Attitude is a favorable or unfavorable evaluative reaction towards something or someone exhibited in ones beliefs, feelings, or intended behavior. It is a social orientation - an underlying inclination to respond to something either favorably or unfavorably (Katz, 2001). According to Fiske & Taylor (2008) cited in Helen et al; (2009: 4) Attitudes are seen as cognitive and affective orientations or dispositions towards an object, idea, person and situation. Ralph and Kings (1997) have defined attitude as a mental predisposition towards people, objects, events, situations or ideas. Attitude may be considered as a mental state of readiness to respond that is organized through experiences and will exert a directive influence or behavior (Ralph &Kings, 1997). Attitudes mean the individual's prevailing tendency to respond favorably or unfavorably to an object (person or group of people, institutions or events). Attitudes can be positive (values) or negative (prejudice). Social psychologists distinguish and study three components of the responses for example cognitive component: which is knowledge about an attitude object whether accurate or not, Affective component: feelings towards the object and behavioral component, which is the action taken towards the object. Jung (2006) cited in Ogott et al; (2011: 1) states the primary function of attitudes is to provide some kind of organization of the world we live in. It defines outward or visible postures and human beliefs. Attitudes determine what each individual will see, hear, think and do. They are rooted in experience and do not become automatic routine conduct. The way individuals perceive themselves results in beliefs, opinions and hence, attitude formation. Individuals perceive themselves in terms of strength and limitations. In addition, they judge themselves on the basis of whether they are capable or incapable to perform certain tasks. In other words, they perceive their self-efficacy out of their own judgment (Hohn, 1995 cited in Ogott et al; 2011: 1, 2). Haber (2005) cited in Ogott et al; (2011: 1) says that attitude is based on both ideas and feelings. It is the result of both cognitive and affective components. Psychologists agree that attitude has three main components: a cognitive or thought, an emotional or affective and a behavioral or action component. Lindzey (1998) cited in Ogott et al; (2011: 1, 2) refers to the concept and beliefs associated with attitude as the cognitive component of the attitude. This is the information we accept about an object, concept or event, whether the information is accurate or not. Beliefs are the actual components of attitude, even though they are perceived rather than being objective facts (Lindzey, 1998 cited in Ogott et al 2011: 1, 2).

In their book titled *Invitational to Psychology*, Ragland and Saxon (1989) define attitude as a learned tendency to respond in a certain way because of beliefs, feelings and readiness to act. Ragland and Saxon (1989:422) continue to assert that:

> *"…There are three levels of attitude. The first is Compliance. This is the weakest level. When you comply, you only seem to form the*

> *attitude, in order to avoid rejection or approval. The second level of attitude formation is Identification. You adopt an attitude as a result of an emotional attachment to a person or a group. While identification is a stronger kind of attitude formation than compliance, the strongest level is internalization. Internalization means you take the new attitude into your own belief system. You believe it for your own reasons, not just because of others. The attitude becomes part of you.*

The terms Instructional materials, Instructional Resources, Teaching Resources, teaching aids and audio visual aids mean more or less the same thing. They are aids that teachers use to assist learning and increase interest in learning. Teachers use resources to enhance student participation in class for effective learning. According to Farrant (1980), in his book titled *Principles and Practice of Education*, he classified instructional resources into four groups; (1) Media for Real and Simulated life are Specimens, Artifacts, models, Diorama, Instructional games and Puzzles. (2) Resources in the classroom are blackboard, maps, Atlases, Globes, Books, Periodicals, Work cards or assignment cards and Wall sheets. (3) Traditional Resources are Folk communicators, Dramatization, Puppetry and interviewing. (4) Education Technology are audio media, Projected media and Audio- Visual media. This study was focused more on the first and the second classification only. Farrant (1980) noted that instructional resources motivate students to learn as they offer stimulus variation and assist in sustaining student’s attention throughout the lesson and continued to note that too complicated resources can discourage students learning or enthusiasm, can sometimes make students passive listeners and discourage them from critical thinking. Instructional resources like wall-sheets modify behaviour, attitude and arouse interest of the students….While teaching resources like textbook can be used individually with learners or with large groups and can be used at whatever speed the reader can absorb its contents (p.296).

In her book, Laurillard (2002) categorized educational media into five forms, Narrative media, Interactive media, Communicative media, Adaptive media and Productive media. Laurillard (2002) continued to elaborates that:

> *"…Narrative media are the linear presentational media that include print (text and graphics) audio, usually audiocassette, audiovisual, broadcast television or film, and videocassette or digital disc…." (p. 91). "…Interactive media are the presentational media that include hypertext, hypermedia, multimedia resources, Web-based resources and internet-delivered television. They share the core common property that they are essentially linear media delivered in an open, user controlled environment, either by disc or over network. Being essentially linear, they offer a given text, in its widest sense, that remains unchanged by the user…." (p.105) "...Adaptive media are the computer- based media capable of changing their state in response to the user's, examples are Simulations, tutorials virtual environment and educational games…." (p.126) "…The communicative media are those that involve communication may be between tutor and student, or between students. The medium of communication is text/ graphics, audio, video, or any combination of the three examples are computer mediated conferencing, Audio-graphics, Video conferencing and student collaboration…."(p.145) "…Productive media include micro-worlds, productive tools and modeling environments. Their key properties are to provide an electronic context in which the learner*

> *can build something, engage with the subject by directly experiencing its internal relationships and learn to represent these relationships in some general formalism…."(p.171).*

Clarke & Bowe (2006) noted that Quality learning is a function of positive attitude towards learning and therefore in selecting the material to use as a teaching aid, the attitude that learners hold towards material should be considered. Several studies have looked at students attitudes towards media resources. Clarke & Bowe (2006) further asserted that Mathematics students reported liking learning resources because they: Were fun and enjoyable, were able to control with respect to the place of learning, Provided timely feedback, were easy to use, Consisted of a number of media tools and helped with learning. Lim et al. (2006) and Nurmi & Jaakkola, (2006) added that the acceptance of Media learning objects was somewhat dependent on the kind of learning object used. Lim et al. (2006) and Nurmi & Jaakkola, (2006) further asserted that students in these studies favoured interactive, constructive learning objects over the "electronic" textbook prototype. Kay and Knack (2007c) offered quantitative evidence that students were moderately, but not exceedingly, positive about using mathematics-based learning objects.

Look (2005) cited that a review of 219 studies on the use of technology in education consistently found that students in technology rich environments experienced positive effects on achievement in all subject areas. A research report produced by Becta (2003) highlighted that Information Communication and Technology (ICT) provide fast and accurate feedback to students, and speed up computations and graphing, freeing students to focus on strategies and interpretation. The use of interactive multimedia software also motivates students and leads to improved performance. The research studies by Look (2005) and Becta (2003) showed that more students finish high schools and many more consider attending college when they routinely learn and study with technology.

A research study done by Nooriafshar (2005) took a group of twenty first-year undergraduate students who were selected for the purposes of an experiment on the effectiveness of teaching basic mathematics concepts via practical teaching aids. These students were from different mathematical backgrounds and the majority did not have a very strong background in quantitative fields. These students were taught the basic principles of identifying and plotting graphs of polynomial equations of different degrees. Nooriafshar (2005) mentioned that these basic skills form the foundations of understanding, learning and using more advanced techniques in quantitative subjects. Curve fitting, regression, linear programming and its derivatives are some of the examples. The students were taught the main concepts in a very practical manner. The majority of the students who participated in the study Nooriafshar (2005) reported above indicated their preference for visual features. These features represent mathematical concepts, relationships and patterns which were demonstrated to them visually. Most of the students rate the usefulness of mathematical subjects such as those presented in the study as high in their future studies and profession. Nooriafshar (2005) concluded that most of the students who participated in that study regarded learning mathematical topics enjoyable by use of instructional media resources.

2.2 Students' Gender and use of Instructional Media

In his study published in the Australasian Journal of Educational Technology, Teo (2008) found no significant relationship for age and gender, and Learning Media attitudes. Another study done by Houtz & Gupta (2001) found that males and female students had rated themselves on the use of the instructional media in significantly different ways. Another study done by (Culley, 1988) suggested that the masculine image of the computer has deterred females from benefiting from the technology and this has made them less confident or more anxious. A study done by (Campbell, 1990) noted that the masculine image of instructional media makes females less confident and more anxious resulting in them holding more negative attitudes to learning media than males Consequently, female students tended to have negative attitudes towards learning resources compared to their male counterparts (Muira, 1987).

The research studies on gender and computing (Brosnan & Lee, 1998; Balka & Smith, 2000) have reported, though not conclusively, that males have more experience and make more use of computers. It is usual to consider the issue of gender in the context of other user variables such as self-efficacy, computer anxiety, and computer experience. For example, Chua, Chen and Wong (1999) and Coffin and Mack (2000) in their meta-analyses on the relationships between computer anxiety, computer attitudes, computer self-efficacy and computer experience stated that most findings usually reinforce the gender effects and suggested that greater levels of computer experience are associated with lower computer experience and more positive computer attitudes. Females usually have more negative attitudes towards computers (Durndell & Thompson, 1997) and greater computer anxiety (McIlroy, Bunting, Tierney & Gordon, 2001) than males. Research on computer self-efficacy in general also revealed that males on average tend to acquire computer self-efficacy faster than females (Todman, 2000). Another study done by Hong, Ridzuan, & Kuek (2003) investigating the Students' attitudes toward the use of the Internet for learning at a university in Malaysia agreed with the study done by Teo (2008) indicating that there were no significant differences in the students' attitudes toward the use of the Internet for learning based on gender.

2.3 The type of School and Students' Attitudes on the Use Learning of Resources

The type of school as an institution influences children learning. The administration of the school, from the head teacher to the class-teacher, as well as non-teaching staff, usually have some influence on the child's learning. The physical surroundings of the school also have a part to play in the child's learning. This includes where the school is built and the layout of the classrooms. For example, if the school is old and run down, it will affect the child's learning. Leaking roofs will disturb the learners, if the classes face one another and interruptions are frequent, then the learner's concentrations will be affected. In some areas, noise from moving vehicles, industrial pollution, rain and hot weather will affect learning. Class size has a direct influence on learning. A small class has positive effect on learner participation in learning activities. Dane (1934) found out that kindergarten classes with fewer children showed increased class discussions, thus discussions increased as the class size decreased. In a study done by Hong, Ridzuan, & Kuek (2003) investigating the Students' attitudes toward the use of the Internet for learning at a university in Malaysia, most of the students agreed that the learning environment in the university encouraged students to use the Internet in their learning tasks. Students' total scores on the seven statements measuring their perceptions of the university's learning environment were correlated with their total scores on the seven statements measuring their attitudes toward the use of the Internet for learning. The Pearson, r, value was 0.398, with p-value < 0.0005. There was a significant relationship between the two variables. Students who felt that the learning environment in the university promoted the use of the Internet had positive attitudes toward the use of the Internet for learning. In a research study done by PISA (2003) on students learning: attitudes, engagement and Strategies, the findings showed that the differences between schools in students' reported characteristics are far less pronounced than the differences within schools. Individual schools do not vary greatly in the profile of students' self-reported approaches to learning has, nevertheless, important implications, even if it does not imply that all schools are similar with regard to the learner characteristics of their intake. PISA (2003) findings showed fewer differences among schools in learner characteristics than in performance. The present study was carried out at the secondary school level and investigated the attitudes of students towards instructional media in the learning of Mathematics.

2.4 Teachers' Qualifications and Students' Attitudes on the Use of Learning Resources

Teachers' characteristics have influence on how the students learn. Use of instructional resources by teachers during math lessons will influence the content the student gets from the teacher. Research done by (Woohall, 1998 & Kawoya, 1988). Bennars et al (1994) have emphasized that:

> *"…Some of the mathematics teachers had been accused of never using teaching aids because their older colleagues do not use them. Many teachers are too boring to listen to. Some teachers enjoy talking and even punishing students who doze when they are teaching. Some tell students to*

run around the school, and others are told to stand up in class for the rest of the lesson just because they are dozing. Teachers should not rely only on words to explain facts and concepts. The use of teaching aids make teaching both lively and interesting to students….”

In a study done by Too (1996), investigating the availability and use of media resources in mathematics instruction done in Nandi District, found out that there was no significant relationship between teachers' qualification and use of media resources in the teaching of geometric constructions. He further noted that this could be so because of the nature of the subject matter itself in that the topic is common at nearly all levels of mathematics curriculum. Too (1996) further found out that it does not require intensive training for one to appreciate the value of instructional media. He continued to note that it is only an enabling environment, encouragement and most important incentives such as promotions that are required to have as many teachers as possible using media in their lessons frequently. In general, Too (1996) tested the same hypothesis with five other topics that require the use of media and found there was significant relationship in the teaching of graphical work, trigonometry and three-dimensional geometry. It was only in transformation geometry and geometric construction that the hypothesis that had no significant relationship. S1/Diploma in Education teachers tended to use instructional media more appropriately than the trained graduate teachers. In graphical methods 44.0%, graduate teachers used media appropriately compared to 60.0% of S1 /Diploma in Education teachers. Too (1996:131) concluded:

"…there was a significant relationship between training and use of media, thus in all the cases there is disparity in the teachers' qualification and use of media; with the S1 /Diploma in Education teachers having an edge over the

rest of the teachers. Training of mathematics teachers at the diploma level particularly with regard to media use appears to be more superior than in other training institutions, even in the university. Apparently, teachers trained in such colleges are well exposed to media use and production skills than the university-trained teachers….”

Some other studies have also looked at teacher attitudes toward the use of media resources in the mathematics classroom. Clarke& Bowe (2006a), Clarke & Bowe (2006b), Gadanidis et al (2003) and Kay & Knaack, (2007c) found out that teachers valued several characteristics of learning objects: the immediate feedback provided the ability to repay and redo tasks for both enjoyment and mastery, and the motivational impact. Kay & Knaack (2007c) continued to add that pre-service teachers felt media benefited students learning.

Studies done by Fine & Fleener (1994), Forgasz & Prince (2001), Manoucherhri (1999), Simonsen & Dick (1997) and Walen, Williams & Garner (2003) time and opportunities to learn (pre-service education, professional development), access to hardware and software, availability of appropriate teaching materials, technical support, knowledge of how to integrate technology into mathematics teaching and beliefs about mathematics and how it is learned.

The present study that was carried out at the secondary school level in Baringo Central district and investigated the attitudes of students towards instructional media in the learning of Mathematics looked at the relationship between students attitude and the teachers qualification.

2.5 Teachers' Experience and Students' Attitudes on the Use of Learning Resources

A research study done by Too (1996: 109) investigating the availability and use of media resources in mathematics instruction done in Nandi District found out:

> *"…27.1% of teachers with experience used media appropriately in teaching various topics, 10.9% of the teachers without experience used media appropriately. Only 9.8% of the teachers with experience did not use any media but 30.4% of the teachers without experience did not use any, Experience in teaching mathematics invariably instills a sense of media consciousness in a teacher. That media consciousness born with experience and coupled with mastery on content makes an effective teacher. It was quite evident that experience is vital quality in teaching and learning of mathematics using media resources. Experienced teachers are more superior in the use of media than the less experienced ones. Experience in teaching would provide the cue and the intuition of the appropriate material that would help the learner learn easily. A novice in the teaching profession may not have a clear understanding of the learner characteristics. With zeal and enthusiasm, a young teacher would embark on teaching with the sole aim of completing the content in the syllabus; with little or no consideration of media use.*

The study done by Too (1996) did not look at the relationship between the teacher's experience and students' attitudes on the use of media resources in the learning of mathematics. The present study carried out in Baringo central district sought to research on the relationship between the learners' attitudes towards use of instructional media and the teachers' experience. Experience in teaching using media is very vital and only teachers with more than five years experience will be able to choose the right learning media for a lesson. Media resources, if carefully selected, have a considerable potential to aid student learning. A research study done by Akpinar & Bal (2006), Liu & Bera (2005), Nurmi & Jaakkola (2006) and Reimer & Moyer (2005) hypothesized that effective multimedia resources require students to construct and manipulate information, Provide rich feedback and interactive, Help students understand abstract ideas with concrete representation and Support key students weaknesses like limited working memory, difficulty in retrieving long term memory, and ineffective cognitive strategies. Akpinar & Bal (2006), Clarke & Bowe (2006a), Nurmi & Jaakkola (2006) and Reimer & Moyer (2005) emphasized in their study that instructional strategies supporting the use of media resources are critical for success regardless of the quality of the learning objects selected. Recent studies done by Sowell (1989) Suydam & Higgins (1997) conducted in mathematics instruction in K-8 grades found that the use of manipulative materials supported the development of connection between concrete and abstract thinking by attaching meaning and importance to mathematics experiences.

Other studies carried out by Gadanidis & Schindler (2003) and Kay & Knaack, (2007c) found out that learning objects offer several promising solutions to the challenges that everyday teachers face with respect to using technology. Gadanidis & Schindler (2003) and Kay & Knaack (2007c) continued to note that learning objects are easy to use and that teachers, even those who have limited computer-based skills, do not need to devote considerable blocks of time toward understanding how to use these straightforward learning tools. Kay & Knaack, (2007c) further asserted that good learning objects have well defined objectives and a clear narrow focus making them easier to develop effective lesson plans and integration strategies. Kay &

Knaack (2007c) continued noting that learning objects are readily accessible over the Internet. A study done by Russell, Bebell, O’Dwyer & O’Connor (2003) titled *Teachers’ Use of Computer-Based Technology Across all Levels of Schooling (K-12)* found that access to technology, pedagogical beliefs, and exposure to particular technologies were the strongest predictors of how frequently teachers incorporated technology into their lessons. Other studies done by Fine & Fleener (1994), Forgasz & Prince (2001), Manoucherhri (1999), Simonsen & Dick (1997) and Walen, Williams & Garner (2003) found out that the factors that influence mathematics teachers use of teaching resources in the learning of mathematics included: skill and previous experience in using instructional technology.The present study done in selected secondary schools of Baringo central district sought to find out if the students’ perception on the learning media had been influenced by the teachers’ experience on the use media.

2.6 Media Resources and Mathematics Instruction

It has been said that Mathematics is a difficult subject (Wan, Wan & Halimah, 2002). Media technologies have a wide impact in the mathematics classroom. Media can facilitate in depth exploration of the mathematical topics previously too complex for typical classroom especially when such topics involve real world ‘‘messy data’’. Media enables students to visually examine concrete representation of mathematics concept (Gningue, 2003). For example in using the graphing calculator, the analysis of the calculator images would provide the student with a concrete learning opportunity to recognize their thinking processes, procedures and structure therefore enabling them to move toward a higher more formalized level of understanding.

The National Council of Teachers of Mathematics (N.C.T.M) has argued even more persuasively in support of the use of computing technologies in the classroom.

Electronic technologies- such as calculators and computers are essential tools for teaching, learning and doing mathematics. They furnish visual images of mathematical ideas accurately. They can support investigation by students in every area of mathematics, including geometry, statistics, algebra, measurement and numbers. When technological tools are available, students focus on decision-making, reflection, reasoning, and problem solving (NCTM, 2000:24)

Research in mathematics education over the last decade has begun to address these new technologies and their effects on learning and teaching of mathematics. Although overall findings concerning the predicted benefits for students' learning have been somewhat inconclusive, many studies have reported that the use of technology has a positive effect on students' attitudes towards mathematics, understanding of function and graphing concepts and spartial visualization skills (Goos & Geiger, 2000).

Usage of symbols, shapes, mental images, concrete models and such kind of demonstrations in expression of concepts in mathematics, is highly significant in terms of the learning process. In mathematics teaching, utilizing just one or two of these types of demonstrations and ignoring the others will not support the process of children's having the concepts of mathematics sufficiently. Providing diversity in types of demonstrations and utilizing concrete models, notably in teaching towards children, will facilitate the meaningful instruction of mathematics on a large scale. In this respect, it is thought that material supporting mathematics education will be able to concretize most of mathematical concepts for students and help them to comprehend these concepts more easily. The importance of material supported mathematics education is realized better when the studies in this area are examined: the study carried out by Öztürel (1987) and Sezer (1989) cited in Uyangor & Kavaca (2010) has put forward that computer supported mathematics teaching makes a significant difference on student's success in mathematics. The study conducted by Asfuroğlu (1990) cited in Uyangor & Kavaca (2010) has indicated that material supported geometry teaching has a positive effect upon developing concepts of triangle, circle and square in students and increases their success.

The study conducted by Dündar (1997) cited in Uyangor & Kavaca (2010) has shown that teaching with supplementary materials in fourth year at primary schools has significantly enhanced the comprehension of mathematics. The study carried out by Toluk, Olkun, Durmuş (2002) cited in Uyangor & Kavaca (2010) has analyzed the effects of problem oriented, and visual model supported geometry teaching upon the geometrically thinking levels of pre-service class teachers and had shown that there had been a significant development in the geometrically thinking levels of students. These results have shown that if the attention of students who have implemented the activities concerning the classification of quadrangles and triangles which are suitable for first and second levels, is not drawn to the relations between shapes and characteristics, students can not establish these connections themselves; besides, it has been helpful for students to establish such relations in forming their own definitions. It has been observed that dynamic models such as master ruler have been effective in student's creating those definitions. It has been provided that success in mathematics has been high when materials are utilized.

The importance of material supported education in mathematics has increased the need for well equipped and well informed teachers in this area. Arousing interest among students, teaching in accordance with their interest and wishes, showing them how to gain information and enabling them to transfer the gained knowledge to the areas necessary for them and to share them, should be the objectives of educational system. Teachers in the system of education are thought to be the most important factors to realize those goals. Besides having enough knowledge and skills in this area, the teachers who will utilize the material supported education using educational technologies, should also believe in the benefits of utilizing material in lessons and should be interested, willing towards this area and develop a positive attitude towards it. Within this context, one of the objectives of this study was to determine the attitudes of secondary school students on the use of instructional resources during the learning of mathematics in relation to the teachers' characteristics.

2.7 Availability of Media Resources and Performance in Mathematics

Direct reference, visual aids and classroom instructions cannot provide all the instruction necessary. We need reference to textbooks in order to cover some of this instruction. Textbooks are designed to present the basic principles of a given subject. They are highly organized; they contain a summary of a specific knowledge and learning activities or suggestions for further study.

Mathematics requires a sequential study treatment. Textbooks provide such a sequence. Learning mathematics depends on mastery of concept and skills. Students may grow in this mastery by performing exercise of the text. Many schools are limited in resources such as library, concrete materials and visual learning aids, community resources and duplicating equipment and so textbooks provide the basic and sometimes the only resources. The availability of textbooks has been reported to be consistently related to achievement in developed and developing countries. Studies carried out in Uganda, Kenya and Tanzania reported that accessibility of learning resources is positively correlated to achievement (Husen et al, 1978). A survey carried out in Uganda indicated that textbooks availability was positively related to achievement.

Maundu (1986) noted that students from schools with highly qualified teaching personnel attained high. On teaching experience, a significant correlation was not found to exist between schools with more experienced teachers and those with less experienced ones. These findings were in line with those of Husen (1967), when he reported neither lack of significant correlation in neither teachers' training nor teaching experience and mathematics achievement. However, these findings by Maundu (1986) were highly questionable as the study did not address the effect caused by the students' intellectual abilities since schools studied were of different categories in terms of student enrolment.

Another study conducted by earlier researchers in an attempt to solve the problem of low Mathematical achievement in Kenya is that of Kombo (1988) in Too, (1996). The main objective of the study was to find out whether there is a relationship between some related factors (independent variables) and the students' low achievement (dependent variable) in the Kenya Certificate of Education among Harambee secondary schools in Machakos district. The teachers' characteristics studied were academic qualification, professional training, teaching experience and in-service training. The students characteristics studied were parental education, education, occupation and encouragement. Other variables studied apart from the above teachers' and students characteristics included: home environment, teaching aids and resources, and administrative characteristics. The results of the study showed that all teachers' characteristics significantly influenced students' achievement in mathematics. On the other hand, the following students' characteristics were also positively correlated to mathematics achievements; parental education, occupation and encouragement. For Kombo, the parental education was a significant factor in that the students from families where education was valued got moral and material support from their parents. These parents were found to be very conscious about their children's general academic progress. The administrative support was measured in terms of the number of staff meetings held each term, the involvement of teachers in making decisions and solving of teaching and administrative problems. The study revealed the students' achievement was high in the schools with optimal job satisfaction. The other important finding of this study was the students' achievement in mathematics was positively correlated with the availability of teaching aids and resources (Kombo, 1988 in Too, 1996). Specifically the study revealed that schools with adequate class texts books achieved higher than those without adequate class texts. The effects of teaching aid was quantified in terms of their availability and problems encountered in using them. Another study done by Irumbi (1990), investigating the factors which influence students' achievement in Kiambu district of Kenya found out that school related factors such as, availability of textbooks, supplementary materials, teachers' training and experience and attitudes had effects on student achievement. The quality of a teacher was assessed with respect to level of training, teaching experiences and frequency of attendance of in-service courses or refresher courses for mathematics. The availability of learning resources was also found to be positively correlated with mathematics achievement. The textbook availability was assessed with reference to the number available for each level, the variety of textbooks available to mathematics and the frequency of their use in the teaching and learning of mathematics. However, most of the studies done either looked at the availability of resources, the teacher characteristics and the students' characteristics. Hence there is need a study to look at the attitudes of students towards the available media resources, how the students' characteristics and the teachers' characteristics affect the learners' attitude.

2.8 Information Technology Assisted Learning

There is substantial research supporting the effectiveness of information technology-assisted project-based learning (IT-assisted PBL). When IT-assisted PBL is used in a constructivist, cooperative learning environment, students learn more and retain their knowledge better. Moreover, students learn the content area being studied, how to design and carry out a project, and uses of IT. Because this approach to teaching and learning is significantly different from the "stand and deliver" didactic approach used by many teachers, it tends to require a significant amount of professional development for its effective implementation. As computer technology becomes more accessible, we increasingly encounter products classified as media documents. These documents are used in electronic format and can include text, sound, graphics, animation, video, color, and interaction with the user. Some authors reserve the term media for electronic documents that have an intrinsic linear design (e.g., powerpoint or clarisworks slide shows) and use the term hypermedia to refer to documents that incorporate a planned non-linear organization (e.g., digital chisel, hyper-studio, or micro-worlds projects). Most authors (and this document) make no distinction between the terms hypermedia and multimedia.

Media documents provide a means of communicating and storing information. Since such documents are used in electronic format only, many variations in viewing result as each user controls the order and manner of interacting with each element in the document. In addition, media documents can also be designed to receive information from the reader and process it to provide individualized responses. This interactivity adds a new dimension to the reading/writing process and the capabilities of reading and writing. A research done by Pierce and Stacey (2004) in Helen et al (2009 :3) found that students with positive attitudes towards mathematics and mathematical computer tools overcame initial difficulties when using such a tool and progressed to more effective behaviours, such as using the tool to explore and develop their conceptual understanding. Negative attitudes led to attempted avoidance of the tool and math tools for lack of success in using it to improve algebraic insight.

A study done by Mwei, Too & Wando (2011) on the *Effect of Computer- Assisted Instruction (CAI) on student's attitudes and achievement in matrices and transformations in secondary schools in Uasin Gishu*, found out that CAI approach is more effective than conventional approach for producing achievement and attitude gains in such a population. The above study was specific to one type of media i.e. computer assisted instruction to learn mathematics while the present study whose findings will be discussed in chapter four did not consider any kind of learning mathematics by the use of Computer but looked at other media like models, printed media, real objects et cetera.

2.9 Summary of the Chapter

This chapter has reviewed literature related to student's attitude towards the use of instructional resources. Quality learning is a function of positive attitude towards learning and therefore in selecting the material to use as a teaching aid the perception that learners hold towards material being used ought to be known by the instructor. The chapter also looked at previous findings relating to the difference between learners characteristics and their attitude, the school characteristics and the learner's attitude towards the learning resources.

CHAPTER THREE

RESEARCH DESIGN AND METHODOLOGY

3.0 Introduction to the Chapter

Methodology is an operational framework within which facts are placed so that meaning may be seen clearly (Leedy, 1974 in Chepyegon, 2011:40). This chapter focused on the following areas: - study area, the target population, sample size and sample technique, research design, instruments of data collection, reliability and validity of data collection instruments; data Analysis technique and ethical issues

3.1 The Study Area

Baringo central district in is one of the districts in the Rift valley province in the greater Baringo county. The district is situated between 35º28`-35º36`E longitude 0º13`-1º10`S latitude. Baringo county stands at an altitude of 1500m above the sea level. Baringo central district was selected due to the poor performance of students in mathematics at the Kenya certificate of secondary education (K.C.S.E) see table 1.2**.**

3.2 Research Design

Research design is the plan, structure and strategy of investigation used to obtain answers to research questions. It refers to the total architectural plan, the tectonic answers to research framework (Leedy, 1974 cited in Chepyegon 2011). The study adopted a descriptive survey design to find out the attitudes of students on the use of media resources in learning of mathematics among secondary students. According to Mugenda & Mugenda (2003), descriptive survey designs are used in preliminary or exploratory studies to allow researchers to gather information, summarize, present and interpret for the purpose of clarification. Borg and Gall (1989) cited in Orodho (2002) noted that Descriptive survey is intended to produce statistical information about aspects of education that interest policy makers and educators. Mugenda & Mugenda (2003) also noted that a survey design is preferred because surveys are the only instruments through which desired information can be obtained more easily and less expensively when compared to other sources.

3.3.0 The Population and the Sample

3.3.1 The Target Population

The target population from which the sample for the study was drawn comprised all the twenty-six (26) secondary schools in Baringo central district. The study was done among students and mathematics teachers of secondary schools in Baringo central district of Rift valley province, Kenya. The accessible population was all Form four students at the time of study with an estimated number of 1800 students and their 44 mathematics teachers who were teaching the form four classes.

3.3.2 The Sampling Technique and The Sample Size.

The study was a survey involving form four students in secondary schools of Baringo central district. According to Kothari (2007) Sampling is a process of selecting units from a population of interest so that by studying the sample may fairly generalize the results back to the population from which they were chosen. Stratified random sampling was used to categorize schools into boys' schools, girls' schools, private schools and mixed schools. Simple random sampling technique was used to select two boy schools, three girl schools, 2 private schools and four mixed schools. At each school level, the study used systematic random sampling to select a proportional number of students according to the population of the form four students from each selected school. For teachers simple random sampling was applied to pick a proportionate sample depending on the number of teachers handling the form four students in the sampled school to score the questionnaires. A total of 180 (10 % of the target population) students and 17 (36.6 % of the population) teachers formed the respondents group for the study. Table 3.1 shows the number and percentages of sampled schools in the study area of Baringo central district by category.

Table 3.1:

Number and Percentages of Sampled Schools by Categories

Category of schools	Total No. of schools	No. of schools selected
Girls	6	3(50%)
Boys	4	2(50%)
Mixed	16	4(25%)
Private	2	2(100%)
Total	26	11(42.3%)

3.4 Instruments of Data Collection

The study used Secondary School Students Questionnaires (SSSQ) and Secondary School Mathematics Teachers' Questionnaires (SSMTQ) that were designed by the researcher to collect data from students and mathematics teachers. A questionnaire consists of a number of questions printed or typed in a definite order on a form or asset of forms (Kothari, 2007). The researcher developed one type of questionnaires after critically studying those designed by Fennema & Sherman (1976) and those by Jepkoech (2002).The questionnaire comprised both the closed and open-ended items.

3.4.1 Students' Questionnaires

The questionnaire for the Secondary School students of mathematics (SSSM) was divided into three sections. Part 1 did seek information regarding student's characteristics i.e. age, gender and type of school; part 2 did seek information on how the students utilized the learning resources they individually own i.e. A set of mathematical instruments, class text and supplementary text and part 3 did seek information on students' attitude towards the use of instructional resources used by their teachers during mathematics learning. Information on students' attitudes was solicited using questions of Likert – type scale containing five response alternatives i.e. Strongly agree, Agree, Undecided, Disagree and Strongly disagree. The questionnaire was constructed by the researcher with the assistance of the university supervisors. The researcher chose questionnaires because the accessible population were literate, there was low cost involved in using the questionnaires in the widely spread Baringo district and that respondents would give well thought out answers which were beneficial to the researcher to meet the objectives of the study.

3.4.2 Teachers' Questionnaires

The Questionnaire for the Secondary School Teachers of Mathematics (QSSTM) was in one part only. This questionnaire did seek information on teachers characteristics regarding age, gender, level of the highest formal education received and years of experience. This helped the researcher to meet some objectives especially objective number four and five, which was to find the difference between the student's attitude and the teacher's characteristics.

3.5 Reliability of Data Collection Instruments

Reliability refers to the extent to which a research instrument yields measures that are consistent each time it is administered to the same individual. A minimum requirement for an evaluation of the instrument should be that the respondent gives the same answer to the same question if the circumstances have not changed (Kothari, 2007). The questionnaires were tested and later re-tested through a pilot study to ascertain their reliability in soliciting information regarding the attitudes of students towards the use of instructional resources. Two schools in the neighboring Koibatek district were randomly selected for this purpose. Reliability of the instruments was established through a test- retest method in the sampled schools. Simple random sampling was used to come up with two schools. At school level, systematic random sampling was applied to select ten percent of the form four students from each of the sampled schools to respond to the SSSQ and lastly two teachers per school were purposively selected to score the SSMTQ. Pearson's Product Moment of Correlation statistic in Appendix D was then used to compute the correlation coefficient (r) between the two tests scores (Taiwo, 1995). The computed Pearson Product Moment Correlation Coefficient (r) yielded a value of +0.78 for SSSQ and + 0.68 QSSTM which was high enough to judge the instruments as reliable for use in a study. This was in line with the recommendations of greater than 0.5 by Kerlinger (1983).

3.6 Validity of Data Collection Instruments

The validity refers to the extent to which a research instrument measures what it is designed to measure. The validity referred to in this study is content validity. Content validity is the degree or success of an instrument in measuring what it set out to measure so that differences in individuals score can be taken as representing true differences in the characteristics under study (Taiwo, 1995). The designed questionnaire for this study was given to staff in the Department of Curriculum, Instruction and Educational Media in the School of Education to determine their suitability. The researcher also considered the opinions of the respondents from the piloting study. Those items in the questionnaires, which yielded inconsistent responses were removed from the questionnaires. The corrections, suggestions and inputs made by the staff were used to improve the questionnaires.

3.7 Data Analysis Technique

Descriptive and inferential statistics were used to analyze the data collected. Descriptive statistics involves comparison of means, cross tabulation, use of tables, pie charts and bar graphs. The chi-square (X^2) test was used to measure relationship between the independent variable and the dependant variables and validity of the null hypothesis based on the selected variables. The data was entered into excel and further transferred to the statistical package for social sciences (SPSS) for data analysis. The Chi- Square formula shown in Appendix E was applied. In order to determine the magnitude of differences between independent and dependent variables, coefficient of contingency (c), a rough and conservative index of strength of relation was calculated from each of the obtained Chi square values using the formula in Appendix F

3.8 Ethical Considerations

The researcher obtained permission from the relevant authorities e.g. the Ministry of Higher Education, Science and Technology through the Department of National Council for Science and Technology (N.C.S.T), The District Commissioner (D.C) of Baringo, The District Education Officer (D.E.O) of Baringo were notified before this research was carried out in the respective schools. The researcher did indicate in the instruments of data collection that the information given by the respondents was to be treated with strict confidentiality. The researcher also informed the respondents about the procedures of the study, the purpose of the study and the benefits of the research to them.

CHAPTER FOUR

DATA PRESENTATION, ANALYSIS AND INTERPRETATION OF THE RESULTS

4.1 Demographic Profiles of the Students

Table 4.1 below shows the frequency and percentages for age, gender and the types of school of each of the sampled respondents

Table 4.1

Frequency and Percentages for Age, Gender of the students and Type of School

Variable	Frequency	Percentage
Age		
14-15	8	4.4
16-17	104	57.8
18 and above	68	37.8
Total	180	100.0
Gender		
Male	93	51.7
Female	87	48.3
Total	180	100.0
Categories of Schools		
Provincial	105	58.9
District	57	35.6
Private	18	5.5
Total	180	100.0

A total of 180 students participated in the research study. From table 4.1 it shows that 57.8% of the students were of the age between 16-17 years while 37.8% were of the age between 17 and above, the remaining 4.4% were between 14-15 years. This implies that the majority of the respondents in the study were between 16-17 years of age. This is expected because of the 8.4.4 system of education in Kenya requires students to go through an 8 year elementary education first before joining secondary education. Table 4.1 also shows that 51.7% of the respondents' were male while 48.3% were females indicating that the majority of the respondents in the study were males. Lastly, Table 4.1 reveals that the 58.9% of the students were studying in public provincial type of schools while 35.6% were learners from public district type of schools and 5.5% of the students were from private type of schools. The research findings showed that the majority of the students who took part in the study were from provincial schools.

4.2 Attitudes of Students towards the Use of Instructional Media Resources

The first objective of this study was to find out students attitudes towards the use of instructional resources in the teaching and learning of mathematics. To achieve this objective, the students were requested to respond to twelve statements that were both negatively and positively rated under the Likert type scale. Table 4.2 shows the responses from the students regarding their attitudes towards the use of instructional media resources.

Table 4.2

Students Responses on their Attitude towards Instructional Media Resources

N=180

STATEMENT	SA	A	U	D	SD
1) Use of solid objects like cuboids, pyramids, prisms does not helps learners in visualizing planes, intersection of planes with lines.	98(54.4)	66(36.6)	3(1.7)	10(5.6)	3(1.7)
2) A teacher does not need to use a set of chalkboard geometrical instruments when teaching geometry provided that I have mine.	1(0.6)	10(5.6)	5(2.7)	27(15.0)	137(76.1)
3) Teaching solid geometry using the models and real objects is better than use of chalkboard diagrams only.	13(7.2)	27(15.0)	27(15.0)	80(44.4)	33(18.3)
4) Use of different sizes of some photographs and model toys enriches the learning of similarity and enlargement in mathematics.	20(11.1)	21(11.6)	24(13.3)	55(30.6)	60(33.3)
5) Use of colored chalk provides contrast and emphasis especially in drawing lines and curves.	76(42.2)	86(47.7)	3(1.7)	13(7.2)	2(1.1)
6) The use of playing cards, dice and coins does not aid understanding of the theoretical probability of occurrence of events.	88(48.8)	52(28.9)	13(7.2)	11(6. 1)	16(8.9)
7) Newspapers and periodicals containing bar graphs, line graphs, pie charts,	76(42.2)	82(45.6)	3(1.7)	13(7.2)	6(3.3)

frequency polygons, forex exchange rates e.t.c about daily life statistical information are useful in the learning of statistics and commercial arithmetic.					
8) Past exam papers are not valuable learning materials.	114(63.3)	49(27.2)	10(5.6)	7(3.9)	0(0.0)
9) calculators motivate learners to solve problems in mathematics.	107(59.4)	43(23.9)	5(2.8)	15(8.3)	10(5.6)
10) Globes, maps e.t.c are not valuable materials in learning bearings, longitudes and latitudes.	11(6.1)	19(10.6)	11(6.1)	51(28.3)	88(48.9)
11) Learning using instructional materials makes a difference and should be used regularly by mathematics teachers even if it delays syllabus completion.	7 (3.9)	10(8.8)	21(11.7)	59(32.8)	77(42.8)
12) Special chalkboard like squared, ruled e.t.c. does not give more illustrations on graphs and geometry when used during learning but the topic needs bright students who can understand.	7 (3.9)	14(7.8)	15(8.3)	52(28.9)	92(51.1)

(The figures in parenthesis represent percentages of students' responses and figures outside represent number responding)

The researcher used the results in the table to discuss the objectives of the research study. The students' responses were analyzed to find the students' attitude towards the use of instructional resources. There were twelve statements measuring students' attitudes toward using the instructional resources for learning mathematics. For each statement the responses were coded as strongly agree (5), agree (4), uncertain (3), disagree (2), strongly disagree (1). The scoring was reversed for negatively worded items. The first statement the students responded to was "Use of solid objects like cuboids, pyramids, prisms does not help learners in visualizing planes i.e. intersection of planes with lines and intersection of planes with planes in three dimensional geometry.” Ninety one percent (91.0 %) of the students agreed with this statement, one point seven percent (1.7 %) were undecided while seven point three percent (7.3 %) disagreed with the statement. This means that most of the students do not see the need of teachers laboring to use models and other learning objects that require the learning three-dimensional geometry during mathematics lessons.

Statement Two “A teacher does not need to use a set of chalkboard geometrical instruments when teaching geometry provided that I have mine”, was about the feeling of the learners on the use of chalkboard geometrical instruments during learning. Majority of the respondents ninety one point one percent (91.1%) disagreed with this statement meaning the students do value these learning materials as very vital for classroom activity. The use of these learning aids cuts across from form one up to form four and is even being used in primary schools to teach mathematics hence the students might have realized it’s usefulness at an early stage resulting to a positive attitude towards these teaching aids.

Statement Three “teaching solid geometry using the models and real objects is better than use of chalkboard diagrams only”. This statement received a backing from twenty one point two percent (21.2%) of the respondents while Fifteen percent (15%) were neutral on the view and Sixty two point seven percent (62.7%) of the learners disagreed with the statements meaning students attitude towards models and real learning objects is negative.

Statement four was to test the attitude of the learners on the instructional media used during transformational geometry. The statement read, "use of different sizes of some photographs and model toys enriches the learning of similarity and enlargement in mathematics". It was supported by twenty two point seven percent (22.7%) of the respondents while Thirteen point three percent (13.3%) were neutral and the rest Sixty three point nine (63.9%) disagreed with the statement. This means that students do not perceive that photographs could be used as learning aids and there have negative attitude towards the use of it to teach transformational geometry.

Statement Five, "use of colored chalks provides contrast and emphasis especially in drawing lines and curves". Eighty nine point nine percent (89.9 %) of the students agreed with the statement; while one point seven percent (1.7 %) of the students were undecided on their opinions and Eight point three percent (8.3 %) disagreed with the statement. This implies that students have positive perception on the use of colored pieces of chalks being used by teachers during mathematics instruction.

Statement six "the use of playing cards, dice and coins does not aid understanding of the theoretical probability of occurrence of events". Seventy seven point seven percent (77.7%) of the students supported this statement, Seven point two percent (7.2%) were undecided and Fifteen percent (15%) disagreed. One possible explanation as to why most students had the above views on the use of playing cards, dice and coins to teach probability is because these resources might not be available in school for use or they are available but not being used by the teachers. This explanation concurs with the research done by Too (1996) on his study titled t*he availability and use of instructional media resources in mathematics instruction in selected of secondary schools of Nandi District*, observed that playing cards were observed as the second largest instructional materials not available in the secondary schools that were surveyed. Playing cards are useful in teaching probability in mathematics. Probability is a topic that students are not comfortable with (Mathematics Report, 1990 cited in Too 1996).This seems to point out that teachers have made little effort to use these instructional media.

Statement Seven, “newspapers and periodicals containing bar graphs, line graphs, pie charts, frequency polygons, forex-exchange rates e.t.c about daily life statistical information are useful in the learning of statistics and commercial arithmetic”. Eighty seven point seven percent (87.8%) of the respondents supported this statement while one point seven percent (1.7%) of the students were neutral and Ten point five percent (10.5%) disagreed with it.

Statement Eight “past examination papers are not valuable learning materials”, was supported by Ninety point five percent (90.5%) of the students, Five point six percent (5.6%) were undecided and Three point nine percent (3.9%) of the learners did not support the statement. This means that the learners hold negative attitude towards print media.

“Calculators motivate learners to solve problems in mathematics”, was statement nine with eighty three point three percent (83.3%) of the students agreeing to this statement, two point eight percent (2.8%) of the learners were undecided and thirteen point nine percent (13.9%) disagreed with the statement. This means students have positive attitude on microcomputers that they can manipulate and give immediate feedback.

Statement Ten, “Globes, maps, atlases e.t.c are not valuable materials in learning bearings, longitudes and latitudes”. Sixteen point seven percent (16.7 %) of the students agreed with the statement; while six point one percent (6.1 %) of the students were undecided on their responses and seventy seven point two percent (77.2 %) disagreed with the statement. This might mean that most of teachers have not been using these instructional resources mentioned in this statement to teach bearings latitudes and longitudes and most of the students now think they are only used during geography lessons.

Statement eleven “learning using instructional materials makes a difference and should be used regularly by mathematics teachers even if it delays syllabus completion”. Seventy five point six percent (75.6%) of the students disagreed with the statement; while eleven point seven percent (11.7%) of the students were neutral and twelve point seven percent (12.7%) of the respondents were positive to the statement. This means that learners have been conditioned to rote learning and cramming such that they are not used to practical and manipulation of learning materials. This finding is in line with the report written by KNEC (2008) which reported that there was a mass failure in National mathematics exam because of rote learning and lack of understanding on topics that require learning using instructional media.

Statement twelve, “Special chalkboard like squared, ruled e.t.c. does not give more illustrations on graphs and geometry when used during learning but the topic needs bright students who can understand”. Eleven point seven percent (11.7%) of the students agreed with the statement; eight point 3 percent (8.3%) of the students were neutral and eighty percent (80%) of the learners were negative to the statement. This means that students are positive to the use of chalkboard use by the teachers and appreciate its use.

4.3 Gender and Attitude towards Use of Media Resources

The second objective of this study was to find out whether there is a difference in attitude towards the use of instructional resources between male and female students. To achieve this objective, the students were asked to react to several statements in table 4.2, which were both negative and positive rated under the Likert type scale. Data on this was analyzed under the hypothesis ‘‘There is no significant difference between the students’ gender and their attitudes towards the use of instructional resources in learning mathematics’’. The results were summarized as in table 4.3

Table 4.3

Analysis of Students Gender and Attitude towards Use of Media Resources

Gender

Attitude	Male	Female	Total
Positive	54 (30%)	46(25.6%)	100(55.6)
Neutral	6(3.3%)	5(2.7%)	11(6.1%)
Negative	33(18.3%)	36(20%)	69(38.3%)
Total	93(51.6%)	87(48.3%)	180(100%)

(The figures in parenthesis represent percentages of students’ responses)

χ^2 =0.6626 df = 2 $p< 0.05$

The results in table 4.3 showed that 55.6% of the students had positive attitude towards the use of learning resources while 38.3% had negative attitude. The male students who had positive attitude were higher than the females. The data was analyzed using Chi-square (χ^2) test to determine if there is a difference between the attitudes of male and female students on the use of instructional resources in the learning of mathematics. Chi-square (χ^2) test yielded a value of 0.663, which was less than the critical value of 5.99. The chi-square (χ^2) test revealed no significant difference at alpha level of 0.05.The null hypothesis was therefore retained. This meant that all students regardless of their gender have similar attitude towards the use of learning resources during mathematics instruction. These results were also ascertained by the coefficient of contingency (C) value of 0.06, which showed a weak or a negligible relationship between the variables. It was concluded that there is no significant difference between the attitude of male students and female students towards the use of media resources during mathematics instruction.

These findings are not in line with the study done by Eshiwani (1976). Eshiwani (1976) studied the relationship between gender factors and mathematics achievement. The main objective of the study was to find out to what extent some of the conclusions found in industrialized countries hold for the African child. The subsidiary goal was to determine whether the following variables were valid predictors of achievement in mathematics for the Kenyan situation. These included: Attitude towards mathematics, Mathematics reasoning, Vocabulary of mathematics terms, Vocabulary of scientific terms and computation and Language of mathematics. The results showed that form two boys had a more positive attitude toward mathematics than girls did, in addition the boys scored higher on tests of mathematical reasoning, computation and comprehension of mathematical and scientific terminologies.

4.4 Attitudes of Students on the Use of Instructional Resources among those in Provincial and District Schools.

The third objective of this study was to find out whether there is significant difference in students' attitudes towards the use of instructional resources among those in provincial and district schools. To achieve this objective, the students were asked to react to several statements in table 4.2, which were both negative and positive rated under the Likert type scale. Data was analyzed under the hypothesis ‘‘there is no significant difference in attitude of students towards the use of instructional resources in the learning of mathematics among those in provincial and district schools.” The results were summarized in table 4.4 below.

Table 4.4

Attitudes of Students on the Use of Instructional Resources among those in Provincial and District Schools.

Type of School

Attitude	Provincial	District	Total
Positive	55(34%)	37(22.8%)	92(56.8%)
Neutral	7(4.3%)	4(2.4%)	11(6.8%)
Negative	43(26.5%)	16(9.9%)	59(36.4%)
Total	105(64.8%)	57(35.2%)	162(100%)

(The figures in parenthesis represent percentages of students' responses)

$\chi^2 = 2.7124$ df = 2 $p < 0.05$

The results in table 4.4 showed that 34% of the students who had positive attitude towards the use of instructional resources in the learning of mathematics were from provincial school while 22.8% of the students from district type of school. The results also showed that 26.5% of the learners who had negative attitude towards the use of instructional resources were from provincial schools while 9.9% of the students from district schools. The results were then analyzed using Chi-square (χ^2) test to determine if there is a difference between the attitudes of students in provincial and district schools on the use of instructional media resources. Chi-square (χ^2) test yielded a value of 2.7124 that was less than the critical value of 5.99. The chi-square (χ^2) test revealed no significant difference at alpha level of 0.05.The null hypothesis was therefore retained. This means that all students regardless of whether in provincial school or district school have similar attitude towards the use of instructional resources in the learning of mathematics.

These results were also ascertained by the coefficient of contingency (C) value of 0.122 which showed a weak relationship between the variables. It was concluded that there is no significant difference in attitude of students towards the use of instructional resources among those in provincial and district schools. This might be so because of the subsidized secondary education (free day secondary education) being offered by the government, a program which pays equal money to all the students at secondary level. All schools are therefore capable of purchasing teaching and learning materials and this puts nearly all schools at par in terms of owning media resources which might have been possible before the program was started in 2008.

4.5 Attitudes of Students on the Use of Instructional Resources among those in Public and Private Schools.

The fourth objective of this study was to find out whether there is a significant difference in students' attitudes towards the use of instructional resources among those in public and private schools. To achieve this objective, the Students were asked to react to several statements in table 4.2, which were both negative and positive rated under the Likert type scale. Data was analyzed under the hypothesis there is no significant difference in attitudes of students towards the use of instructional resources in the learning of mathematics between those students in public and private schools. The results were summarized in table 4.5 below.

Table 4.5

Analysis of Attitudes of Students on the Use of Instructional Resources among those in Public and Private Schools.

Type of School

Attitude	Public	Private	Total
Positive	92(51.1%)	8(4.4%)	100(55.6%)
Neutral	11(6.1%)	0(0%)	11(6.1%)
Negative	59(32.8%)	10(5.5%)	69(38.3%)
Total	162(90.0%)	18(10%)	180(100%)

(The figures in parenthesis represent percentages of students' responses)

$\chi^2 = 1.8214$ df = 2 $p < 0.05$

The results in table 4.4 showed that 51.1 % of the students who had positive attitude towards the use of instructional resources in the learning of mathematics were from publicl school while 4.4% of the students were from private schools. The results also showed that 32.8% of the learners who had negative attitude towards the use of instructional resources were from public schools while 5.5% of the students from private schools. The results were then analyzed using Chi-square (χ^2) test to determine if there is significant difference in attitudes of students towards the use of instructional resources in the learning of mathematics between those students in public and private schools. Chi-square (χ^2) test yielded a value of 1.8214, which was less than the critical value of 5.99. The chi-square (χ^2) test revealed no significant difference at alpha level of 0.05.The null hypothesis was therefore retained. This means that all students regardless of whether in public or private school have similar attitude towards the use of instructional resources during learning of mathematics.

These results were also ascertained by the coefficient of contingency (C) value of 0.1 which showed a weak relationship between the variables. It was concluded that there is no significant difference in attitudes of students towards the use of instructional resources in the learning of mathematics between those students in public and private schools.

4.6 Teacher's Qualification and Student's Attitude towards Use of Instructional Resources.

The fourth objective of the research study was to find out the influence of mathematics teachers academic qualification on students' attitudes towards the use of instructional resources. To achieve this objective, the Students were asked to react to several statements which were both negative and positive rated under the Likert scale. Data on this objective was analyzed under the hypothesis ''there is no significant difference between the mathematics teacher's qualification and the attitudes of students on the use of instructional resources in learning of mathematics. The results were summarized in table 4.6 below.

Table 4.6

Analysis of Teacher's Qualification and student's Attitude towards Use of Media Resources.

	Teachers' Qualification			
Attitude	Diploma	Graduate	Post-Graduate	Total
Positive	40(22.2%)	48(26.7%)	12(6.7%)	100(55.6%)
Neutral	3(1.7%)	3(1.7%)	1(0.6%)	11(6.1%)
Negative	25(13.9%)	37(20.6%)	7(3.9%)	69(38.3%)
Total	68(37.8%)	92(51.1%)	20(11.1%)	180(100%)

(The figures in parenthesis represent percentages of students' responses)

$\chi^2 = 2.163$ df = 4 $p< 0.05$

The results in table 4.6 showed that among the students who had positive attitudes towards the use of learning resources, 22.2% were taught by diploma teachers, 26.7% taught by graduate teachers and 6.7% taught by post-graduate. The result also showed that among the respondents who had negative attitudes towards the use of teaching resources, 13.9% were being taught by diploma holder teachers, 20.6% by graduate teachers and 3.9% by postgraduate teachers. The results were analyzed using Chi-square (χ^2) test to determine if there is a difference in the attitudes of students on the use of instructional resources; Chi-square (χ^2) test yielded a value of 2.163, which was less than the critical value of 5.99. The chi-square (χ^2) test revealed no significant difference at alpha level of 0.05.The null hypothesis was therefore retained. This meant that students' attitude towards the use of learning resources during mathematics instruction does not depend on the qualification of the teacher.

These results were also ascertained by the coefficient of contingency (C) of 0.109 which showed a negligible relationship between the variables. Conclusion was made that there was no significant difference between the teachers' qualification and attitude of students towards the use of media resources during mathematics instruction. The study revealed that teachers have no influence on the student's attitude on the learning material used during mathematics instruction in class. It could be that the media used by the teachers (which were the ones under study) are the ones which are not appealing to the students. The study was in line with the one done by Husen (1967) which found no significant correlation in neither teachers' training nor teaching experience and mathematics achievement.

4.7 Teacher's Experience and Student's Attitude towards Use of Learning Resources.

The fifth objective of the study was to find out the influence of mathematics teachers experience on students' attitudes towards the use of instructional media resources. To achieve this objective, the students were asked to react to several statements which were both negative and positive rated under the Likert type scale. Data on this objective was analyzed under the hypothesis **"**There is no significant difference between the mathematics teacher's experience and the attitudes of students on the use of instructional resources in learning of mathematics**"**. The results were summarized in table 4.7 below.

Table 4.7

Teacher's Experience and Student's Attitude towards Use of Learning Resources.

Teachers' Experience in years (X)

Attitude	X<5	X>5	Total
Agree	22(12.2%)	78(43.3%)	100(55.6%)
Undecided	4(2.2%)	7(3.9%)	11(6.1%)
Disagree	14(7.7%)	54(30.0%)	69(38.3%)

Total	40(22.2%)	140(77.8%)	180(100%)

(The figures in parenthesis represent percentages of students' responses)

$\chi^2 = 1.3938$ df =2 $p< 0.05$

The results in table 4.7 showed that 12.2% of the students had positive attitude towards the use of learning resources are taught by teachers who have been teaching for less than 5 years, while 43.3% of the students who had positive attitude towards learning materials were taught by experienced teachers. It was also depicted that 7.7% of students holding negative attitude towards the use of learning resources are taught by teachers who are less than 5 years in the profession while another 30% were taught by the experienced teachers. The results were analyzed using Chi-square (χ^2) test to determine if there is a difference in the attitudes of students on the use of instructional resources. Chi-square (χ^2) test yielded a value of 1.3938 which was less than the critical value of 5.99. The chi-square (χ^2) test revealed no significant difference at alpha level of 0.05.The null hypothesis was therefore retained. This meant that students' attitude towards the use of learning resources during mathematics instruction does not depend on the experience of the teacher.

These results were also ascertained by the coefficient of contingency (C) value of 0.088 which showed a negligible relationship between the variables. It was therefore concluded that there is no significant difference between the teachers' experience and attitude of students towards the use of media resources during mathematics instruction. The study revealed that teachers years of teaching experience have no influence on the student's attitudes on the learning material used during mathematics instruction in class. The finding of the study was in line with the one done by Maundu (1986) cited in Too (1996) which found no significant correlation between schools with more experienced teachers and those with less experienced ones.

CHAPTER FIVE

DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS

5.0. Introduction to the Chapter

This chapter discusses the findings of the study and recommendations of the study. The major purpose of the study was to investigate the attitude of the students towards the use of learning materials during mathematics instruction in selected secondary schools of Baringo District. The study was guided by the following objectives:

1. Find out students attitudes towards the use of instructional resources in the learning of mathematics.
2. Find out whether there is a significant difference in attitudes of students towards the use of instructional resources between male and female students.
3. Find out whether there is a significant difference in students' attitudes towards the use of instructional resources among those in public provincial and public district schools.
4. Find out whether there is a significant difference in students' attitudes towards the use of instructional resources among those in public and private schools.
5. Find out the influence of mathematics teachers' academic qualification on attitudes of students towards the use of instructional resources.
6. Find out the influence of mathematics teachers' experience on attitudes of students towards the use of instructional resources.

The findings were discussed under the following headings: - student's attitude, student's gender, school type, the teachers' qualification and teachers' experience.

5.1 Students Attitudes towards the Use of Instructional Resources

The first objective of the study was to find out student's attitude towards the use of instructional resources in teaching and learning of mathematics. Data analysis done in chapter 4 found out that students have negative attitude towards expository learning materials being used by mathematics teachers but favor the learning materials that they are in co-operated into and those that they can easily manipulate and have a prior knowledge on how to handle. These results confirm findings by Clarke & Bowe (2006a); Clarke & Bowe (2006b), Kay & Knaack (2007c); Lim, Lee & Richards (2006); Lopez – Morteo & Lopez (2007); Nurmi & Jaakkola (2006) and Reimer & Moyer (2005). Who jointly found that Mathematics students like learning resources because they: were fun and enjoyable, were able to control with respect to the place of learning, provided timely feedback, were easy to use, consisted of a number of media tools and helped with learning. Lim et al, (2006) and Nurmi & Jaakkola, (2006) also reported that the acceptance of media learning objects by mathematics students was somewhat dependent on the kind of learning object used by the instructor.

1.1 Student's Attitudes towards the Use of Instructional Resources and the Gender

The second objective of the study was to find out whether there is a difference in attitude towards the use of instructional resources between male and female students. Data analysis done in chapter four found out that there is no significant difference in the students' attitude. This means that all students regardless of their gender have similar attitude towards the use of learning resources during mathematics instruction. The results confirm findings by Teo (2008) who found out that there were no significant differences in the students' attitudes toward the use of the Internet for learning based on gender. However, the findings are different from that of Durndell & Thompson (1997) who found out that females usually also have more negative attitudes towards computers and greater computer anxiety than males. Another research done on computer self-efficacy in general also revealed that males on average tend to acquire computer self-efficacy faster than females (Todman, 2000).

5.3 Students Attitudes towards the Use of Instructional Resources and Category of School

The third objective of the study was to find out the differences in student's attitudes towards the use of instructional resources among those in public provincial & public district schools and public schools & private schools. Data analysis done in chapter four found out that there was no significant difference in attitudes of students towards the use of instructional resources among those in public provincial and public district schools and that there was no significant difference in attitudes of students towards the use of instructional resources between those students in public and private schools. This means that the type of school i.e. public provincial, public district and private schools has no influence on the attitude of the learners on the instructional resources used in class during learning of mathematics. The results confirm the findings done by PISA (2003) on students learning: attitudes, engagement and strategies, which showed that the differences between schools in students' reported characteristics are far less pronounced than the differences within schools. The results differs with the findings of Dane (1934) who found out that kindergarten classes with fewer children showed increased class discussions and participation of the pupils in class, thus class discussions increased as the class size decreased leading to better performance. Hong, Ridzuan, & Kuek (2003) also reported that there was a significant difference between the learning environment and the students' attitude towards the use of learning materials. In a study investigating the students' attitudes toward the use of the internet for learning, they found out that the students who felt that the learning environment in the university promoted the use of the Internet had positive attitudes toward the use of the Internet for learning.

1.2 *Students Attitudes towards the Use of Instructional Resources and the Teachers' Academic Qualifications*

The fourth objective of the study was to find out the influence of mathematics teachers' on attitudes of students towards the use of instructional resources. Data analysis done revealed that there was no significant difference. This meant that the attitude of the students is independent and does not relay on the qualification of the teachers. The results confirms the findings by Too (1996), who investigated the availability and use of media resources in mathematics instruction in Nandi district found out that there was no significant relationship between teachers' qualification and use of media resources in the teaching of transformation geometry and geometric constructions. However the findings are different from some parts of the study done by Too (1996) on graphical work, trigonometry and three dimensional geometry where he found that there was significant relationship between teachers' qualification and use learning materials.

It was realized that the teacher's qualification have no effect on the student's attitude on learning materials used during mathematics instruction. This could be correct because most schools in the district are still using the traditional media resources instead of the modern leaning resources which are most favored by the students. A research report produced by Becta (2003) highlighted that ICT provide fast and accurate feedback to students, and speed up computations and graphing, freeing students to focus on strategies and interpretation. The use of interactive multimedia software also motivates students and leads to improved performance. Other reasons for this were revealed by Fine & Fleener (1994; Forgasz & Prince, (2001) Manoucherhri (1999) Simonsen & Dick (1997) Walen, Williams & Garner (2003), who found out that factors that influence uptake and implementation of instructional media during mathematics instruction include: skill and previous experience in using technology; time and opportunities to learn (pre-service education, professional development); access to hardware and software; availability of appropriate teaching materials; technical support; knowledge of how to integrate technology into mathematics teaching; and beliefs about mathematics and how it is learned. The teachers in Baringo-central district may have skills, pre service and in service development but they lack access to hardware and software, appropriate teaching materials, technical support and knowledge of how to integrate modern technology into mathematics teaching, which comes out as one way bringing effect on the students to have positive attitude on the media used.

1.3 *Attitudes towards the Use of Instructional Resources and the Teachers' Academic Experience*

The last objective of the study was to find out the influence of teachers' experience on student's attitude towards the use of instructional resources. Data analysis done in chapter four found out that there is no significance difference between the two variables. This means that the attitude of the students does not rely on the experience of the teachers, the students will still have a negative attitude even if the teacher is more experience and the students can have a positive attitude even when the teacher lacks experience. The results confirm findings by Too (1996) who found that there was no significance relationship between the variables in the teaching of transformation geometry and geometric construction.

5.6 Conclusions

Conclusions were made based on the research findings discussed in chapter four of this thesis and were as follows;

Students in Baringo district holds a negative attitude towards the learning materials used by the teachers during mathematics instruction, and this attitude could be one of the contributing factors that make the students also have negative attitude towards mathematics as a subject. Mathematics teacher's qualification and experience does not affect the attitude of students towards the use of media resources during learning and lastly the attitude of the student towards media resources during mathematics instruction is not affected by his/her gender or whether the school is a provincial, district or private school.

The study findings offer insight into what students like and do not like about instructional objects. Not surprisingly, students liked easy to use, interactive learning media resources that provided good visual supports. They reacted negatively, though, to poor quality help and having to read excessive amounts of text. Finally, it is interesting to note that even though students were negative about the learning media resources used in the study area, a noticeable number of students reported that using instructional media resources is an improvement over other teaching methods.

5.7 Recommendations

The negative attitude that the learners hold on some of the learning resources can be changed by adopting modern learning technologies like computer assisted learning

(CAL), computer managed learning (CML) and use of smart boards instead of traditional chalkboard or talk and chalk methodology. This recommendation was also supported by a study done Mwei, Too & Wando (2011) in their study on the effect of Computer-Assisted Instruction (CAI) on student's attitudes and achievement in matrices and transformations in secondary schools in Uasin Gishu, found out that CAI approach is more effective than conventional approach for producing achievement and attitude gains in such a population. Hence school management should adopt modern learning technologies like computer assisted learning; computer managed learning and use of smart boards instead of traditional chalkboard or talk and chalk method of teaching.

The Kenya Institute of Education (KIE), should use the research findings to help them produce modern learning resources that appeal and are acceptable to the current generation of students. This could change the unsatisfactory performance that has been recorded in the district due to students' negative attitude on the media resources used by the teachers during mathematics instruction and on the subject as a whole. Mathematics teachers should also work hard and instill positive attitude on students towards the subject by using learning resources regularly and this will make the learners appreciate the use of media resources during instruction.

5.8 Suggestion for Further Research

This study suggests the following areas for further research:

- A similar study can carried out in other districts in Kenya to determine whether the findings documented in this study hold the same for all districts.

- This study did not correlate performance of students with their attitudes there is need for another study to correlate attitudes of students towards the use of instructional materials and their performance in exams.
- Another study can be done in other forms apart from form four students of Baringo-central district, Kenya to determine whether the findings documented in this study hold the same for all forms in the districts.
- A similar study can be done in other subjects offered at this level of learning.

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APPENDIX A

Secondary School Students Questionnaires (SSSQ)

Questionnaire no.…………

Date……………………….

School…………………….

Do not write your name or admission number anywhere on this questionnaire.

This questionnaire aims at finding out the attitudes of students towards the use of media in the teaching and learning of mathematics in secondary schools of Baringo District. You are kindly requested to give your honest response to each question which will be treated with strict confidentiality. Note that there are no correct or wrong responses to these items, but only what is appropriate for you.

1. Personal Details

Respond by putting a tick [√] against all that apply to you.

i) Age (years)

14-15 [ ]   16-17 [ ]   18 and above [ ]

ii) Gender

Male [ ]   Female [ ]

iii) Type of school

Provincial [ ]   District [ ]   Private [ ]

2 Information on the use of media

i) How often do you solve problems in mathematics during your own free time?

Never [ ]   Sometimes [ ]   Always [ ]

ii) How do you handle your mathematics assignment left by the teacher?

Personally [ ]   Assisted by A friend [ ]   copy [ ]   Never [ ]

iii) How would you rate the quality of textbooks used by your mathematics teacher as class texts?

Good Quality [ ]   Average Quality [ ]   Low Quality [ ]

vi) How often do you use the following resources?

- A set of geometrical instruments
- Four figure mathematical table

During exams only [ ]   weekly [ ]   Once a day [ ] regularly [ ]

3) Attitude of Students towards Instructional Media Resources

In this section, you are given a series of statements with 5- possible answers for each statement. **Strongly Agree (SA), Agree (A), Undecided (U), Disagree (D) and Strongly Disagree (SD).** You are expected to choose the answer that closely approximates to your opinion regarding each statement given by putting a [√] in the corresponding box.

STATEMENT	SA	A	U	D	SD
1) Use of solid objects like cuboids, pyramids, prisms Does not helps learners in visualizing planes, intersection of planes with lines.					
2) A teacher does not need to use chalkboard geometrical instruments provided that I posses one.					
3) Teaching solid geometry using the models is better than use of chalkboard Diagrams only.					
4) Use of different sizes of some photographs and model toys enriches the learning of similarity and enlargement in mathematics.					
5) Use of coloured chalk provides contrast and emphasis especially in drawing lines and curves					
6) The use of playing cards, dice and coins does					

not aid understanding of the theoretical probability of occurrence of events.	
7) Newspapers and periodicals containing bar graphs, line graphs, pie charts, frequency polygons, Forex exchange rates e.t.c about daily life statistical information are useful in the learning of statistics and commercial arithmetic	
8) Past exam papers are not valuable learning materials	
9) calculators motivate learners to solve problems in mathematics and I use it regularly.	
10) Globes, maps e.t.c are not valuable materials in learning bearings, longitudes and latitudes.	
11) Learning using instructional materials makes a difference and should be used regularly by mathematics teachers even if it delays syllabus completion.	
12) Special chalkboard like squared, ruled e.t.c. does not give more illustrations on graphs and geometry when used during learning but the topic needs bright students who can understand.	

APPENDIX B

Secondary School Mathematics teachers Questionnaires (SSMTQ)

Questionnaire no.…………

Date……………………….

Do not write your name or phone number anywhere on this questionnaire.

This questionnaire is aimed at finding out the attitudes of students towards the use of media in the teaching and learning of mathematics in secondary schools of Baringo District. You are kindly requested to give your honest response to each question which will be treated with strict confidentiality. Note that there are no correct or wrong responses to these items, but only what is appropriate for you.

Respond by putting a tick [√] against all that apply to you.

i) Age

18-28 [ ]   29-39 [ ]   40-49 [ ]   50 and above [ ]

ii) Gender

Male [ ]

Female [ ]

iii) Level of highest formal education received

Diploma [ ] Degree [ ] Post graduate [ ] Any other (specify) _______________

iv) Length of service as a mathematics teacher in years

Less than 5[ ] 5-10[ ] 10-20[ ] 20-30[ ] 30 and above [ ]

APPENDIX C

Letter to the School Principal

ONG'OU WYCLIFFE OTIENO,

P.O BOX 3900,

ELDORET,

DATE………………………

THE PRINCIPAL

…………………………………….

…………………………………….

Dear Sir/Madam

<u>RE: REQUEST TO CARRY OUT RESEARCH IN YOUR SCHOOL</u>.

I am a student in Moi University pursuing Masters Degree course in Mathematics Education. As part of my study I am required to carry out research on "Attitudes of Students Towards the use of Media Resources in Mathematics Instruction: A survey of Secondary Schools in Baringo District, Kenya."

The purpose of this letter is to request you to allow me to collect the required information from students in your school. If allowed I promise to abide by your rules. Attached are copies of my research abstract, questionnaire and a letter from the university.

Thank you in advance,

Yours faithfully,

Ong'ou Wycliffe Otieno.

APPENDIX D

Pearson Product Moment Correlation Coefficient (r) Formula

$$r = \frac{N \sum XY - \sum X \sum Y}{\sqrt{[N \sum X^2 - (X)^2][N \sum Y^2 - (Y)^2]}}$$

Where r = Pearson product moment correlation.

$\sum X$ = Sum of scores in X variables.

$\sum Y$ = Sum of scores in Y variables.

$\sum XY$ = Sum of product of X and Y variables.

$\sum X \sum Y$ = the product of $\sum X$ and $\sum Y$.

$\sum X^2$ = each score in the X variables squared and then the squares summed up.

$(\sum X)^2$ = the score in the X variable are summed up, and then the sum is squared.

$\sum Y^2$ = each score in the Y variable are squared, and then the squares are summed up.

$(\sum Y)^2$ = the score in the Y variable are summed up, and then the sum is squared.

N = Number of paired X and Y scores.

APPENDIX E

Chi- Square Formula

$$X^2 = \frac{\sum (O-E)^2}{E}$$

Where X^2 = Chi-Square

O = Obtained frequency

E = Expected frequency

$\sum$ = Summation of

APPENDIX F

Coefficient of Contingency Formula

$$C = \frac{\sqrt{X^2}}{\sqrt{X^2 + N}}$$

Where C = Coefficient of contingency.

X^2 = Chi-square Value.

N = Total sample used in the study.

APPENDIX G

Lists of Schools in Baringo District

Girls Schools

1. A I C Philemon Chelagat Secondary school
2. Kapropita Girls High School
3. Ngetmoi Girls High School
4. Pemwai Girls High School
5. Sangarau Girls Secondary School
6. Tabagon Girls Secondary school

Boys Schools

7. Kabarnet High School
8. Kapkawa High School
9. Oinobmoi Boys High School
10. Tenges Boys High School

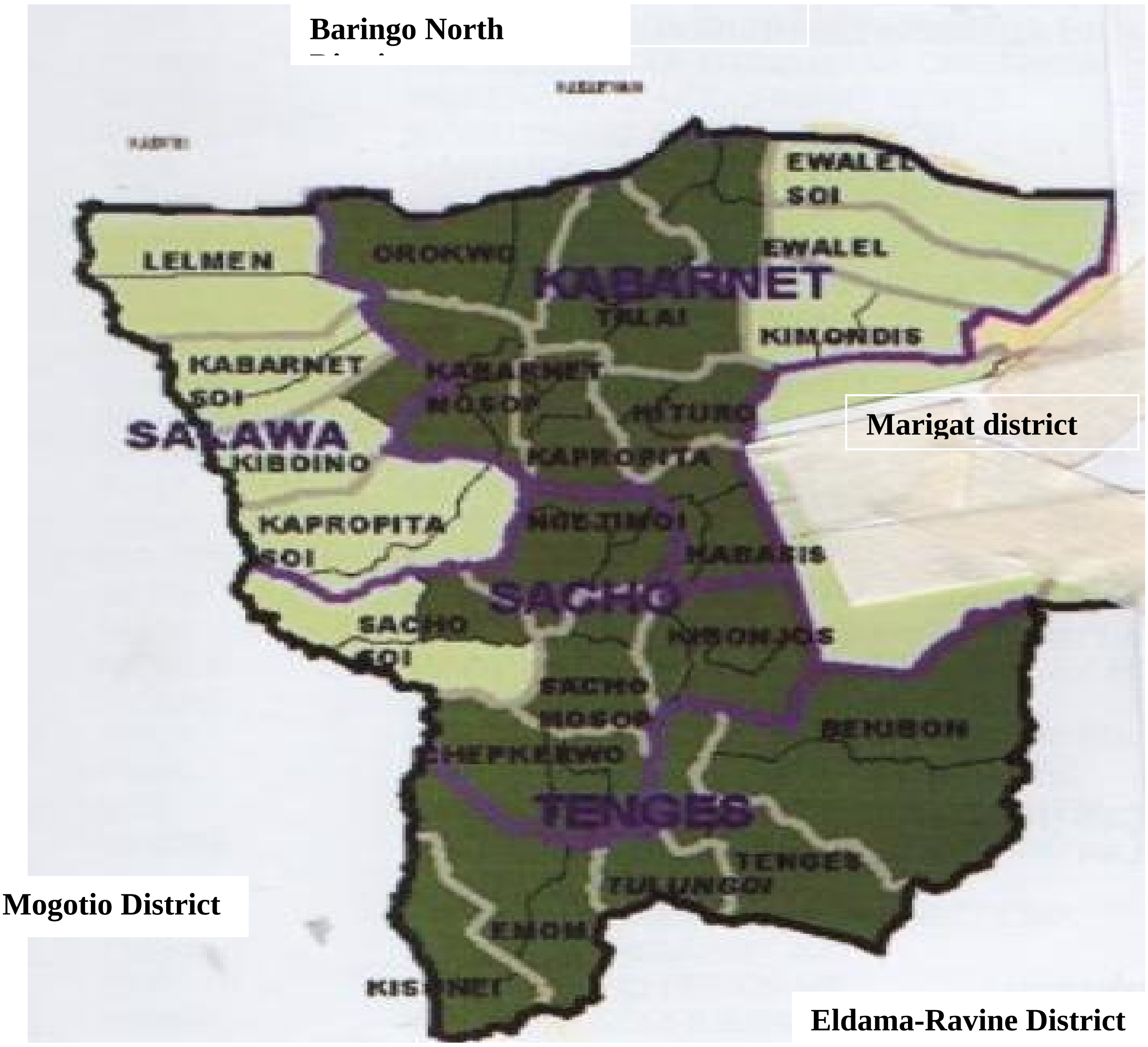
Mixed Schools

11. A I C Ebenezer Academy
12. A I C Kapkelelwa Secondary School
13. Kapchomuso Secondary School
14. Kaptimbor Mixed Day Secondary School
15. Kabarnet Hurth Day Secondary School
16. Kiboino Day Secondary School
17. Kipsoit Secondary School
18. Kisonei Secondary School
19. Kituro High School
20. Riwo Secondary School

21. Sacho High School
22. Seretunin Day Secondary School
23. ST Marys Salawa Secondary School
24. Talai Secondary school
25. Tenges Day Secondary School
26. Timboiwo Secondary School

APPENDIX H

Map of Baringo Central district



APPENDIX I

Research Permit

PAGE 2

THIS IS TO CERTIFY THAT:

~~Prof./Dr.~~/Mr./~~Mrs./Miss~~ ONG'OU WYCLIFFE OTIENO

of (Address) MOI UNIVERSITY P.O.BOX. 3900 ELDORET

has been permitted to conduct research in ....

..................Location,

BARINGO District,

RIFT VALLEY Province,

on the topic Attitudes of Students towards the use of Media Resources in Mathematics instruction: A Survey of Secondary Schools in Baringo District,Kenya.

for a period ending 30th November 20 10

PAGE 3

Research Permit No. NCST/5/002/R/1089

Date of issue 24.11.2009

Fee received SHS 1000

Applicant's Signature

Secretary
National Council for
Science and Technology

CONDITIONS

1. You must report to the District Commissioner and the District Education Officer of the area before embarking on your research. Failure to do that may lead to the cancellation of your permit
2. Government Officers will not be interviewed with-out prior appointment.
3. No questionnaire will be used unless it has been approved.
4. Excavation, filming and collection of biological specimens are subject to further permission from the relevant Government Ministries.
5. You are required to submit at least two(2)/four(4) bound copies of your final report for Kenyans and non-Kenyans respectively.
6. The Government of Kenya reserves the right to modify the conditions of this permit including its cancellation without notice

GPK6055t3mt10/2009

REPUBLIC OF KENYA

RESEARCH CLEARANCE PERMIT

(CONDITIONS— see back page)