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**THE EFFECT OF USING MICRO-SCIENCE KITS IN
TEACHING PRIMARY SCIENCE: A CASE OF PRIMARY
SCHOOLS IN GETEMBE DIVISION, CENTRAL KISII
DISTRICT, KENYA.**

BY

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**THESIS SUBMITTED IN PARTIAL FULFILLMENT OF
THE REQUIREMENTS FOR THE DEGREE OF MASTERS
OF EDUCATION OF KENYATTA UNIVERSITY**

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*The effect of using
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DECLARATION

This thesis is my original work and has not been presented for a degree in any other university.



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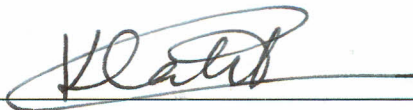
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ABSTRACT

Science and technology greatly contribute and are fundamental to both the economic and social development of man. However, in Kenya the performance of learners in science at national examinations is still very poor. It is on this premise that this study was focused on introducing an intervention by introducing micro-science kits to supplement the existing and locally available teaching resources. This was to establish if its introduction would improve the learner's conceptualization and change their attitude towards science.

From the literature reviewed it was evident that the status of science teaching in schools is very poor partly due to lack of resources poor attitude from the learners and teachers and many other factors. This implies that its teaching is more by exposition than heuristic. This research thus 'plugs a hole' into the science teaching in Primary schools to bridge the gaps identified and advocate for a resource-based approach to science teaching.

To achieve the study objectives a quasi-experimental design was used with an experimental and control groups. Four schools were sampled from 28 schools in Getembe division; the sample size was influenced by the resource available. 92 students of the 229 students who participated from the sample schools were subjected to analysis and they formed 40.17% of the student population. To answer the research questions and test the null hypotheses data was gathered by using two research instruments that is classroom observation schedule and science achievement test.

After administration of the pre-test the experimental group ($M=47.27$, $SD= 13.34$) did not significantly score higher than the control group ($M= 47.76$, $SD= 12.15$), $t(90) = 0.184$ $p=0.855$ which implied the learners were fairly matched. On administration of the post-test, the analysis of skills development items showed

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the experimental group (M=30.92, SD=8.79) scored fairly significantly higher than the control group (M=27.75, SD= 6.58) $t(90) = -1.978$ $p=0.051$ and $r=0.619$. On experimental items the experimental group (M=34.62, SD =9.39) scored significantly higher than the control (M =26.04, SD =6.81) $t(90) = -5.081$ $p=0.001$ and $r=0.654$. In the overall analysis the experimental (M= 65.81, SD =16.75) scored significantly higher than the control group (M =53.85, SD =11.45) $t(90) = -4.071$ $p= 0.001$ and $r =0.727$. This significant relationship may be attributed to treatment effects. This re-emphasizes the centrality of practical activities in science teaching and learning

From the findings of this study, the poor performance in sciences can be addressed with a re-orientation of science teaching to emphasize on the heuristic approaches to teaching. Science teaching also requires being more resource-based if the learners' have to acquire the necessary skills and concepts in science. This will in turn improve the learners' attitude positively towards sciences.

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CHAPTER ONE

INTRODUCTION

1.1 BACKGROUND TO THE STUDY

Science is a term that is derived from the Latin word 'Scientia' that means knowledge about oneself and the environment. It is an inter-connected series of concepts and conceptual schemes that have developed as a result of experimentation and observation, and are likely to grow with further experimentation and observation. Like any other intellectual discipline it provides for a means whereby the individual can organize his or her concepts and attitudes, classify experiences and communicate with others. Science and other related fields of engineering and technology contribute greatly to the improvement of the quality of life and generation of wealth for the good of the general population in the world.

Clark and Juma (1991) make reference to evidence from economic history which indicates that the industrialized countries broke from the bondage of poverty largely through the use of technological application while most African countries have registered economic decline in the last few decades due to their low level of application of science and technology. Therefore, the third world countries cannot avoid pursuing a technological route in their efforts to improve the living condition of their populations. This may be only possible if they tie their policy reforms to the

application of science and technology to development. The government of Kenya is realising this as observed in one of its policy statements:

The Government of Kenya recognizes that availability of a well-educated and trained workforce is critical to the success of Kenya's industrialization process. This would only be possible if there is an assured supply of well-trained and skilled technicians . . . The 8-4-4 curriculum will be reviewed to be more focused on the national strategy of achieving a newly industrialized country (NIC) status by the year 2020
(Republic of Kenya 1997: 30)

There is a lot of evidence on the role of science and technology in contribution to the improvement of the quality of life for example, in the field of agriculture it has resulted in improved food production techniques. This has been possible by use of high yielding seed species such as maize, wheat, development of disease resistant plant varieties and use of fertilizers and pesticides that are scientifically developed.

In the field of health, science has played an important role in development of drugs and vaccines to fight diseases, medical instruments to perform diagnosis and delicate operations; Gene technology for the discovery and control of Cancer causing agents , and microbiology in culturing pathogens for diagnostic purposes. In the area of energy, science has had its contribution in the discovery of sources of energy such as coal, petroleum, electricity, solar and the nuclear power. The benefits and side effects of each source of energy are determined through science.

Science and technology have equally played an important role in the field of communication. This is through the development of the state of the art technologies such as computers, mobile phones, automated teller machines, and other technologies. All these have contributed to the improvement of the quality of life.

Due to the increasing recognition of science as one of the most important agents to economic change, the government of Kenya has since independence shown increasing need to link scientific and technological skills to the national development goals. This has been evident by the changing trends in science education since independence as a result of educational policy reports such as :The education Commission Report -1964 (Ominde commission) , the National Committee on Educational Policies and Objectives-1976 (Gachathi commission report), the Mackay commission report -1981and the Koech commission report -1999. These reports appreciate that the status of science teaching in schools is poor; there are insufficient teaching resources and the central place of science in economic development. The Koech commission for example makes the following recommendation on science education:

'Science teaching and examinations be oriented to problem-solving approach. Children should be exposed to scientific concepts from on an early age'
(Republic of Kenya 1999:47)

A science program that is oriented to problem solving and concept learning require emphasis on practical and resource based approach. However, the necessary

resources for teaching and learning are not available in schools. Developed economies and other emerging economies such as South Africa, Cameroon, and Rwanda have embraced the use of micro science kits for teaching and learning in their secondary schools science curriculum.

The science curriculum in Kenya is within three levels namely, Primary level, Secondary level and Tertiary level. For the purpose of this research the Primary science curriculum which is the basis of the other levels was considered. The Primary science curriculum is divided into two main categories; the Lower Primary science course, which covers standard one to three. In this level, science is taught as an integrated course whereby the content is drawn from the surrounding of the school or the learners environment both at home and in the school setting. The other category is the Upper Primary, which consists of class four to eight. At this level the course is divided into units. The order in which these units are taught is dictated by both the environmental conditions and the children's interest. Emphasis is given to teaching of science by doing rather than exposition while employing a variety of teaching methods such as nature walk, group activity, project work, demonstration and experimentation. The use of various methods of teaching are meant to arouse in the learner the interest in science, develop the necessary skills both psychomotor and process skills, develop positive attitudes towards science and meet the learner's needs.

The aims of science at the Primary school level have been spelt out by the Ministry of Education Science and Technology (MOEST) as follows;

- Develop ability to observe and explore the environment;
- Develop manual and mental skills for rational decision-making;
- Develop creativity and critical thinking to address new and emerging challenges;
- Develop and use appropriate skills and technologies for solving problems;
- Acquire basic scientific knowledge;
- Develop interest in science and science related careers.

(KIE: 2002:25)

These objectives can best be achieved if there are properly trained teachers who use proper methods and resources for skill development. At the Primary school level the physical science related topics present most difficulty to students (Twoli and Maundu -1998) and they are the ones likely to contribute to the low performance in science.

The choice of method and resource for instruction highly influence the efficiency of the knowledge delivery and concept development such that the suitability of the method and resource enhance the learning process. There are two main approaches that are applicable in teaching learning process. These approaches are dependent on the focus during the teaching learning process. When the focus is on the teacher then the approach is referred to as expository or teacher centred. The teaching methods associated with this approach include lecture method and teacher demonstration ((Ole Shanguya, 1995).

This approach though commonly used by most teachers does not enhance effective learning. This is because the learners are passive and as such play a very minimal role in their learning. The use of resources by the learners during the learning process is very low. The few resources that are available are normally for the teacher's use during teacher demonstration.

Das (1985) identifies the other approach to teaching as one in which the focus is on the learners. The approach is known as heuristic approach or learner centred approach. In this approach the learner is mainly responsible for his /her learning and the role of the teacher is that of the facilitator or guide to learning. The teaching methods associated with this approach are student experiments, discovery learning, project work, field trips, excursions, and group discussion method. For effective learning it may be useful sometimes to employ both approaches, that is, expository and heuristic in teaching and learning science. A combination of both approaches will enable existence of a continuum and to emphasise all objectives of science learning.

Since the inception of the 8-4-4 system of education in Kenya the performance of science has been rather poor both at Primary and Secondary school levels.

This is evident from the low mean score for the examination as shown in the tables 1.1 and 1.2.

Table 1.1: % Mean score for Sciences and Geography in KCSE 1997-2000.

	BIO	PHY	CHEM	GEO
1997	49.35	37.89	37.50	87.92
1998	47.66	41.87	36.12	80.74
1999	49.93	43.07	40.50	78.06
2000	44.50	43.81	41.84	73.28

Source: KNEC Exam analysis Report.2001

Table 1.2: % Mean score for science and GHC / RE in KPCE between 1992- 1998

Year	1992	1993	1994	1995	1996	1997	1998
Mean score for Science	14.34	13.39	13.92	15.37	17.01	17.93	12.14
Mean score for GHC	32.67	31.35	33.34	35.88	35.52	31.31	34.17

Source: KNEC newsletter for 1996 and 1999

From the examination analysis for KCPE (KNEC 1996) it was noted that learners do not perform very well on the items testing practical skills, which indicates that there is probably a problem in the teaching of this aspect of practical application of science.

This poor performance in science has evoked questions about the status of teaching and learning of science in schools. This debate is centered on 'what is taught' in terms of content, its relevance and how it is taught. At the Primary school level where the scientific base is built among the pupils many teachers have been associated with the use of expository approach in teaching with limited use of resources to do practical work (Twoli and Maundu ,1998).

1.2 STATEMENT OF THE PROBLEM

The 8-4-4 system of education was introduced in Kenya with a noble idea of ensuring that students graduating at every level have some scientific, practical and technical knowledge and skills that would be utilized for self or salaried employment. There is, therefore, a lot of emphasis on skills development among the learners who are going through this system of education. To achieve all these, key resources are required for instruction. However, resources are not easily available in schools especially at the Primary school level of education.

This lack of conventional resources and their use in teaching science is, probably, one cause for the poor performance in science subjects in schools to-day. This study looked at a special type of resource, which could supplement other resources in the learning of science at Primary school level. It specifically looked at the use of a micro-science kit that is developed under the concept of mini-labs. This is one resource that has not been explored at the Primary school level in

Kenya. By introducing this resource, the study hoped to determine whether its use contributes significantly to improvements in science learning.

1.3 THEORETICAL FRAMEWORK

Science teaching methods can be based on Piaget's principle that an individual interprets reality through intellectual structures characterized by action schemes that change with age. Piaget (1952) suggests that an individual has a biological age, intellectual age, social maturity age, physical age and others. All these ages differ from person to person, such that biological age-mates are not necessarily intellectual age-mates.

To achieve maximum learning among learners with such diverse differences in human development, the teacher must understand the learner well so that apposite learning experiences are selected for each learner. Given the poor performance in science subjects, there is call for or concern from the government, parents, employers and students about their performance in national examinations since the inception of the 8-4-4 system of education. This was emphasised by the minister of education's statement while releasing the 2003 K.C.S.E results:

“The poor performance in these subjects (maths and sciences) remains a matter of concern to my ministry. I appeal to all secondary school teachers, parents and other readers to make deliberate efforts to improve the delivery of quality performance in these key subjects” (East African standard newspapers No.270028 of 2004)

This poor performance in sciences has been subjected to debate in seminars and workshops organized by agencies such as Female Education in Mathematics and Science Association (FEMSA) - Kenya, Japan International Cooperation Agency (JICA), and Kenya National Academy of Sciences (KNAS).

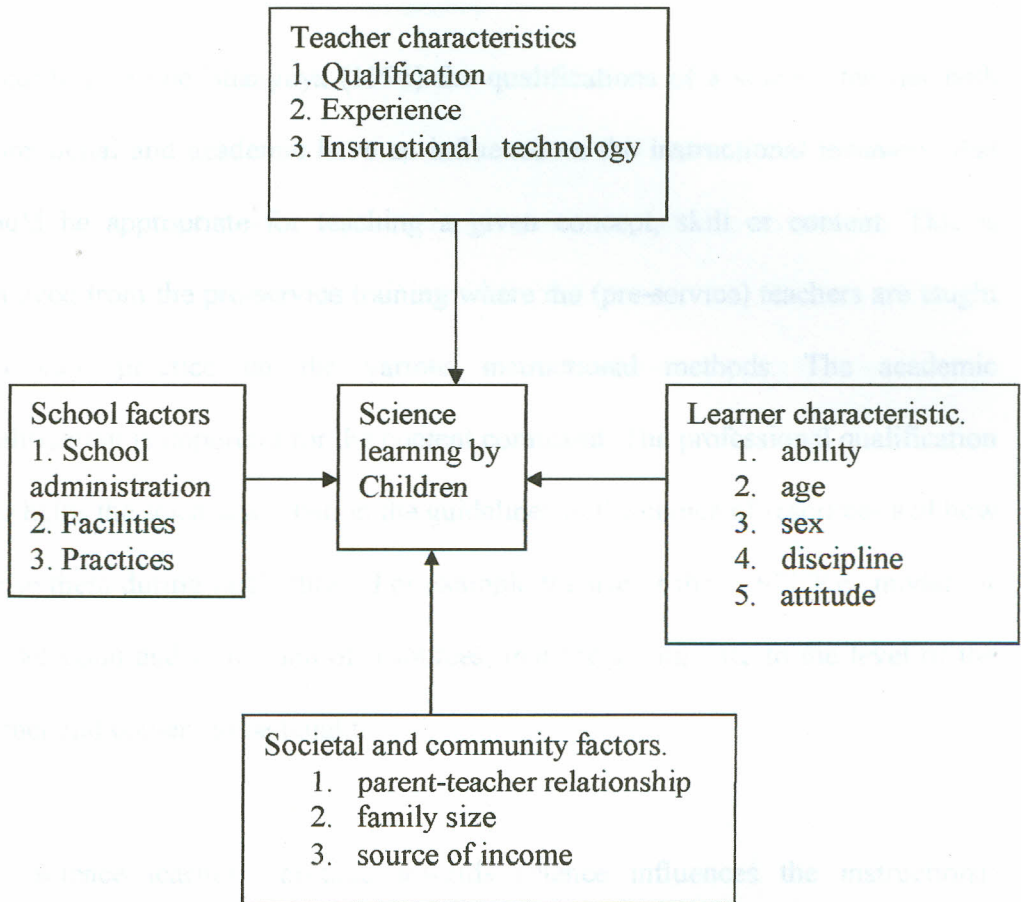
Research has also been done to study the factors that determine achievement in science education by researchers such as Twoli (1986), Achola (1990), Maundu (1986), Eshiwani (1983) and Orodho (1996). These studies indicate that there are four main factors that determine achievement in science:

- (i) The school factors which constitute considerations of the school administration, teacher characteristic, school facilities and practices on teaching and assessment of learners with the aim of improving the quality of teaching.
- (ii) Teacher characteristics which include teacher professional qualifications, teaching experience, sex and instructional technique frequently employed.
- (iii) Student characteristics which include their age, ability, sex, awareness of pupils about the value of education, school attendance and discipline.
- (iv) Community and societal factors which include parent-teacher relationship, size of family, source of income of family, educational levels and occupational status of the parents and the siblings.

Learning science at the Primary school level is likely to be more determined by the teacher characteristics than others although all have an influence on each other. Orodho (1996) carried out a study considering all the four factors at the Secondary school level and re-emphasized their effects on achievements in science. Figure 1.1 summarizes how the four factors influence Science learning.

The teacher's characteristics at the Primary school level assert more influence since the teacher is the one who guides and provides for the opportunities for the learning experiences. In a science class the teacher is the role model of a scientist to the learner and should place the learner in that position of the scientist by the choice of appropriate learning experiences. This will in turn direct the class or learners attitude towards science positively as they appreciate their positions as young scientists.

Figure 1.1: a model of the factors influencing science learning



1.4 CONCEPTUAL FRAMEWORK

In developing a conceptual framework for this study an attempt was made to show how the teacher characteristics influence the instructional or teaching techniques or methods. Likewise, how these characteristics influence the choice

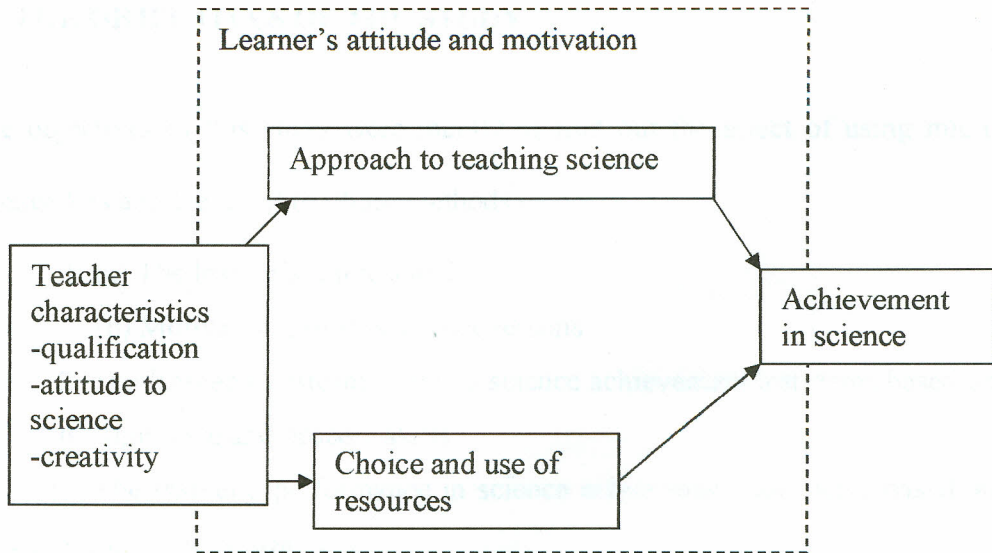
and use of resources in teaching science and their effects on the learners' performance in science.

According to Ole Shanguya (1995) the qualifications of a science teacher both professional and academic have an influence on the instructional technique that would be appropriate for teaching a given concept, skill or content. This is achieved from the pre-service training where the (pre-service) teachers are taught and they practice on the various instructional methods. The academic qualification is important for the content command. The professional qualification also helps the science teacher on the guidelines to the choice of resources and how to use them during instruction. For example the use of the 'ASSURE' model for the selection and utilization of resources, that are appropriate to the level of the learner and content to be taught.

The science teacher's attitude towards science influences the instructional technique and the use of resources in teaching. Teachers with negative attitude are likely to use the expository approach more and use minimal resources in their science lessons. The use of appropriate methods and suitable resources influence the learner's performance in science. This study was thus intended to establish whether resources would make a difference in the teaching and learning of science.

The learner's attitude and motivation during science lessons is highly dependent on the teacher characteristics; qualification, attitude, creativity and experience of the science teacher. It is also dependent on the instructional technique and the effectiveness and suitability of the resources used during instruction. The individual learner's achievement in science also affects his/her motivational level. This relationship between the teacher characteristics, achievement in science and learner motivation can be summarized as in Figure 1.2.

Figure 1.2: A conceptual model for the relationship between teacher characteristics, motivation and achievement.



1.5 PURPOSE OF THE STUDY

The purpose of this study was to address part of the problem of poor performance in sciences. This was by introducing a new resource in the teaching of sciences to supplement the other resources being used currently. During this study the effects of this introduction of resource were monitored or determined to show if there was any improvement in the performance in the science tests that were administered.

Likewise the learners were observed to find if there was any change in their attitude through this introduction of micro science kits in their learning of science.

1.6 THE OBJECTIVES OF THE STUDY

The objectives of this study were mainly to find out the effect of using micro science kits and the usual teaching methods on:

1. (a) The learner's interest and
(b) Motivation towards science lessons
2. The learner's performance in a science achievement test items based on manipulative and process skills
3. The learner's performance in science achievement test items based on experimental type problems.
4. The learners' overall performance in SAT

1.7 RESEARCH QUESTIONS

During the study the following research questions were answered:

- 1). is there any difference between the control and experimental group in the learners' interest and motivation towards science lessons?
- 2). is there any significant difference in the learners performance in science achievement test items based on skill development?
- 3). is there any significant difference in the learners performance in science achievement test items based on practical and application?
- 4). is there any significant difference between the control and experimental group in the overall performance in the science achievement test (post test)

1.8 RESEARCH HYPOTHESES

The following null hypotheses were tested using the study findings.

H₀ 1: There is no significant difference between the experimental and control groups in performance in science achievement tests based on skills development.

H₀ 2: There is no significant difference among the experimental and control groups in the performance of science achievement test based on experimental or practical problems

H₀ 3: There is no significant difference between the experimental and control groups on their overall post test performance

1.9 SIGNIFICANCE OF THE STUDY

It is hoped that this study's findings and recommendations will be able to add up to the world of knowledge on the teaching methods in science more so by a resource-based approach. It is also important to the curriculum developers, teachers, schools and the government in their concern for the poor performance in sciences. The findings will help them in their quest for the solution to improvement of the performance in science.

The study is also of use to the interested groups for the poor performance such as FEMSA, JICA and other agencies in the design of worksheets and constitution of the components or learning resources that would be relevant to the primary science course. The relevant resource to consider is the science kit. These agencies include the Kenya National Academy of Sciences (KNAS). The School Equipment Production Unit (SEPU), and the Centre for Science and Technology Innovations (CSTI)

1.10 ASSUMPTIONS:

The following assumptions were made about this study:

- (a) The subjects of this research that is the experimental and control groups' pupils were of nearly the same ability

- (b) The science teachers in both the experimental and control groups had nigh on the same characteristics in terms of qualification both academic and professional attitude and experience.
- (c) The presence of the researcher in the observation lessons did not influence the desired behaviour greatly.
- (d) Learners tailored fast the use of the main resource which was a Science kit.

1.11 SCOPE AND LIMITATION OF THE STUDY

The study was mainly restricted to the effect of using micro-science kits and the conventional teaching approaches in teaching science in Primary schools. These effects were in terms of achievement levels in science tests and the motivational level of the learners' towards/during science lessons. The other variables that could have influenced the research variables were assumed to be constant and taken care of by the control group, which did not get the treatment of the experimental group.

The major limitation to this study was the cost of acquiring the teaching resources that were used in this study. This was because the teaching resources were not available in schools. Therefore, the sample size was limited to a few schools as per the number of kits that were available.

1.12 DEFINITION OF TERMS:

Learning: this refers to the gaining scientific knowledge and acquisition of science process skills through practice or teaching.

Practical Approach: This is a teaching method that stressed the importance of observation and the use of senses in obtaining scientific knowledge. It allows for the learners the opportunity to manipulate the learning materials and equipment.

Resource: This is an auxiliary instructional device such as a micro-science kit which is intended to facilitate learning.

Teaching: This is the act of imparting knowledge (scientific) or skills to the learner.

1.13 ACRONYMS AND ABBREVIATIONS

7-4-2-3: Refers to the old/former system of education in which learners take seven years at primary level four years at secondary level two years at high school or advanced level and three years at university.

8-4-4 - The current system of education in which learners take eight years at primary level four years at secondary level and four years at university level.

ASSURE – Model for selection and utilisation of resources `Analyse State objective, Select material, Utilize material, Require learner performance and Evaluate (ion)´

CSTI: - Centre for Science and Technology Innovations.

FEMSA- Female Education in Mathematics And Sciences Association.

JICA - Japan International Co-operation Agency.

K.C.P.E - Kenya Certificate of Primary Education.

K.C.S.E - Kenya Certificate of Secondary Education.

K.N.E.C - Kenya National Examinations Council.

MOEST - Ministry of Education Science and Technology.

NIC - Newly Industrialized Country

SAT - Science Achievement Test.

SMASSE - Strengthening of Mathematics And Sciences in Secondary Education.

CHAPTER TWO

LITERATURE REVIEW

2.0 INTRODUCTION:

This chapter is mainly concerned with the review of the literature that is related to this study. However in Kenya, this kind of study on the use of micro science kits in teaching science has not been common, hence limited literature. This is because these kits are a new idea at Primary school level even though they are being tried out at the secondary level by the Kenya National Academy of Science in some pilot schools across the country. For the purpose of this study, the researcher emphasised literature on some of the research that has been done in science education and teaching methods, the use of mini-laboratories, which have also an almost similar concept to the micro-science kits, and the role of practical work in the teaching- learning of science.

2.1 LITERATURE ON RESEARCH IN SCIENCE EDUCATION:

Much of the research that has been done in Kenya on science education has been based on achievement in science and thus has had their concern on the factors which determine achievement. Kyalo (1984) in his study found out that teachers disregarded improvising apparatus and hence the lack of appropriate apparatus hinders effective science teaching. He further emphasized that the predominant

approach to teaching of Primary science was theoretical and practical approach was largely neglected.

This, therefore, implies that the pupils are not able to acquire some of the necessary process skills of science. Eshiwani (1974) also emphasizes that the teaching methods in science have for a long time been geared to the pursuit of knowledge per se and due to such an approach the teachers are more concerned with the theoretical approach rather than the practical approach.

The Commonwealth Regional seminar report (1976) also indicates that the state of science teaching in the commonwealth Caribbean countries, until recently, have for a long time been hindered by lack of science equipment and thus the type of science taught in the majority of the countries was 'nature study'.

However most countries have attempted to develop and introduce into their school systems a structured science program, which is related to their local environment. Bajah (1981) in his study recommended that since science is a practical subject, children should be exposed to the practical aspects of science.

However, the teaching resource requirements for sciences have always been an issue in terms of their provisions to school. This was also echoed by the Ominde commission (1964), which pointed out, that the poor classroom facilities and lack of teaching equipment in most rural Primary schools have hindered the success of the science programs at the primary level. The report emphasizes that the quality of science education ultimately depends on the quality; the devotion, the

perseverance, the patience and the skill of the science teacher. This is all in terms of the organization of the science lessons, the choice and use of resources both from the environment and improvised ones for the purpose of enriching the learning environment. These studies thus note that the teaching of science in primary schools needs to be improved in terms of the approach to teaching by varying the environment by using various methods and approaches. This study advocates for the enrichment of the classroom resources with the introduction of the micro-science kits which will make the science lessons more resource based.

2.2 SCIENCE TEACHING METHODS

The teaching and learning of science in schools at any level is mainly concerned with two main fundamental questions. The first one is 'What is taught' which mainly concerns on the science contents and its relevance. This is already prescribed in the curriculum in terms of the course outline or topics supposed to be covered by the end of a curriculum cycle. This means that the teacher has no direct control on the choice of what is taught.

The second question is concerned with the 'how it is taught' which is mainly a question of the teaching approaches and method. Although the curriculum may also suggest the approaches and method to be used; it may be argued that the selection of the method or approach to use in presentation of the content is ultimately the task of the teacher facing a particular class. In exercising this

prerogative, the teacher is guided by factors such as class size and the available resources for teaching a particular topic.

In choosing the methods of teaching Ole Shanguya (1995) indicates that whichever method a teacher adopts for a lesson must however aim towards effectiveness both in quantity (equally benefiting all the learners) and quality (effectiveness) of learning. He further notes that most learning tasks involve a combination or any of the following processes: recognition, memory, algorithmic problem solving, understanding and change of attitude. To achieve any of these processes require a particular instructional approach or combination of approaches.

Higher (1985) observes that traditional teaching involves some common stages such as lesson preparation, lesson presentation to the learners, provision of learning activities and environment to enable the learners learn the lesson, evaluation and analysis of the learning outcome which may result in re-mediating the unlearnt parts using whatever learning variations available such as varying the methods, medium, techniques or environment.

The teaching – learning process involves activities aimed at helping students to arrive at the learning outcome or objective that the teacher has set to achieve at the end of a given lesson. The achievement of the set objectives largely depends

on the approach and the method employed by the teacher. Hence the activities must be carefully selected when formulating the kind of instructional procedure and techniques best suited for achieving the objectives of a particular lesson.

2.2.1 Teaching Approach:

A teaching approach may be defined as a combination of ways that a science teacher uses when presenting the content of a lesson. There are two main approaches, which are used in teaching science. This includes the expository approach and the heuristic.

The expository approach involves the kind of teaching, which is characterized by predominance of teacher talk with little or no student participation in practical activities. Thus the approach is teacher-centred whereby the teacher gives facts, explains concepts and gives illustrations. Anything that requires a practical approach is done through teacher demonstration. The role of the learners in this approach is limited to listening, answering and asking questions, and writing notes as the lesson progresses. Although this approach is not effective in teaching science, some topics are by their nature difficult or risky to teach practically and are, therefore, approached by exposition.

The second approach is the heuristic approach. Praagh (1989) defines the heuristic approach of teaching as methods which involve on the teacher placing students as far as possible in the attitude of the discoverer, such methods involves them in finding out instead of being merely told about things. This approach is

characterized by the high degree of the students participation in learning science and is hence referred to as a student centred approach discovery or inquiring approach. In this approach the teacher involves the student in the search for scientific knowledge and the development of the process skills such as the ability to make observation, perform experiments, collect data, make deductions and present the results. The learners have also an opportunity to develop skills such as the manual dexterity in handling apparatus and using them for data collection, and chance to discuss procedures and observations amongst themselves.

The role of the teacher in this approach is to guide students by clarifying instructions where necessary and being available to answer any questions that may arise in the course of the learning process. The learning activities should be able to help the learners to develop in them the process skills such as the ability to plan and carry out investigations in which they ask questions, predict results, hypothesize, make observations, make measurements, manipulate variables, interpret results and evaluate evidence.

2.3 DETERMINANTS OF TEACHING METHODS:

A teaching method may be defined as the techniques the teacher uses in presentation of the lesson content. The choice of the method to be used by the teacher is determined by a number of factors. Ole Shanguya (1995) identifies the determinants for the choice of method of teaching as:

(1) The Learner:

The learner is identified as the most important person in any learning situation. All learners are worth and none of them should be pre-consigned to failure; such that learners have a right to a choice of teaching approach appropriate to their individual personality physical constitution and needs. It is on this ground that the instructional objectives are centred on the learners as “By the end of the lesson/course the learner should be able to.....”

(2) Learning Objectives:

The concern of educationists and educational administrators is provision of effective and accountable learning. This can only occur when learners are afforded the means, media, material and methods that are supportive to achievement of objectives or instructional goals.

(3) Resources:

The manner and way in which the content is passed to the learner in part is depended on the resources. Where there are no teaching resources for science, teachers are forced to improvise and if they are not able, they are compelled to use only the expository approach to teaching.

Das (1985) also indicates that in choosing the method of teaching science the teacher should consider; the objective to be achieved; the learner and the nature of content to be taught. He emphasizes that the science teacher should be acquainted with the use of a variety of methods and procedures of teaching science. As much

as possible the science teaching should be based on the students' everyday experience and should be focused on activities, which enables the learners to relate the classroom activities to real life situations. Some of the following methods are used in teaching science.

2.3.1 Lecture Method:

This is the usual classroom 'chalk and talk' method. It is not scientific since it involves giving factual information with very little or no participation by the learners. This method has got the following draw backs as noted by Das (1985).

- (a) It does not offer training for the attainment of scientific skills. This method ignores experimentation, which is the basis of modern scientific knowledge, and the scientific skills are mainly attained by experimentation.
- (b) The content taught in a lecture is quickly forgotten. This is because the method encourages memorization of facts, which are fast forgotten, and it does not utilize all the senses but only the auditory.
- (c) Lectures can also be boring if they are lengthy and if the teacher lacks appropriate communication skills.

2.3.2 Demonstration:

The term demonstration refers to show. In science education a demonstration is a teaching method that means more than showing as it serves a variety of purposes such as providing means by which the teacher can explain or clarify certain parts of the contents quickly and economically. It can also be used as a motivating

device by introducing a lesson with an interesting experiment, which keeps the pupil interested and curious. During lessons it can be used to demonstrate principles and their application while the theory is being done in the class. They are also used when the apparatus is costly and sensitive with a chance of damage if pupils handle them. This then requires that the teacher demonstrate the working of the apparatus to the class.

Some experiments are by nature dangerous such as working with high voltage, X-rays, radioactive substances, and burning hydrogen in air to form water are unsuitable and risky to the juniors. Thus the students should not be allowed to perform such experiments but be demonstrated by the teacher and to a small scale. Das (1985) indicates some points, which may be considered as criteria for a good demonstration:

- (i) The demonstration should be tried out in advance so that everything is in working order. The try out whether simple or elaborate should preferably be made a short while before the start of the lesson. The apparatus and materials needed for the experiment should be secured and kept available when needed. This saves a lot of time
- (ii) The purpose of the demonstration should be clear from the beginning. This is to ensure that the learners are focused on the main feature of the experiment and do not deviate from the objective of the demonstration.

(iii) The apparatus and the equipment used in the demonstration should be as simple as possible. The apparatus should be large – sized as the complexity of the apparatus may obscure the purpose and should be observable from a distance. The demonstration is usually interesting when it is connected to what pupils have seen or experienced or to their practical work.

(iv) Whenever and wherever possible the teacher should ask some pupils to help him read scales, note data, describe the reaction to the other pupils in class. This enhances pupil participation in the class. The teacher should keep the pupil's interest by inspiring them and creating a dramatic atmosphere in the class.

(v) While arranging for a demonstration the teacher should not forget that some apparatus and materials are affected by climatic condition. Thus the demonstration should be adjusted to the time and season that suit the performance.

(vi) The demonstration should be visible to all the pupils in the class and hence there should be sufficient lighting on the demonstration table and in the background. If necessary some extra illumination should be provided for. Pupils should be allowed to change position and may stand around a demonstration table at a safe and convenient distance.

(vii) While performing a demonstration the teacher should be able to show how the demonstration fits into the problem at hand. The pupils should be asked to take careful notes on their observation, data which is needed to arrive at generalizations.

(viii) The use of questioning should accompany a demonstration. This helps in making the teaching of science more helpful and more effective. This helps in making the pupils more active in observing and recording data as the demonstration progresses and also discussing the results to come up with generalization.

2.3.3 Project Method

Das (1985) defines a project as a piece of whole-hearted and purposeful activity carried out to a completion in its natural environment. The method consists of building up a comprehensive unit of connected facts a round a central theme which may be some matter of scientific interest, principle, theory or topic of immediate interest to the pupils.

This method is based on the fact that students learn through association, activity and teamwork. The learners through this method are able to appreciate the basic steps of the scientific method which combines the following skills: observation, identification of the problem, discussion, formulation of hypotheses, design of the investigation, data gathering, data analysis, making deductions, report writing and presentation.

The planning and carrying out of a project involves more work on the parts of the teacher who should constantly provide encouragements and inspiration so that the original enthusiasm may not slowly fade away. He must also guide and direct the learners to acquire the information they seek and achieve the end they aim at.

2.4 RESOURCE – BASED LEARNING IN SCIENCE:

A resource-based learning systems is one where children learn chiefly from materials of one sort or another either directly or indirectly with the teacher having an intermittent role, though nonetheless vital. Thus a resource-based system is a carefully managed system, which attempts to lead pupils to common educational goals whilst catering for their individual abilities, aptitudes and interests.

Teachers attempt to plan and organize their teaching/ pupils learning by giving it direction and trying to maximize its effectiveness. This can best be done when pupils are considered in class as individuals and when it is recognized that the style of learning that best suits one pupil does not necessary suit another. Teachers, therefore, must provide a high degree of variety and flexibility in both the contents and style of the learning experience they create. Class teaching, small group- work independent learning and many other teaching –learning strategies all have a part to play. A well-managed system of resource-based learning enables a wide range of strategies to be effectively integrated and allows teachers to cater for the needs of individual pupils.

A resource- based learning system in science has got the following advantages:

- a) The wide range of abilities, attitudes, interests and rates of working of pupils in a class is catered for.

- b) The best or most effective learning style for each pupil can be assessed in a resource-based system.
- c) The teacher is able to give personal attention to pupils during lesson time, planning of appropriate courses of work, tutoring and helping with learning difficulties. Whole class lessons due to their less frequency can be more effective.
- d) Pupils are more actively involved as individuals in their work.
- e) Pupils are trained to work on their own and accept responsibility for organization of their work. This is especially important in preparing them for long- life education.

2.5 THE ROLE OF PRACTICAL WORK IN SCIENCE EDUCATION:

Practical activities are a central feature of science teaching. The roles of practical work in science teaching can be classified into acquiring information, concepts and principles; developing process skills; learning about the nature of science; and improving attitudes to science. Hofstein (1991) defines practical work (Laboratory activities) as contrived learning experiences in which students interact with material to observe phenomena. These experiences may have different levels of structure specified by the teachers or Laboratory handbook (manuals) and they may- include phases of planning and design, analysis and interpretation, and application as the central performance phase. Laboratory activities usually comprise of students experiments or investigations; individually

or in small groups and does not include large group demonstration, science museum visits or field trips.

Practical work has had its place in science since the nineteenth century. During this period, text books and laboratory manuals began to acquire a more applied utilitarian orientation. However there were some arguments raised against laboratory activities and this included lack of or few secondary school teachers who were able to use the laboratory effectively. Also too much emphasis on laboratory activities leads to a narrow conception of science. The experiments that were being performed in secondary schools were also thought to be trivial and some of these activities were often remote from and unrelated to the capabilities and interests of the children.

Following the World War I laboratory work was used for confirming and illustrating information learnt from the teacher or text book. After 1960 a new science curriculum was developed which stressed the processes of science and emphasized on the development of higher cognitive skills. The laboratory acquired a central role not just as a place for demonstration and confirmation but also as the core of the science learning process (Shulman and Tamir, 1973).

Thus the uniqueness of the laboratory lies principally on providing students with opportunities to engage in processes of investigation and inquiry.

According to Ausubel (1968) the laboratory gives the students appreciations of the spirit and method of science, promotes problem solving, analytic and generalization ability, provide the student with some understanding of the nature of science. Lunetta and Hofstein (1980) suggested a way of organizing the goals of science education that have been used over years to show the importance of laboratory teaching.

These goals are grouped under cognitive, practical and affective domains. These are summarized in table 2.1

Table 2.1: GOALS OF LABORATORY ACTIVITY

COGNITIVE DOMAIN	PRACTICAL DOMAIN	AFFECTIVE DOMAIN
Promote intellectual development	Develop skills on performing science investigations	Enhance attitudes towards science
Enhance learning of scientific concepts	Develop skills in analysing investigative data	Promote positive perceptions of one's ability to understand to affect one's environment.
Develop problem solving skills	Develop skills in communication	
Increase understanding of science and scientific method	Develop skills in working with others	

(Source: Hofstein (1991); practical work and science education II)

Woolnough and Allsop (1985) suggests that if we want the students to acquire skills that are used by practicing scientists and if we are concerned with the teaching of the process skills of science, practical work seems to be vital in this context. Laboratory activities can enable students to integrate their experience

with materials and with phenomena of science to conceptual aspects of these activities and also to more formal schemes and models for practical investigation. Laboratory activities can and should involve both manual and intellectual abilities, which are in some way distinct from those used in work that is exclusively verbal.

The development of favourable attitudes towards science is one of the important goals of science teaching. Various studies by Ben-zvi et al (1976a and 1976b), Hofstein et al (1976), Raghbir (1979), Okebukola (1986a, 1986b), Milner et al (1987) all have shown from their studies that students enjoy laboratory work. In some courses it is responsible for the students' decision to enrol in science courses and it generally results in positive and improved attitudes towards and interest in the science.

2.6 SUMMARY

From the literature reviewed it was evident that there is concerted effort by various scholars in their quest to address low achievement in science. These studies have more specifically sought to understand and isolate the various factors that maybe contributing to the poor performance at national examinations. From the results of most studies they have shown what would be the determining factors such as poor attitude towards sciences, poor approaches to science teaching, lack of resources both human and non human and many more. This study therefore seeks to bridge these gaps of in adequate resources and change of

attitude towards sciences/ therefore an intervention micro science kits are introduced in this study to determine if they will address this gap.

Hofstein (1991) has also shown that practical activities are central in science teaching and learning. They enhance the achievement of objectives of science education both cognitive, practical (psychomotor) and affective. This study also tries to confirm this assertion from the research findings

1.1 VARIABLE

1.1.1 Dependent Variable

According to Sibat et al (2014) (2014) task is a variable that is measured as an indicator of the individual's performance. In this study, the dependent variable in this study is the science achievement. The study is done in the pre-test and post-test and is conducted during the study intervention. Since the pre-test and post-test examination is conducted at the same time there was the need of comparing the scores and comparing scores. Therefore the scores were subjected to statistical test to measure the effect of the intervention and effects of the treatment on the secondary dependent variable.

1.1.2 Independent variable

This is the variable that an experimenter set up to cause an effect in an experiment. Independent variables may be existing features of the subject or an

CHAPTER THREE

METHODOLOGY

3.0 INTRODUCTION

This chapter is mainly concerned with the description of the research methodology that was employed during the research process. The chapter describes the variables that were considered during the study, a description of the study and the elements and unit studied. The study design, locale and population from which the sample was drawn are also described. Instruments for the data collection, their administration and mode of analysis of data are also outlined.

3.1 VARIABLES

3.1.1 Dependent Variable

According to Stratton and Hayes (1988) this is the variable that is measured as an indicator of the outcome of an experiment. The key dependent variable in this study was academic achievement. The students' score in the pre-test and post-test administered during the study represented it. Since the pre-test and post-test examination administered were the same there was no need of converting the scores into standard scores. Therefore the scores were subjected to analysis to test the hypothesis. In addition motivation and interest of the learners was the secondary dependent variable.

3.1.2 Independent variable

This is the variable that an experimenter sets up to cause an effect in an experiment. Independent variables may be existing features of the subject or can

be created by the experimenter. In this study, the main independent variable was the introduction of the Micro-science kits in teaching of primary science skills.

3.2 DESCRIPTION OF STUDY

This research was done in two parts: First the current primary science practice (teaching/learning) to try and get the feel of the way science is taught in primary schools. This was catered for by the control group where the independent variable (micro science) was not used. Secondly was the study of the science teaching using the current science teaching practise and the independent variable in co-operated.

The science lessons in the control schools representing the current or conventional teaching practice were basically based on the introduction, discussion/body and conclusion. Practical activities were minimal and limited to showing the learners what the dry cells were, Positive and Negative terminals of cells. This was during lessons of electricity.

For the purpose of this study on the current state of science teaching and the role of practical activities in science learning, four schools were used; two as control and two as experimental. The following table 3.1 shows a summary of the description of the schools.

Table 3.1: DESCRIPTION OF SCHOOLS IN THE STUDY

SCHOOL	LOCATION	TYPE	NO OF STUDENTS	COMMENTS
Mwamisoko	Rural approx 5.5 km off Kisii-Migori road.	Mixed school Government	23	School is in the Rural setting of Central Kisii District: low class.
ST. Mary's Nyabururu Girls Boarding	Municipality approx. 2Km along Kisii – Kisumu Road	Girls School Government	44	School is within the Municipality of Kisii town. It is for working class.
Nyanchwa	Municipality approx. 1Km from town centre	Mixed School Government	113	School within Municipality. A middle class.
Bobaracho	Rural approx. 5Km along Kisii – Kericho road	Mixed School Government	49	School outside Municipality along the Kisii –Kericho Road. A middle class school.

NB: Low class school- Most pupils come from families of low social economic status

Middle class school-Pupils come from families of average economic status

Working class school- Pupils come from families of above average economic status

3.3 DESCRIPTION OF WORK COVERED

The science topics covered during term III in standard seven were: Properties of matter and Electricity. In properties of matter the students covered states of matter, separation of mixtures, acids and bases. On the other hand in electricity

the following sub topics were covered: sources of electricity, electric current, cell connections in series and parallel, bulb connections in series and parallel.

3.3.1 DESCRIPTION OF ELEMENTS OF UNIT

One of the units covered during the study was electricity. While covering this topic, the learners had an opportunity to use a science kit to carry out a number of circuit connections involving cells and bulbs. In one activity the learners tried to connect bulbs in series and parallel. The learners were put into groups of six students and were provided with the bulbs, dry cells, wires, springs, cell holder and a combo plate, all from the Basic Micro Electricity Kit. The following figure 3.1 shows the components of the micro science kit used in the study

3.4 RESEARCH DESIGN

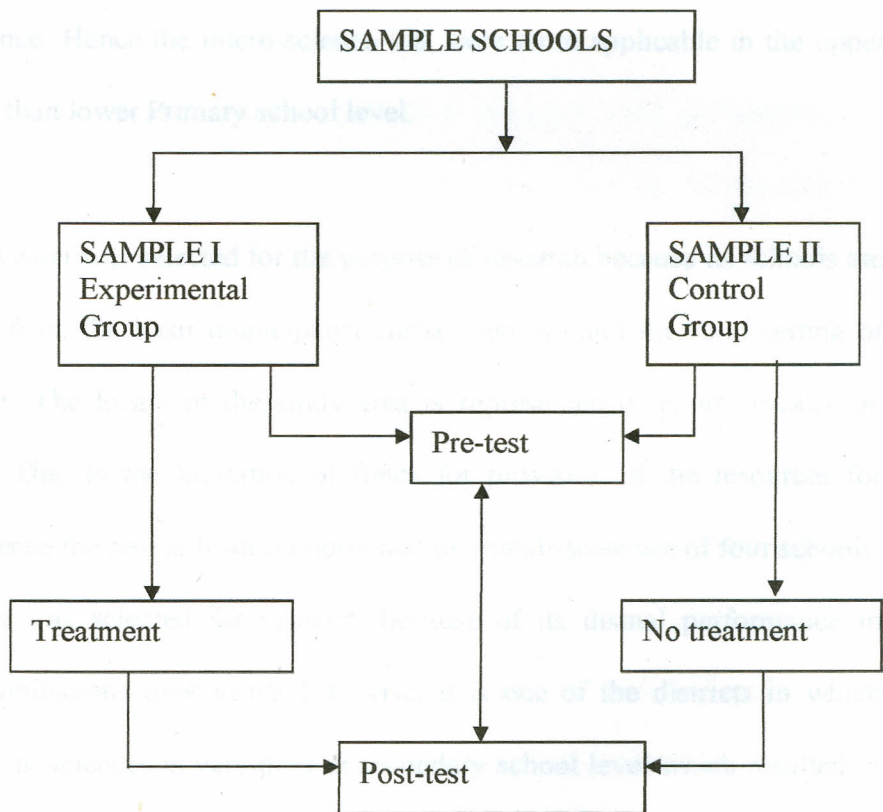
In this research, an experimental design was used. There are a number of experimental designs such as experimental group only designs, quasi-experimental designs, Solomon four experimental designs and the factorial designs.

For this research, the quasi-experimental design with the experimental and control group was used. This is because in classroom research, it is difficult to control all the variables especially the learner's abilities. The schools that were used for this research were from the same geographical setting; they were more or less the same in terms of resources for teaching (local community resources where they improvise from). The teacher qualifications were matched and were more or less the same. The experimental and control groups were drawn from the population.

The purpose of an experimental design is to gather information or data from a situation, which is created. This data does not exist but it can be made available by creating the situation. In this study, the situation was the use or introduction of the kit as a learning resource.

The flow chart diagram in Fig. 3.2 gives the design, which considers experimental and control groups. The experimental group was subjected to the use of a kit while the control group was taught in the usual instructional mode.

Figure 3.2: Experimental design used in the study



3.5 RESEARCH POPULATION

The population from which the sample was obtained / selected consisted of all the primary schools in Getembe division Kisii district. The subjects in the sample were all the standard seven (7) pupils in the sample schools.

The standard seven pupils were selected because of the following reasons.

- a) They were not under pressure of preparing for the national examination like the standard eight.
- b) The science content is more developed in the physical science for upper Primary school level unlike in the lower Primary school level that is more of life science. Hence the micro-science kits were more applicable in the upper Primary than lower Primary school level.

Getembe division was selected for the purpose of research because its schools are drawn both from the Kisii municipality (urban setting) and the rural setting of Kisii district. The locale of the study area is represented diagrammatically on appendix F. Due to the limitation of funds for provision of the resources for teaching science the research was conditioned to a small-scale use of four schools. Kisii district was selected for research because of its dismal performance in K.C.P.E examinations over years. Likewise, it is one of the districts in which performance in sciences is very poor at secondary school level which resulted in its selection for the SMASSE project to try improving performance in both mathematics and sciences. The researcher was familiar with the geography of the area of study, which was useful when administering research instrument.

3.6 SAMPLE AND SAMPLING TECHNIQUE

In developing a sampling frame for this study, the schools were first stratified into urban and rural schools from the population. This was done purposefully to avoid

a possibility whereby in the sample, more schools from one category were being over represented or under represented. On the other hand, the mean scores for the schools clustered as rural was relatively the same and that for the urban was also comparable. This is very important for matching and improving on the validity of the quasi- experimental design.

In stage two, the sample schools from each category were probabilistically sampled by tossing a coin. This helped the researcher in determining the experimental schools and control schools. In the last stage, the subjects (standard seven pupils) were sampled from each school (group). In this 40% of the total number of pupils in standard seven were selected from each sample school. This was irrespective of the number of standard seven streams, where there was more than one stream. To obtain the 40% the researcher selected the pupils by using the class register numbers and entered or used the random number tables. However, all the students were taught together, sat for the same test without separating the 40%. This was very important in controlling the reactive effects of experimentation of the sample. To avoid contamination the experimental and control groups were relatively far apart. In determining the sample size, the resource and time availability consideration were made.

For the purpose of this study, four schools were sampled from the population that is two from each category. One school was sampled from each group to form the

experimental and control group. The sampling grid for the schools in Getembe division is shown in table 3.2.

Table 3.2 Sampling Grid for Getembe Division Schools

Category of school	Number of schools	Sample schools
Urban	12	2
Rural	16	2
Total (N)	28	4

3.7 INSTRUMENTS

The researcher used two main instruments

a) Observation schedule

This was used during observation lessons when the pupils were being taught in both the experimental and control sample classes. In this observation lessons, the pupils' classroom interaction was observed. The interaction was in terms of use of the resource and any behaviour observed during the science lesson that indicated their attitude or motivation towards the science lessons. This was used to monitor the motivational indicators in a classroom.(Appendix D)

b) Achievement test.

These were used as pre-test and post-test data generators to both groups. The items were constructed from the topics taught. (Appendix C)

3.8 DATA COLLECTION

3.8.1 Pilot study stage.

Before the main data collection, the instruments were piloted. During this stage, the research instruments were tested to establish their reliability and validity. The pilot study was also used to see whether the instruments were sufficient to collect the expected data.

For this purpose two schools were selected from those not in the sample, one from each category (urban and rural). The instruments were administered that is the pre-test and the post test. The results were then analysed by the split half method to establish there reliability. The test items were adopted from the exercises from learning science textbooks for standard seven, past papers for KNEC and District Mocks. The pre-test had a reliability of 83.44 % while the post-test items had a reliability of 94.63%. The pre-test was first administered to one primary school that was not in sample during the piloting stage. The reliability values show that the two instruments were sufficient enough to measure and test the desired behaviour. The following SPSS Output shows the computed result for pre-test

Reliability

RELIABILITY ANALYSIS - SCALE (SPLIT)

Reliability Coefficients

N of Cases =92.0 for data analysis N of Items = 2

Correlation between forms =.7267 Equal-length Spearman-Brown =
.8417

Guttman Split-half =.8344 Unequal-length Spearman-Brown =.8417

1 Items in part 1

1 Items in part 2

Alpha for part 1 = 1.0000

Alpha for part 2 = 1.0000

The piloting stage helped in saving the research time and help the researcher contain any circumstances that might arise from differential syllabus coverage.

3.8.2 Administration of the instruments

Before the administration of the research instruments, the researcher made a courtesy call on the Central Kisii District Education Officer. The D.E.O was informed of the research programme that included inducting the teachers from the experimental schools on how to use the science kit, observations and administration of achievement test.

After sampling of schools the researcher visited the schools before the actual study to familiarize him with the science teachers and standard seven pupils. The head teachers of the sample schools introduced the researcher to the teachers and students. The researcher then organized with the teachers for administration of pre-test, teaching and post-test.

3.8.3 Methods used for data analysis

Both qualitative and quantitative methods of data analysis were used since the study generated both qualitative and quantitative data. Analysis of observation of science lessons was done qualitatively. The quantitative data was analyzed by use of computer data analysis program that is Statistical Package for Social Sciences (SPSS). The Pearson product moment correlation coefficient (PPMC) was used to analyze the correlation between the learners score in manipulative and process skills items and also the pre-test scores. The t-Test was used to compare the mean scores of the experiment and control groups.

Descriptive statistics was used to describe the distribution of scores in the achievement tests using mean and standard deviation. Table 3.3 shows the summary of the statistical techniques used for analyzing both the qualitative and quantitative data.

Table 3.3: Summary of statistical techniques used in the study.

OBJECTIVE	HYPOTHESIS/QUESTION	METHOD OF DATA ANALYSIS
1 a) The learner's interest and (b) Motivation towards science lessons	Is there any difference in the learner's interest and motivation towards science lessons	Description of observations and excerpts with photographs
2. The learner's performance in a science achievement test items based on manipulative and process skills.	H₀ 1: There is no significant difference between the experimental and control groups in performance in science achievement tests based on skills development.	Pearson's product moment correlation PPMC. Between learners scores; paired t-Test
3. The learner's performance in science achievement test items based on experimental type problems.	H₀ 2: There is no significant difference among the experimental and control groups in the performance of science achievement test based on experimental or practical problems	Pearson's product moment correlation PPMC. Between learners scores; paired t-Test
4. The learners' overall performance in post-test SAT	H₀ 3: There is no significant difference between the experimental and control groups on their overall performance in SAT	Pearson's product moment correlation, sample student t-Test

3.9 SUMMARY

In summary this study constituted the identification of the variables, description of the population, sampling, design of the study, validation of the instruments, administration of the pre-test, induction of the teachers on the use of the science kits observation lessons and administration of the post-test. The other steps that

follow include presentation of the results, discussion of the results and drawing conclusions and recommendation on the basis of the findings. The following figure 3.3 shows the summary of the steps followed during the study

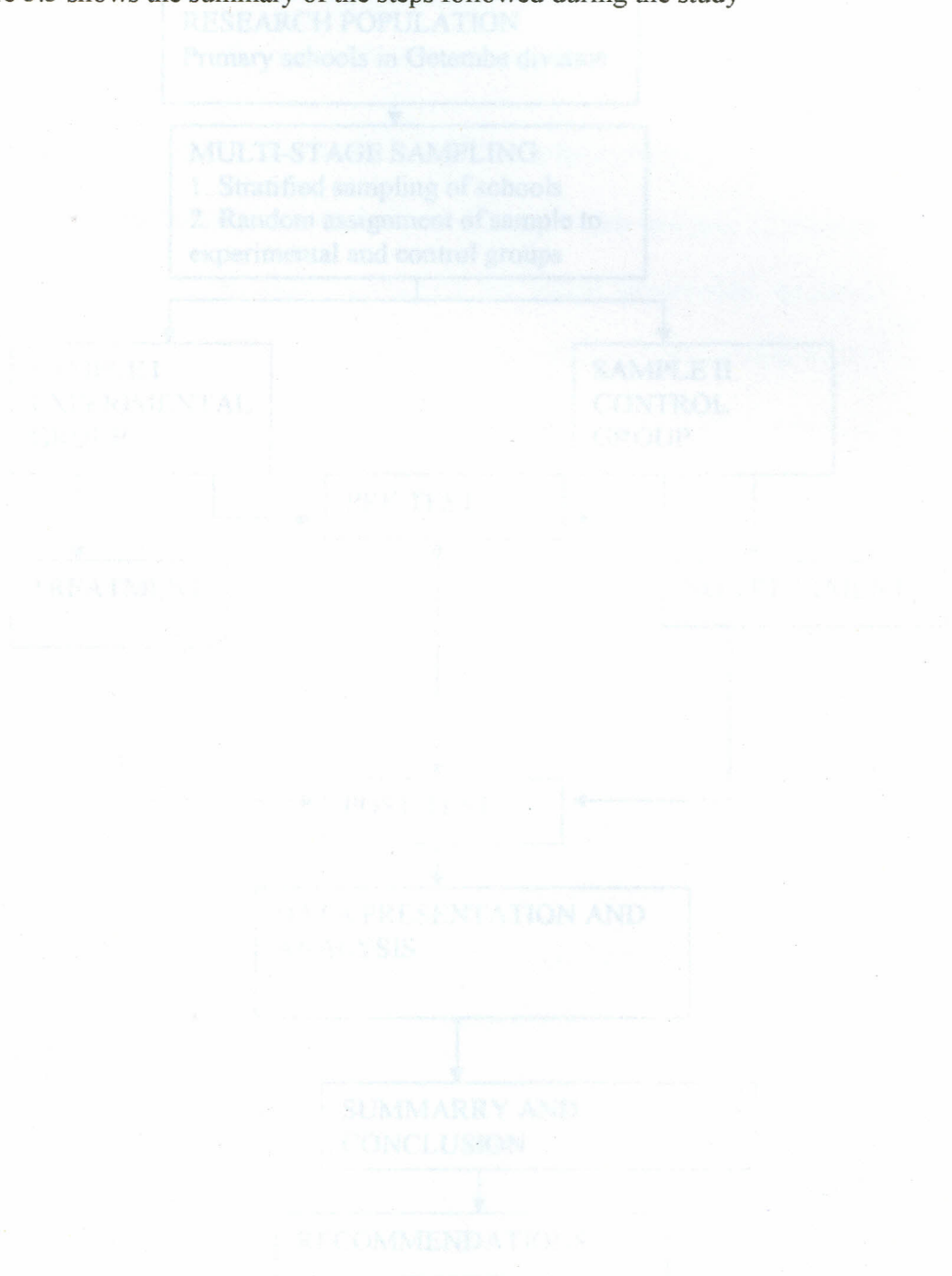
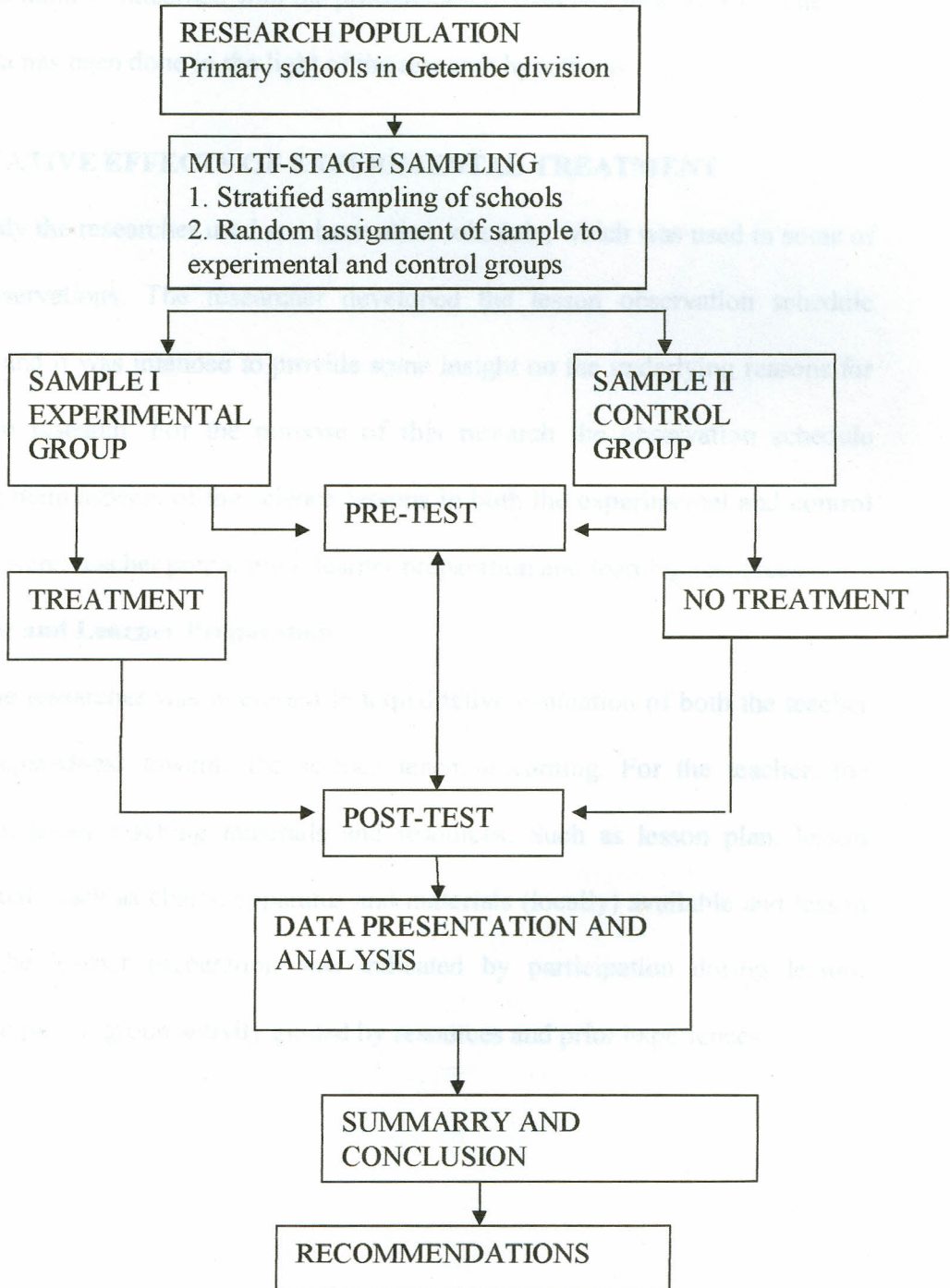


Fig 3.3: The summary of steps followed in this study.



CHAPTER FOUR

DATA PRESENTATION AND ANALYSIS

4.0 INTRODUCTION:

This chapter is mainly concerned with the presentation of data and its analysis. . The analysis of data has been done in the light of the research hypothesis.

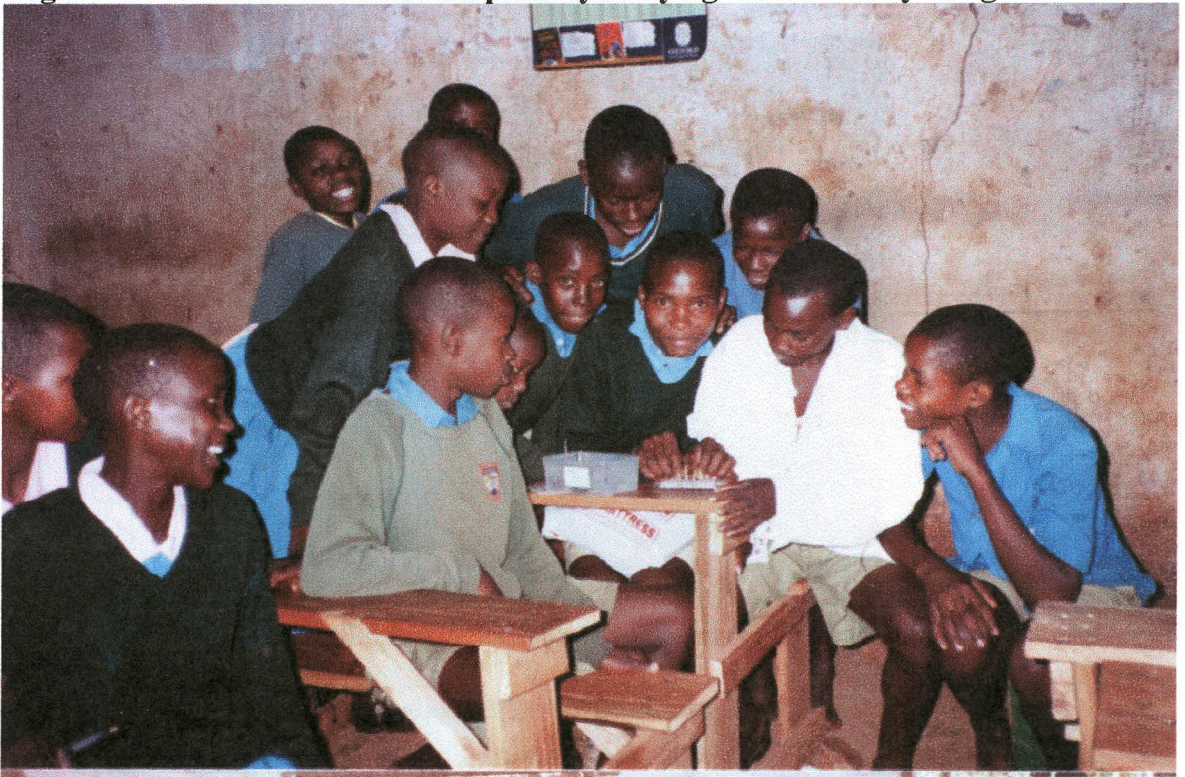
4.1 QUALITATIVE EFFECTS OF EXPERIMENTAL TREATMENT

During the study the researcher used an observation schedule, which was used in some of the lesson observations. The researcher developed the lesson observation schedule (Appendix D) and it was intended to provide some insight on the underlying reasons for the quantitative research. For the purpose of this research the observation schedule indicated three main aspects of the science lessons in both the experimental and control schools. These were: teacher preparation, learner preparation and learning resources.

4.1.1 Teacher and Learner Preparation

In this study the researcher was interested in a qualitative evaluation of both the teacher and learner preparedness towards the science teaching/learning. For the teacher, the indicators were: lesson/teaching materials and resources. Such as lesson plan, lesson notes, audiovisuals such as charts, apparatus and materials (locally) available and lesson presentation. The learner preparation was indicated by participation during lesson, readiness to take part in group activity guided by resources and prior experiences.

Figure 4.1: Learners of Bobaracho primary carrying out an activity using kit.



The learners in the control schools were less active because most of their lessons were limited to lectures which likely made it difficult to conceptualise the ideas such as effect of series connection on the brightness of the bulbs as it was not observable as was observable in the experimental schools.

4.1.2 Learning Resources

The observation schedule was also used to note the variety of learning resources that the teachers were using when presenting the units in science. The resources were varied as per the unit but were limited to the locally available materials, which were few. The micro science kits were a great add-on to the resources in experimental schools (Figure 4.2). The figure shows a teacher demonstrating an activity using locally available materials and micro-science kit.

Figure 4.2: St. Mary's Primary school teacher demonstrating an activity.



The following is an illustration of the student – teacher interaction in one of the experimental schools while carrying out bulb connections in parallel.

Jane: Why does the bulb not go off, when removing one from the circuit as they did in series connection.

Teacher: That is a very good observation, Jane. Class why do you think it is so?

Opanga: Because there is no break in circuit.

Teacher: Very good. In series connection when we remove one bulb, the circuit is not complete and the other Bulbs go off. However, in parallel connection for each bulb is like it has an independent circuit.

Teacher: Is there any other observation that is different from the ones in series connections?

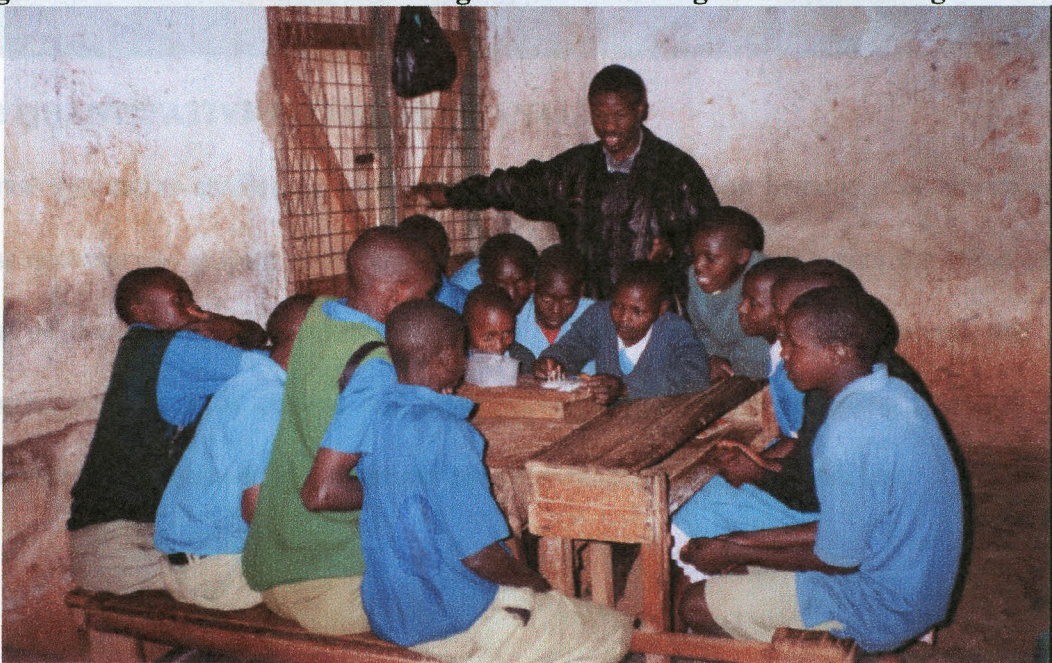
Damaris : The bulbs in parallel are brighter than in series.

The willingness to handle and use the kits during learning is a motivation factor. This try out of experiments using kits was captured by use of exposures showing various activities such as:

Figure 4.3: Teacher demonstrating the use of kits to learners



Figure 4.4 Science teacher observing learners working on a circuit using kit



The girls were also excited at their success in manipulating the learning resources on their own as shown in the following exposure

Figure4.5: Researcher observing girls working on an activity



4.2 QUANTITATIVE METHODS OF ANALYSIS

Since qualitative studies are not very powerful in explaining behaviour or situations, it was necessary to employ analytical tools that were capable of measuring the effect of the use of the micro science kits in learning science. A science achievement test was administered to both control and experimental groups. The following tables of data analysis were obtained for the various analyses of the pre-test and post test

Table 4.1: Inferential statistical results for pre-test

Group Statistics					
	schooltype	N	Mean	Std. Deviation	Std. Error Mean
TSPRE	control	55	47.76	12.15	1.64
	experimental	37	47.27	13.34	2.19

Independent Samples Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
TSPRE	Equal variances assumed	.545	.462	.184	90	.855	-.49	2.69	-4.85	5.83
	Equal variances not assumed			.180	72.381	.857	-.49	2.74	-4.96	5.95

Table 4.2: Inferential statistical results for skill development items in SAT

Group Statistics					
	schooltype	N	Mean	Std. Deviation	Std. Error Mean
PSPRE	control	55	25.13	6.11	.82
	experimental	37	24.81	7.83	1.29
PSPOST	control	55	27.75	6.58	.89
	experimental	37	30.92	8.79	1.45

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
PSPRE	Equal variances assumed	1.658	.201	.217	90	.828	.32	1.46	-2.58	3.21
	Equal variances not assumed			.207	64.287	.837	.32	1.53	-2.74	3.37
PSPOST	Equal variances assumed	2.978	.088	-1.978	90	.051	-3.17	1.60	-6.36	1.36E-02
	Equal variances not assumed			-1.871	62.365	.066	-3.17	1.70	-6.56	.22

Table 4.3: Pearson's product moment correlations for skill development in SAT

Correlations

		PSPRE	PSPOST
PSPRE	Pearson Correlation	1.000	.619**
	Sig. (2-tailed)	.	.000
	N	92	92
PSPOST	Pearson Correlation	.619**	1.000
	Sig. (2-tailed)	.000	.
	N	92	92

** . Correlation is significant at the 0.01 level (2-tailed).

Table 4.4: Inferential statistical results on experimental skills items on SAT

Group Statistics

schooltype		N	Mean	Std. Deviation	Std. Error Mean
ESPRE	control	55	22.64	7.48	1.01
	experimental	37	22.46	7.18	1.18
ESPOST	control	55	26.04	6.81	.92
	experimental	37	34.62	9.39	1.54

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
ESPRE	Equal variances assumed	.050	.823	.113	90	.910	.18	1.57	-2.93	3.29
	Equal variances not assumed			.114	79.482	.910	.18	1.55	-2.91	3.27
ESPOST	Equal variances assumed	5.421	.022	-5.081	90	.000	-8.59	1.69	-11.94	-5.23
	Equal variances not assumed			-4.777	60.915	.000	-8.59	1.80	-12.18	-4.99

Table 4.5: Pearson's product moment correlations for experimental skills item in SAT

		ESPRE	ESPOST
ESPRE	Pearson Correlation	1.000	.654**
	Sig. (2-tailed)	.	.000
	N	92	92
ESPOST	Pearson Correlation	.654**	1.000
	Sig. (2-tailed)	.000	.
	N	92	92

** . Correlation is significant at the 0.01 level (2-tailed).

Table 4.6: Inferential statistical results on the overall performance in SAT (Post-test)

Table 4.7: Pearson's product moment correlations on the overall performance (post-test)

		N	Mean	Std. Deviation	Std. Error Mean
TSPRE	control	55	47.76	12.15	1.64
	experimental	37	47.27	13.34	2.19
TSPOST	control	55	53.85	11.45	1.54
	experimental	37	65.81	16.75	2.75

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
TSPRE	Equal variances assumed	.545	.462	.184	90	.855	.49	2.69	-4.85	5.83
	Equal variances not assumed			.180	72.381	.857	.49	2.74	-4.96	5.95
TSPOST	Equal variances assumed	10.046	.002	-4.071	90	.000	-11.96	2.94	-17.79	-6.12
	Equal variances not assumed			-3.788	58.339	.000	-11.96	3.16	-18.27	-5.64

Table 4.7: Pearson's product moment correlations on the overall performance (post-test)

Correlations

		TSPRE	TSPOST
TSPRE	Pearson Correlation	1.000	.727**
	Sig. (2-tailed)	.	.000
	N	92	92
TSPOST	Pearson Correlation	.727**	1.000
	Sig. (2-tailed)	.000	.
	N	92	92

** . Correlation is significant at the 0.01 level

CHAPTER FIVE

DISCUSSION OF FINDINGS

5.1 ATTITUDE AND MOTIVATION

From the observations that were carried out, the pictures (figures 4.1, 4.2, 4.3, 4.4 and 4.5) and the excerpts for the classroom interaction. The following are some of the interpretations that the researcher was able to make.

a) Both teachers from the experimental and control schools appeared prepared for the science lessons in terms of lesson planning and presentation. Class control was good. However, it is important to note that, this is on the assumption that the same is true always and the fact that they were being observed did not influence them.

b) In terms of resources the control school teachers had less number of resources at their disposal than their experimental school counter parts whose lessons were more enriched by the provision of the treatment using micro science Kit and other locally available materials.

One of the teachers from the control groups was innovative in trying to improvise some materials for learning circuits where they were using some timber, nails and wires collected from the surrounding. The use of flower extracts as acid-base indicators was also quite innovative.

c) The learners' in the experimental schools were actively involved in the science lessons. This was in terms of the willingness to handle the learning materials (Figure 4.1), being inquisitive and even relating to real life situations the learnt concepts. This was for example, wiring at homes and street lighting, use of ash as an anti-acid to neutralize heart burns.

These observations on the qualitative effects of treatment were used to answer the first research question. The question sought to find out the effects of treatment on the learner's motivation and attitude towards science. From the above observations in section 4.2 however, it is worth to note that the learner's readiness to handle the resources, integration of locally available resources in teaching implies motivation which in turn results in increased academic learning time for experimental group as the learners were trying various activities using the micro- science kits

From the illustration above it is evident that the learners in this class were able to connect what they had learnt in the previous lesson to the present situation. This was reinforced by the interaction with the materials and the fact that the concept was practically observed by the student activity. This was unlike in the control group where the learners were less or not actively involved with practical activities. This would have been best captured by video that was not possible. The use of varied methods and materials in learning creates variety and hence its motivations. This was evident in experimental groups. Participatory learning is motivating as it helps the teacher in placing the learners in the position of the scientists. This was quite motivating and intriguing to the learners as they manipulated the learning materials for example in construction of the circuits, classifying substances as acids/bases using the plant extracts, litmus papers and pH chart.

5.2 TEST OF HYPOTHESES

In this study there were three main null hypotheses that were being tested. The first two are tested from the test scores obtained from both the control and experimental schools. A third hypothesis that follows is on the comparison of the total learner performance between the pre-test and post-test achievement items for the control and experimental

groups. The hypotheses were accepted / rejected at the 95% confidence level that is at $p \leq 0.05$.

Before the main study was carried out, a pre-test examination was administered to both control and experimental schools. The following table 5.1 is a summary of the overall pre-test results as shown in table 4.1.

Table 5.1 Descriptive and inferential statistics pre-test

Control group mean	Experimental group mean	t- value	Sig. 2- tailed $p \leq 0.05$	Comment
$\bar{x}_c = 47.76$	$\bar{x}_e = 47.27$	0.184	0.855	N S

The mean between the science achievement test (SAT) scores for the control and experimental groups were comparable i.e. $\bar{x}_c = 47.76$ and $\bar{x}_e = 47.27$ (table 5.1).

The small difference in the mean between control and experimental groups (0.49) i.e. $\bar{x}_c - \bar{x}_e$ is probably due to the natural individual differences in learner abilities. The inferential statistic that was obtained was $(t(90) = 0.184, p = 0.855)$. The difference in mean was not significant at the 0.05 confidence level since the $p_{\text{observed}} \geq p_{\text{critical}}$.

H₀₁ There is no significant difference between the experimental and control groups in the performance in S AT based on skill development.

In testing this hypothesis the post-test score on items based on process skills development (questions: 3,4,7,11,12,13,14,15,18,20,24,25,26,29,30) were subjected to statistical analysis. The following descriptive and inferential statistics were obtained as shown in table 5.2 extracted from tables 4.2 and 4.3.

Table 5.2: Descriptive and inferential statistics on skill development.

	Control mean	Experimental mean	t-value	Sig. $p \leq 0.05$	r
Post-test	$\bar{x}_c = 27.75$	$\bar{x}_e = 30.92$	-1.978	0.051	0.619
Pre-test	$\bar{x}_c = 25.13$	$\bar{x}_e = 24.81$	0.217	0.828	

On administration of the post-test, there was a slight increase in the mean score for the control group (2.62), which would probably be attributed to the effect of teaching after the pre-test. For the case of the experimental group, the difference in mean between post and pre-test was 6.11. The mean difference between the experimental and control groups were 3.17. This would have been due to the effect of teaching and treatment. The Pearson product moment (table 4.3) was $r = 0.619$, which was significant at 0.01 level.

The inferential statistics (table 4.2) was $(t(90) = -1.978, p = 0.051)$. At this significance level, the null hypothesis is accepted since $p > 0.05$ i.e. no significant difference in performance.

HO₂: There is no significant relationship between control and experimental groups in performance in SAT items based on experimental skills/items.

In testing this hypothesis the post-test scores of the learners on items based on practical skills (questions: 1,2,5,6,8,9,10,16,17,19,21,22,23,27,28) in the SAT were also analysed.

Table 5.3 is a summary of the results both descriptive and inferential as obtained from the analysis (tables 4.4 and 4.5).

Table 5.3: Descriptive and inferential statistics for experimental skills.

	Control mean	Experimental mean	r	t-value	Sig. $p \leq 0.05$	Comment
Post -test	$\bar{x}_c = 26.04$	$\bar{x}_e = 34.62$	0.654	5.081	0.001	Significant
Pre-test	$\bar{x}_c = 22.64$	$\bar{x}_e = 22.46$		0.113	0.910	N S

The descriptive statistics showed that for the control group there was an increase in the mean score of 3.4. This was probably due to the effects of teaching after the pre-test. On the other hand for experimental group, there was an increase in mean score of 12.16. This may be attributed to the effects of teaching and experimental treatment after the pre test. Between the groups there was a mean difference in performance of 8.58 in the post-test. This is probably attributed to the treatment effect. The correlation coefficient between the two was $r = 0.654$, which implied a significant relationship at $p = 0.001$ significance level.

The inferential statistic analysis gave ($t(90) = 5.081, p = 0.001$). At this significance level $p < 0.05$ which implies that there is a significant difference in performance between experimental and control groups. Thus the null hypothesis is rejected. This means that the experimental group gained a lot of practical skills than the control group. The introduction of the micro-science kits therefore increases the acquisition of practical skills amongst the learners.

HO₃: There is no significant difference between the control and experimental groups in performance in science achievement test.

In testing this hypothesis the overall performance of the SAT was analysed descriptively and inferentially. Table 5.4 is a summary of the results of the analyses in tables 4.6 and 4.7.

Table 5.4 Descriptive and inferential statistics of overall SAT performance

Control mean	Experimental mean	r	t-value	Sig. P<0.05	Comment
$\bar{x}_c = 53.85$	$\bar{x}_e = 65.81$	0.727	-4.071	0.001	Sig.

The post-test mean scores indicated a difference of 11.96 between experimental and control groups. This difference may be attributed to the effect of treatment. The Pearson product moment table 4.7 was $r = 0.727$ ($p = 0.001$) which indicated significant relationship at $p < 0.01$ level.

The sample student t-test gave a t value of $t(90) = -4.071$ with a significance of $p = 0.001$. At this significance level, ($p < 0.05$) it implies that there was a significant difference between the performance of the experimental and control groups. Hence the null hypothesis is rejected. Thus, the introduction of teaching resources such as micro-science kits in science learning enhances the general performance in science. Therefore introduction of a resource based approach to science teaching and learning is the solution for the government and the other stakeholders to pursue in order to alleviate the dismal performance. This will also prepare the learners actively participate in economic and technological activities.

CHAPTER SIX

SUMMARY, CONCLUSION AND RECOMMENDATIONS

6.1 SUMMARY OF THE STUDY

The effect of using micro-science kits in primary science was a study based on the role of practical activities and resource based learning in science. To achieve this goal, the study was guided by research questions and hypotheses. To answer the research questions and test the hypotheses, two instruments were used during the study. These were; observation schedule and science achievement test.

The design of the study was a quasi experimental with the control and experimental groups. The study was quasi-experimental because it was difficult to control or match the learner abilities. The study was limited to a small sample of four schools. The subjects or number of pupils used for this study were 92, which constituted 40% of the sample population. The study was carried out by first administering a pre-test to both the control and experimental groups O_1 . The control group was then taught without treatment \otimes while the experimental group was taught with treatment X. A post-test O_2 was then administered to both the control and experimental groups. Table 6.1 shows the design of the study.

Table 6.1 Study symbol design

Control	O ₁	⊗	O ₂
Experimental	O ₁	X	O ₂

O₁ - Pre-test

⊗- No treatment (No use of kits)

X-Treatment (Use of kits)

O₂-Post-test

From the earlier data in table 5.1, the pre-test results indicated a mean difference of 0.49 in performance and a sample student t- test value of $t(90) = 0.184$ ($p = 0.855$) implying that it was non – significant. After the administration of the post-test, the results showed (table 5.4) a mean difference of 11.96 in performance with a $t(90) = - 4.07$, ($p = 0.001$) implying significant relationship at $p < 0.05$ significant level for the overall performance in the science test. Likewise from table 5.3, it was evident and established a significant relationship for the learners performance on practical skills i.e. $t(90) = 5.081$, ($p = 0.001$).

The researcher also observed that the learners in the experimental group were actively involved in learning than the control group hence highly motivated and appeared more interested to know more about science. This was probably due to the treatment effects and success in manipulation of learning materials when performing experiments.

6.2 CONCLUSION

From this study it was evident that practical activities are a central feature of science teaching. This was in terms of acquisition of knowledge, concepts and principles, process skill development, motivation and improvement of attitudes towards science.

This is supported by the improved or increased motivation of the learners in the experimental group as indicated from the observations, learner excitement and their participation in classroom. This was unlike the learners in the control group who were passive as most science lessons were lectures with minimal activities.

The improved or significant difference in the learner performance between the experimental and control groups also emphasize the importance of practical activities. This showed that the learner's performance can be improved using resources based learning. This study has just proved this. It has also been realised that the science kits which are adaptable without the requirement of functional laboratories, economical in terms of cost and accompanying chemical requirements, environmentally friendly and easy to use can make a great difference in learner performance..

6.3 RECOMMENDATIONS

From the study findings:

- a) the science kits make a difference in motivating the learners during science learning,
- b) the learners attitude towards science can be changed by making science lessons more resource based and helping the learners access resources for practicals,
- c) the learners as achievement in science can be improved by encouraging a practical approach to science teaching,
- d) The teachers lack a variety of resources for teaching sciences.

The following recommendations are made for action by the stake holders.

1) The Government and Ministry of Education should support Primary schools in acquisition of micro science kits. These will supplement the other teaching resources (locally available). These kits are much better than the ordinary science equipment because:

- a) They are micro (small) rather than macro (large) hence the material (chemicals) requirements are small. This is advantageous in cutting down costs hence cost effective.
- b) The kits (micro science) do not require functional science rooms or laboratory; since they are adaptable for use without the running water, gas taps, etc.
- c) The kits are adaptable to use in performing experiments both for physics, chemistry and biology related topics in the syllabus. Thus the micro-science kits are versatile

2) The Ministry of Education should encourage in servicing the science teachers in the primary school level like in the secondary level where they have adapted the SMASSE programs. This will help in strengthening the teachers' capacity and encourage sharing of experiences on improvisation and new approaches to teaching science. This will also help in changing their attitudes as effects their teaching.

3) The Centre for Science and Technology Innovations to develop worksheets and science kits that will be more applicable to the science course in primary schools. The kits used in this study were adopted from the secondary school kits.

The following recommendations are also suggested for purposes of further research;

- 1) There is need for further research in large scale since this study was conducted only on small scale with a small sample. This will facilitate concrete generalisations of the findings to the whole population.
- 2) There is need for a cohort study to determine the role of practical work from Primary school to Secondary school level achievement.

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APPENDICES

APPENDIX A

List of Public Schools in Getembe Division, Central Kisii District:

Getembe Division is divided into two Zones i.e. Getembe East and Getembe West with Fourteen Primary schools in each zone.

GETEMBE EAST

Daraja Mbili
Nyambera
Jogoo
Kisii Campus
KARI
Kiamwaso
Kiongongi II
Kianyabinge
Nyakongo
Kiomakondo
Kionganyo M
Bobaracho
Nyaura
Nyamage

GETEMBE WEST

Nyanch
Gekomu
Getembe D.E.B
Kisii D.E.B
St. Marys Nyabururu
St. Joseph Nyabururu
Kisii Special School
Nyasancha
Ekerore
Kiamagundu DOK
Mosando SDA
Mwamisoko DOK
Nyamokenye
Nyamerako DOK

APPENDIX B

STRATIFIED LIST OF SCHOOLS IN GETEMBE DIVISION

URBAN

- Darajambili
- Nyambera
- Jogoo
- Kisii Campus
- KARI
- Nyanchwa
- Gekomu
- Getembe D.E.B
- St. Marys Nyabururu
- St. Joseph Nyabururu
- Kisii Special School

RURAL

- Kiamwaso
- Kiongongi II
- Kianyabinge
- Nyakongo
- Kiomakondo
- Kionganyo M
- Bobaracho
- Nyaura
- Nyamage
- Nyasancha
- Ekerore
- Kiamagundu DOK
- Mosando SDA
- Mwamisoko DOK
- Nyamokenye
- Nyamerako DOK

APPENDIX C

SCIENCE ACHIEVEMENT TEST (SAT) FOR STANDARD SEVEN

NAME: _____ SCHOOL _____ CLASS _____


TIME 1HR 30MIN

Instructions

- I. Write your name school and class on the spaces provided above
- II. For each questions four answers are given, the answers are lettered A,B,B,D. in each case only one of the answers is correct. Choose the correct answer in each question and circle it.

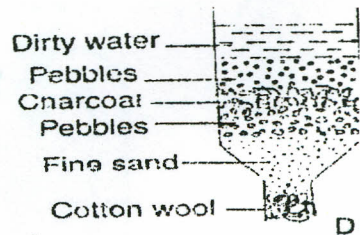
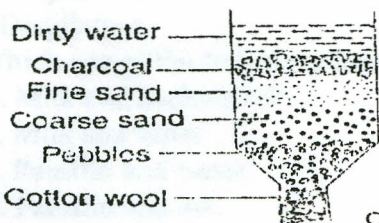
ANSWER ALL QUESTIONS

1. Which one of the following is the best method of separating a mixture of water and soil?
 - A. Sieving using a piece of cloth.
 - B. Decanting and filtering.
 - C. Filtering and evaporating.
 - D. Sieving and decanting.
2. As Joseph was cooking ugali, he accidentally mixed salt, water and maize flour. Which of the following methods, could he use to recover salt only?
 - A. Evaporating and filtering.
 - B. Filtering and then evaporating.
 - C. Sieving and then decanting.
 - D. Decanting and then evaporating.
3. In science class, pupils working in groups made filters shown in the diagrams below. Which group collected the cleanest water?

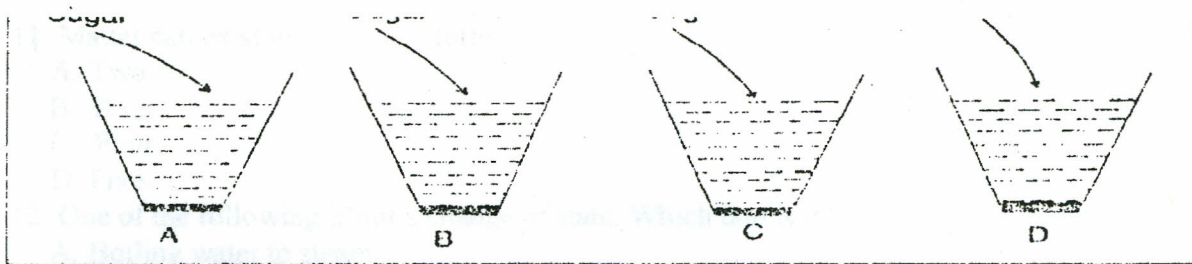
Cotton wool — 

A

B



4. The following diagrams show sugar being dissolved in four drinking glasses.



In A cold water was used.

In B warm water was used.

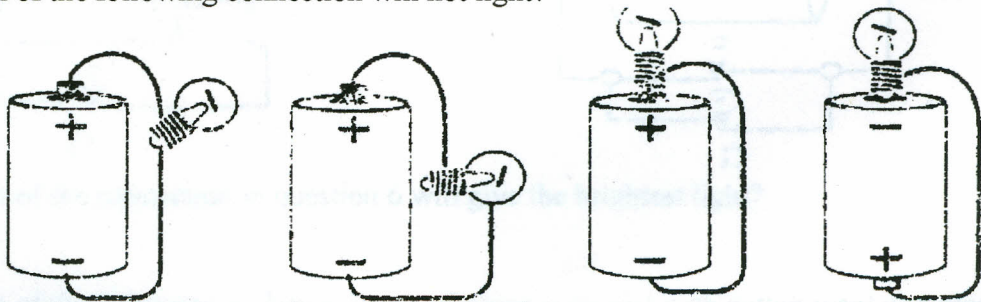
In C warm water was used.

The mixtures in A and C were stirred but the mixtures in B and D were not stirred.

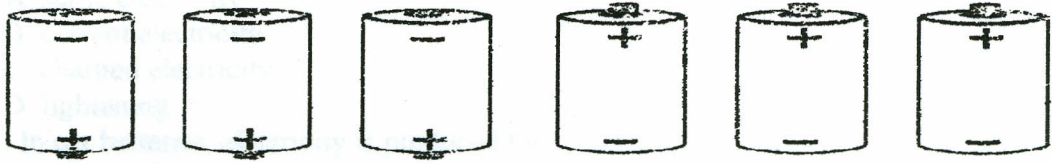
In which container did the sugar take the longest time to dissolve?

- A. B. C. D.
5. Which one of the following pairs of substances cannot make a uniform mixture?
 - A. Paraffin and water.
 - B. Water and milk.
 - C. Sand and salt.
 - D. Beans and maize.
 6. Which one of the following mixtures can be separated by using a magnet?
 - A. Flour and salt.
 - B. Flour and iron fillings.
 - C. Sand and salt.
 - D. Flour and husks.
 7. One of the following materials is a magnetic material. Which one is it?
 - A. Copper wire.
 - B. Aluminium sulfuria.
 - C. Iron nail.
 - D. A sheet of glass.
 8. Drinking water can be purified by the method of:
 - A. Decantation.
 - B. Filtration.
 - C. Evaporation.
 - D. Distillation.
 9. Which one of the following pairs of liquids are miscible?
 - A. Milk and cooking oil.
 - B. Milk and water.
 - C. Paraffin and water.
 - D. Paraffin and ink.
 10. Which one of the following is a solute in water?
 - A. Salt.
 - B. Salt.
 - C. Chalk.
 - D. Ash.

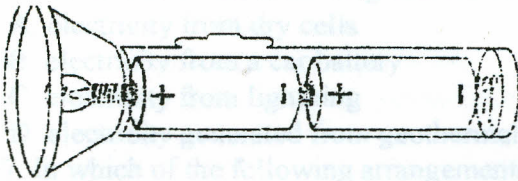
11. Matter can exist in _____ form.
- Two
 - Three
 - Four
 - Five
12. One of the following is not a change of state. Which one is it?
- Boiling water to steam.
 - melting ice to water
 - freezing water to ice
 - crashing stone to powder form
13. Weight is defined as _____
- quantity of matter in an object
 - downward pulling of object by earths gravity
 - the force that lifts objects upward
 - the air pressure acting on an object
14. The following is the right order of change of state
- solid → gas → liquid
 - solid → liquid → gas
 - gas → solid → liquid
 - liquid → solid → gas
15. Density is found by _____
- dividing the volume by the mass of an object
 - dividing the mass by the volume of an object
 - multiplying the mass by volume of an object
 - subtracting the mass from the volume of an object
16. Electricity will not flow through
- iron
 - copper
 - zinc
 - plastic
17. Which of the following connection will not light?



18. In a series connection, six dry cells of 1.5V each have a total voltage of
- 1.5 V
 - 4.5 V
 - 9.0 V
 - 6.0 V
19. Copy the diagram in your answer book and show by completing the diagram how you would connect all the following six cells to produce light in a series

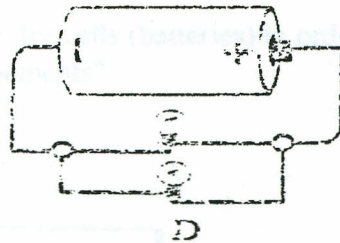
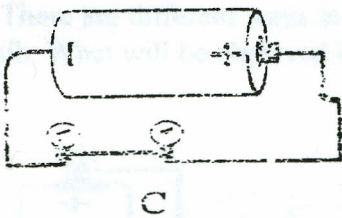
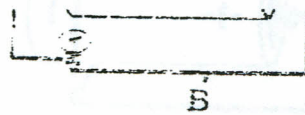
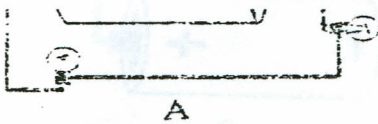


20. This is a simple torch. Which of the following is correct about it?



- A. the cells are in parallel
- B. the cells are in series
- C. it needs two bulbs to light
- D. the bulb is in parallel

21. In which one of the following arrangements are the bulbs in parallel?



22. Which of the connection in question 6 will give the brightest light?

23. Which of the following will pick pieces of paper if rubbed with cotton wool or a piece of cloth?

- A. a piece of wood
- B. a piece of rubber
- C. a plastic ruler
- D. a piece of metal

24. At kindaruma and kamburu dams, electricity is produced using water from the Tana River. The form of electricity produced is:

- A. static electricity
- B. current electricity
- C. charged electricity
- D. lightning

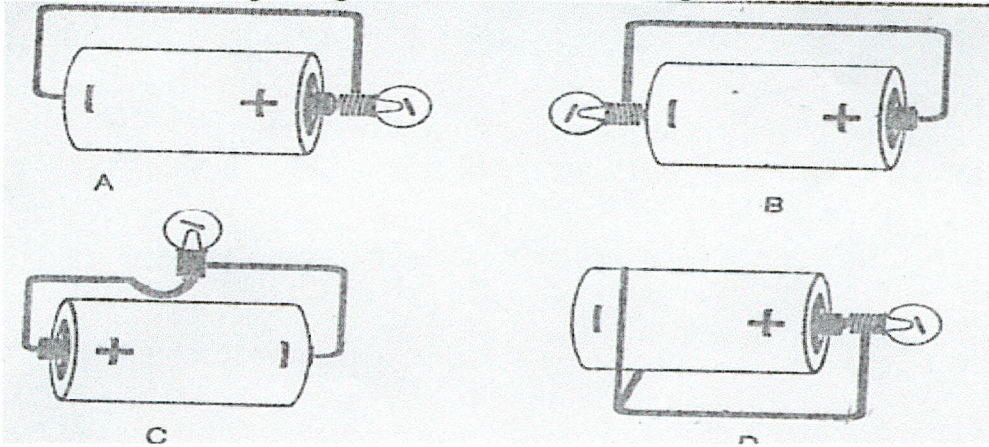
25. In car batteries, electricity is produced by:

- A. water turbines
- B. chemicals
- C. salt water
- D. petrol in a car tank

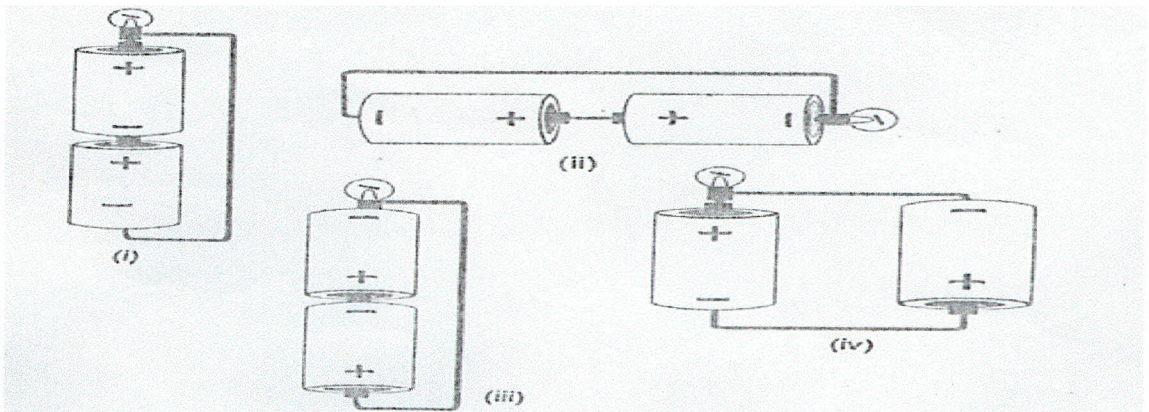
26. Which one of the following sources of electricity is not useful to us:

- A. electricity from dry cells
- B. electricity from a car battery
- C. electricity from lightning
- D. electricity generated from geothermal wells

27. In which of the following arrangements will the bulb not light



28. There are different ways in which we can arrange dry cells (batteries) in order to light a bulb. What will be observed in the following arrangements?



- A. only (ii) and (iv) will light
- B. only (iv) will light
- C. only (iii) will light
- D. all will light

29. Electricity can pass through many materials. Which one of the following materials is a non-conductor (poor) of electricity?

- A. copper wire
- B. iron wire
- C. brass wire
- D. glass rod

30. Which of the following statements is false about electricity ?

- A. electricity is carried through wires
- B. we can see electricity as it passes through wires
- C. electricity can be stored
- D. hydro-electricity is produced by the force of water

1. How does the teacher introduce the topic?

- (i)
- (ii)
- (iii)
- (iv)

2. What teaching resources indicated in his or her preparation?

- (i)
- (ii)
- (iii)
- (iv)
- (v)

3. How does the teacher introduce the topic?

- (a) By lecture
- (b) By demonstration
- (c) By use of student experiential
- (d) By questioning
- (e) Any other

4. How are the students involved during the lesson?

- (i) Asking questions
- (ii) Performing experiments
- (iii) Taking notes
- (iv) Making observations and data gathering
- (v) Setting up apparatus
- (vi) In discussion groups

APPENDIX D

CLASSROOM OBSERVATION SCHEDULE

School _____

Subject _____

Class _____

Observation number _____

Lesson topic _____

Date _____

Time _____

1. a) Does the teacher appear prepared?
Yes [] No []
- b) If yes in (a) what form is the preparation
 - (i)
 - (ii)
 - (iii)
 - (iv)
2. List the teaching resources indicated in his or her preparation?
 - (i)
 - (ii)
 - (iii)
 - (iv)
 - (v)
3. How does the teacher introduce the topic
 - (a) By lecture []
 - (b) By demonstration []
 - (c) By use of student experiment []
 - (d) By questioning []
 - (e) Any other []
4. How are the students involved during the lesson
 - (i) Asking questions []
 - (ii) Performing experiments []
 - (iii) Taking notes []
 - (iv) Making observation/data gathering []
 - (v) Setting up apparatus []
 - (vi) In discussion groups []

5. How are the students organized when using teaching resources during the lesson ?
- (i) Individually []
 - (ii) In pairs []
 - (iii) In groups []
 - (iv) Whole class []
6. How do the students use the teaching resources
- (i) To do an exercise []
 - (ii) To raise questions []
 - (iii) To recall experience []
 - (iv) To express ideas []
 - (v) To illustrate a concept []
 - (vi) To verify a law /principal []
7. Are the students willing to handle apparatus?
- Yes [] NO [] UNCERTAIN []
8. a) Does the teaching resources help the learners to express their ideas
- YES [] NO []
- b) If yes how do the runners express their ideas
- (i)
 - (ii)
 - (iii)
9. How does the teacher draw the attention of the learners
- (i)
 - (ii)
 - (iii)
 - (iv)
 - (v)
- 10.a) Are the students given clear instructions on how to use the resources
- YES [] NO []
- b) What form of instructions are given
- (i) Verbal
 - (ii) Worksheet
 - (iii) Chalk board
11. Do the students follow the instructions as given by the teacher
- YES [] NO []
12. How do the learners give feed back
- (i) Answering /doing exercise []
 - (ii) Writing a report []
 - (iii) Asking questions []

13. Who generate the problem to be investigated

- (i) The teacher []
- (ii) The learners []
- (iii) Text books []
- (iv) Any other (state) []

14. What is the role of the teacher when using the resources

- (i)
- (ii)
- (iii)
- (iv)

15. How are the learners involved during the lesson?

- (i)
- (ii)
- (iii)
- (iv)

16. How prepared are the learners for the science lesson by:

- a) Asking questions
- b) Answering questions
- c) Doing assignment
- d) Being attentive in class
- e) Coming to class in time

APPENDIX E

RESEARCH BUDGET

RESEARCH PROPOSAL (Typing, Photocopying& Binding)	5,000
PILOT STUDY	20,000
MICROSCIENCE KITS 30 SETS @ 2000	60,000
CHEMICAL KIT 2 SET @ 6500	13,000
WORKSHEETS 30 SETS @ 500	15,000
TRANSPORT & SUBSISTENCE	24,000
STATIONERY	5,000
PRODUCTION OF THESIS	10,000
TOTAL	<hr/> 152 000

