INFLUENCE OF LABORATORY FACILITIES ON STUDENTS' PERFORMANCE IN SCIENCE SUBJECTS IN PUBLIC SECONDARY SCHOOLS IN MACHAKOS SUB-COUNTY, KENYA

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DECLARATION

This project is my original work and has not been presented for the award of a degree in any other university.

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DEDICATION

This work is dedicated with a lot of love, respect and appreciation to my husband Francis Mutua and our children Felix, Joyce and Mark.

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I wish to thank the Almighty God for giving me opportunity to study. I also wish to appreciate the help of all those without whom this work would not have been completed. It may be impractical to mention all of them individually. I am deeply indebted to my supervisors Dr. Richard Kimiti and Dr. Pamela Muriungi who despite their busy schedule found time to read through my work. Their guidance, suggestions, encouragement and moral support culminated in completion of this work. Special thanks go to Chairman, Department of Educational Management and Curriculum Studies Machakos University, for encouraging me and ensuring that this work is completed. I also wish to thank the lecturers and staff at the Department of Educational Management and Curriculum Studies of Machakos University for their supportive roles in the course of my study.

I appreciate the efforts expended by Virginia Mumbua of Masaku Speed Bureau for typing this work. Last but not least, I must thank my husband Francis Mutua who provided an enabling and inspiring environment during my studies. I am equally grateful to our children Felix, Joyce and Mark for their patience and sacrifice exhibited during this study.

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ABSTRACT

The purpose of the study was to establish the influence of laboratory facilities on students' academic performance in science subjects in public secondary schools in Machakos Sub-County, Kenya. Specifically, the study was set to establish the availability of laboratory facilities and equipment in public secondary schools, to find out the extent to which the science teachers use laboratory facilities in teaching science subjects, to establish the relationship between laboratory facilities and the students' academic performance in science subjects and to establish the challenges faced by the school principals in provision of laboratory facilities. The study was influenced by the fact that the performance of students in science subjects in Machakos Sub- County is still low. The researcher used purposive sampling to select one (1) national school, one (1) extra county school and two (2) county schools. The researcher used simple random sampling to select twenty one (21) sub-county schools. The researcher sampled twenty three (23) principals, one hundred and five teachers (105) and three hundred and fifty one (351) form three students. The researcher used descriptive survey design. The target population of the study was 75 principals, 350 teachers and 4500 form three students. The researcher used three sets of questionnaires, one for the principals, the other for the teachers and another for students. Quantitative data was analyzed using statistical Package for Social Sciences and the results presented in frequency tables, bar graphs and percentages to make meaningful conclusions. From the study it was established that; there is significant relationship between laboratory facilities and the students' academic performance in science subject. Teachers' use of laboratory facilities in teaching science subjects had effect on students' performance in science subjects and managing class sizes posed a challenge to principals in provision of laboratory facilities in public secondary schools. The researcher recommends that principals should work hand in hand with parents, sponsors and other stakeholders in education to prioritize the provision of adequate laboratory facilities, Science teachers should also be taken for further training to make them more competent in teaching of science subjects. Students should be given more opportunities to experience science by being exposed to more laboratory practicals and the government should provide some laboratory equipment to schools to subsidize their costs and encourage the local chemical manufacturers to produce more affordable chemicals and laboratory equipment.

LIST OF ABBREVIATIONS AND ACRONYMS

ALT	Academic Learning Time
GOK	Government of Kenya
HOD	Head of Departments
KCSE	Kenya Certificate of Secondary Education
KNEC	Kenya National Examinations Council
NACOSTI	National Commission for Science, Technology and Innovation
SMASE	Strengthening Mathematics and Sciences in Education
SPSS	Statistical Package for Social Sciences
UNESCO	United Nations Educational,Scientific and Cultural Ogarnization

CHAPTER ONE: INTRODUCTION

1.1 Background to the Study

Education is a very important human activity (GoK, 2003). It helps any society fashion and model individuals to function well in their environment. Boit, Njoki and Chang'ach, (2012), highlighted the benefits of education as: improving the productive capacity of the society, reducing poverty by mitigating its effects on population, health and nutrition. Secondary education is an important sector for national and individual development. Secondary education plays a vital role in creating a country's human resource base at a level higher than primary education (Achoka, Odebero, Maiyo & Mualuko, 2007). The vital role played by secondary education may partly explain the Kenyan government's decision to introduce Free Secondary Education (FSE) in public secondary schools in order to increase its demand (Ohba, 2011).

The provision of quality secondary education is therefore important in generating the opportunities and benefits of social and economic development (Onsomu, Muthaka, Ngware & Kosimbei, 2006). One of the indicators of quality of education being provided is cognitive achievement of learners (United Nations Educational, Scientific and Cultural Organization, (UNESCO, 2006). According to Adediwura and Tayo (2007), academic achievement is designated by test and examination scores or marks assigned by the subject teachers.

In Kenya, the education system is largely examination oriented. The quality of education tends to be evaluated in terms of the number of students passing national examinations (Eshiwani, 1993). Educators and the general public have time and again expressed concern over factors that influence student performance in examinations especially in science subjects. The students' academic performance of science subjects has always been wanting in Kenya hence drawing a widespread interest on improving the levels of science subjects achievement in public secondary schools. Apart from the economic benefits that it is argued this would bring, by better preparing young people for the numeracy demands of modern work places and raising the overall skill levels of the workforce, there are also social benefits tied to improving access for larger numbers of young people to past- school education and training opportunities and laying stronger foundations to skills for life learning.

For successful achievement of academic performance in schools there is need to provide key physical infrastructure which include:- science laboratory, school library, classrooms and various types of solid waste disposal. Science laboratory is central to scientific instruction where theoretical work is practicalized where else practicals in any learning experiences involve students in activities such as observing, counting, measuring, experimenting and recording (Ogunniyi, 1983). Without proper and well- equipped science laboratory, it is not possible to carry out the science teaching process effectively in any school or educational institution.

One of the vehicles by which the process in inquiry can be leant is the laboratory where the student experiences the inquiry process, thus the study in a laboratory is an integral and essential part of science subjects. Science laboratory activities are hands-on experiences which emphasis process skills (Dike, 2008) which Agbo (2003) posited as motor skills that help the scientists to find answers to problems and enhance the learning of science. Laboratory activities stimulate learners interest as they are meant personally engage in useful scientific activities and experiments. This affords the learners the basic skills and scientific methods of problem solving. Ado (2003) further opined that it is very necessary that students manipulate materials and equip in learning of Science through equipment; this will help them not only to acquire science process skills and new knowledge but also scientific attitude such as honesty, open-mindedness and cooperation as moralities of science and enhance understanding and retention of difficult concepts and procedures. Laboratory facilities give students some basic insight into scientific concepts and leave them with feeling of the reality of science which in turn improves their academic performance in examination (Habu, 2005).

The interest in raising levels of achievement has led to a focus on identifying the range of factors that shape achievement as well as understanding of how these factors operate to limit, as well as enhance the achievement of different groups of students. Such efforts include the introduction of SMASE Project and in-service training for the teachers. This study will therefore seek to establish the influence

of laboratory facilities on students' academic performance of science subjects in Machakos Sub-County.

1.2 Statement of the Problem

The Kenya Certificate of Secondary Education (KCSE) results released in every year by Kenya National Examinations Council (KNEC) have shown that science subjects are recording low (poor) grades in Machakos Sub- County, contrary to the expectation of students, teachers and parents (Gok, 2014). Efforts have been made by the government to improve the performance of sciences by introducing SMASE Project, embracing in-service training for the teachers and rewarding the best performing students by giving them scholarship for higher education. However, the performance of students in science subjects in Machakos Sub-County is still dismal as shown in table 1.1 below.

Table1.1Machakos Sub-County KCSE Science Subjects Mean Scores 2012-2016

Year	Meanscore Chemistry	Meanscore Physics	Meanscore Biology
2012	4.8	4.2	5.6
2013	4.6	3.8	5.8
2014	4.3	3.6	5.4
2015	4.5	3.8	4.5
2016	4.2	3.4	4.2

Several studies have been carried out to establish the factors that contribute to poor performance in secondary schools; however such studies focused on students' attitude towards education, cultural factors and personal characteristics of students. Although the above factors have been addressed towards students' performance, there is still need to address the performance challenges in science subjects faced by students. This study therefore seeks to establish the influence of laboratory facilities on students' academic performance in science subjects in K.C.S.E in public secondary schools in Machakos Sub-County, Kenya.

1.3 The Purpose of the Study

The purpose of this study was to determine the influence of laboratory facilities on students' performance in science subjects in public secondary schools in Machakos Sub-County, Kenya.

1.4 Objectives of the Study

The objectives of this study were:-

(i) To establish the availability of laboratory facilities and equipment in public secondary schools, Machakos Sub- County.

(ii) To find out the extent to which the science teachers use laboratory facilities in teaching science subjects in public secondary schools in Machakos Sub-County.

(iii) To establish the relationship between laboratory facilities and the students' academic performance in science subjects in public secondary schools in Machakos Sub-County.

(iv) To establish the challenges faced by the school principals in provision of laboratory facilities in public secondary schools in Machakos Sub-County.

1.5 Research Questions

The study was guided by the following research questions:-

i). Which laboratory facilities are available in teaching of science subjects in public secondary schools?

ii). To what extent do science teachers use laboratory facilities in teaching of science subjects in public secondary school?

iii). What is the relationship between the available laboratory facilities and students' performance in science subjects in public secondary schools?

iv). What challenges do the principals face in provision of laboratory facilities in teaching of science subjects in public secondary schools?

1.6 Significance of the Study

This study will be useful to the teachers who teach science subjects in secondary schools because it contributes valuable knowledge on the influence of laboratory facilities in enhancing the academic performance of students in Science subjects in KCSE. The study may also help the teachers and pupils re-think their approach on the use of laboratory facilities in schools. The study also suggests significant

policy statements through its recommendations on availability of physical resources in the secondary schools. The recommendations will help the school administration and management boards to prioritize and avail the necessary resources to improve the academic performance of students in science subjects.

1.7 Limitations of the Study

Some of the principals were not available for interviews due to tight schedules. Efforts were made to make prior appointments booking on the date the researcher was to meet the respondents. Some respondents hesitated to provide useful information for the study due to fear of exposing the status of their institutions. The researcher overcame this by assuring the respondents that the findings of the study were used for academic purpose only.

1.8 Delimitations of the Study

The study focused on influence of laboratory facilities on students' academic performance in science subjects in Machakos Sub-County. The study respondents included principals, teachers and form three students in public secondary schools.

1.9 Assumptions of the Study

The study was carried out on the assumption that all respondents would give genuine and honest responses to the questionnaires. The study also assumed that poor performance in science subjects in Machakos Sub-County is associated with inadequate provision of science laboratory facilities in public secondary schools.

1.10 Theoretical Framework

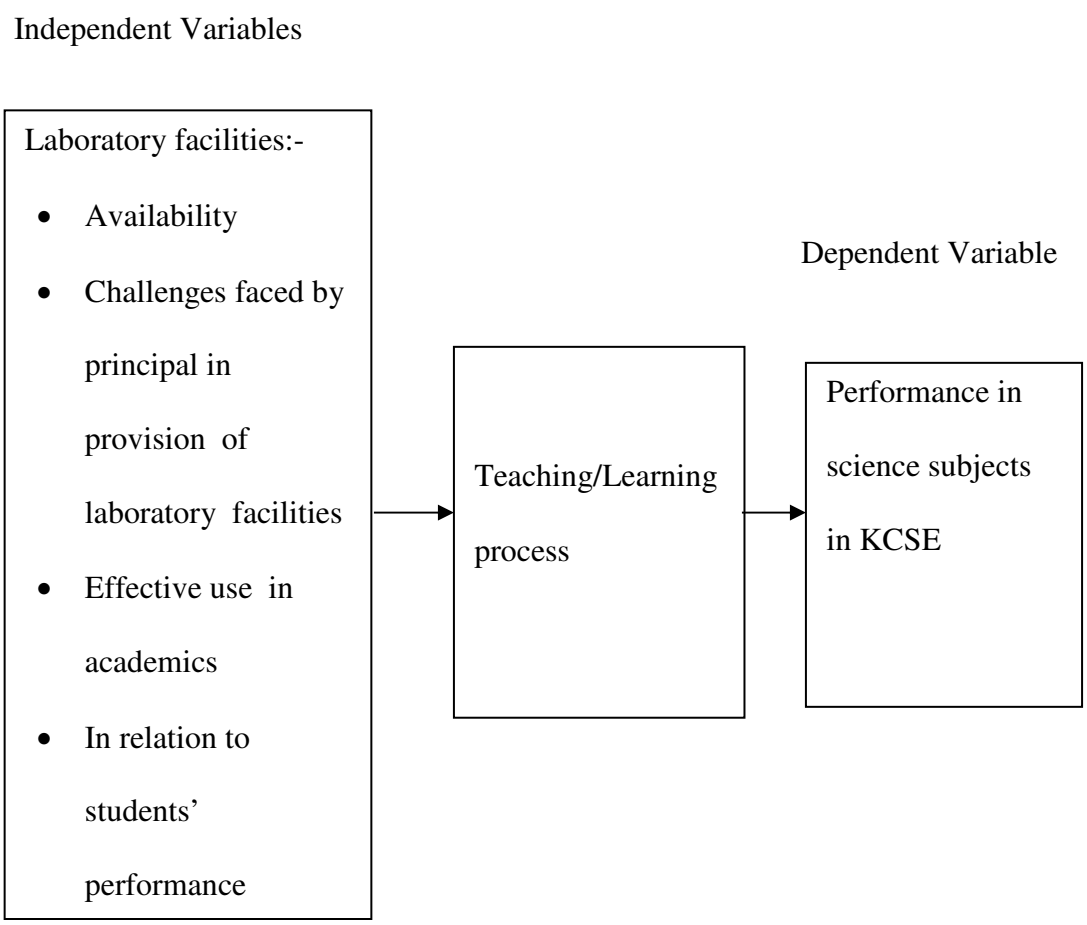
This study was based on input-output process theory developed by McDonwell and Oakes (1987). The theory presents the education system in terms of inputs (including contents), processes and outputs. The inputs include the economic, physical infrastructure and human resources supplied to different levels of the education system, the characteristics of the teachers and the background of the students. In this case since the laboratory facilities are part of the input in education system the provision of such facilities is very key in relation to the output. This theory is suitable for this study because it will establish the contribution and influence of laboratory facilities and equipment on students' academic performance in examinations. The study sought to determine how laboratory facilities influence students' academic performance in science subjects in public secondary schools in Machakos Sub-County.

1.11 Conceptual Framework

The conceptual framework was based on related literature to the study. The inputs in this study were the independent variables and include the adequacy, effect of laboratory facilities, extent to which science teachers use laboratory facilities, the challenges faced by principals in provision of laboratory facilities. Quality teaching and learning process is achieved when various inputs under an educational production process are utilized. The output indicated by the students' performance in science subjects were the dependent variable. The students' background factors were treated as intervening variable. Teachers' experience of

two years and above was the control for teachers' characteristics. From the related literature the variables of the study were conceptualized as shown in Figure 1.1.

Figure 1.1 Conceptual Framework



Performance by students in science subjects and in this case attaining a grade D and below at KNEC examinations have been consistently recorded in Machakos Sub- County for the last four years. Performance is treated as the dependent variable. The inputs were the independent variables which included adequacy, effects of use, extent of use, challenges in provision of laboratory facilities. If these factors are well managed, they result into enhanced teaching/ learning which

results into better performance in science subjects by students in public secondary schools.

1.12 Operational Definition of Terms

Laboratory Facilities: refers to the building and equipment used in teaching science subjects.

In-service: refers to taking teachers who are already employed for further training, seminars and workshops organized by the employer while they are still on the job.

Principal: refers to school's administrator appointed by TSC in accordance with education Act. 2012.

Public School: refers to schools owned by the government and benefiting from government subsidiary and staffing.

Science Subjects: refers to chemistry, physics and biology offered in public secondary schools.

Students' Performance: refers to the grades both per subject and overall that the students obtains in Kenya Certificate of Secondary Education Examinations.

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CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

This chapter contains various scholarly works that have been reviewed for the purpose of this study. It focuses on the adequacy of laboratory facilities in public secondary schools, the effects of laboratory facilities on the academic performance of students in science subject in public secondary schools, the extent to which the science teachers use laboratory facilities when teaching science subjects in public secondary schools, and the challenges faced by the school principals in provision of laboratory facilities in public secondary schools. Summary and research gaps are also discussed.

2.2 Overview of School Science Laboratory and Science Performance

Science educators increasingly perceive the school science laboratory as a unique learning environment in which students can work cooperatively in small groups to investigate scientific phenomena and relationships. Hofstein and Lunetta (1982), Lazarowitz and Tamir (1994), and Lunetta (1998) suggested that laboratory activities have the potential to enable collaborative social relationships as well as positive attitudes toward science and cognitive growth. In this review, it is noted that the more informal atmosphere and opportunities for more interaction among students and their teacher and peers can promote positive social interactions and a healthy learning environment conducive to meaningful inquiry and collaborative learning. The laboratory offers unique opportunities for students and their teachers

to engage in collaborative inquiry and to function as a classroom community of scientists.

Such experiences offer students opportunities to consider how to solve problems and develop their understanding. Through collaboration, they can also come to understand the nature of an expert scientific community. These are among the learning outcomes now thought to be very important in introductory science.

The importance of promoting cooperative learning in the science classroom and laboratory received substantial attention during the 1980s (e.g., Johnson et al., 1981; Johnson & Johnson, 1985; Lazarowitz & Karsenty, 1990) as a way to engage diverse students in collaboration with others in inquiry and to develop a classroom community of scientists.

Large numbers of studies demonstrated distinct benefits in students' achievements and productivity when cooperative learning strategies were utilized in the classroom-laboratory. In the intervening years, research intended to examine the effects of student collaboration and the development of "classroom community of scientists" has been increasingly visible. Okebukola and Ogunniyi (1984) compared groups of students who worked cooperatively, competitively, and as individuals in science laboratories and found that the cooperative group outperformed the other groups in cognitive achievement and in process skills. Similarly, Lazarowitz and Karsenty (1990) found that students who learned science subjects in small cooperative groups scored higher in achievement and on

several inquiry skills than the students who learned in a large group class setting. Several papers have reported that the more informal atmosphere and opportunities for more interaction among students and their teacher and peers can promote positive social interactions and a healthy learning environment conducive to meaningful inquiry and collaborative learning (DeCarlo & Rubba, 1994; Tobin, 1990).

2.3 The Effects of Laboratory Facilities on Students' Academic Performance

Laboratory has been conceptualized as a room or a building specially built for teaching by demonstration of theoretical phenomenon into practical terms. Farombi (1998) argued the saying that "seeing is believing" as the effect of using laboratories in teaching and learning of science and other science related disciplines as students tend to understand and recall what they see than what they hear or were told. Laboratory is essential to the teaching of sciences and the success of any science course is much dependent on the laboratory provision made for it. Affirming this, Ogunniyi (1983) said there is a general consensus among science educators that the laboratory occupies a central position in science instruction. It could be described as a place where theoretical work is practicalized whereas practicals in any learning experience involve students in activities such as observing, counting, measuring, experimenting, recording, observation and carrying out field work. These activities are totally different from the theoretical work which involves listening to talks and taking down notes from such talks.

According to Ango (1986) laboratory work stimulates learners' interests as they are made to personally engage in useful scientific activities and experimentation; promotes that science is not only product or process; affords the learner the basic skills and scientific method of problem solving and knowledge obtained and promotes long term memory.

Laboratory helps to provide a forum wherein the learner is given the exercise to subjects, his beliefs, ideas, statements, theoretical propositions etc. to some forms of experimental test (Soyibo, 1990). To maintain and arouse the interests of students in subjects involving laboratory work, the teacher should be effectively involved in order to transfer knowledge and facts to learners for a good performance in any examinations. In line with this, one then pauses to ask, to what extent has laboratory been able to achieve its objectives. Odulaja and Ogunwemimo (1989) highlighted that the teacher assumes a position of dispenser of knowledge with the laboratory serving the function of drill or verification. They further explained that at the other extreme, the teacher assumes the position of guide to learning and laboratory as a place where knowledge is discovered. However, there are growing evidences that teachers do not exhibit behaviours which are complementary to achieving the stated objectives. They include methods of teaching practical work; inadequacy or absence of well-equipped laboratories; high enrollment of students; inadequacy of resources for teaching and learning practical work; quantity and quality of teachers.

Nwachukwu (1984) discovered in her survey of the resources for the teaching and learning of Science subjects in some of the new secondary schools in Lagos that there was a general inadequacy of resources. She also found out among other things that out of 80 per cent of the old schools that accepted as having laboratories, none had a well-equipped laboratory and 40 per cent of the schools had no laboratory at all, while the remaining 60 percent had rooms labeled "laboratory" without adequate apparatus, she concluded that teaching of science subjects practicals' by teachers would be difficult and that students learning experiences would be limited. In his contribution, Balogun (1982) submitted that no effective science education programme can exist without equipment for teaching. Writing on the situation of our secondary schools today, Okoli (1995) reported that laboratories have become shelves of empty bottles of chemicals. In terms of academic achievement, Soyibo and Nyong (1984) have shown that schools with well-equipped laboratories have better results in the school certificate science examinations than those that are ill-equipped. Corroborating this, Gana (1997) reiterated that students instructed entirely by the laboratory methods had higher attitude's scores but lower achievement scores than students instructed entirely by the traditional lecture or textbook mode.

Yadar (2011) opines that no course in science subjects can be considered as complete without including some practical work. The practical work ought to be carried out by individuals either in science laboratories or in classes. At school

level, practical work is even more important because of the fact that we learn by doing. Scientific practices and applications are thus rendered more meaningful. It is an established truth that an object handled impresses itself more firmly on the mind than the object merely seen from a distance or in an illustration. Thus practical work forms an important feature in science subjects courses (UNESCO, 2008). In view of these different and conflicting findings, the study found the relationship between teachers' quality and students' academic achievement.

2.4 The Extent to which the Laboratory Facilities are used by Teachers in Teaching Science Subjects

Tobin and Gallagher (1987) found that science teachers rarely, if ever, exhibit behavior that encourages students to think about the nature of scientific inquiry and the meaning and purposes for their particular investigation during laboratory activities. On the basis of a comprehensive study on implementation of the laboratory in schools in British Columbia, Gardiner and Farrangher (1997) found that although many Science subject teachers' articulated philosophies appeared to support an investigative, hands-on, minds-on approach with authentic learning experiences, the classroom practice of those teachers did not generally appear to be consistent with their stated philosophies. As noted in the preceding section, Hodson's observations of the mismatch between teacher's rhetoric and practice, also complicate obtaining valid and reliable information based only upon teachers' self-reports.

Several studies have reported that very often teachers involved students principally in relatively low-level, routine activities in laboratories and that teacher–student interactions focused principally on low-level procedural questions and answers. Marx et al. (1998) reported that science teachers often have difficulty helping students ask thoughtful questions, design investigations, and draw conclusions from data. DeCarlo and Rubba (1994) reported similar findings in chemistry laboratory settings. Earlier, Shymansky and Penick (1978) had written that teachers do not perceive that laboratory activities can serve as a principal means of enabling students to construct meaningful knowledge of science, and they do not engage students in laboratory activities in ways that are likely to promote the development of science concepts. They may not perceive that they can manage laboratory activities in ways that are consistent with contemporary professional standards. In addition, many teachers do not perceive that helping students understand how scientific knowledge is developed and used in a scientific community is an especially important goal of laboratory activities for their students. As noted in other sections of this review, several researchers have continued to observe that many science teachers do not utilize or manage the unique environment of the school laboratory effectively.

Conditions are especially demanding in science laboratories in which the teacher is to act as a facilitator who guides inquiry that enables students to construct more scientific concepts. Contemporary teaching standards place a heavy burden on the

science teacher. Inquiry-focused teaching now rests on the constructivist notion that learning is a process in which the student actively constructs her or his own ideas that are linked with other ideas in increasingly complex networks. The constructivist model, when practiced, is a relatively radical departure from traditional teaching and learning practice.

Teachers are often not well informed about these new models of learning (Cohen, 1990; Polman, 1999) and their implications for classroom teaching and curriculum. While excellent examples of teaching can be observed, the classroom behaviors of many teachers continue to suggest the conventional belief that knowledge is directly transmitted to good students and that it is to be remembered as conveyed.

In addition, many teachers lack experience with assessment methods aimed at assessing their students' understanding and performance in the science laboratory (Yung, 2001). As a result, in many cases, students' final grades do not include a component that directly reflects their performance in laboratory work and their understanding of that work. Furthermore, Brickhouse and Bodner (1992) reported that students' concern about their grades has a strong influence on teachers' practices. More specifically, they suggested that some teachers will emphasize goals for learning and use teaching techniques that are aligned with students' ability to earn high grades. The need for meaningful, long-term professional

development for science teachers on these issues and for better communication between the science education research community and the community of science teachers is abundantly clear. These important issues are discussed further in the Teacher Education and Professional Development section later in this review.

2.5 Challenges Faced by Principals in Provision of Laboratory Facilities

Principals are faced with multiple, complex and wide ranging challenges as they execute various roles and responsibilities relating to acquisition and implementation of laboratory facilities.

The challenges include dealing with low motivation, managing class sizes, dealing with inadequate resources and managing with fewer funds (Oduro, 2009). In Liberia, for instance, education is engulfed with bribery, lack of infrastructural facilities and equipment coupled with unqualified lab instructors. Qualified and competent teachers are insufficient (Lavalah, 2012). In Southern Thailand, principals work under intensified and vulnerable situation, insufficient funding and also dealing with the effect of the intensity of cultural unrest and safety of students and staff (Sungtong, 2007).

Inadequate finance has also been noted by Kamunde (2010). In Pakistan head teachers have to deal with issues affecting teachers and student in laboratory related issues, the curriculum, parents, school visitors and central office. Other challenges include role ambiguity, the conflicting expectations of various stakeholders, the tension between inadequate financial resources and the lack of

incentives and authority to deal with relevant issues relating to laboratory use. There are also issues linked to socio-political and sectarian conflicts and disruptions. As a result head teachers pay more attention to maintaining order and discipline than addressing the issues of staff development and support, and students' academic achievements (Shafa, 2011). Other challenges that affect head teachers or principals include issues with sponsors, security and quality of education. It is important however to mention that the challenges principals face are compounded by the fact that they are not trained and/supported in their roles and responsibilities.

2.6 Summary of Literature Review

Laboratory activities offer important experiences in the learning sciences that are unavailable in other school disciplines. For many years, laboratory experiences have been shown to promote key science education goals (Hudson, 1993). This implies that laboratory experiences are therefore very important to a student as they enhance better understanding of science and lead to better performance in sciences. Lack of adequate exposure to practical work has been noted as one of the contributing factors to dismal performance in examinations. G.O.K (1995) observes that some students saw and handled experimental equipments only during national examinations. The purpose of this study is therefore to investigate availability and use of school laboratory facilities and their influence on students' academic performance in science subjects in public secondary schools in Machakos Sub-County.

CHAPTER THREE: METHODOLOGY

3.1 Introduction

The chapter presents the research design, location of the study, the target population, sampling techniques and sample size, research instruments, pilot study, validity, reliability, data collection techniques and data analysis techniques.

3.2 Research Design

This study used descriptive survey design. Descriptive survey describes collecting of data in order to answer questions concerning the current status of the study. Descriptive survey is chosen because it is appropriate for educational fact-findings and gives a great deal of information which is accurate. It also enables a researcher to gather data at a particular point in time and use it to describe the nature of the existing conditions (Colen, 2000).

3.3 Location of the Study

The study was conducted in Machakos Sub-County, Kenya. Machakos Sub-County is 37.4681^{o} East and 1.3304^{o} South. The climate is semi arid with hilly terrain with an altitude of 1000 to 2100 metres above sea level. Tourist related activities such as camping, hiking safari, ecotourism and cultural tourism, dance and music festivals among many more are more excitingly done due to the highly terrain. The hospitality industry in the region is decent.

Subsistence agriculture is mostly practiced with maize and drought-resistant crops such as sorghum and millet being grown due to the areas semi-arid state. However, the Sub-County also plays host to the open air market concept with major market days where large amounts of produce are traded. Fruits, vegetables and other food stuffs like maize and beans are sold in this market. Machakos Sub-County neighbors Makueni County to the South, Athi River Sub-County to the West, Mwala Sub-county to the east and Kathiani Sub-County to the north.

3.4 Target Population

Borg and Gall, (1989) defines the target population as the population to which the researcher wants to generalize the results of the study. Machakos Sub-County has 75 public secondary schools, 350 secondary schools teachers, 2350 boys and 2150 girls in form three (Sub-County Director of Education, Machakos). The target population of the study will be 75 principals 350 teachers and 4500 form three students.

3.5 Sampling Techniques and Sample Size

Kothari, (2004) defines a sample as a representative part of a population. Thus by studying the sample, one can be able to know more about the population without having to study the entire population. The sampling was done in Machakos Sub-County which has one (1) National School, one (1) Extra County School, two (2) County Schools, Seventy (70) Sub County Schools (Machakos Sub-County

Education Management Information System). The study used purposive sampling to select one National School which is hundred percent (100%) one extra county school which hundred per cent (100%), two County schools which is hundred per cent (100%). When the population is small the whole population is taken as the sample. Simple random sampling was be used to select 21 Sub-County Schools which is thirty per cent (30%) of the Sub-County Schools.

The researcher sampled 23 principals which is thirty per cent (30%), 105 teachers which is thirty per cent (30%) of the teachers. According to Mugenda and Muganda (2003), a sample of thirty per cent (30%) is sufficient for a study. To sample the students, the researcher used Krejecie and Morgan table to select 351 form three students in public secondary schools, Machakos Sub-County.

Table 3.1 Population and Sample Size

School Category	**Total Number**	**Sample Size**	**Percentage of the total schools**
National Schools	1	1	100
Extra County Schools	1	1	100
County	2	2	100
Sub-County	70	21	30
Subjects			
Principals	75	23	30
Teachers	350	105	30
Students	4500	351	78

3.6 Research Instruments

The researcher used three questionnaires and observation schedule to conduct the study. According to Orodho (2004) a questionnaire is most used method when respondents can be and are willing to cooperate. Questionnaires ensure confidentiality of the respondents and thus they can gather candid and objective responses.

Questionnaires were administered to the principals, teachers and students. The researcher used close-ended questions, open-ended questions, contingency and matrix questions. Open ended items required the subjects to give direct views. Close- ended items required definite answers. The research instruments used provided the researcher with an easy accumulation of data in the study. Questionnaires give respondents freedom to express their views and make suggestions. The questionnaires collected background information in section A, Availability of laboratory facilities in section B, extent to which the teachers use laboratory facilities in section C, relationship between laboratory facilities and academic performance in section D and challenges faced by principals in provision of laboratory facilities in section E.

3.7 Pilot Study

The researcher selected two secondary schools in Machakos Sub-County to pilot the study instruments. The two public secondary schools in pilot study were not used for the final study. The purpose of piloting was to test the appropriateness of

the items to respondents in order to improve the instruments and enhance their reliability and validity. The pilot study helped to identify any ambiguous items in the instruments. The results of pilot study helped the researcher to modify or rephrase the questions.

3.8 Validity of Research Instruments

Validity indicates the degree to which an instrument measures what it purports to measure (Kothari, 2004). That is the extent to which differences found in the measuring instrument reflect true differences among those already tested. To ascertain the validity, the instruments were discussed with supervisors and experts in science education. The researcher assessed the relevance of the content used in the instruments developed and made structural changes for purpose of improvement and reinforcement of the instruments before embarking on actual data collection.

3.9 Reliability of Research Instruments

Mugenda and Mugenda (2003) define reliability as a measure of the degree to which a research instrument yields consistent results or data after repeated trial.

Piloting enabled the researcher to test the reliability of the instrument. To ensure reliability, the researcher employed the test-retest technique. This involved administering the test to one appropriate group selected randomly. After two weeks, the same test was administered to the same group. The two sets of scores

were regressed using the Pearson's product moment correlation coefficient formula, to determine the correlation coefficient (r) between the two sets of scores.

$$r = \frac{n\Sigma XY - (\Sigma X)\ (\Sigma Y)}{\sqrt{[n\Sigma^2 - (\Sigma X)^2]\ [nY^2 - (\Sigma Y)^2\ ]}}$$

Where x = first set of scores; Y = second set of scores; $\sum x$ = the sum of the first set of scores; $\sum y$ = the sum of second set of scores; $\sum x^2$ = the sum square of first set of scores; $\sum y^2$ = the sum square of second scores; $\sum xy$ = the sum of cross product of x and y and n = total number of respondents.

The correlation coefficient obtained was 0.733 for principals' questionnaire, 0.709 for teachers' questionnaire and 0.765 for students' questionnaire. This means the research instruments could be relied upon for this study. A correlation coefficient of between 0.7 to 1 is considered reliable (Mugenda & Mugenda 2003).

3.10 Data Collection Techniques

The researcher obtained research permit from the National Commission for Science, Technology and Innovation (NACOSTI) before embarking on the study. The researcher then paid a courtesy call to the Sub-County Director of Education, Machakos Sub-County and explained the intention to carry out the research. The researcher then made appointment with the public secondary school principals. The researcher personally administered the research instruments to the subjects. The secondary school teachers accompanied the researcher in their classes, introduced her to the students and allowed her to administer the questionnaires.

The researcher then collected the questionnaires immediately after they have been filled.

3.11 Data Analysis

This is the process of organizing the collected data and putting it together so that the researcher can meaningfully, categorize and synthesize information from the data collecting tools,

Mugenda and Mugenda (2003). Data gathered is coded for analysis and entered using SPSS. This is done often editing and checking out whether all questions have been filled in correctly.

Quantitative data was analyzed using statistical package for social sciences and the results presented using frequency tables, bar graphs and percentages to make meaningful conclusions. This was deemed to make interpretation easy and convenient in giving general overview of the problem under study. Research questions were analyzed using descriptive statistics and the results represented in tables and bar graphs.

Qualitative data was analyzed through content analysis which in turn were analyzed by organizing data into themes, patterns and sub- topics according to themes in the research objectives, and presented in a continuous prose.

3.12 Logistical and Ethical Considerations

The researcher sought to collect data for the study by way of dealing with each education zone individually. This was for the purpose of ensuring minimal costs in

the wake of the data collection exercise reduces instances of duplicity while carrying out the activity. The researcher sought consent of the respondents to take part in the study. The respondents were assured that strict confidentiality was to be maintained in dealing with their identity. The researcher saw to it that all the respondents were adequately informed and sensitized on the need to have them participate in the study and she sought to administer only the willing respondents with the research instruments.

CHAPTER FOUR: DATA ANALYSIS, PRESENTATION AND INTERPRETATION

4.1 Introduction

This chapter deals with the analysis, presentation and interpretation of the data and discussions based on the objectives. The study sought to establish the influence of laboratory facilities on students' performance in science subjects in public secondary schools in Machakos Sub-County.

4.2 Response Rate

The respondents involved were the school principals, teachers and students. They returned the questionnaires as tabulated in Table 4.1.

Table 4.1: Instrument Return Rate

Respondents	Sampled Size	No. Collected	Return Rate (%)
Principals	23	23	100
Teachers	105	80	76.2
Students	351	211	60

Table 4.1 shows that the average questionnaire return rate was well above 70% which according to Mugenda and Mugenda (2003) is an acceptable proportion and can be termed adequate for analysis.

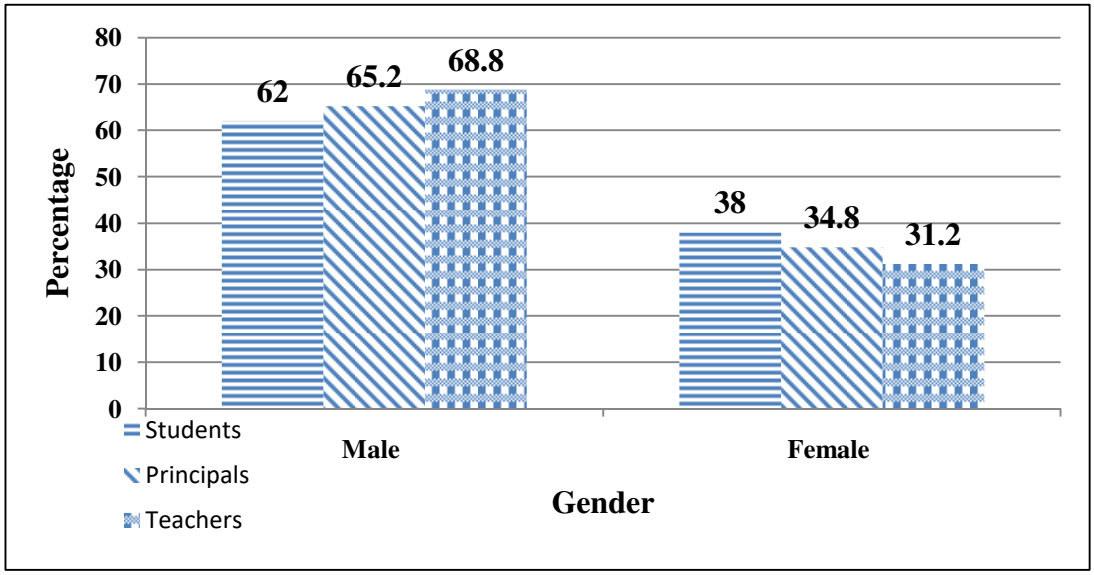
4.3 Demographic Information

4.3.1 Demographic Data of Principals, Teachers and Students

The demographic data of principals, teachers and students was based on their gender, age, highest academic qualification, professional experience in years and the number of years in the current school.

Respondents were asked to indicate their gender. Responses are summarized and presented in figure 4.1.

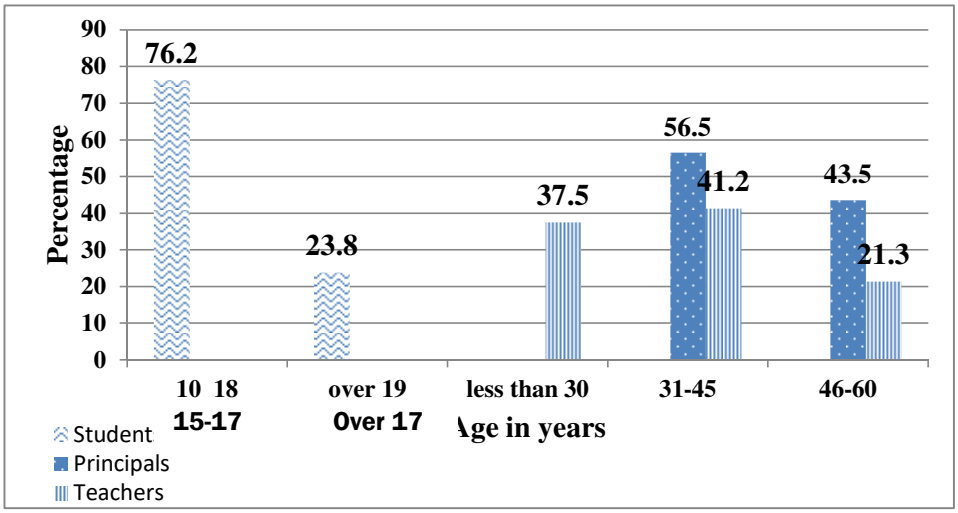
Figure 4.1: Gender of Principals, Teachers and Students



Findings in figure 4.1 show that 65.2% of the principals were male, 68.8% of the teachers were male and 62% of the students were male. This shows that the study was dominated by male principals, teachers and students which could be attributed to the fact that most schools in the study were boys' schools.

The study sought to establish the age of principals, teachers and students. Responses are summarized and presented in figure 4.2.

Figure 4.2: Age of Principals, Teachers and Students

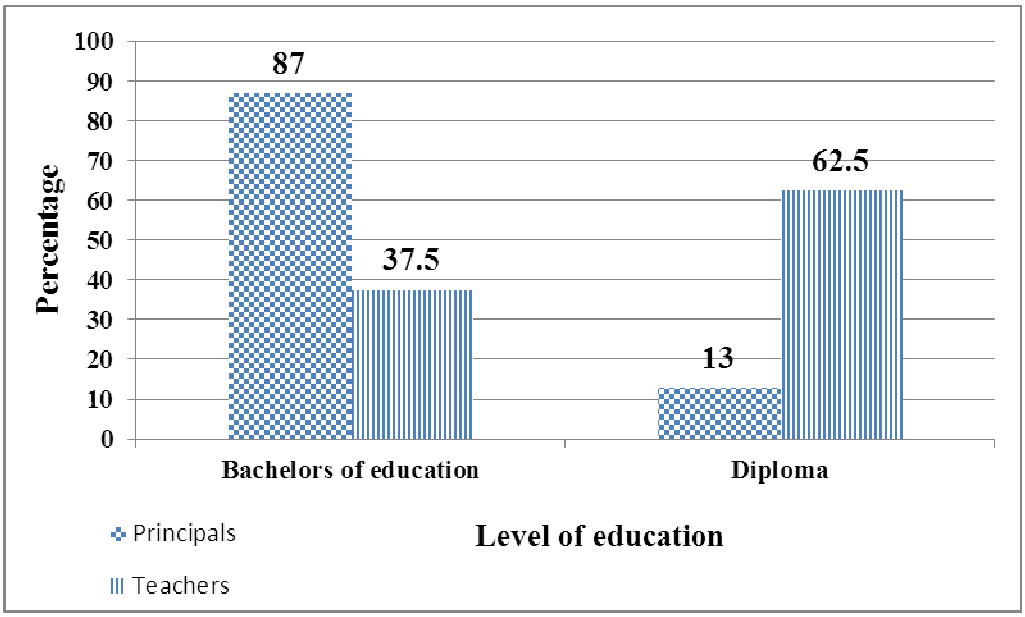


Findings in figure 4.2 show that 56.5% of the principals were aged between 31-45 years, 41.2% of the teachers were aged between 31-45 years and 76.2% of the students were aged between 15-17 years. This shows that the principals, teachers and students were relatively mature and hence would understand the concept of the study.

The principals and teachers were asked to indicate their level of education.

Responses are summarized and presented in figure 4.3 page 32.

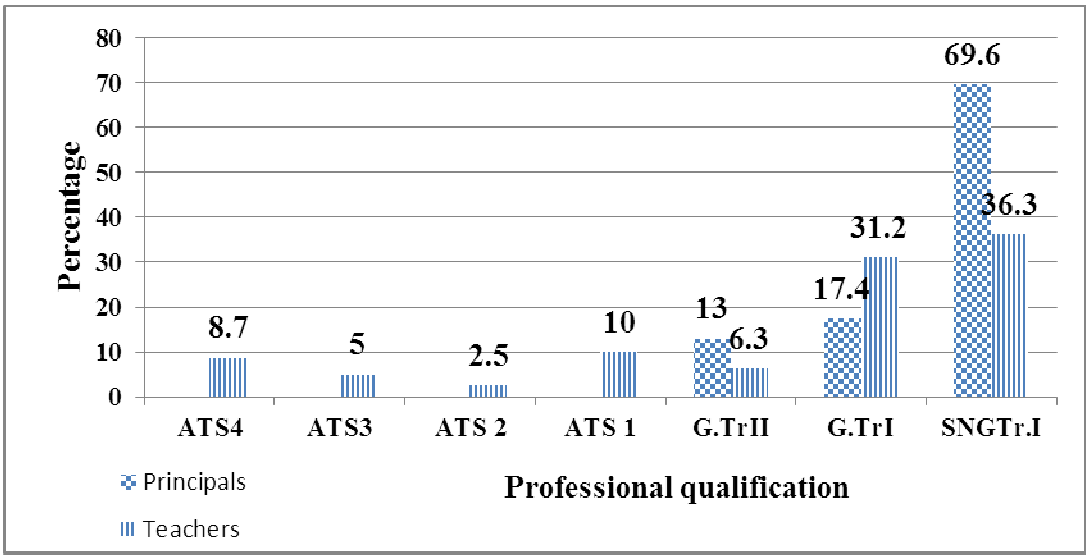
Figure 4.3: Principals' and Teachers' Level of Education



Findings in figure 4.3 show that 87% of the principals had attained Bachelors of Education and 62.5% of the teachers had attained Diploma. This shows that the principals and teachers were well educated to take up school leadership and teach science subjects.

The principals and teachers were also asked to indicate their highest professional qualification. Responses are summarized and presented in figure 4.4 on page 33.

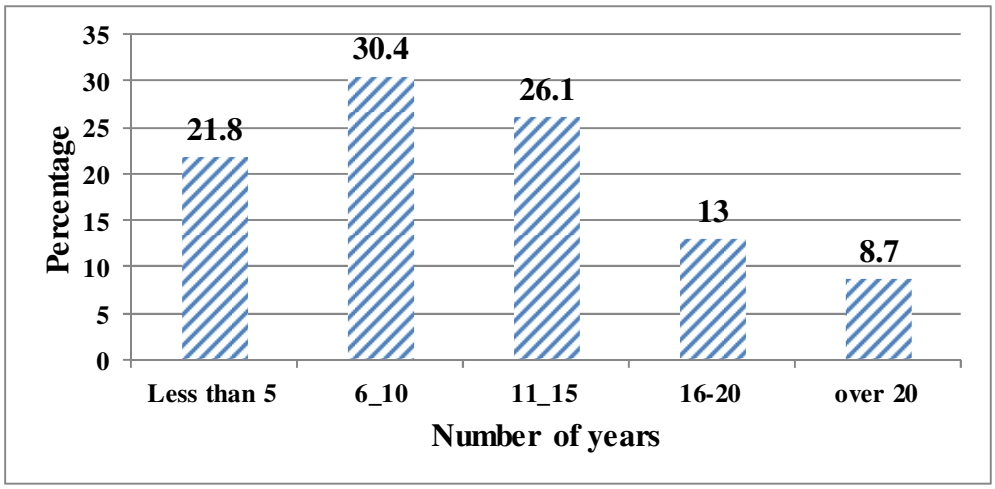
Figure 4.4: Principals' and Teachers' Highest Professional Qualification



Findings in figure 4.4 show that 69.6% of the principals and 36.3% of the teachers possessed a senior grade teacher. This shows that the principals and teachers were well trained to teach in secondary schools.

Principals were asked to indicate the number of years they have been heading the school. Responses are summarized and presented in figure 4.5 on page 34.

Figure 4.5: Number of Years as Principal

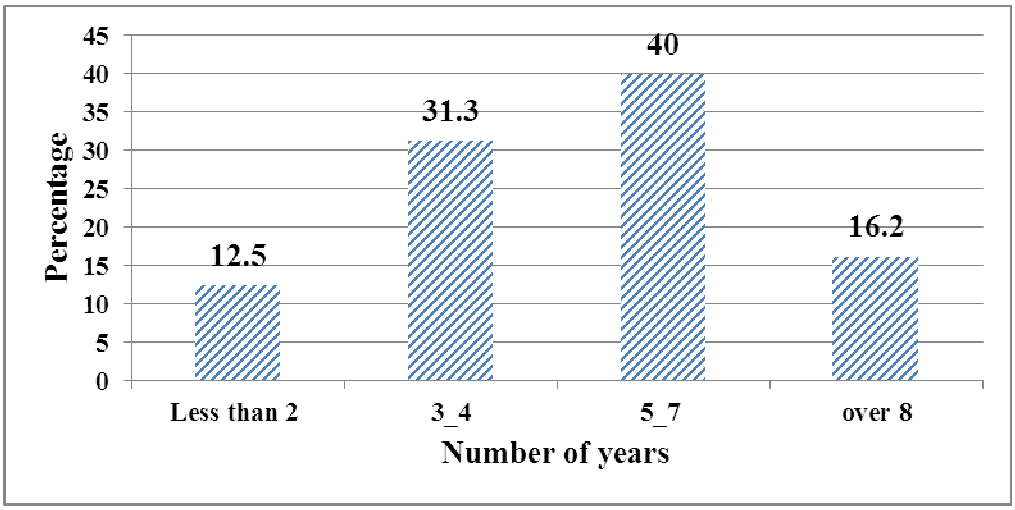


Findings in figure 4.5 show that 30.4% of the principals have been school heads for between 6-10 years. This shows that the principals were in a position to understand the influence of laboratory facilities on students' performance in science subjects in public secondary schools in Machakos Sub-County due to the number of years they have been the head of school.

Teachers were also asked the number of years in the teaching profession.

Responses are summarized and presented in figure 4.5 on page 35.

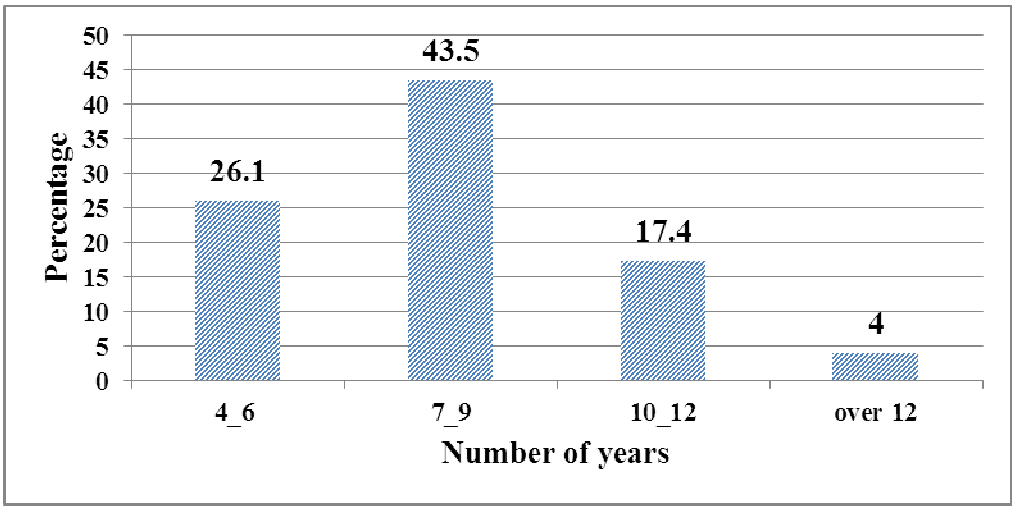
Figure 4.6: Number of Years in the Teaching Profession



Findings in figure 4.6 show that 40% of the teachers have been in the teaching profession for between 5-7 years. This implies that the teachers were in a position to understand the influence of teaching aids in the laboratories on the performance of students.

Principals were further asked to indicate the number of years they have been in the current school. Responses are summarized and presented in figure 4.7 on page 36.

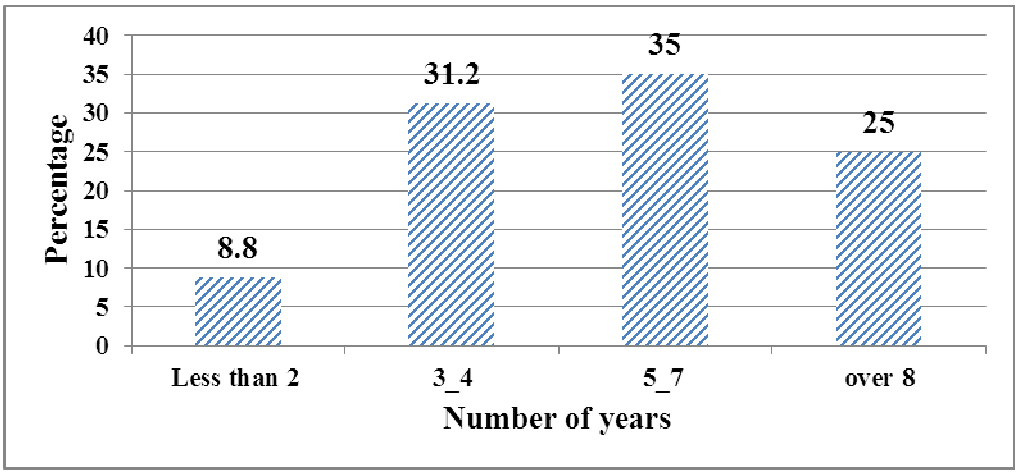
Figure 4.7: Period of Working in the Current School



Findings in figure 4.7 show that 43.5% of the principals have been in the current school for between 7-9 years. This shows that principals had enough experience in management of schools thus in a position to understand the influence of laboratories on performance.

The teachers were also asked to indicate the number of years they have taught science subjects. Responses are summarized and presented in figure 4.8 on page 37.

Figure 4.8: Period of Teaching Science Subjects.



Findings in figure 4.8 show that 35% of the teachers have been teaching mathematics and sciences for between 5-7 years thus in a good position to understand the impact of well-equipped laboratories on performance of the Science subjects.

4.4 Availability of Laboratory Facilities and Equipment

The first objective of the study was to establish the availability of laboratory facilities and equipment in public secondary schools. Principals and teachers were asked to indicate the adequacy of laboratory facilities in their schools. Responses are summarized and presented in table 4.2.

Table 4.2: Adequacy of Laboratories

Adequacy	Frequency	Percentage
Very adequate	10	9.7
Adequate	23	22.3
Inadequate	70	68.0
Total	**103**	**100**

Findings in table 4.2 show that 68% of the respondents indicated that laboratory facilities in their schools were inadequate which affected learning of science subjects. This implies that secondary schools in the study area have very few laboratories and it concurs with Yadar (2011) who argued that no course in science subjects can be considered as complete without including some practical work which is carried out in the laboratory. Shortage of laboratories contributes to low performance especially in science subjects.

Principals were asked to indicate the appropriate situation of the laboratory facilities in their schools. Responses are summarized and presented in table 4.3.

Table 4.3: Situation of the Laboratory Facilities

Facility	**Very Adequate %**	**Adequate %**	**Not Sure %**	**Inadequate %**	**Very Inadequate %**
Chemistry laboratory		8.7	13.0	34.8	43.5
Biology laboratory		4.3	8.7	48.0	39.0
Physics laboratory			17.4	56.5	26.1
Computer laboratory			8.7	26.1	65.2

N=23

Findings in table 4.3 show that: the chemistry laboratory are very inadequate as indicated by 43.5% of the respondents, biology laboratory are inadequate as indicated by 48%, physics laboratory are inadequate as indicated by 56.5% and computer laboratories in the schools are very inadequate as indicated by 65.2% of the respondents. This implies that the situation of the laboratory facilities in the

schools in the study area is very devastating thus science education programs in the schools are ineffective. The findings concur with Balogun (1982) who asserted that no effective science education program can exist without facilities for practical teaching like laboratories. Laboratory is essential to the teaching of sciences and the success of any science subject is much dependent on the laboratory provision made for it and lack of it contributes to dismal performance in science subjects.

The researcher also sought to find out from the teachers the instructional materials available in their school for teaching/ learning. Responses are summarized and presented in table 4.4.

Table 4.4: Instructional Materials Available for Teaching/ Learning

Instructional materials	**Very adequate%**	**Adequate %**	**Not Sure%**	**Inadequate %**	**Very Inadequate%**
Improved teaching Aids		3.8	8.7	25.0	62.5
Teachers prepared teaching Aids	25.0	36.3	12.5	16.2	10.0
Text books	12.5	38.8	15.0	25.0	8.7
Exercise books	41.2	21.3	15.0	12.5	10.0
Other apparatus	5.0	10.0	33.8	37.5	13.7

N=80

Findings in table 4.4 show that: the improved teaching aids were very inadequate as indicated by 62.5% of the respondents. Teachers' prepared teaching aids were adequate as indicated by 36.3%, text books were adequate as indicated by 38.8%,

exercise books were very adequate as indicated by 41.2% and other laboratory apparatus were inadequate as indicated by 37.5% of the respondents. This implies that the teachers in the study area prepare their teaching aids although the improved teaching aids were inadequate which pose a challenge to teaching/learning of science subjects. The finding is in agreement UNESCO (2008) report that practical work forms an important feature in science subjects' courses. Essential instructional materials available in the laboratories help teachers to teach science subjects which help them understand the concepts taught.

Students were asked to indicate the physical features available in their school. Responses are summarized and presented in table 4.5.

Table 4.5: Physical Features Available in Schools

Physical features	**Available**		**Not available**	
	F	**%**	**F**	**%**
Laboratory	80	38.0	130	62.0
Library	75	35.7	135	64.3
Classroom	120	57.0	90	43.0

N=210

Findings in table 4.5 show that; the classrooms were available as indicated by 57%, laboratories were unavailable as indicated by 62% and libraries were unavailable as indicated by 64.3%. This implies that secondary schools in the study area have a shortage of the most critical physical facilities. This is in agreement with Eshiwani (1993) that school physical features such as laboratories,

libraries, classrooms, have a direct impact on academic performance among students in developing countries. Laboratories offer unique opportunities for students and their teachers to engage in collaborative inquiry and to function as a classroom community of scientists thus improving academic performance.

4.5 Extent to which the Science Teachers use Laboratory Facilities

The second objective of the study was to find out the extent to which the science teachers use laboratory facilities in teaching science subjects. Principals and teachers were asked to indicate how often they make use of the laboratory facilities in teaching science subjects. Responses are summarized and presented in table 4.6.

Table 4.6: Extent to which Teachers use Laboratory Facilities

Extent	Frequency	Percentage
Very great extent	29	28.1
Great extent	52	50.5
Moderate extent	12	11.7
Little extent	10	9.7
Total	**103**	**100**

Findings in table 4.6 show that teachers make use of the laboratory facilities in teaching science subjects to a great extent as indicated by 50.5% of the respondents. This implies that science teachers are ready and willing to use laboratories in teaching science subjects so as to help students understand the sciences and improve their performance. The finding differs with Shymansky and

Penick (1978) who asserted that teachers do not engage students in laboratory activities in ways that are likely to promote the development of science concepts. In order to maintain and arouse the interests of students in sciences, the teachers should be effectively involved in order to transfer knowledge and facts to learners for a good performance in examinations.

Students were also asked to indicate how often they take science subjects in the laboratory. Responses are summarized and presented in table 4.7.

Table 4.7: Frequency of Students using Laboratory Facilities

Frequency	**Frequency**	**Percentage**
Very frequently	36	17.0
Frequently	90	43.0
Rarely	51	24.3
Very rarely	33	15.7
Total	**210**	**100**

Findings in table 4.7 show that students frequently take science subjects in the laboratory as indicated by 43% of the respondents. This implies that teachers make effort to teach science subjects in the available laboratories to help students understand the subjects. This is in agreement with Brickhouse and Bodner (1992) who reported that students' concern about their grades has a strong influence on teachers' practices. Allowing students to use science laboratories frequently shows teachers' commitment to teach science subjects in laboratories.

4.6 Relationship between Laboratory Facilities and Academic Performance

The third objective of the study was to establish the relationship between laboratory facilities and the students' academic performance in science subjects. Teachers were asked to indicate the extent to which availability of laboratory facilities affect performance of students in science subjects. Responses are summarized and presented in table 4.8.

Table 4.8: Extent to which Laboratory Facilities Affect Academic Performance

Extent	Frequency	Percentage
Very great extent	41	51.2
Great extent	25	31.3
Moderate extent	11	13.8
Little extent	3	3.7
Total	**80**	**100**

Findings in table 4.8 show that 51.2% of the respondents indicated that availability of laboratory facilities affect performance of students in science subjects to a very great extent. This implies that schools with well-equipped laboratories have better results in the school certificate science examinations than those that are ill-equipped. The finding concurs with Soyibo and Nyong (1984) that schools with well-equipped laboratories have better results in the school certificate science examinations than those that are ill-equipped and lack of adequate exposure to practical work is one of the contributing factors to dismal performance in

examinations. Laboratory work stimulates learners' interests as they are made to personally engage in useful scientific activities and experimentation which promotes that science is not only product or process but also affords the learner the basic skills and scientific methods of problem solving and knowledge obtained and promotes long term memory.

4.7 Challenges Faced by School Principals

The fourth objective of the study was to establish the challenges faced by the school principals in provision of laboratory facilities in public secondary schools. Principals were asked to indicate the challenges they face in providing the laboratory facilities. Responses are summarized and presented in table 4.9.

Table 4.9: Challenges Faced by School Principals

Challenges	Frequency	Percentage
Inadequate resources	20	87.0
Unqualified lab instructors	18	78.3
Insufficient competent teachers	13	56.5
Managing class sizes	10	43.5

N=23

Findings in table 4.9 show that 87% of the respondents indicated that they face a challenge of inadequate resources to equip laboratories, 78.3% do not have qualified laboratory instructors, 56.5% have insufficient competent and qualified science teachers and 43.5% of the respondents face challenges in managing the class sizes. This shows that the principals face various challenges in provision of

laboratory facilities in public secondary schools. The finding is in agreement with Oduro (2009) that challenges facing principals in provision of laboratory facilities include dealing with low motivation, managing class sizes, dealing with inadequate resources and managing with fewer funds. Inadequate finances to equip laboratories pose a great challenge to principals thus the need to partner with other stakeholders to outsource funds for equipping laboratories.

CHAPTER FIVE: SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter presents a summary of the major findings of the study and giving conclusions which attempt to give answers to specific questions that were investigated. It also presents recommendations for possible actions and suggestions for future research.

5.2 Summary of Findings

Findings established that laboratory facilities in the study area were inadequate as indicated by 68% of the respondents whereby the chemistry laboratories were very inadequate as indicated by 43.5%, biology laboratories were inadequate as indicated by 48%, physics laboratories were inadequate as indicated by 56.5% and computer laboratories were very inadequate as indicated by 65.2% of the respondents. Findings also established that teachers lacked improved teaching aids as indicated by 62.5% and the students indicated that the laboratories were not enough as indicated by 62%. Laboratory is essential to the teaching of sciences and the success of any science course is much dependent on the laboratory provision made for it and lack of well- equipped laboratories affect students' performance in science subjects. This finding concurs with Balogun (1982) that no effective science education programme can exist without facilities and equipment for practical teaching like laboratories.

Findings established that teachers make use of the laboratory facilities in teaching science subjects to a great extent as indicated by 50.5% of the respondents whereby teachers allow students to take science subjects in the laboratory frequently as indicated by 43% of the respondents. Using laboratories in teaching and learning of science and other science related disciplines helps students to understand and recall what they see than what they hear or were told in theory. This finding differs with Shymansky and Penick (1978) who asserted that teachers do not engage students in laboratory activities in ways that are likely to promote the development of science concepts.

The findings revealed that there is a relationship between laboratory facilities and students' academic performance as indicated by 51.2% whereby availability of well-equipped laboratory facilities affect performance of students in science subjects since laboratory work stimulates learners' interests as they are made to personally engage in useful scientific activities and experimentation; promotes that science is not only product or process; affords the learner the basic skills and scientific method of problem solving and knowledge obtained and promotes long term memory. This concurs with Soyibo and Nyong (1984) that schools with well-equipped laboratories have better results in the school certificate science examinations than those that are ill-equipped and lack of adequate exposure to practical work is one of the contributing factors to dismal performance in examinations.

Findings also established that principals face challenges in provision of laboratory facilities which include inadequate resources to equip laboratories as indicated by 87% of the respondents, lack of qualified laboratory instructors as indicated by 78.3%, insufficient competent and qualified science teachers as indicated by 56.5% and managing class sizes as indicated by 43.5% of the respondents. This is in agreement with Oduro (2009) that challenges facing principals in provision of laboratory facilities include dealing with low motivation, managing class sizes, dealing with inadequate resources and managing with fewer funds.

5.3 Conclusion

It was concluded that public secondary schools in Machakos Sub-County have inadequate chemistry, biology, physics and computer laboratories and the schools that have enough laboratories lack equipment and competent science instructors. Laboratory is very crucial to the teaching of sciences and the performance of any science subject depends on the laboratory provision and lack of well- equipped laboratories affect student' performance in sciences.

It was also concluded that the frequency of teachers teaching science subjects in laboratories and also allowing students to use laboratories frequently help improve their academic performance in the science subjects. Engaging students in laboratory activities promotes the development of science concepts.

The study established that there is a significant relationship between availability of laboratory and students' performance in sciences since laboratory equips students

with practical skills which help them to remember what they are taught in theory thus improving their performance in science subjects examinations. Schools with well-equipped laboratories have better results in the school certificate science examinations than those that are ill-equipped.

The study also established that principals face challenges in provision of laboratory facilities which includes managing funds so as to equip laboratories, incompetent teachers and laboratory instructors and managing the big class sizes intended to use the few laboratories.

5.4 Recommendations

Based on the findings of this study, the researcher makes the following recommendations:

- Principals should work hand in hand with parents, sponsors and other stakeholders in education to prioritize the provision of adequate laboratory facilities to ease the problems of inadequacy of laboratories in public secondary schools.
- Science teachers should be encouraged and motivated to use science laboratories more frequently. Science teachers should also be taken to workshops and in-service training to make them more competent in teaching sciences subjects theoretically and practically. This could trigger teachers' creativity and innovation in the use of laboratory equipment in teaching and learning process.

- Students should be given more opportunities to experience science by being exposed to more laboratory practicals which may enhance better performance in science subjects.
- The government should provide some laboratory equipment to schools to subsidize their costs and encourage the local chemical manufacturers to produce more affordable chemicals and laboratory equipment.

5.5. Suggestions for further study

Given the scope and limitations of this study, the researcher recommends the following as areas for further studies:

i. Similar studies could be carried out in other counties to establish whether or not the findings of this study apply to other areas.

ii. Similar studies focusing on performance of science subjects topic wise in order to diagnose the specific areas that need to be given more attention and this will enable the educators to know the areas which are not well covered.

iii. An in-depth study could be done to investigate the teachers' and students' attitude towards the use of laboratories in teaching and learning in Kenyan public secondary schools.

REFERENCES

Achoka, J. S. K., Odebero, S., Maiyo, J. K. &Mualuko, N. J. (2007). Access to Basic Education in Kenya: Inherent Concerns. *Educational Research and Review*, 2 (10): 275-284.

Adediwura, A. A. & Tayo, T. (2007).Perceptions of Teacher Knowledge, Attitude and Teaching Skills as Predictor of Academic Performance in Nigerian Secondary Schools. Educational Research and Review, 2(7): 165-171.

Ado, S. (2009). *A survey of the relationship between availability of laboratory facilities and students academic performance in secondary schools*. Katsina State. Nigeria. Journal of science & Educational Research.

Agbo, F.O.(2003). *An investigation into students' performance in scientific skill in science subject examinations.* The Jos Journal of Education.

Ango,M.L. and Sila,M.D. (1986). *Teaching and Learning of Biological; Experience of some Nigerian Secondary Schools*. Journal of Science Teaching Association of Nigeria 124 (2): 33-47.

Balogun, T. A. (1982). Improvisation of science teaching equipment, *Journal of Science Teachers Association* 20(2):72-76.

Boit, M., Njoki, A. &Chang'ach, J. K. (2012).*The Influence of Examinations on the Stated Curriculum Goals.*American International Journal of Contemporary Research*,* 2(2), 179-182.

Brickhouse, N., & Bodner, G. M. (1992). *The beginning science teacher: Classroom narratives of convictions and constraints*. Journal of Research in Science Teaching, 29, 471–485.

Cohen, D. K. (1990). *A revolution in one classroom*: The case of Mrs. Oublier. Educational Evaluation and Policy Analysis, 64, 1–35.

DeCarlo, C. L., & Rubba, P. (1994). *What happens during high school chemistry laboratory sessions?* A descriptive case study of the behaviors exhibited by three teachers and their students. Journal of Science Teacher Education, 5, 37–47.

Dike, N.I. (2009). *Collaborative involvement in funding laboratory equipment and facilities in tertiary institution in Nigeria: Issues and approaches*. Nigerian Journal of Science and Educational Research.

Eshiwani, G. S. (1993). *Education in Kenya since independence*. Journal of information for Teacher Education, 9(1), 53-77. Nairobi: East African Publishing.

Farombi, J.G. (1998). *Resource Concentration, Utilization and Management as Correlates of Students' Learning outcomes*: A study in School Quality in Oyo State. Unpublished Ph.D. Thesis, university of Ibadan.

Gana, E. S. (1997). *Effects of Using Visual Designed Training Models on the Learning of Mathematics at J.S.S*. Unpublished PhD Thesis, University of Ibadan, Nigeria. 284pp.

Gardiner, P. G., & Farrangher, P. (1997). *The quantity and quality of biology laboratory work in British Columbia high schools.* Paper presented at the National Association for Research in Science Teaching (NARST) Meeting, Oak Brook, IL.

Government of Kenya (2003). *Education Sector Review and Development*: Nairobi Government Printer.

Government of Kenya (2012).*Education Sector Review and Development*: Nairobi Government Printer.

Gunstone, R. F., & Champagne, A. B. (1990). *Promoting conceptual change in the laboratory*. In E. Hegarty-Hazel (Ed.), The student laboratory and the science curriculum (pp. 159–182). London: Routledge.

Habu, I.C. (2005). *The influence of laboratory apparatus in the teaching of science subjects*. Department of Education, Ahmadu Bello University, Zaria, Nigeria.

Hodson, D. (1993). *Re-thinking old ways: Towards a more critical approach to practical work in school science.* Studies in Science Education, 22, 85–142.

Hodson, D. (2001). *Research on practical work in school and universities: In pursuit of better questions and better methods.* Proceedings of the 6th European Conference on Research in Chemical Education, University of Aveiro, Aviero, Portugal.

Hofstein, A., & Lunetta, V. N. (1982). *The role of the laboratory in science teaching*: Neglected aspects of research. Review of Educational *Research*, 52(2), 201–217.

Hofstein, A., Shore, R., & Kipnis, M. (In press). *Providing high school chemistry students with opportunities to develop learning skills in an inquiry-type laboratory*—A case study. International Journal of Science Education.

Jimenez-Aleixandre, M. P., Rodriguez, A. B., & Duschl, R. A. (2000). "*Doing the lesson" or "Doing science": Arguments in high school genetics*. Science Education, 84(6), 757–792.

Johnson, D.W., Johnson, R. T., Maruyama, G., Nelson, D., & Skon, L. (1981). *Effects of cooperative, competitive, and individualistic goal structures on achievement:* A *meta* analysis. Psychological Bulletin, 89, 55–63.

Johnson, D.W., & Johnson, R. T. (1985). *Learning together and alone: Cooperative, competitive, and individualistic learning* (2nd ed.), Engelwood Cliffs, NJ: Prentice Hall.

Kamunde, F. (2010).*The role of the headteacher in the implementation of free primary education in Kenya*. International Journal of Educational Development, Vol. 30(2010) ,p.646.

Karplus, R. (1977). *Science teaching and the development of reasoning*. Journal of Research in Science Teaching, 14, 169–175.

Kempa, R. F.,&Diaz, M. (1990). *Motivational traits and preferences for different instructional modes in science.* International Journal of Science Education,12, 195–203.

Kennedy, M. M. (1998). *The relevance of content in in-service teacher education*. Paper Presented at the Annual Meeting AERA, San Diego, CA.

Kothari, C. R.(2004). *Research methodology* : Methods and Techniques 4th Edition, New Delhi, New International Publication Limited.

Lavalah, S.(2012). Liberia: *Rising expectation involving challenges a welcome note to Ambassaodor Dehorah Malec.*All Africa.

Lazarowitz, R., & Tamir, P. (1994). *Research on using laboratory instruction in science*, In D. L. Gabel (Ed.), Handbook of research on science teaching and learning (pp. 94–130). New York: Macmillan.

Lois, M (2013): *Influence of provision of school physical infrastructure on students' performance in KCSE*, Mwingi Central District, Kenya. Unpublished thesis. University of Nairobi.

Lunetta, V. N. (1998). *The school science laboratory: Historical perspectives and centers for contemporary teaching.* In B. J. Fraser & K. G. Tobin (Eds.), International handbook of science education. Dordrecht: Kluwer.

Lunetta, V. N., & Hofstein, A. (1991). *Simulations and laboratory practical activity*. In B. E. Woolnough (Ed.), Practical science (pp. 125–137). Milton Keynes: Open University Press.

Mugenda, O. and Mugenda, A .(2003). *Research method: Qualitative and Quantitative approaches.* Nairobi : Acts Press.

Nwachukwu, G. O. (1984). *A Survey of the Resources for the Teaching and Learning of Biology in Some New Secondary Schools in Lagos,* Unpublished PhD Thesis, University of Ibadan, Nigeria. 272pp.

Oduro, G. (2009). *The missing ingredient: Head teacher leadership development in Sub-Saharan Africa*. Looking Ahead at 50, Oxford.

Ohba, A. (2011).*The abolition of secondary schools fees in Kenya: Responses by poor.* International Journal of Educational Development, Vol. 31(2011), p. 402- 408.

Okebukola, P. A &Ogunniyi, M. B (1984). *Cooperative and competitive and individualistic laboratory interaction patterns: Effects on achievement and acquisition of practical skill*s. Journal of Research in Science Teaching, 22 (9), 198 – 206.

Okoli, A. (1995). *Education: A Year of Disaster at all Levels*, Vanguard publishers, Lahore. 12–13 pp.

Ogunniyi, M.B. 1983. *An analysis of laboratory activities in selected Nigerian Secondary Schools*. Journal of Science Education, 5(2): 195-201.

Onsomu, E, Muthaka, D., Ngware, M. &Kosimbei, G. (2006). *Financing of Secondary Education in Kenya: Costs and Options. KIPPRA Discussion paper No. 55*. Nairobi: Kenya Institute for Public Policy Research and Analysis.

Orodho, J.A. (2004). *Elements of Education and Social Sciences research methods*: Nairobi: Masola Publishers.

Shafa, M.(2011). *Role of Head teachers in managing the forces emanating from external world of schools in Gilgit- Baltisten of Pakistan*. American International Contemporary Research.Vol.1(2) September 2011.

Shymansky, J. E., &Penick, J. E. (1978).*Teachers' behavior does make a difference in the hands-on science classroom.* Paper Presented at the Annual Conference of the Association for the Education of Teachers of Science (AETS).

Soyibo, K. (1987). *Progress and Problems in Nigerian Secondary School Education* 1960 – 1984. Journal of Research in Curriculum (Special) 1, March, 51 – 61.

Soyibo, K. and Nyong, G. O. E. (1984). *An analysis of the school certificate biology result of old and new secondary schools in Cross Rivers State* 1978–1982.*Nigerian Educational Forum* 7(2): 245–250.

Sungtong, E. (2007). *Leadership challenges public secondary school principals in the Era of education reform and cultural unrest in Border provinces of Southern Thailand.* Faculty of the graduate school at the University of Missouri- Columbia.

Tobin, K. G., & Gallagher, J. J. (1987).*What happens in high school science-classrooms.* Journal of Curriculum Studies, 19, 549–560.

UNESCO (2008).*Challenges of implementing free day secondary education in Kenya. Experiences from district,* Ministry of Education, Science and Technology, Nairobi. 53pp.

UNESCO (2006).*Education for All global Monitoring Report. Paris: UNESCO*. Polman, J. L. (1999). Designing project-based science: Connecting learners through guided inquiry. New York: Teachers College Press.

Yadar, K. (2001). *Teaching of Life Sciences*. Anmol Publication Ltd., New Delhi. 87pp.

Yung, B. H. W. (2001). *Three views of fairness in a school-based assessment scheme of practical work in biology.* International Journal of Science Education, 23, 985–1005.

APPENDICES

Appendix A: Letter of Introduction to Respondents

Marietta N. Mulinge

Machakos University College

Dear Sir/Madam,

RE: REQUEST TO FILL QUESTIONNAIRES FOR RESEARCH PURPOSE

I am a post graduate student at the Machakos University College pursuing a Masters Degree in education. I am carrying out a research on the influence of laboratory facilities on public secondary school students' performance in sciences. Your school has been sampled for the study and you have been selected as a respondent. Please answer the questions as truthfully as possible.

Yours Faithfully,

Marietta N. Mulinge

Tel: 0712925387

APPENDIX B: QUESTIONNAIRE FOR PRINCIPALS

The purpose of this research is purely academic. Kindly take your time to answer the questions as honestly and truthfully as possible. The information collected in this questionnaire will be used solely for the intended purpose and therefore any responses or information given will be treated with utmost confidence. Respond to all items by ticking (√) the correct option or providing the accurate information.

PART I: Information about the Head teacher

1. Indicate your Gender.

Male [ ]

Female [ ]

2. Indicate your age in the appropriate box

(a) Less than 30 [ ]

(b) 31 – 45 [ ]

(c) 46 – 60 [ ]

3. What is your highest Academic qualification?

(a) KCSE / KCE [ ]

(b) Diploma [ ]

(c) B.Ed [ ]

(f) Other (specify) [ ]

4 What is your highest professional qualification?

a. ATS 4 [ ]

b. ATS 3 [ ]

c. ATS 2 [ ]

d. ATS 1 [ ]

e. G.Tr. II [ ]

f. G.Tr. 1 [ ]

g. SNR G.Tr. I [ ]

5. How long have you been a Head teacher?

Less than 5 yrs [ ]
6 – 10 yrs [ ]
11- 15 yrs [ ]
16- 20 yrs [ ]
Over 20 yrs [ ]

6. How long have you been in this school?

Less than 3 yrs [ ]

4 - 6 yrs [ ]

7 – 9 yrs [ ]

10-12 yrs [ ]

Over 12 years [ ]

PART II: Information about the Institution

SUB-COUNTY…….....**DIVISION**…….....

ZONE ……..…**SCHOOL**……...……

1. Please indicate the mean grade for your school in the following years

SUBJECT	2010	2011	2012	2013	2014	2015
Mean grade						

2. Laboratory facilities

Indicate the appropriate situation of the laboratory facilities in your schools

Facility	**Very Adequate**	**Adequate**	**Not Sure**	**Inadequate**	**Very Inadequate**
(a) Chemistry laboratory					
(b)Biology laboratory					
(c) Physics laboratory					
(d) Computer laboratory					

3. Please comment on the availability of laboratory equipment and chemicals in your School …….

…….....

4. What challenges do you face in providing the laboratory facilities?

……....

5. How often do your teachers make use of the laboratory facilities in teaching science subjects?…….....

APPENDIX C: QUESTIONNAIRE FOR TEACHERS

Please complete this questionnaire as truthfully as possible. The information given will purely be used for the purpose of this study and will be treated with the strictest confidence.

1. Indicate your gender. Male [ ] , Female [ ]

2. What is your highest academic qualification?

   i. Diploma [ ]

   ii. B.Ed [ ]

   iii. M.A [ ]

   iv. Others (specify) …….....

4. Indicate your professional qualification. (Tick as appropriate)

   a. ATS 4 [ ]

   b. ATS 3 [ ]

   c. ATS 2 [ ]

   d. ATS 1 [ ]

   e. G. Tr II [ ]

   f. G.Tr I [ ]

   g. Snr. Gtr. I [ ]

5. How long have you been a teacher?

   Less than 2 years [ ] 3 – 4years [ ] 5 – 7 years [ ] over 8 years [ ]

6. How long have you been teaching mathematics and science?

1. Less than 2 years [.] 3. 5 – 6 years [.]

2. 3 – 4 years [ ] 4. Over 7 years [ ]

7. What instructional materials are available in your school for teaching/ learning Science.

	Very adequate	Adequate	Not sure	Inadequate	Seriously Inadequate
Improved teaching Aids					
Teachers prepared teaching Aids					
Text books					
Exercise books					
Other apparatus					

8. How adequate are the laboratory facilities in your school?

……

9. To what extent does the availability of laboratory facilities affect performance of students in science subjects?

Kindly explain.....

……....

10. How often do you use the laboratory facilities in teaching the science subjects?

……

……....

APPENDIX D: QUESTIONNAIRE FOR STUDENTS

You are kindly requested to answer the following questions as honestly as possible. Do not write your name anywhere on this paper.

Part I: Personal Information

1. Tick your gender Male [ ] Female [ ]

2. Indicate your age

   a. 13-15 years

   b. 16- 18 years

   c. over 19

Part II School information

3. (a) How big is your class? Boys _____ Girls _____ Total _____

4. Which of the following physical infrastructure are available in your school?

   a) Laboratory [ ]

   b) Library [ ]

   c) Classroom [ ]

   d) Toilets [ ]

   e) Bathrooms [ ]

5. How many laboratories are there in your school?

……...……

….……...

6. How often do you take science subjects in the laboratory?

……

…..…..…….

APPENDIX E: INTERVIEW SCHEDULE

Facilities	Comment/Observation by the researcher
Laboratory	
Laboratory equipment	
Laboratory chemicals	
Laboratory timetable	

APPENDIX F: RESEARCH PERMIT

THIS IS TO CERTIFY THAT:
MS. MARIETTA NDINDA MULINGE
of MACHAKOS UNIVERSITY, 1855-90100
machakos,has been permitted to
conduct research in *Machakos County*

on the topic: *INFLUENCE OF LABORATORY FACILITIES ON STUDENTS' PERFORMANCE IN SCIENCE SUBJECTS IN PUBLIC SECONDARY SCHOOLS IN MACHAKOS SUB-COUNTY, KENYA*

for the period ending:
2nd June,2018

Permit No : NACOSTI/P/17/67650/17018
Date Of Issue : 2nd June,2017
Fee Recieved :Ksh 1000

.....
Applicant's Signature

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

CONDITIONS

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

REPUBLIC OF KENYA

National Commission for Science, Technology and Innovation

RESEACH CLEARANCE PERMIT

Serial No.A 14280

CONDITIONS: see back page

APPENDIX G: AUTHORIZATION LETTER

NATIONAL COMMISSION FORSCIENCE, TECHNOLOGY ANDINNOVATION

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

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

Ref: No. **NACOSTI/P/17/67650/17018**

Date: **2nd June, 2017**

Marietta Ndinda Mulinge
Machakos University
P.O. Box 136-90100
MACHAKOS.

RE: RESEARCH AUTHORIZATION

Following your application for authority to carry out research on ***"Influence of Laboratory facilities on students' performance in science subjects in public secondary schools in Machakos Sub County, Kenya,"*** I am pleased to inform you that you have been authorized to undertake research in **Machakos County** for the period ending **2nd June, 2018.**

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

On completion of the research, you are expected to submit **two hard copies and one soft copy in pdf** of the research report/thesis to our office.

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

Copy to:

The County Commissioner
Machakos County.

The County Director of Education
Machakos County.