EFFECT OF PHYSICS INSTRUCTIONAL VIDEOS AS AN E-LEARNING RESOURCE ON PERFORMANCE AMONG SECONDARY SCHOOL STUDENTS IN GITHUNGURI DISTRICT, KIAMBU COUNTY, KENYA

BY

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DECLARATION

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

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This work is dedicated to my wife and children for their support and encouragement my late father Maina and my mother Esther for all the assistance they have given me in my studies.

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TABLE OF CONTENTS Page

LIST OF TABLES

LIST OF FIGURES

ABBREVIATIONS AND ACRONYMS

KCSE	Kenya certificate of secondary education.
KESSP	Kenya education sector support programme.
KIE	Kenya institute of education. (now KICD).
KICD	Kenya institute of curriculum development
KNEC	Kenya national examinations council.
KSTC	Kenya science teachers' college.
PSSC	Physical science study committee.
SMASSE	Streangthening of mathematics and sciences in secondary education.
SMSG	School mathematics study group.
SSP	School science project

ABSTRACT

Of the three secondary schools' science subjects taught in Kenya, physics has the lowest enrolment of about 30% compared to chemistry and biology which have an average of about 95% and 90% respectively. This has been caused by poor performance in the subject at the lower classes leading to few students opting for the subject in the upper classes. This study explored the use of physics video as an additional media resource in teaching and learning of the subject as a way of improving students' performance. It is a resource that has not been in use due to its unavailability but today quite elaborate physics video are available from the internet and the equipment required are now affordable to many schools. In an attempt to improve the performance in the subject, most researchers devoted their work on teaching modalities review of the syllabus, utilization of resources in the laboratory but no research so far has been carried out on use of video as they were not readily available. The study was quasi-experimental in design and carried out in two schools in Kiambu county, Githunguri district which had a sample size of 52 students in the control group and 61 students in the experimental group. Instruments used to collect data were achievement tests and an observation schedule. Results were analyzed by using both descriptive and inferential statistics which showed that there was a higher performance for the experimental class especially in process skills and concept development, being significant at 0.05 level. On motivational orientation, it was observed that the experimental class exhibited more frequent motivational behaviours than the control class. These results are an improvement and a demonstration that integrating video can bring about an improvement in the teaching and learning process of physics at secondary school level and therefore strongly recommended for schools that offer the subject. It is also an important resource that practicing teachers and learning institutions can use to document physics related information rather than mainly relying on textbooks.

CHAPTER ONE

INTRODUCTION

1.0 Introduction

This study focused on the use of physics videos as an additional resource in classroom instruction of the subject at secondary school level. In this chapter the problem and its key components are explained; the background to the study, highlighting the rationale for the study, purpose, objectives of the study and specific research questions. It ends with significance, assumptions, limitations, scope of the study and definition of terms.

1.1 Background to the study.

Over the years the physics curriculum in Kenya has undergone numerous reviews in an attempt to make it more stimulating, so that learners use their scientific knowledge rather than just memorize it to discover knowledge and learn from their own observations. The most recent was in 2000 and implemented in 2002 which gave an extremely high improvement in KCSE results in the year 2005 as indicated in table 1.1. However, the changes have been slow with a number of content areas in the syllabus being entirely eliminated. This has been characterized by poor performance at the end of the course as stated in the Kenya national examinations report, (KNEC report, 2007).

Table 1.1 shows that physics has extremely low enrolment which can be attributed to poor performance in schools mainly in the upcoming schools due to inadequate teaching resources. With the use of instructional videos, visualization can enhance conceptualization which in effect would improve performance. As a result, the problem of low enrolment in physics would be minimized. Other measures aimed at improving the results were to specify the topics to be examined which is not the case in the other science subjects. From year 2005 when the new syllabus was first examined, the physics paper I examination consisted of 80 marks with questions drawn from topics related to heat and mechanics. Paper II has equivalent marks and questions are set from the rest of the topics in the syllabus and both papers take 2 hours. The practical examination is paper III having 40 marks and takes 2½hrs, while chemistry and biology take 2hrs and 1½ hrs respectively.

Table 1.1 Enrolment and mean scores of science subjects.

Subject		**Phy.**	**Chem.**	**Bio**	**Maths**	**Total enrolment**
2002	**Enrolment**	**54,180**	**187,261**	**177,251**	**197,118**	**198,354**
	Mean	**41.55**	**34.27**	**36.24**	**39.39**	
2003	**Enrolment**	**55,877**	**198,016**	**184,438**	**205,232**	**207,730**
	Mean	**44.06**	**37.42**	**41.11**	**38.62**	
2004	**Enrolment**	**60,082**	**214,520**	**200,797**	**221,295**	**222,676**
	Mean	**47.84**	**39.62**	**49.07**	**37.20**	
2005	**Enrolment**	**69,424**	**253,508**	**234,975**	**259,280**	**260,665**
	Mean	**49.18**	**38.05**	**41.59**	**31.91**	
2006	**Enrolment**	**72,299**	**236,831**	**217,675**	**238,684**	**243,453**
	Mean	**40.32**	**49.82**	**54.89**	**38.24**	
2007	**Enrolment**	**83,162**	**267,719**	**248,519**	**273,504**	**276,239**
	Mean	**41.31**	**50.78**	**41.85**	**39.46**	

KNEC report, 2008

Table 1.2 National percentages of physics students in KCSE examinations

Year	Physics students	Total enrolment	Percentage
2007	83162	273239	29%
2008	93692	340794	27%
2009	104883	335415	30%
2010	109811	354935	30%

KNEC report, 2011

It can be noted from the enrolment that slightly over a quarter of the candidates register for physics in the KCSE examinations creating the erroneous conclusion that physics is done better than other science subjects when the means are worked out. If the three sciences had comparable enrolment, the average marks for physics would be far below that of chemistry and biology. It is for this reason that the research targeted the students in form two when they are doing all the three science subjects rather than form three and four when physics has been offered to a few students. The district performance in appendix A for the selected location shows that 47 schools out of 67 schools offered physics and the subject is only done in well performing schools. When the research was being undertaken, the sampled schools had 20 students out of 89 candidates and 19 students out of 70 candidates for the experimental and control group schools respectively showing that many students did not choose physics though the KCSE average scores may be high. Only the few bright students sit for the physics exams giving the wrong impression that the subject is done better than the other science subjects. The true picture could only be found at the form two level where the groups were homogeneous in terms of performance and enrolment These two captions from different local newspapers emphasized this, both from the Ministry of Education when releasing KCSE results.

> "The poor performance in these subjects (Maths and Sciences) remains a matter of concern to the Ministry and intervention measures should be urgently taken." (East African Standard newspaper No 270028 of 1st March,2004, pg. 3).

The following year, physics was singled out of the Sciences.

> "The government admitted yesterday that students in secondary schools were avoiding Physics. Education Minister said low enrollment in Physics was a cause of concern at the Ministry owing to its importance in career progress for students" (Daily Nation newspaper 28th Feb, 2005 pg.4)

1.2 Statement of the Problem.

The content in secondary school physics shows that there are many topics where resources to teach the subject are not available and the students are left to imagine the physical items being taught. For example, topics such as X-rays, radioactivity, electronics and all the topics that include some form of motion yet represented as two dimensional diagrams in books or on the board have to be imagined by the learners. It is with the use of videos that this research sought to fill the gap of imaginative learning so that the students can visualize the ideas and hence have a better understanding of the subject. Being a practical subject, the performance can highly be improved if the research shows that videos can supplement areas where resources for demonstrations and practical work are inadequate or entirely lacking.

Waititu,(2004) working on difficult topics in physics attributes poor performance to poor general school instructional methods and recommended further studies on finding possible solutions to better the instructional methods for topics that teachers and students perceived to be difficult. In another research by Amadalo, (1998) on instruction in physics, he observed that most of the researches were devoted to the issues of school factors teaching modalities and innate students' predisposition, availability and utilization of resources. Despite the input of these research findings, there seems to be little change in the conventional methods of instructions and the performance in physics has remained poor.

This study looked at the effect of incorporating instructional videos to supplement the other resources available to the teachers at secondary school level. The factors that had hindered exploration of using videos such as lack of electricity, unavailability of video equipment and software have now been overcome by modern technology.

1.3 Purpose of the study.

The purpose of this study was to address the problem of poor performance which leads to low enrolment and seek the effect of intervention of physics videos as an instructional material to supplement the other available resources being used currently. Their effect in teaching and learning of the subject was analyzed to determine if there was any improvement in performance. This study's findings will mainly be of great benefit to students who wish to pursue courses related to physics by making the subject more interesting and therefore improving their performance.

1.4 Objectives of the study.

The following were the two specific objectives of the study:

1. To determine the effect of instructional videos on performance in physics.
2. To find the motivational effect on the learners by incorporating videos on the subject.

General objectives were to determine the effect of instructional physics videos on:

1 Mathematical skills.

2. Theoretical concepts formation.

3. Process skills.

1.5 Research questions.

Half of Physics examinations questions are based on mathematical skills and the others are on theoretical concepts formation and process skills which include practical work. The study therefore focused on the following research questions:

1. Is there an improvement in performance between control and experimental groups in achievement test items based on process skills?
2. Is there an improvement in performance between control and experimental groups in achievement test items based on theoretical concept formation in physics?
3. Is there a difference in performance on achievement test items based on mathematical skills?
4. Is there a difference between control and experimental group in the learner's interest and motivation towards physics after the introduction of instructional videos?

1.6 Significance of Study.

It is hoped that this study's findings and recommendations will be of benefit to students who have declined studying physics and hence missing a chance to join a field of their choice in this fast changing industrial world. The examinations council, quality assurance officers teachers and parents have all decried the poor performance in physics. They would all benefit from this mode of instruction in that the performance will be comparable with the other subjects and thus create a balanced number of students enrolling in all the science subjects. Teachers in schools with inadequate resources, which hold the bulk of the students in our country, will be able to teach more effectively topics that were abstract for lack apparatus.

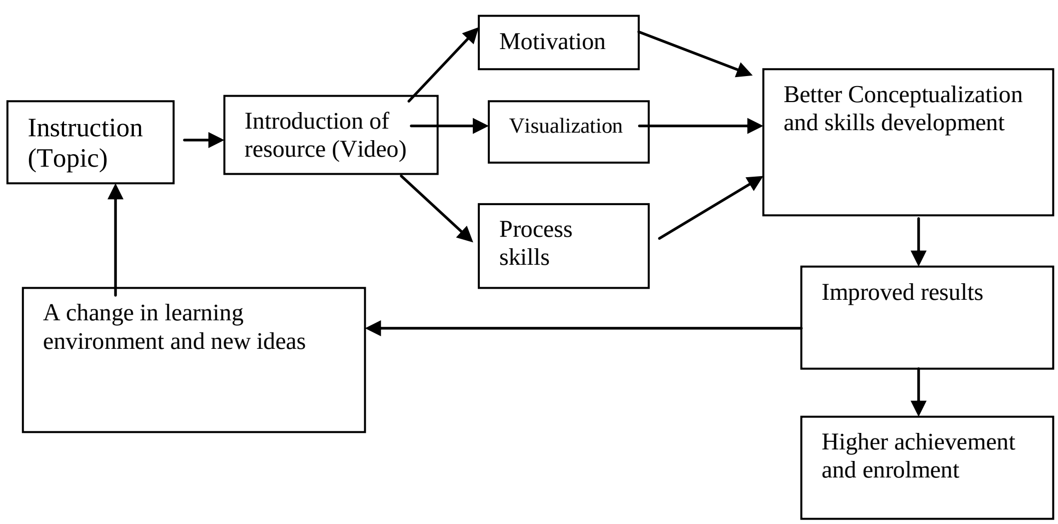
Teacher trainers in colleges and universities can show teaching skills by recording videos of their best teachers in addition to the lectures in areas where equipment are not available. Field work or demonstrations can also be recorded for future use instead of always repeating the same work to be used by students at their own time.

1.7 Conceptual Framework

In developing a conceptual framework for this study the teacher's role in selecting what the learner should watch and what to look for in the physics videos was given exceptional attention because not all the videos were relevant to the Kenyan syllabus. Bassey,(1963) observed that people are not simply reactors to external influences; they select, organize and transform the stimuli that impinge upon them. Sense of sight is the strongest of all in creating a more accurate cognitive representation to reproduce the observed behavior in real life(Carroll and Bandura,1985) and this is why the researcher choose video as a resource that required an in depth study.

The teacher would play an important role in bringing about a change in performance and enrolment, which has ever so remained an issue of concern to the ministry of education. This clearly shows reciprocal determinism as no improvement in the subject's performance is being registered unless the subject is fully overhauled. The teacher's role was to use the physics videos as a new resource that would reshape the learners environment hence alter the student-environment interaction for a different outcome and this is what the study sought to establish. Reciprocal determinism advocated by Bandura, best explains the persistent situation in physic's poor performance in that the learner is influenced by the environment but the learner also chooses and shapes the environment which in turn shapes the person who in return shapes the environment. The relationship between control and choice is a reciprocal, or a "back and forth" one. By introducing physics videos, we use observational learning (acquiring a new behaviour, or learning, by watching someone else) to change or reshape the existing environmental influence, which in turn will influence the learner. This would alter the joint function of behavioral, cognitive and the environment that determines what is learnt.

Fig. 1.1 Conceptual model for the study.



1.8 Assumptions of the Study.

The following assumptions were made about the study:

a) That no other factors, such as transfer of teachers, other than the introduction of physics videos would influence the outcome of the research findings.

b) That the learners did not have prior access to the instructional videos.

c) Any changes in video technology would be geared towards improving it while keeping the prices affordable.

1.9 Delimitations and limitations of the study.

1. The research was carried out only in two district schools that were sampled out in Githunguri division because it was realized that provincial schools were well equipped and videos would not be necessary to supplement for actual practical work.. They may therefore not reflect the true situation in other regions.
2. The sample size of the study was limited to one experimental and one control group due to constraint of time and expenses in the research work.
3. There was lack of adequate training of teachers in handling of ICT resources and it was hoped that the teachers support material guides would be sufficient in preparing the teachers on how to use the videos while teaching.

1.10 Definition of terms.

1. **Internet-** A worldwide publicly accessible network of interconnected computer networks that transmit data by packet switching connections.
2. **Resource** – An instructional device that is intended to enhance learning
3. **District schools –** Schools with minimal learning resources and mainly established in the rural areas.
4. **Video –** Several storage formats of moving pictures such as digital video formats including DVD, VCD and MPEG-4 or analog video tapes including VHS and Betamax.
5. **World Wide Web (www)** – A collection of interconnected documents and other resources such as videos linked by hyperlinks and accessible via the internet.

1.11 Summary

The chapter has given an elaborate introduction to the problem under study and reasons behind the researcher's choice of this topic. It has also given the objectives, research questions, significance of the study and the conceptual framework with the later parts of the chapter highlighting limitations and assumptions that the researcher took in carrying out the study. The following chapter is a literature review of key previous work done in areas related to this study.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

This chapter is concerned with the review of the literature related to use of video as an instructional medium. However, it is a resource that is relatively new and therefore most of the literature available is based on foreign countries and video use in other subject areas.

Physics curriculum review and other efforts have not yielded much success in improving the subject's image to the students and this chapter addresses the missing link using the conceptual framework covered in the previous chapter.

For this particular study, the emphasis is on the literature of some of the researches done in science education and teaching methods which have an inclination that is similar to the idea of finding the effect of using videos. This includes government's initiative on use of ICT resources, introduction of different learning theories, effect of practical work, various teaching methodologies and motivation of learners.

2.1 Review of recent developments in physics curriculum

The changes in Kenyan physics curricula are initiated by the demands of the society and innovative changes that have occurred elsewhere in the world particularly Europe and the United States of America. Maundu et al, (1998) observed that the initial one was brought about by the physical science study committee (PSSC) project in 1956 and the Nuffield science teaching project of

1960. The Soviet Union exploded the first hydrogen bomb in 1949 that was considered more dangerous that the atomic bomb and then launched the first rocket (The Sputnik) into the space in 1957. This brought about the review and changes in curriculum. Maundu et al, (1998) also describe the west to have been complacent with their curriculum before these two wake up calls.

The west had a course that was rather abstract and lacked relevance to the daily life of the students (Bassey, 1963) and thus teachers and students found a lot of content rather difficult and unappealing. He points out that content was presented by an authoritarian teacher to students who learned mainly through rote memorization and regurgitated the facts back during examinations. Needless to say, a similar situation existed in our country for being a colony of the western European country-U.K. To have a change for instance, the science teachers through the Science Masters Association in the UK pioneered efforts in this regard.

Between 1960 and 1964, many new curricula in the various science subjects were developed particularly for the secondary level. Among the most known in the USA were the materials for the physical science study committee (PSSC), the School Mathematics Study Group (SMSG), while the Nuffield Foundation Project in Mathematics, Physics, Biology and Chemistry were in the U.K. Killian and Byron (1965) in his preface to the 1st edition of Physics course book stated that the Physical Science study committee (PSSC) project team was working to develop an improved Physics course that would involve developing concepts through exploration in the laboratory, analysis of textbook materials and study of films. Today these films are available in form of VCDs and DVDs. The aim of their production was in reaction to fact that Physics was not motivating to the learners.

There was emphasis to shift away from didactic classroom presentation of Physics as a stable body of knowledge to Physics as a system of dynamic inquiry in which the learner is actively involved.

In almost all the new science curricula of the 1960s a major objective was to help students acquire the process skills of science such as observing, hypothesizing, measuring, experimenting analyzing and interpreting data controlling and manipulating variables, correct handling and use of scientific apparatus and making inferences, finally making a conclusion.

During this period many African countries were just gaining independence from western European colonial masters and had inherited the educational systems of these countries. The wave of physics curricula reforms in the west was therefore felt in Kenya with technical and financial assistance from UNESCO and other organizations overseas. This saw the establishment of Kenya Science Teachers` College (KSTC) in 1968 with grants from the Swedish Government to cater for the shortage of science teachers with Physics being the hardest science subject hit. Leading science educators in collaboration with the associations of science teachers elsewhere in Africa embarked on science curriculum reforms that were in line with developments in the west. Such efforts produced curricula incorporating contemporary approaches, methods and material for science teaching and subsequently a massive training of science teachers in Kenya. In effect, the Nuffield project initiative to teaching and learning that had been piloted in some schools in 1969 was replaced by the school science project (SSP) in 1973 though the later was modeled on the Nuffield Science method to fit the Kenyan situations. The SSP faced the same problems as the Nuffield project as it placed a great demand on the initiative powers of the students and the need to continuously provide hands-on approach (Amadalo, 1998). The textbooks available to students were manuals that require the learner to actually do the practical work and so they could not be read as revision books. As such, the teacher and students resorted to using the textbooks that were not prepared for the project. The project was abandoned for insufficient hands-on apparatus, inadequate qualified teachers, classes being too large and the education system being examination oriented. The teaching of physics went back to the “traditional” approach that emphasized theory and expository method as stated by Eshiwani (1982). To date, this has not changed and provision of learning resources particularly for physics has always been inadequate. The use of videos then could possibly be a bridge to a better understanding of seeing what the students are taught theoretically.

Though the 8-4-4 Physics curriculum puts emphasis on science process and science context its success rate is low, characterized by poor performance at national level and low enrolment. Njuguna (1999) attributes this to overloading of the curriculum and high status placed on passing the examination. The teachers have devised a methodology of teaching that can indicate a high grade by focusing on a small number of bright students. This reduces the cognitive demand on academic work, observes Koballa et al, (1988).

These unprofessional strategies have subsequent problems on the learner experiencing difficulties in understanding the basic physics concepts resulting to the poor performance by majority of the students and consequently low enrolment.

2.2 Aims of the Physics Curriculum

Aims of Secondary science were summarized by Bassey, (1963) as follows:

1. To provide an understanding of the simple aspects of nature of material world.

1. To make the learner appreciate major achievement of science and its significance in the world.
2. To give the learner and ability to approach problems in a scientific manner.

The recently reviewed curriculum incorporates these aims (KIE 2006). Some of the general objectives for physics related to the study state that by the end of the course the learner should be able to:

i. Select and use appropriate instruments to carry out measurements in the physical environment.

ii. Use the knowledge acquired to discover and explain the order of physical environment.

iii. Apply the principles of physics and acquired skills to construct appropriate scientific devices from available resources.

iv. Develop capacity for critical thinking in solving problems in any situation.

v. Contribute to the technological and industrial development of the nation.

vi. Acquire positive attitude towards physics

The success rate of the Physics curriculum is low as indicated by the poor performance and low enrollment and therefore the objectives set above are not being achieved because among other factors, the teaching in Kenya emphasizes on passing the examinations (KIE, 1999) so that the learner may secure a place in institutions of higher learning. The case is the same in other African countries such as Malawi and Zimbabwe as studied by Mawande (Koballa et al, 1988) where the science education stressed on learning outcomes to do with just the lower levels of Blooms taxonomy of cognitive domain.

In a KNEC (2002) report, it was stated that as regards the sciences poor performance, the syllabus coverage was poor with the teacher either skimming over some of the topics or ignoring some altogether. For the teachers who were reviewed as exemplary by producing good results, they tended to put greater emphasis on completing the work on time and embarking of revision of past examination papers rather than on students understanding the concepts. This strategy said Koballa, tended to reduce cognitive demand on academic work. By use of a video to show a demonstration, better concept formation would possibly be achieved and less time spent explaining it and this is the main gap that the outcome of this research sought to fill.

2.3 Approaches and methods of teaching sciences.

The selection of a suitable method is based on the objectives of the lesson, needs of the learner and the nature of the content. The common methods used in teaching of sciences are lecturer method, demonstrations project method, problem solving, practical laboratory and discovery method.

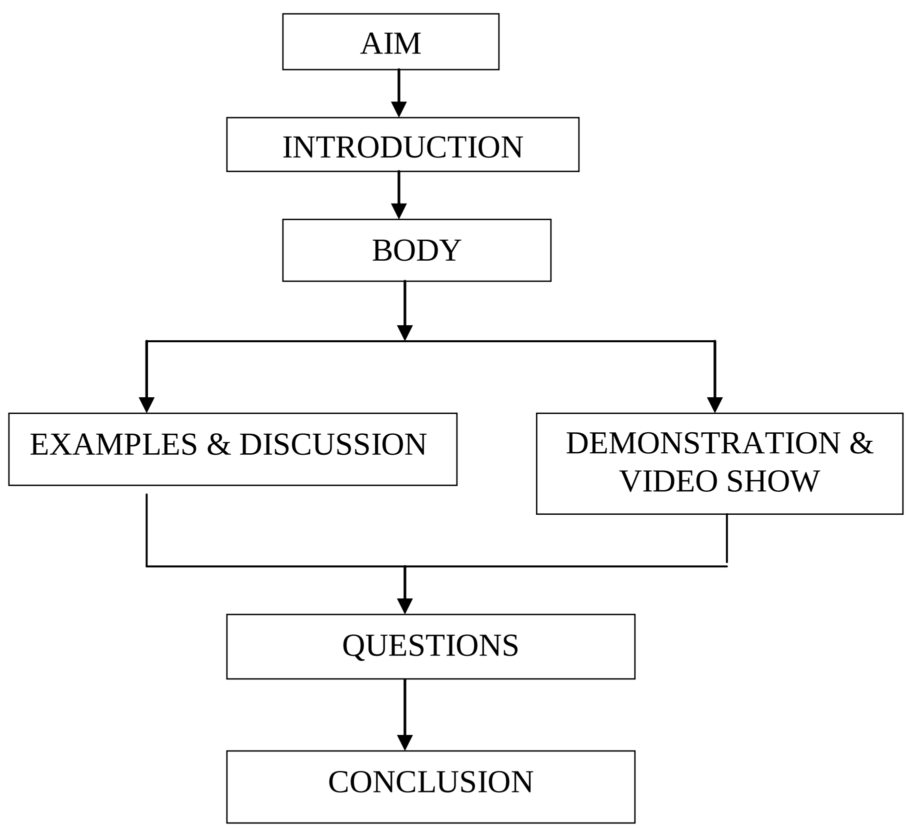
A teaching approach may be defined as a combination of ways that a science teacher uses when presenting the content of a lesson. There are two major approaches, namely expository and heuristic approach. The expository approach involves the kind of teaching which is characterized by predominance of teacher talk with little or no student participation. It is an approach that is teacher-centered with the teacher giving facts and anything that requires a practical approach is done through teacher demonstration. Although this approach is not effective in teaching of sciences some topics are by their nature difficult to teach by heuristic approach.

Heuristic approach employs methods where students discover the facts by themselves. Heuristic is derived from the Greek word HEURISKIN meaning discovery. This method was advocated by instructors who felt that by placing the student in the position of a discoverer he would learn much more than being merely told about things, (Bruner, 1996). It is based o the principle of learning by doing where the student is expected to conduct activities such as experiments, take observations, record and make conclusions. The learner has the opportunity to develop skills such as the manual dexterity of 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 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 and measurements, manipulate variables, interpret results, and evaluate evidence. In this study, physics videos will provide a link between expository and heuristic approach in that the learner observes and discovers by himself how to go about finding his way along the path of those who first discovered the facts, principles and laws which are now known to all. They would therefore suit any of the methods discussed below as an additional teaching resource.

Lecture method.

This is the normal chalk and talk method. It is the most common and least effective method. In science, formal lecturing is used largely to build up basic theoretical knowledge, which must be gained before practice of skills. Audio-visual aids such as videos can provide useful supplementary information. A well planned lecture can slot in a video clip to highlight and improve the instructional value of the lesson.

Fig. 2.1. A Schematic illustration of position of video in organizing a lecture method lesson.



Demonstration method

This is a technique designed to show or illustrate a procedure, process or phenomenon. It is very effective in arousing interest, curiosity and introducing a lesson in a dramatic and stimulating way. Demonstrations can also be used to teach students how to operate science equipments as well as procedures in making accurate readings. For instance, the operation of a microscope, vernier calipers or micrometer screw gauge is best taught when a demonstration is included in a lesson. There are various websites which have demonstration videos and this study will seek to address the effectiveness of such clips. The applications of a concept in daily life can be well understood if demonstrated. For example, magnetic effect of an electric current. Some problems are best solved when a demonstration is presented to student which also provides room for the teacher to be creative. In cases where apparatus are costly, sensitive or dangerous for pupils to handle, the teacher may be required to demonstrate the working of such apparatus to the students.

Its purpose must be relevant to the lessons objectives simple as possible and visible to all the learners. In a bid to shift from the teacher-centered lessons, some demonstrations can be carried out by a student with the teacher's guidance while the others observe.

Experimental Method

The need to develop learning skills saw the lecture and demonstration methods inadequate. This saw the introduction of science laboratory as a unique way of instruction which helps the student understand complex abstract ideas and gives students the opportunity to participate in and have an appreciation for the methods of science. It involves students in hands-on activities that help them participate in scientific investigations and to verify for themselves scientific concepts, principles and laws.

Project method

The project method entails planning for activities that usually involve a task or problem calling for constructive thought action or both on the part of the student. It is a bit of real life that has been imparted into school and offers an approach of education which is consistent with the psychological principles of “learning by doing” and “learning by living”.

The project method is an ideal way of promoting creativity and the spirit of enquiry in students. The steps to be followed include: providing a problem, purposing, planning, executing, evaluating and recording as a project report. In the process of carrying out a project, the student learns through association, activity and teamwork.

They go through the basic steps of the scientific method which combines the following skills: observation, identification of the problem, discussion, formulation of hypothesis, design of the investigation, data gathering, data analysis, making deductions, report writing and presentation. This is a method that promotes creativity, critical thinking and the students can work at their own pace, it enhances social interaction and co-operation among the learners and the teacher. Woolnough, (1985) suggests that if we want students to acquire skills that are used by practicing scientists, and if were concerned with the teaching of the process skills of science, then practical work seems to be vital in this context. But district schools have few resources which has contributed to poor performance and low enrollment in sciences particularly physics. In deed biology registers highest enrollment as the basic materials are readily available. With physics videos then, it is hoped that they will bridge the gap of inadequate equipments in this area.

2.4 ICT in education in Kenya

A report from World Bank by Glen Farrell (2007) provided an overview of the progress made in Kenya from the ministry of education. To promote e-learning resources, the ministry established the Kenya education sector support program (KESSP) that featured ICT as one of the priority areas with the aim of streamlining its teaching and learning process under the following key objectives:

1. Integrate e-learning in private and public institutions with other existing resources.
2. Develop a portal for ICT information sharing by the stakeholders.
3. Promote distance learning and virtual institutions particularly in higher learning.
4. Establish a national ICT centre of excellence that will provide affordable infrastructure to facilitate dissemination of knowledge and skills through ICT platforms.
5. Establish a national computer assembly centre.
6. Promote the development and production of e- learning materials.

As regards teaching physics using videos, the KIE has no current videos that go hand in hand with the existing curriculum indicating the gap that the researcher intends to fill. But with establishment of affordable and available internet facilities even in the rural areas, any interested teacher does not require to rely on KIE for the provision of physics videos as long as they prove to be a resource that can improve performance in the subject.

2.5 Unique Characteristics of Video as an instructional medium

Copeland,(1981) compares educational technologist's approaches to the relationship between communications engineering and the process of human learning. Much teaching takes place through effectiveness of any teaching and learning process if the learner is encouraged to respond his degree of understanding by giving feedback. In assessing the properties of educational media in terms of this expository/inquisitional continuum, it is seen that all permanent materials such as textbooks and charts can be supplemented with video which is transient and expository as well. Copeland further postulated that the most efficient medium is that which contributes to most of the human senses simultaneously thus giving video an edge over printed text.

2.6 ICT integration in teaching and learning of physics

Technology has been a party of schooling for many decades but until recently the technologies being used were rather simple and changed slowly. When the field of physics developed the area of electronics, cheaper gadgets have been manufactured and their production, demand and uses has dramatically increased. To underscore this, in 1983 there were just about 50,000 computers in American schools (Stantrock,2004).Ten years later there were more than 6 millions, today all their schools have computers and the outdated ones are being donated to third world countries such as Kenya. With the introduction of cheap modems and competing internet service providers (ISP), a teacher in the rural areas can easily access the internet and specifically for this study there are various websites that have physics videos and physics animations that can be downloaded to suit any topic within the

Kenyan curriculum. Besides, video cameras and DVD players were previously having a prohibitive price but now, any school that wishes to invest in these hardware can do so as their prices has really gone down. Unlike other science subjects physics has many demonstrations that can be recorded and considering that the basic scientific principles do not change any recorded videos can be used without getting outdated. For instance a recording to show X-ray machine operations can be used as long as the topic remains in the syllabus.

The internet is the core of computer mediated communication. In many cases it has more current up-to-date information than the physics text books. This would therefore be of great use to the teachers in keeping abreast with immerging issues in the subject so as to be at par with the rest of the world.

Howell and Dunnivant,(2002) argued that only when schools have technologically trained teachers and current workable technologies will the technology revolution have an opportunity to truly transform classrooms. In light of this the subject teachers that closely relates to this field in our district schools is the physics teachers. In deed when computer studies as a subject was introduced many physics teachers took the advantage of studying courses that would enable them teach the new subject as there was a serious shortage of computer studies teachers back in 1994.

2.7 Basic Process Skills to be assessed.

For the purposes of this research, a review of process skills is essential as they are key to the teaching of sciences and physics in particular. According to Johnson and Christiensen (2000) while teaching the sciences process skills should access the following:

1. **Observing**

   There would be points to look for in the video as guided by the teacher. However in process skills, observing involves using one or more of the senses to gather information about objects and/or events. When making observations, the students are expected to compare and contrast what they observe with something else, look for similarities and differences.

2. **Classifying**

   Classification begins with observing similarities and differences among objects and/or events in order to categorize them according to a predetermined set of properties or schemes.

3. **Measuring**

   This involves using quantitative observation on standardized measuring tools or non standardized objects.

4. **Communicating**

   This is giving or exchanging information. It also involves using words and/or graphic symbols to describe an action, an object, or an even orally or in writing.

5. **Inferring**

   This is the learner making an attempt to explain what they observe; whatever they think after observing. An inference is any one possible explaining for what is observed when one infers he draws conclusions based on information or knowledge of cause and effect or knowledge of cause and effect or on past experience. From these experiences, one recognizes patterns and expects the patterns to recur under the same conditions.

6. Predicting

The learner is expected to state the expected outcome of a future event based on a pattern of evidence. Predictions are based on prior knowledge gained through experiences or data collected. The learner would give an inference of an expected future event. This would be based on patterns or general trends in the information collected.

2.7 Motivation to learning Science

Motivation involves the processes that energize, direct and sustain behaviour. When few students opt for Physics in Form Three and Four in favour of the other sciences, then there is lack of motivation. The interest in the subject is not sustained. Twoli, et al, (2007) gives the role of audio visual aids as materials that teachers use to assist learning and increase learner's interest.

The behavioural perspective of motivation emphasizes external rewards or incentives. It's also referred to extrinsic motivation. A teacher uses percentage scores or grades which provide feedback about the students performance and if grades are consistently low in Physics, then the learners get less motivated leading

to low enrolment. Intrinsic motivation or the cognitive perspective on motivation considers that students' thoughts guide their motivation and their beliefs, that they can control their environment. So in contrast, whereas the behaviourist perspective sees the students' motivation as a consequence of external incentives, the cognitive perspective recommends that students should be given more opportunities and responsibility for controlling their own achievement outcomes, (Stantrock,2004). Intrinsic motivation involves the internal drive to do something for its own sake (an end in itself). In this case the students will be motivated in Physics because they enjoy the content of the course in the videos that they can also watch at their own time.

In secondary schools, students shift from intrinsic to extrinsic motivation because of the grading practices and ranking. That is, as students get to higher classes, they look into the increasing emphasis on their mean grade and the internal (intrinsic) motivation drops, (Harter,1999). There is also less communication between adolescents and the teachers and this can easily harm the motivation of students in the science subject that they are not performing well.

Though table I.I shows that the mean grades for Physics compare favorably with the other sciences, the schools have a tendency of choosing the bright students for Physics and the subject is mainly offered in provincial and national schools, (KNEC report, 2005).

2.8 Summary.

This chapter has explored the various aspects that have dealt with use of video as an instructional medium based on the conceptual framework adopted in the previous chapter. It has highlighted the past research work done on advantages of video over live broadcasts on television, enhancing concept formation by use of the sense of sight and then went on to expand on the basic process skills to be assessed in the study. All the research done was outside Kenya. The chapter also includes physics curriculum aims which have recently been released to cater for emerging issues and technological advancements. These are not well achieved and it is the purpose of this study to explore the effect of video use in the teaching and learning of physics with the hope of enhancing some of these aims. The section on motivation gap between enrollment in physics as compared to the other sciences has been created by poor general performance in schools, thus lowering the students extrinsic motivation. To reduce this difference in intrinsic motivation, use of physics instructional videos could be one way. The next chapter gives details of the methodology that will be used in carrying out the research.

CHAPTER THREE

METHODOLOGY

3.0 Introduction

This chapter deals with the description of the research methodology to be used. It includes the design of the study, variables to be considered in the research, locale and target population. The sample and sampling technique used is also described and the chapter ends with an elaborate description of research instruments used for the data collection, piloting and mode of analysis of the data.

3.1 Research Design of the study

A pseudo-experimental design was used in this research and figure 3.1 shows the symbolic design of experimental part of the work. This best satisfied the study because the effect of using videos was considered to be the main factor affecting the outcome of the results once the other variables are controlled. This was done by sampling schools that are within the same locality and students with comparable ability and background. Figure 3.2 shows the process that was followed where the experimental group used physics videos incorporated in their lessons as the mode of treatment. Since the control group was chosen from separately sampled schools, the teaching in these schools for the same topics was done without showing videos. However as an ethical matter, the videos were provided to the students after the research.

Figure 3.1 Symbolic Design of the Research

R	0_1	X	0_3	Experimental Group
R	0_2	⊗	0_4	Control Group

0_1 and 0_2 are the pre-test observations in the experimental and control groups respectively.

0_3 and 0_4 are the post-test observations in experimental and control groups respectively.

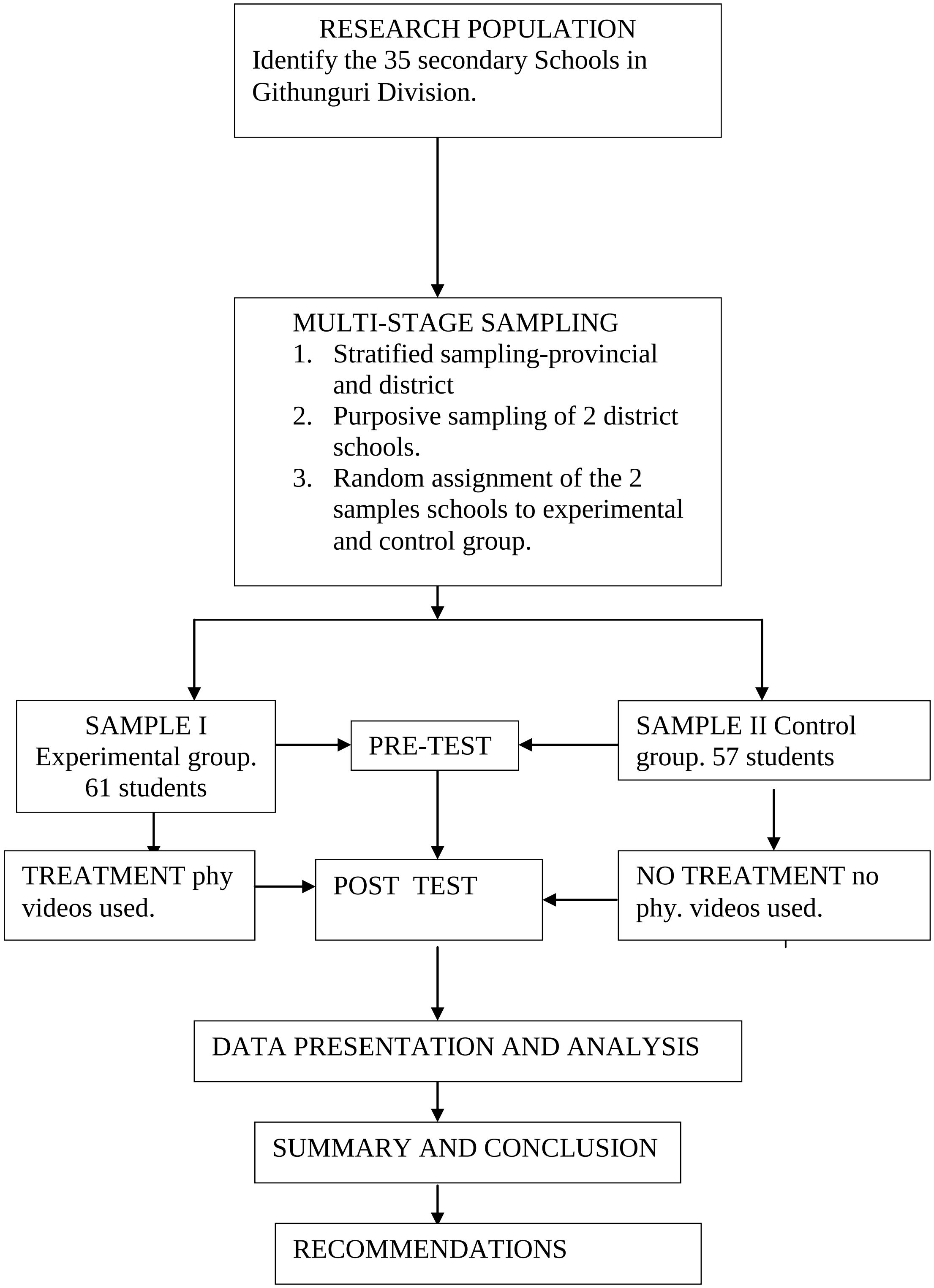
X indicates treatment and ⊗ No treatment..

Both pre-tests and post–tests are the same in control and experimental groups.

In both experimental and control groups, the usual conventional methods of teaching were used to teach the first topic on moments. Tests and observations according to the observation schedule were made; this was O_1 and O_2 respectively. Then after teaching the second topic on Hooke's law, a video on the same was shown to the experimental group but a general video unrelated to physics and chosen by the physics teacher was shown to the control group. For ethical reasons the teacher was provided with the physics videos but to show them to the students at a later time after the research. This was to ensure that any difference that could arise in the outcome of the results is only due to the content of the video. Tests and observations were made and this was indicated as O_3 and O_4 respectively.

This research targeted district schools and this was reached by initially listing all the secondary schools in the division then stratifying them into provincial and district schools categories. The next sampling stage was selecting randomly, two schools from the district schools category of which one served as the experimental and the other as the control group. Randomly assigning the schools as experimental or control group was done by teachers from the two selected schools to minimize any biasness.

Figure. 3.2. Design and the Process of the Study



3.2. Variables

A number of variables were used in this study. They included dependent and independent variables.

3.2.1 Dependent variables:

In any research, the variable that is measured as an indicator of the outcome of an experiment is the dependent one (Hayes, 1986). In this study the major change is on performance indicated by use of pre and post tests. The students in the experimental and control groups sat for the same tests and their performance determined. The performance, therefore, becomes the dependent variable. In addition learner's attitude towards instructional videos was determined using an observation schedule. Motivation in general was considered as a dependent variable as well.

3.2.2 Independent Variables:

These are the variables that the researcher manipulates to affect the dependent variable. They do not depend on the changes taking place in either of the two groups. They include teachers' characteristics, social economic status of parents, students' entry behaviour resources and time allocated for the Physics lessons. In this study, the main resource which is the video was an independent variable.

3.3 Description of locale

This research was done in Githunguri division, Kiambu East district. One division was chosen so as to allow minimal regression differences in all the factors that determine performance in the control and the experimental groups. There are 29 schools in this division out of which two were selected for the study. Table 3.1 gives the population distribution used in the study.

Table 3.1 Schools and Students forming the study sample.

School	Type	No of Form 2 Students	Audio Visual Aids	AVG. KCPE Marks Form II Students	No of Physics Teachers
J.G. Kiereini Sec School	District Boys Boarding	1 3 2	TV and VCD Player	3 0 7	3
Komothai Boys' Sec School	District Boys' School	1 5 4	TV,VCR and VCD Player	3 0 4	3

3.4 Description of target population

The population from which the sample was obtained was within the areas selected on the basis of the subject area, study design and the special resources to be used. Out of all the 35 secondary school in the district, not all of them were found to be offering physics in the district especially the upcoming ones. It is at Form two level that all the students take physics and therefore this gave a better sample. Further the topics in form two have videos that are readily available. Teachers for these classes in all the schools under the study were professionally trained and no other major factor was expected to affect the out come of the results for this population.

3.5 Sampling Technique

All the schools in the division were the first considered then stratified into provincial, and district schools. This was done by purposive selection of schools with students who had the same background and the same entry behaviour.

The second sampling stage was to select the experimental and control class by inviting the physics teachers in the two purposefully selected schools to randomly choose their classes to be used either as experiment or the control group. The teachers were then briefed on keeping the research confidential to the students to avoid any other factors influencing the outcome of the design. Further, they were trained on how to incorporate use of videos in their teaching and following the support materials accompanying the videos.

3.6 Research instruments.

Three research instruments used in the study are shown in the appendices. An observation schedule (Appendix D) for the first research question and achievement test items in the pre-test and post-test (Appendix B). These test items were selected such that they could be analyzed to answer the research questions stated . To have a standardized marking a common marking scheme was prepared, shown in Appendix C. Then a brief interview was also carried out to establish the methods used in teaching the subject and size of the classes that responded to the research.

3.7. Procedure.

Conventional teaching methods were used in teaching two different topics but related in concepts. These topics were Hooke's law and Turning effect of a force (Moments). For the experimental group, there was an instructional video on Hooke's law, this being the treatment but for the control group, the video shown was not related to any of the two topics. An observation schedule was filled in to establish the motivational effect of the videos and achievement tests were done after teaching each of the two topics to both groups giving a set of four results tables to be analyzed.

3.8 Pilot Study

Two district schools other than the ones to be used in the actual data collection were used for piloting. The main objective of piloting was to establish the time needed in answering the test items, adjustments in lesson plans to see the type of responses given by the students, to clarify or remove any ambiguity and to check the validity of the instruments. One school was the experimental class where videos were used while the other was the control class. In choosing the schools for the pilot study their nature was similar to the ones used for research in terms of performance, population and facilities.

The researcher and the physics teachers administered the pre-test and post test instruments after teaching of the two chosen topics to be used in the research, removed any items that were ambiguous and added information that made them more clear. These clarifications and adjustments were then incorporated in the final instruments.

3.9 Reliability and Validity of instruments.

To produce consistent and dependable scores, split half reliability was done by dividing the scores on the achievement test items into two. The first 10 items are on topic 1 (Moment) and the last 10 items are on topic 2 (Hooke's Law). The scores on the two sets of items are compared to determine how consistently the students performed across each set. The reliability index was r=0.67rendering the tests acceptable (where r is the correlation coefficient of the two sets for each group).

For content validity two topics selected are closely related in subject matter. The results obtained after the test was then compared to establish whether there was any consistency in performance. The co-relation of the two tests measured validity of video effect in teaching subject. Experienced teachers also went through the test items to ensure that the content of the topics was well covered.

For each test item, difficulty index was calculated from:

$$\text{Difficulty index} = \frac{u+L}{N}$$

u = Upper score

L= Lower score

N = No of test items (In this case 20)

This was be used after the pilot study in identifying the question that required to be replaced.

3.10 Data Analysis

The data collected for establishment of video effect on performance was analyzed in two ways:

i) Using Pearson product moments correlation.

Experiment group		**Control group**	
School 1 O_1 x O_2	r = ________	$O_1 – O_2$	r = __________
School 2 O_3 x O_4	r = ________	$O_3 – O_4$	r = ___________

High values of r obtained in the experimental group would be an indication that the use of video for instruction has no effect; if the correlation coefficient is low, then there is an effect in use of videos.

ii) *t*- Tests were performed on the means for experimental and control groups scores. Formula used in working out the t-ratios is given as.

$$t = \frac{D_{\overline{X}_2 - \overline{X}_1}}{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}}$$

The achievement tests items were set such all the questions outlined for the research were covered.

3.11 Rationale for choice of topics.

The topics chosen were 'Turning effect of a force' and 'Hooke's law'. The two topics are closely related in that they both contain the same basic concepts of force and distance and students require the same mathematical skills.

The key sub-topic in the test topic of turning effect of a force is the principle of moment; moment being a product of force and perpendicular distance. As regards the topic on Hooke's law it has a similar concept of spring constant- force per unit distance. On applications, Hooke's law is employed in construction of a spring balance while principle of moments is used in beam balances. According to Waititu, the difficulty index for both topics is equivalent at 5.4 and therefore an experimental design was found suitable for this research.

3.12Summary.

This chapter has given a detailed description of the methodology used in the research; the variables, research design, sampling of the target population, piloting, methods used in data analysis and how the reliability and validity of the instruments was established. The chapter also explained how the choice of topics taught was arrived at and formulas used in all the calculations. The next chapter analyses the results obtained, gives graphical representations and discussions for each result.

CHAPTER FOUR

DATA ANALYSIS, PRESENTATION AND DISCUSSION.

4.0 Introduction

This chapter gives a detailed analysis of the data collected for each research question and also an overall interpretation and discussion of the research findings. Given that the research design was pseudo experimental, quantitative statistics in the form of tables and graphs are used to represent the findings and graphically show the comparison between the control and experimental groups' pre-and post-test results. The chapter begins with an overview of the findings, then a thorough analysis of each research question's data with its subsequent interpretation and finally the concluding discussion.

4.1 Method of data analysis

The data was analyzed according to the objectives of the study using both descriptive and inferential statistical methods. From the pre and post test results quantitative analysis involved sorting the scores per student per group into marks scored in the questions related to mathematical skills, theoretical concepts formation and process skills questions. For each of these areas the researcher then worked out the means, standard deviation, standard error and the t- ratio from which it was then possible to interpret the data using established convectional tables. To find the motivation effect when videos are used in teaching physics, an observation schedule was used and the qualitative analysis involved making inferences from the questions of the respondents with the analysis presented in a tabular form.

4.2 Interpretation of the coefficients of correlation 'r'

Garrett, (1977) explains the interpretation of coefficient of correlation in terms of ranges. In order to determine whether an event occurred over and above chance, 'r' values are computed in order to determine the degree of closeness of a relation when association is known or is assumed to exist. Garrett further says that as regards mental measurements, the interpretation of 'r' with what is being measured, there is fairly good agreement among research in psychological and educational tests that the ranges in table4.1 can be applied as a general guide.

The significant of difference between the two 'r's in this research further compares the correlation of control group with the experimental group through the two set of tests. This was done by determining the standard error (S-E) of the difference between the two 'r' s. it required the first we convert the 'r's into square z functions, and then the difference between the two z's is determined.

Table 4.1 Coefficients of correlation ranges interpretation

' 'r' range	**Interpretation of relation**
-0.20 ---+0.20	Indifferent or negligible
- 0.40 --- +0.40	Low or present but negligible
- 0.70 --- +0.70	Substantial relationship
- 1.00 --- + 1.00	Very high relation

4.3 Groups overall performance

The teaching of physics and subsequent testing at secondary school level was based on the three areas under the study namely the mathematical questions, theoretical questions and practical questions which test process skills. However past examination papers show a bias towards mathematical questions in order to suit the set curriculum objectives. So in the researcher's tests, some of the answers from the mathematical questions were necessary in answering the related theoretical questions and therefore a general overview of the performance was found necessary. For instance, the calculated gradient of graph in Hooke's law was required in answering a theoretical question on whether the scientific law is obeyed or not.

Table 4.2 Computed coefficient of correlation between pre and post tests.

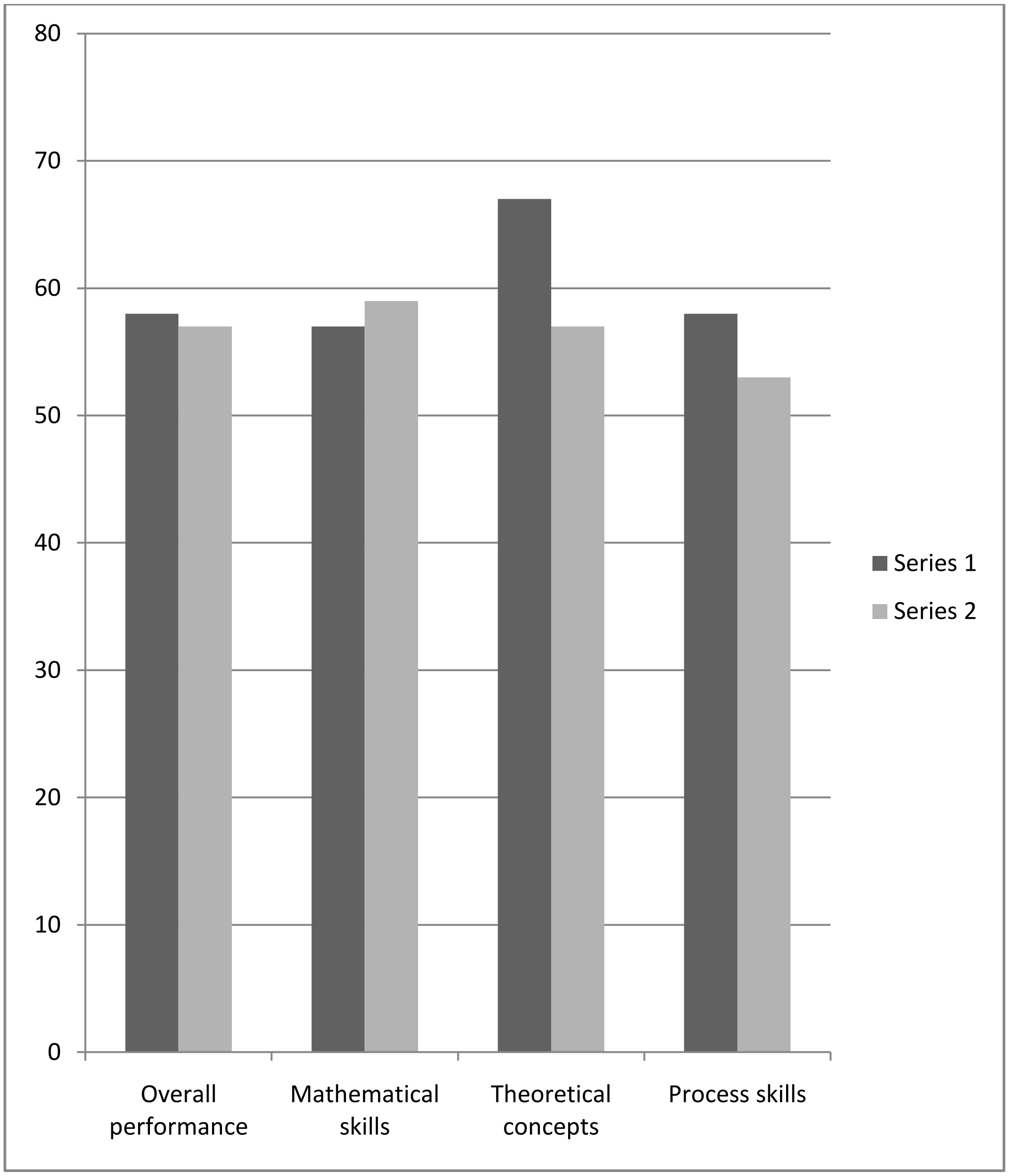
Group	Experimental	Control
Population	N1=61	N2= 57
Question area		
Overall	+0.263	+0.341
Mathematical skills	+0.656	+0.461
Theoretical concept formation	+0.237	-0.416
Process skills	+ 0.582	+ 0.449

Table 4.3 Overall mean percentage scores and standard deviations.

		Control Group	Experimental group
Mean	pre-test	58.327	61.008
	post -test	56.346	67.131
standard Deviations	pre-test	5.233	4.207
	post-test	6.558	5.392

This information is in Figure 4.1 and 4.2 as graphical representations of the mean scores placed one after the other for easier comparison.

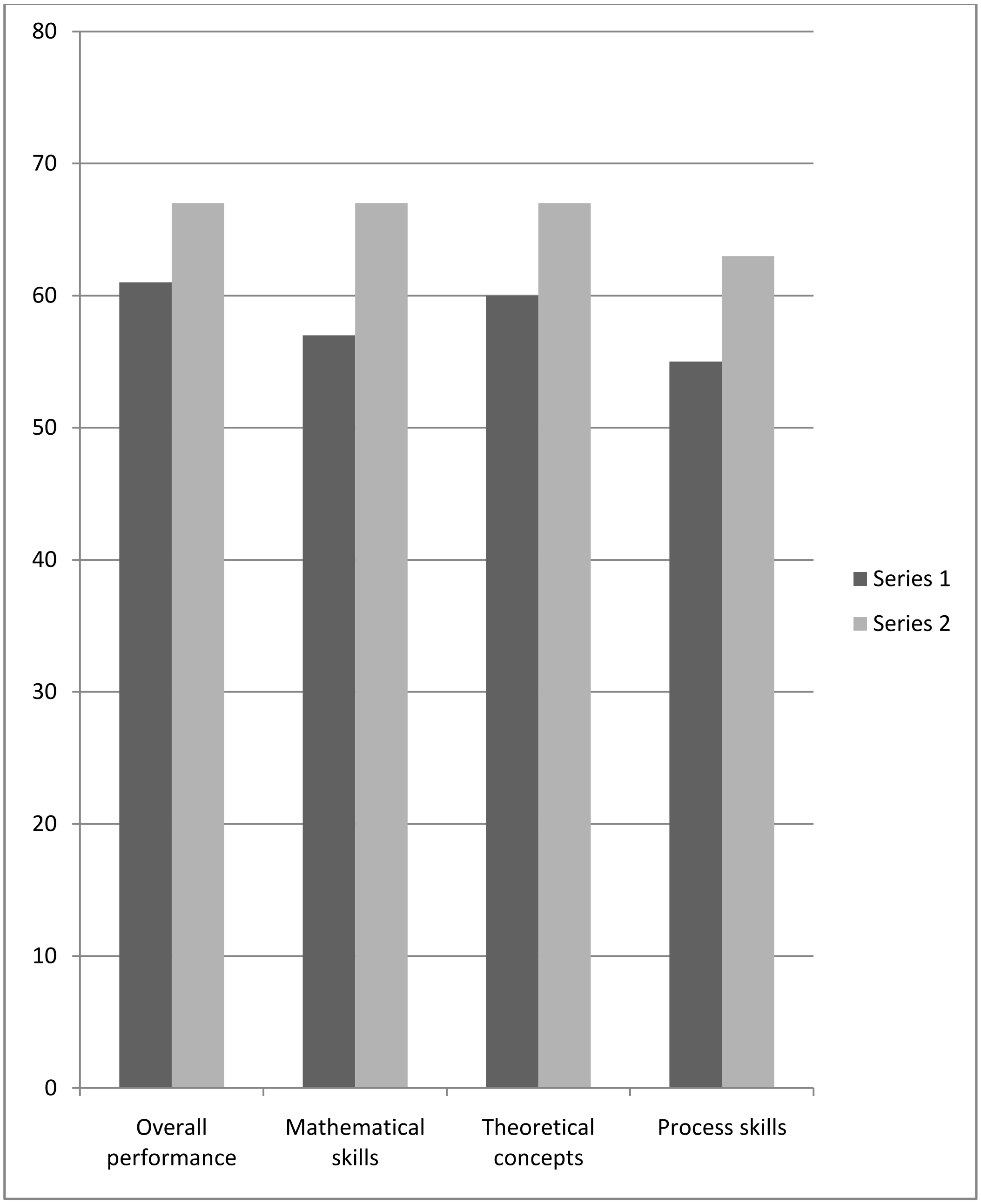
Figure 4.1 Percentage scores for control group



Key : Series 1- pre-test scores

: Series 2- post test scores

Figure 4.2 percentage scores for experimental group



Key : Series1- pre-test scores

: Series 2- post test scores

4.3.1 Control group overall performance analysis

The control group had an overall mean of 58.327% in the pre- test and dropped slightly to 56.346% in the post- test as indicated in table 4.3. This was consistent with past research findings in that the second topic is taught later in the year as students perceived it to be more difficult (SMASSE survey 1999).

The control group standard deviations for the pre and post tests were 5.233 and 6.558 respectively. This again showed that there was no significant difference meaning that the students who scored the low marks remained the same and those who scored the high marks in the pre-test also scored highly in the post- test. It also meant that the scores were evenly distributed about the mean in a similar way for both the pre and post tests.

4.3.2 Experimental groups overall performance analysis

The experimental group had an overall mean of 61.008% in the pre-test and 67.131% in the post- test. This was a significant difference at 0.05 level when compared to the control group where the mean remained almost the same. The standard deviations were 4.207 and 5.392 for pre-test and post-test respectively. This implies that the students' performance did not vary as much as in the control group though the distribution was more spread out in the post- test.

4.3.3 Comparison between the control and experimental groups overall performance

The control and experimental groups showed equal ability in the pre-test as they had a mean score of 58.327% and 61.008%, standard deviation of 5.233 and 4.207 respectively. This agreed with the past results in the school and also consistent with the KCSE results for the two schools shown in Appendix E. In the post-test there was a remarkable difference where the control group had a mean of 56.346%

and experimental group had 67.131%. The difference was mainly found in the process skills and theoretical concepts questions which are discussed further under section 4.5 and 4.6.

Table 4.4 shows further analysis in terms of t-technique, the control group had a t-ratio of 1.421 which is not significant at both 0.001 and 0.005 levels as the value is below 1.98. For the experimental group, the t- ratio was 2.264 which is significant at 0.01 level but not at 0.005 level. This shows that the difference in the performance is by chance because from established data results on social studies fields such as education, a change in performance is by chance if the t- ratio is below 1.98 for a sample not exceeding 100.

Table 4.4 Overall t-ratio and correlation for pre and post test results.

Group	N-population	Pre and post test t- ratio	Pearson's prod. Moment correlation on pre& post tests.'r'	Comments
Control group	52	1.421	0.341	Not significant at both 0.1and 0.05 levels
Experimental group	61	2.264	0.263	Significant at 0.001 only

It can therefore be inferred from the results that the treatment in the experimental group created an overall difference between the pre- and post test performance giving a t- ratio of 2.264. The Pearson's product moment correlation for the experimental group was r= 0.263 while that of control group was 0.341. The interpretation is that there was a low relationship in the performance for both control and experimental group. The students who had scored highly in the pre-test did not necessarily do the same in the post-test though this cannot be established by the overall scores alone and this necessitated further analysis on each of the question areas as explained in the following three section.

4.4 Descriptive and inferential statistics on mathematical skills.

Table 4.5 Mathematical skills question data analysis.

Group	Test	Mean	Std. Dev	Pre/post t ratio	Comment on performance
Control	pre	56.058	3.272	2.39	
	post	59.495	2.126		Slight improvement
Experimental	pre	56.987	2.129	1.709	
	post	66.495	2.710		High improvement

In testing the hypothesis on mathematical skills there were 5 and 4 broad questions in pre and post test items. Their scores were then equated to percentages for further r and t test analysis.

The control group scored 56.058% in the pre-test while the experimental group scored 56.987% in the same test which is a negligible difference. This again showed that the two groups had the same general mathematical skills at the beginning of the research. Upon administration of the post-test, the control group scored 59.495% which was a slightly higher score than that in the pre-test. The experimental group scored 66.495% which was also an improvement but the difference between the means for the two groups does not show any significance indicating that the improvement is not out of the treatment. The calculated standard deviation is close, showing that the students from both groups who scored highly remained the same in pre and post-tests. The only possible interpretation is that the mathematical skills tested were learnt in the mathematical lessons or elsewhere in the syllabus.

As regards the t-test the control group had ratio of 2.39 which is significant at 0.05 level. It means that 5 times in a sample 100 students, a divergence as large as that obtained may be expected under the null hypothesis. The sample for the experimental groups was slightly larger and the ratio was 1.709 which again is significant at both 0.01 and 0.05 levels. These results show that in control and experimental groups, the change in performance was not by chance but since the changes occurred in both groups the treatment as a possible cause is disqualified. From the above results the conclusion is that there is no significant difference between the control and experimental group in performance based on mathematical skills arising from videos in the teaching of physics at secondary level and therefore the null hypothesis is retained.

4.5 Descriptive and inferential statistics on theoretical concept formation.

Table 4.6 Theoretical concept formation questions data analysis.

group	N	test	mean	t-ratio	Std. Dev.	comments
control	52	Pre-test	67.949	0.991	1.600	dropped
		Post-test	56.250		2.250	
experimental	61	Pre-test	60.011	7.109	1.805	improved
		Post-test	66.530		2.177	

The difference between the means for the control and experimental groups indicated that there was a drop in the control group on questions based on theoretical concepts formation and a rise for the experimental group.

The standard deviations varied considerably. For the control group there was a change from 1.66 to 2.25 and the experimental group had 1.805 in the pre- test and 2.177 in the post-test. This is out of the treatment in the experimental group and secondly, the second topic has a higher level of difficulty. Arrangement in the schools' curriculum is such that the harder topics are taught later in the year and this explains the drop in the performance for the control group. The t-ratio for control group was 0.991 while that of the experimental group was 7.109. It is evident that this is significant at 0.05 level of confidence and it leads to the conclusion that the use of videos had a positive impact on the theoretical concept formation. It is also clear that the theoretical concepts are the easiest to the learners since this is where they scored highest as indicated by graphs 4.1 and 4.2. It agrees with the findings that recall questions are less challenging as compared to synthesis questions,(Bloom,1956).

4.6 Descriptive and inferential statistics on process skills.

Table 4.7 Process skills questions data analysis.

Group	N	Test	Mean	Std Dev.	t-ratio	comments
Control	52	pre	58.217	1.584	0.393	Slight drop
		post	52.224	2.058		
experimental	61	pre	54.545	1.975	4.749	Significant improvement
		post	64.480	2.138		

Questions set on process skills with information derived from the mathematical questions or theoretical questions proved more challenging as indicated by the results. The mean in the two groups was relatively lower than in the other areas with the lowest in all the given tests being for post-test control group at 52.224%. These results are in agreement that learners can not fully comprehend practical knowledge which is the basis of process skills without actually being involved in activities (Hofstain, 1991). There was a considerable standard deviation for the control group with the pre-test at 1.584 and post-test as 2.058 meaning that the performance spread out more in the post test.

For the experimental group there was a relatively higher improvement with the mean gain of about 10 (from 54.545% to 64.480%). Standard deviations were 1.975 and 2.138 for pre and post tests. The interpretation is that though the second topic was perceived to be more difficult, the learners in the experimental group performed better in the post-test than the pre- test. It can only therefore be attributed to the treatment of incorporating videos in the teaching of the second topic. The standard deviations are almost the same when rounded off; 2.0 and 2.1 for the pre and post-tests. So, the distribution of the learner's scores is basically the same in both tests. The t-ratio for the control group was 0.393 and 4.749 for the experimental group. This is significant at both levels of confidence for the experimental group but significant at 0.01 level only in the control group. The 0.05 means 5 out of 100 or 1 out of 20 students. The study groups were 52 and 61 so the effect of the videos would not have been acceptable if the groups were lower than 20 in numbers. For the experimental group, the students with high scores did not improve with a bigger margin as those with low scores. Improvement in physics should therefore target the low achievers and videos shows can greatly enhance their understanding as it is a visual aid. The experimental group improved more on process skills compared to the control group which included observing, inferring, classifying and measuring. Thus it can be concluded that there is a significant difference in performance between control and experimental group in achievement test based on process skills.

4.7 Findings on teaching methods and assessment techniques.

The physics teachers were asked about the methods they use to teach and assess their students within a period of one term. From an analysis of their responses, the outcome was as in table 4.8.

Table 4.8 Teaching methods sampled.

	Never		Sometimes		Often		Very often		Always		
Teaching method	No.	%	No.	%	No.	%	No.	%	No.	%	Total
Lecture	0	0	1	16	2	34	2	34	1	16	6
Demonstration	0	0	2	34	2	34	1	16	1	16	6
Project	0	0	3	50	1	16	1	16	1	16	6
Experiment	0	0	2	34	1	16	2	16	1	16	6
Total	0		8		6		6		4		24

4.7.1 Assessment techniques.

The teachers gave the following frequencies for the term's assessment techniques.

		Komothai Boys' (Control group)	J.G.Kiereni Boys' (Expl. Group)
1.	Exercises from class text books	2	1
2.	Supervised exercises done by students	1	2
3.	Extra lessons to weaker students	5	7
4.	Class discussions and presentation	2	2
5.	Assignment	2	3
6.	Practical questions	2	2

From the topics covered per term it was evident that the teachers used all the assessment techniques frequently outlined during the term. This is because the physics syllabus is set to cover three topics every term, meaning an average of two or three exercises and practicals at the end of every chapter. In particular the teachers gave exercises from the class text-books but hardly gave the minor demonstration and project work at the end of every topic.

4.7.2 Teaching methods.

For teaching to be effective, the most appropriate method needs to be used so as to produce at least an observable change in the student's performance at the end of each topic. The researcher asked the physics teachers in the sampled schools how often they use the different teaching methods based on the Likert scale.

Table 4.8 gives a summary of the teaching methods that they used and their frequency per term as required by the topics to be taught. The results indicated that generally most the teachers use lecture method (34%) though they employed all the four common science teaching methods. The reason teachers gave for commonly using the lecture method was that it is convenient due to the constrain of allocated time, inadequate apparatus and few text books per student. 16% of the same teachers often gave experiments to student while none of them gave project work.

4.8 Motivation of the students

Given the current situation in sampled schools, it was evident that the teachers were using the resources available to them adequately. Physics being an optional subject the emphasis was to buy equipment for the upper classes and this made teaching in lower classes more theoretical not withstanding the fact that the basic physics fundamental concepts are taught in Form one and two. As such, the teaching in these classes appeared rather boring to the students and the teachers were asked which methods they used to motivate the students. They were to indicate whether they always, often, sometimes or never attempt to motivate the learners. Their responses were as indicated in table 4.9.

Table 4.9 Teachers' response on motivational techniques used.

Motivational technique	Never		Sometimes		Often		Very often		Always		
No. of teachers and percentage	No.	%	No.	%	No.	%	No.	%	No.	%	Total
Using a teaching aid	2	33.3	2	33.3	0	0	0	0	2	33.3	6
Varying method of teaching	2	33.3	0	0	2	33'3	1	16	1	16	6
Giving frequent feedback	1	16	1	16	1	16	2	33.3	1	16	6
Offering incentives	2	33.3	2	33.3	1	16	1	16	0	0	6
Paying to individual attention	1	16	1	16	1	16	2	33.3	1	16	6
total	8		6		5		6		5		30

It can be infered from these results that most physics teachers (33.3 %) strongly agreed that using teaching aids enhanced student's performance by making the class more exciting and increasing student's participation. Only 3% offered incentives to students while 6% of the teachers under study hardly varied their teaching method in a bid to motivate (stimulus variation).

From observations that were carried out and the extracts from the classroom observation schedule, the following are some of the inferences that the researcher made.

a) Teachers in both experimental and control group were well prepared for the physics lessons in terms of notes, lesson planning and preparation. There was good class control in both cases. It was assumed that the same is true always and the fact that they were being observed did not influence them.

b) In terms of resources both control and experimental group schools had sufficient materials for the topics selected and the students carried out similar practical work before the pre and post tests. The school selected for control group had a VCD player and a TV which were used to show general videos to compensate the time that the experimental group was watching physics related videos.

c) Students watched videos with their physics teacher and in the first instance it was noted that they do it for leisure. The experimental group had to be asked to takes notes and consider it as a normal session of the lesson.

d) The experimental group paid more attention to the second topic with the expectation of watching the physics related videos. They were glued to the TV screen with interjections of “pause” to take notes of the captions summarizing the key points.

e) In both experimental and control groups the teacher introduced the lessons by lecture method.

f) On the experimental group, the students were in class early and arranged themselves randomly but could all see the screen clearly.

g) When the video was on, the teacher did not play any role in the control group but in the experimental group the teacher had to pause upon students request so as to answer questions or for them to put down some information on the screen, occasionally there was the need to rewind and have the student watch again a section of the video when a later section required to be related with a former one.

h) Before watching the video, the physics teacher had previewed it and informed students the key points to look for.

i) The students appeared disinterested with any additional information in the video that was not related to the physics content in the revised textbooks.

j) After the video, the students were interested in the gadgets used to show the video and even watching their own recording done as they watched the video.

k) The students were interested in watching other instructional digital physics videos.

4.9 Discussion from the observations.

These observations on the qualitative effect of the treatment were used to answer the first questions on learners' interest and motivation towards the subject. It is worth noting that the learner's readiness to handle equipment in an experiment was mainly determined by his familiarity to the items provided.

When the learners had a prior concept of the items by having viewed them in the video, they were more motivated which in turn resulted in better results from the experimental group. Past studies have shown that increase in Academic Learning Time (ALT) result to a significantly improved performance. The use of varied methods and materials in learning creates variety and stimulus variation and thus motivating. This was evident in the experimental group. Particularly learning where more of the senses are used gave the students a chance to ask questions and compare their work with what they saw on the video and thus helped the teacher in placing the learners in a position of a scientist. The learners were even more intrigued when they watched themselves viewing the video as a recording of the lesson was done. This showed that it would even be more exiting if they were viewing the videos recorded by students they are familiar with in a familiar setting.

The conclusion therefore is that incorporating videos teaching of physics enormously enhance the interest and motivation of learners and this drives them towards spending more time in the subject with the subsequent effect of improving their performance.

4.10 Summary

This chapter has outlined the researchers work in the field in collecting data that was relevant in answering the research questions. It has shown the application of statistical methods in analyzing the data and inferences drawn thereafter. The following chapter gives a summary, conclusion and recommendation on the research work at hand.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.0 Introduction

This chapter summarizes the findings if the entire research concerning the use of physics instructional videos as an added resource. The information was obtain through an observation schedule and well balanced achievement test in terms of areas in which physics is taught and examine at secondary school level. The chapter also includes a conclusion derived from the findings, leading to the ideas that gave the recommendations. Actions based on the findings are then suggested ending the chapter with a list of possible recommendations for further research that this study did not manage because of time, resources and scope.

5.1 Summary

The effect of using videos as part of teaching and learning process in secondary school physics brought out several unexpected findings and experiences. The observation on the qualitative effect of treatment was used to answer the question on motivation due to the physics videos. Michieka, (2004) who used models in this study has lamented that a video captured the learner's behavior in a lesson during his research in the same area. From what was observed it was evident that the learners in the experimental group were able o connect what they had learnt in a normal session or the lesson with what they observed in the video which made the entire topic mo re interesting implying that the students were motivated and this resulted to an increased overall performance.

This was unlike the control group where learners found no difference in the delivery of the two topics, neither did they see any difference with the placebo video they watched over the videos they watch during entertainment.

It was realized that whichever area of physics was being researched on, whether on process skills, concepts formation or mathematical skills development, the key factor in improving performance is how the learners' attention is captured and maintained. The students were more interested in watching instructional videos where they were captivating to the level of the normal entertainment videos they frequently watch. In this regard, the recordings have to as stimulating as possible and address to the specific objectives of the topic under study.

5.2 Conclusion

The conclusion for this research is based on the answers to the research questions that had been set and they are as follows:

1. Introducing videos that are specific to a topic enormously enhance the learners' interest and motivation towards physics which in turn leads to an overall improved performance.

2. Mathematical skill required for the physics at secondary school level can not be necessarily improved using instructional videos.

Physics instructional videos mainly improve learners' theoretical concepts formation and scientific process skills such as observing, classifying, measuring, inferring and ability to conduct an experiment. Most videos in the market are mainly for entertainment but this research has shown that there is great potential in video technology as a teaching aid that can turn around the poor performance in physics if the right content is available to the learners. With the rapid development in technology in the country, data transfer will be much cheaper but so far, specific content to the curriculum is not sufficient more so in the field of sciences. During the research it was realized that there was just one physics video from KIE and this provides an opportunity for science teachers to fill this gap by preparing science videos that are relevant to the ever changing Kenyan curriculum.

5.3 Recommendations

1. As it was observed in the literature review improved performance is dependent on preparation of a curriculum that considers spiraling of related subjects and maturation of students. There is need therefore for the curriculum content in physics to be prepared in conjunction with those who prepare the mathematics curriculum to ensure that the learners in physics have developed sufficient mathematical skills that will enable them handle the syllabus in physics at various levels. The research clearly showed that the videos did not improve answering of the mathematical questions in physics.

2. The learners' motivation can greatly be enhanced by making physics lesson more resource based in creating variety in the lessons when videos are used to reinforce what is learnt. The ministry of education through the KIE and educational institutions should endeavor to develop instructional videos in physics and other sciences that are affordable to schools since the equipment required are now readily available and affordable. Just like for physics the other science subjects can benefit from instructional videos as the concepts are reinforced by increase in academic learning time and process skills are the same for all science subjects.

3. Teacher training colleges and universities should highly encourage science teachers to use digital science videos and demonstrations that are now readily available from the internet as part of their teaching resource. As technology improves, cheaper and more convenient video recorders will be available or use of mobile phones with high memory capacity interfaced for recording. Teachers can record digitally the innovations they have achieved while teaching and exchange them in seminars or via internet.

4. Middleton and Goefert,(1996) had earlier recommended that instead of purchasing low-ended computers, schools should purchase one really good top of line computer along with projection devices or large screen monitor and them have them networked. This allows students participation using the available technology. Even in Japan and China teachers do not allow the every day use of calculators, computers or video in sciences and math because they want students to understand the underlying concepts and operations required to solve problems (Stevenson, 2001).

5. As it was realized in the research, their was no significant improvement in physics questions that required mathematical computation and it is therefore recommended that physics students should opt for mathematics alternative(A) which would give them ample practice to enable them solve physics questions.

6. It needs to be reemphasized that using video only supplements but does not substitute hands-on laboratory investigation. But there are many cases in the syllabus where the teachers lack the necessary apparatus for experiments and demonstrations. It is particularly in these cases where a video recording comes in hardy for example the applications of hydraulic lift. Science learners are

likely to have seen a hydraulic jack lift in use or a tipper; such a recording would form the basis of background knowledge for the learners. The recommendation from this research is that as a constructivist teaching strategy, video recording that would be most motivating would be the ones that link the outside world with what is in the curriculum.

7. After showing the videos, it was realized that the student were overly excited by watching a recording of themselves performing various tasks even just watching a recording of themselves watch the educational videos. According to a study done on Biological sciences, most students are far more interested in science that address the problems relevant to their lives than they are in discussing abstract theories, (Biological sciences curriculum study, 1989). As such, to make an instructional video effective in teaching, it should involve local participant, local scenes and familiar materials that can be used to solve their daily problems.

8. As the instructional videos were not very effective in improving students performance in mathematics, greater emphasis in any physics instructional video should be laid on theoretical concepts formation and development of process skills with deeper exploration of aspects to do with scientific thinking, theory, prediction, real world problems and critical thinking as the key components.

9. The sequence in which a teacher uses videos also proved to be challenging in the research. Whether the video should be watched before the lessons or after the lesson depends upon the contents of the topic and whether the apparatus for the topic are available or not. It is recommended that if the apparatus for a

given topic are available, by all means hands on activities should be prepared then watch the video. If the apparatus are not available then the students can watch a video and it would give them a better understanding than the usual teaching methods.

5.4 Suggestions for further research.

1. Though hands-on activities surpass watching videos in helping the learners understand the topics it was not certain whether a student understands better by first watching the video before performing an experiment or the other way round. Some research needs to be done on this to determine the sequence so that the teacher is certain of how to order or plan a lesson where both a video and the apparatus are available for a given topic.

2. The video used in the research were not locally prepared. It would be interesting to find out if the students would be equally motivation by local instructional videos that do not comprise on the quality, creativity and innovativeness of the recording.

3. Since the mathematical section in the videos did not have profound effect on the student performance, more research should be done with videos that mainly have theoretical concepts and demonstrations.

4. Just as the textbooks are provided to learners to read at their own time, research could be done where the students watch the video at their own time to cater for individual differences. This could possibly give a different outcome on their performance.

5. There are various websites in the internet that have physics demonstrations that could be added to any instructional videos to make it more interesting. Several recordings on the same topic but with difference demonstration could be made and then determine the one that best captures the learners interest. In deed, learners may be found to prefer one video to another yet on the same topic. So this would be an area for further research just the same way we have different textbooks on the same subject.

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Appendix A Public Secondary Schools in Kiambu East District offering Physics

No.	School	A	A-	B+	B	B-	C+	C	C-	D+	D	D-	E	ENTRY(2008)	2006	2007	2008
1	Kagwe G.	9	6	7	10	5	2	1	0	0	1	0	0	42	9.021	8.674	9.683
2	St. Annes L.	6	4	5	13	3	2	3	1	1	0	0	0	39	8.460	9.302	9.158
3	Kiambu H.	35	16	30	40	9	18	10	3	3	8	0	0	152	8.619	8.356	9.136
4	Loreto Kiambu	4	2	6	7	8	10	7	7	2	0	0	0	57	8.174	6.811	7.774
5	J.G. Kiereini	6	2	3	6	3	11	10	4	6	6	0	0	58	5.708	6.000	6.746
6	Kanunga	6	4	6	13	12	13	5	13	8	14	3	0	102	6.222	7.037	6.753
7	Gitwe	0	0	0	3	4	3	5	7	4	1	0	0	27	6.046	5.859	6.047
8	Karuri H	2	0	2	2	3	3	6	11	6	6	0	0	40	6.161	4.778	5.925
9	Snr. C. Koinenge	1	0	4	5	3	10	16	17	17	19	1	1	97	5.049	7.176	5.319
10	Kambui	0	0	1	3	1	3	11	6	6	9	3	0	43	5.328	6.143	5.093
11	Kamburu	0	0	0	0	0	0	0	1	0	0	0	0	1	1.732	2.750	6.000
12	Gathiruini	1	1	2	1	2	2	4	3	3	2	10	3	38	3.733	3.971	4.765
13	Gatamaiyu	0	0	2	2	4	9	6	4	9	14	10	11	65	5.123	4.463	4.762
14	St.Josephs	0	0	2	5	3	11	7	10	16	16	17	1	93	6.694	7.227	4.602
15	Komothai B.	0	0	1	0	1	2	0	6	2	6	2	0	20	3.433	5.015	4.579
16	Githiga	0	1	2	0	2	3	2	3	0	11	6	1	37	3.191	5.393	4.528
17	Nduriri	0	0	1	0	0	2	1	1	2	5	1	1	14	4.231	4.455	4.357
18	Kiambu Township	1	0	0	0	1	1	1	3	4	9	3	0	24	3.379	4.889	4.217
19	William Ngiru	1	0	1	1	0	4	1	4	5	9	11	4	44	3.991	3.378	3.857
20	Lioki	0	0	0	0	0	1	1	0	1	6	1	0	10	3.318	3.214	3.700
21	Banana Hill	0	0	0	1	0	2	2	1	1	3	5	3	16	2.538	3.306	3.667
22	Gachoire	0	0	0	0	0	0	1	5	8	6	6	0	24	3.765	4.400	3.542
23	Gathugu	0	0	0	0	2	2	1	0	4	7	10	1	29	2.070	2.553	3.481
24	Ting'ang'a	0	0	0	0	0	2	0	2	3	8	5	1	22	2.962	4.094	3.381
25	Githima	0	0	0	1	0	0	0	1	0	0	2	2	8	1.423	1.786	3.333
26	Komothai G.	0	0	0	0	0	1	1	5	6	10	11	0	33	3.500	3.177	3.333
27	St.Patricks	0	0	0	0	0	0	0	1	2	2	0	1	6	New	3.333	3.333
28	Nyaga	0	0	1	1	2	0	3	1	5	4	22	3	42	3.212	3.400	3.205
29	Kanjai	0	0	0	1	0	0	0	0	1	2	3	1	8	2.263	1.429	3.050
30	Gathurimu	0	0	0	0	0	3	2	2	5	12	11	4	40	3.636	3.167	3.205
31	Hillside	0	0	0	0	0	0	0	0	2	2	1	0	5	2.220	2.428	3.200
32	Nyanduma	0	0	0	0	0	0	0	2	2	3	4	0	11	3.071	2.217	3.198
33	Ndumberi	0	0	0	0	1	0	0	1	3	8	6	1	20	5.000	4.625	3.158
34	Mugumo	0	0	0	0	0	0	1	0	0	1	1	1	4	2.833	3.625	3.000

Appendix B

Achievement test on turning effect of a force.

Time:1 ½ hrs.

Instructions

i) ***Answer all questions on the separate sheets given***

ii) ***Mathematical tables or electronic calculators may be used.***

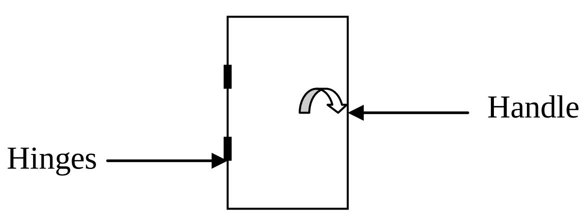
iii) ***Where necessary, use g=10N/kg***

1. A boy of mass 50 kg sits at a pivot 2.0 m from the pivot of a see-saw. Find the weight of a girl who can balance the see-saw by sitting at a distance of 3.2 m from the pivot. (3mks)

2. Explain why:

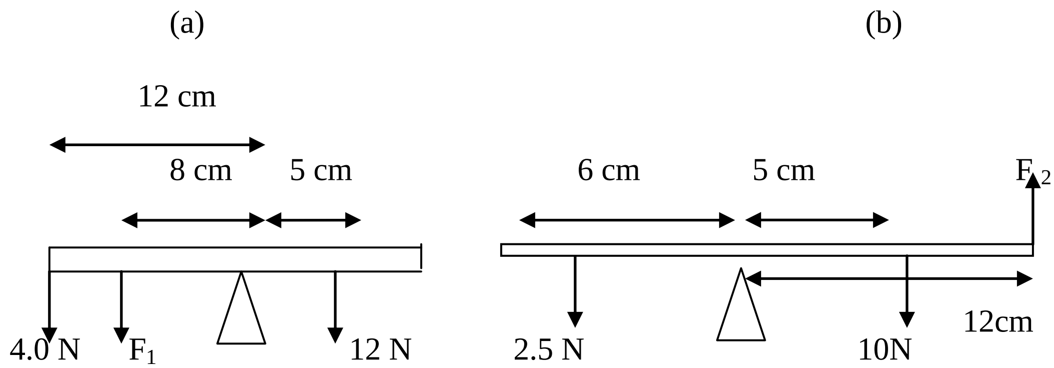
a) It is easier to loosen a nut using a spanner with a long handle than one with a short one. (2mks)

b) The handle of a door is usually placed as far as possible from the hinges. (2mks)



3. The diagrams below show uniform bars balanced about their centre by different forces.

Calculate the unknown forces denoted by F_1 and F_2 marked in each case. (4mks)



4. a) State the principle of moments. (1mk)

b) A uniform metre rule of mass 120g is pivoted at the 60 cm mark. At what point on the metre rule should a mass of 50g be suspended for it to balance horizontally? (3mks)

5. a) State the basic items you would need to construct a simple beam balance. (3mks)

b) How would you calibrate it? (2 mks)

6. Different masses were placed on a triple beam balance and the ridder mass on one of the beams

was moved the distances shown below.

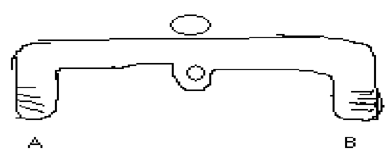
Mass (g)	0	10	20	30	40	50	60
Distance (cm)	0	5	10	15	20	25	30

a) Using these results plot a graph of mass against distance. (5mks)

b) Find the gradient of the graph. (2mks)

c) What mass would be balanced by a distance of 18 cm?(2mks)

7. a) This diagram shows a bicycle's handle bars. Indicate the direction of forces to be applied at A and B to turn the wheel towards the right. (2mks)



b) Give two other examples where two parallel opposite forces are applied. (2mks)

8. A metre rule is balanced by masses 24g and 16g suspended from its ends. Find the position of its pivot. (3mks)

9. Which claw hammer is easier to use in pulling out a nail, one with a long handle or one with a short handle? Explain. (2mks)

10. According to the principle of moment, how is distance from a turning point related to the force applied when using a wheel spanner to open a wheel nut? (2mks)

Achievement test on Hooke's law.

11. What change in shape of an object is evident when it is acted upon by

i. A stretching force? (1mk)

ii. A compressive force? (1mk)

12. (a). State Hooke's law (2mks)

(b) Give two examples of

i. Elastic objects (2mks)

ii. Inelastic objects (2mks)

13. According to Hooke's law how is the amount of stretch or compression (e) related to applied

force (F) as a Mathematical expression. (3mks)

14. Which spring is harder to stretch (or compress) one with a high spring constant or one with a

low spring constant? Explain (3mks)

15. Steel bars are commonly placed in concrete before it sets. Explain their purpose? (3mks)

16. If a force of 10.N stretches a certain spring 4 cm, how much stretch will occur for an applied

force of 15 N? (3mks)

17. A load of 200N causes an extension of 2 cm in a wire. What load will cause an extension of 10 cm. (3mks)

18. A student obtained the following readings for the load and corresponding extension of a spring.

Load (N)	0	100	200	300	400	500	600
Extension (cm)	0	5	10	15	20	25	32

a. Using these results, plot a graph of load against extension (5mks)

b. Beyond which load is Hooke's law not obeyed? (2mks)

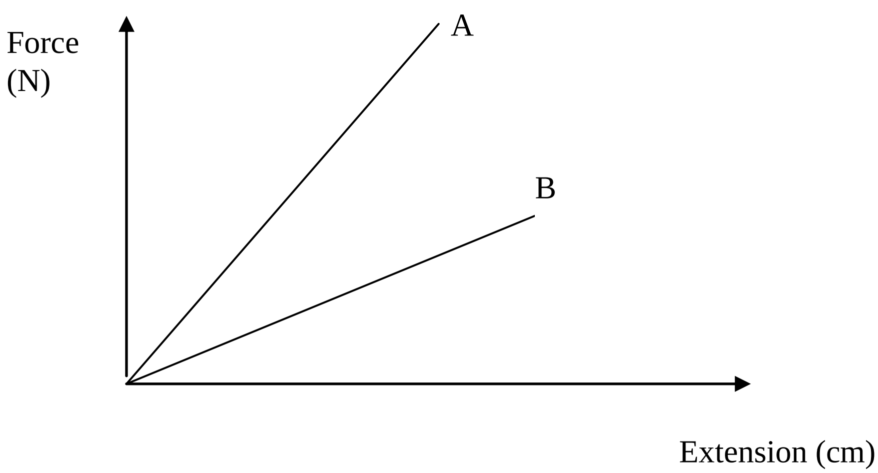
c. From the graph, find the spring constant. (2mks)

19. a) State the basic items you would need to construct a simple spring balance

b) How would you calibrate it? (2mks)

20. The sketch below shows the graph for two springs A and B with different spring constants.

Which graph represent the spring with a higher spring constant? Explain (3mks)



Appendix C

Marking Schemes for Achievement tests

Q.1 Clockwise moment = Anticlockwise moment (1mk)

500 N x 2 = Wt of girl x 3.2 (1mk)

Wt of girl = $\frac{500 \times 2}{3.2.}$ =312.5N (1mk)

Q.2a) It is easier to loosen a tight nut using a spanner that has a long handle because the longer the handle, the greater the moment as moment is a product of force and distance from turning point(2mks)

b)The handle of a door is usually placed as far as possible from the hinges because the moment is increased by fixing the handle at the greatest distance between the hinges and the far edge of the door. (2mks)

Q. 3 a) Clockwise moment = Anticlockwise moment

(4 x 12) + 8 F_1= 12 x 5 cm

$F_1 = \frac{60 - 48}{8}$ = 1.5N(2mks)

a) Clockwise moment = Anticlockwise moment

$5F_2$ **+(** 2.5 x 6) = 12 x 10

$F_2 = \frac{120 - 15}{5}$ = 21 N(2mks)

Q4. a) The principle of moment states that at equilibrium the clockwise moment is equal to anticlockwise moment. (1mk)

b) Let X be distance that the mass is placed,

$X = \frac{1.2 \times 10}{0.5}$ = 24 cm(3mks)

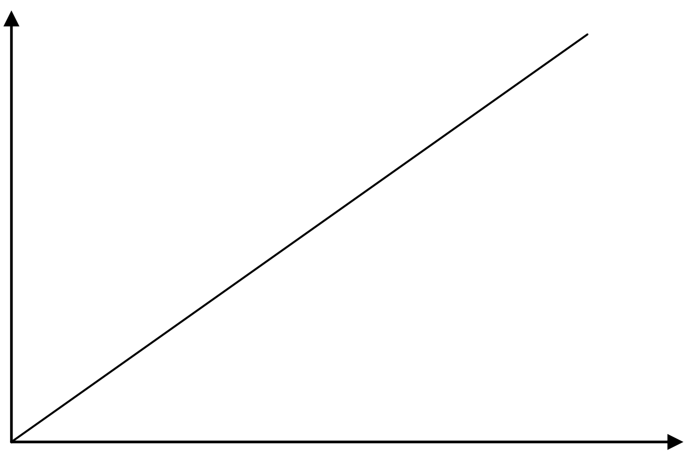
Q5. a) Items for a simple beam balance would include a uniform beam, a pivot, a metre rule to graduate the beam and several known masses.(3mks)

b) Using the metre rule the uniform beam would be marked into equal division say of 1 cm intervals. The pivot would then be placed at the centre.(2mks)

Q6. (i)

Mass(g)

(5mks)



Distance in (cm)

(ii) Gradient of graph = $\frac{60}{30}$ = 2g/cm (2mks)

(iii)If 2g is balanced by a distance of 12cm, then 18cm will balance a mass of 36g.(2mks)

Q7. a) For the wheel to turn towards the right the forces are in clockwise direction at points A and B(2mks)

b) Other examples include a steering wheel of a car, opening a tap, turning a screw driver (2mks).

Q8. If a pivot is x cm from the end having 24g suspended, then

24x = 16 (1-x) (2mks)

x = 0.4m (1mk)

Q9. One with a long handle. The long handle of the claw hammer increases the moment.(2mks)

Q.10 When using a wheel spanner, only a small force needs to be applied when it is held at a long distance from the nut while a large force has to be applied if it is held at a short distance from the nut.(2mks)

Q. 11 i**)** There is extension of the object e.g. a rubber band.(1mk)

ii). A compressing force creates a reduction of the length of the object. (1mk)

Q. 12 a). Hooke's law states that for a helical spring or other elastic material, the extension is directly proportional to the stretching force, provided the elastic limit is not exceeded.(2mks)

b). Spiral or helical spring or a uniform metal bar fixed at one end. (2mks)

c). Rubber band, wooden or plastic metre rule fixed on one end. (2mks)

Q 13. F = ke where F = Force applied, e = Extension, k = Spring constant (3mks)

Q. 14. A spring with a high spring constant is harder to stretch e.g. if k = 5 N/m for one spring and another spring has 10N/m the 1st spring with a lower spring constant would stretch twice the distance for a force of 10N.(3mks)

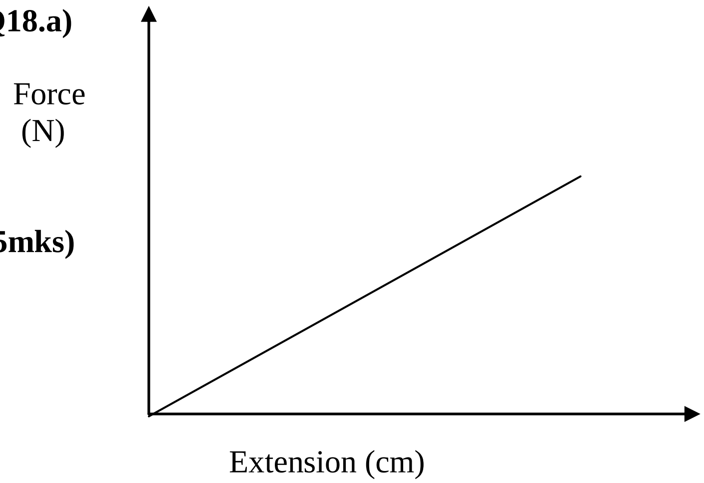
Q. 15. To reinforce the concrete and allow for expansion.(3mks)

Q 16. 10N stretch a spring by 4 cm
15 N will stretch it by 15/10 x 4 = 6 cm(3mks)

Q.17 200N extend the wire by 2cm the force that will extend it by 10cm is 10cm/2 x 200 = 1000N(3mks)

Q18.a)

(5mks)



b) Hooke's law is not obeyed beyond 25cm (2mks)

c) Spring constant = Gradient of graph (2mks)

19. a) To construct a simple spring balance the basic items needed are a spring, pointer, metre rule and known masses. (2mks)

b)To calibrate the spring balance, hang a known mass and then mark the extension, repeat for several known masses then graduate uniformly using the metre rule. (2mks)

20) Spring A has a higher spring constant because its graph has a higher gradient. (3mks)

Appendix D

Classroom observation schedule.

date....................

School..Class..

Topic...Sub topic..

Which teaching resources has the teacher prepared for his/her lesson?

i)
ii)
iii)
iv)

How does the teacher introduce the topic

a) By questioning [ ]
b) By lecture [ ]
c) By demonstration [ ]
d) By use of experiment [ ]
e) Any other [ ]

How are the students involved in the course of the lesson?

i) Asking questions [ ]
ii) Performing experiments [ ]
iii) Taking notes [ ]
iv) Making observations [ ]
v) Discussion groups [ ]
vi) Any other [ ]

How are the students arranged when watching the educational video?

i) Normal class arrangement [ ]
ii) Random [ ]
iii) In rows [ ]
iv) Any other [ ]

How are the learners involved during the video presentation?

i)
ii)
iii)
iv)

How prepared are the learners for the lesson by:

i) Asking questions [ ]
ii) Being attentive in class [ ]
iii) Answering questions [ ]

What role is the teacher playing when students are watching the video

i)
ii)
iii)
iv)

How punctual are the students for the lesson when there is an instructional video.

i) Attended normally [ ]
ii) Attended earlier [ ]
iii) Attended late [ ]

Are there any interruptions during the video presentation by:

	Yes	No
i) Students	[ ]	[ ]
ii) Teacher	[ ]	[ ]
iii) Others	[ ]	[ ]

Did students ask questions related to what they observed in the video after the presentation?

Yes [ ] No [ ]

Did the teacher pre-view the video before the lesson

Yes [ ] No [ ]

Are the students informed on key points to look for in the video

Yes [ ] No [ ]

How was any time left after the video presentation spent?

i) Answering questions [ ]
ii) Reviewing the lesson [ ]
iii) Any other [ ]
iv) No extra time left [ ]

How did the students respond to any additional information in the video that is not in the reviewed textbooks?

i) Took note of it [ ]
ii) Ignored [ ]
iv) Asked questions about it [ ]
v) Did not realize [ ]

Did the students ask the teacher to pause at intervals for the students to take note of key points?

Yes [ ] No [ ]

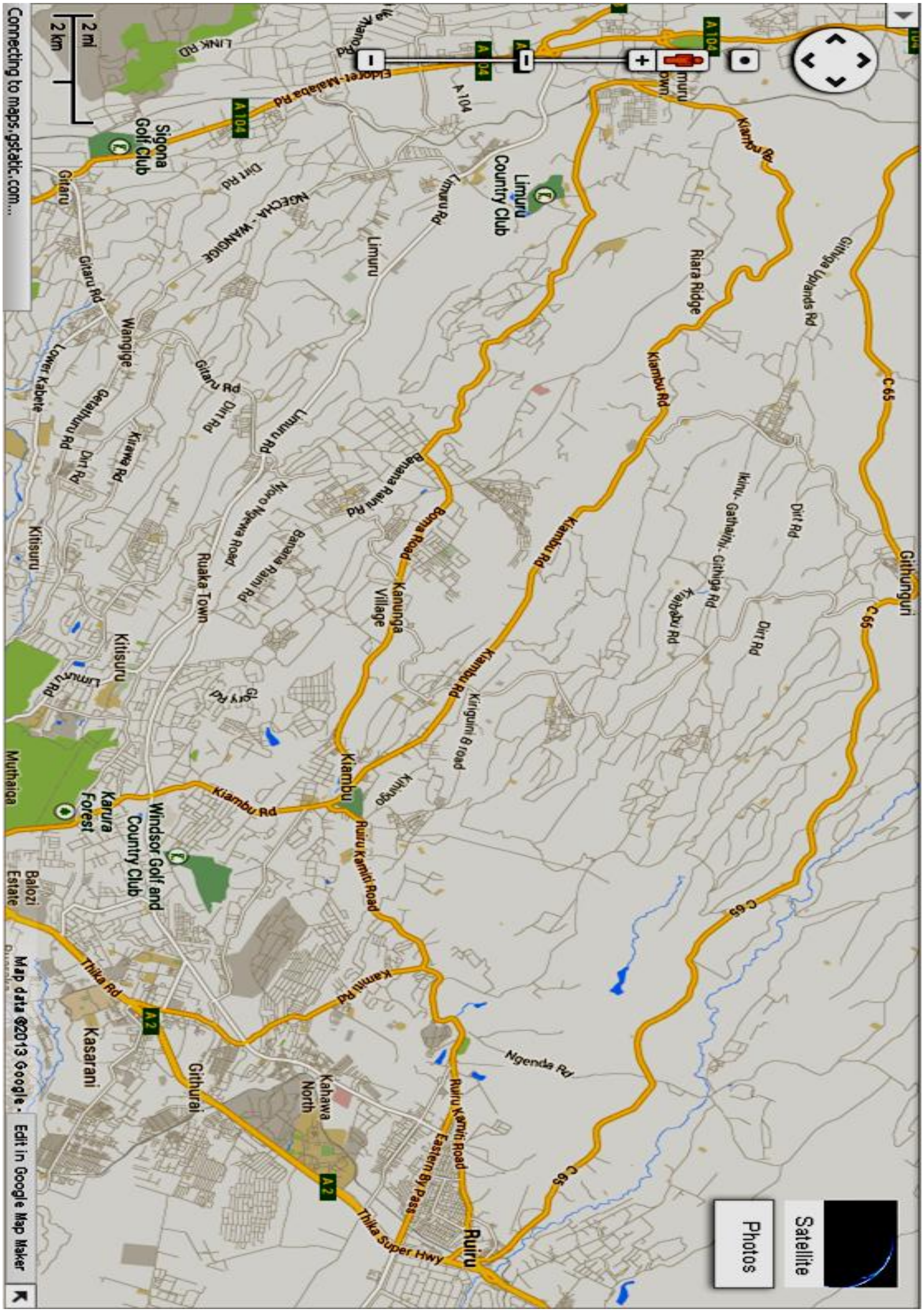
Were the students interested in watching other educational Physics videos?

Yes [ ] No [ ]

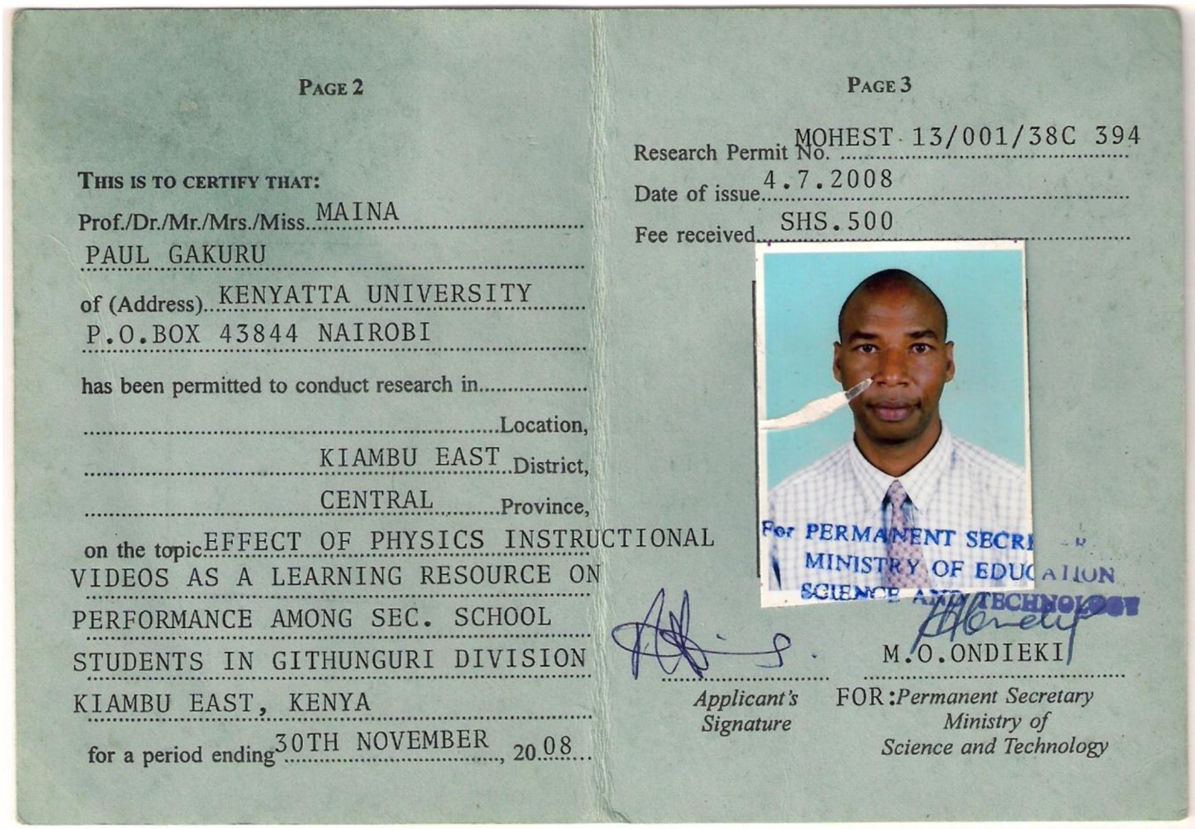
Appendix E Kiambu East K.C.S.E Physics Analysis 2005 – 2008

	School Name	2007	2006	2005	2006 - 07 Change
1	St. Annes Lioki	9.3023	8.4500	5.5700	0.8423
2	Kagwe Girls	8.6744	8.0210	8.5000	0.3455
3	Kiambu High Sch	8.3576	8.6194	7.7633	0.2818
4	St. Joseph Githunguri	7.2264	8.6839	6.1800	1.5325
5	Snr. Chief Koinange	7.1754	8.0488	5.5151	2.1289
6	Kanunga	7.0357	8.2200	7.6530	0.8167
7	Wanginyu	7.0000	New	New	New
8	Loreto Kiambu	6.3111	8.1739	5.4314	-1.08828
9	Kambui Girls	6.1429	5.3280	3.8900	0.8149
10	J. G. Kiereini	6.0000	5.7083	3.7870	0.2917
11	Gitwe Girls	5.8582	8.0488	5.2400	-0.1895
12	Githiga Sec	3.329	5.1805	3.0125	2.2024
13	Komothai Boys	5.1053	3.4333	3.4348	1.8723
14	Kamuchege	4.8889	3.1538	4.4826	1.7359
15	Kiambu Township	4.8039	3.3783	2.7143	1.5090
16	Karuri	4.7778	6.1310	4.5350	-1.3532
17	Ndumberi	4.6250	5.0000	3.4118	-0.3750
18	Gatamaiyu	4.4330	5.1225	3.5410	-0.5589
19	Nguriri	4.4545	4.2305	3.1287	0.2237
20	Gachoire Girls	4.4000	3.4545	4.3750	0.9455
21	Ting’ang’a	4.0838	2.9524	3.0000	1.1414
22	Gathiruini	3.9737	3.4333	3.7847	0.5404
23	Mugumo-Ini	3.6250	2.8339	2.0000	0.7917
24	Nyaga	3.4000	3.2121	3.2933	0.1879
25	William Ngiru	3.3784	3.3908	3.0000	-0.0122
26	St. Patricks	3.3333	New	New	New
27	Gachii	3.3333	2.5200	2.4830	0.8133
28	Banana Hill	3.3077	2.5334	2.1818	0.7683
29	Lioki	3.2143	3.5182	3.2000	-0.6039
30	Kagaa	3.2143	2.5333	2.5000	0.5310
31	Komothai Girls	3.1765	3.5000	3.2500	-0.3235
32	Gathirimu	3.187	3.6384	2.5128	-0.4897
33	Riara	3.0000	3.0800	2.8000	-0.0800
34	Cianda	3.0000	New	New	New

Appendix F **Map of Kiambu East District – location of the Schools under study**



Appendix G Permit Copy



PAGE 2

THIS IS TO CERTIFY THAT:

Prof./Dr./Mr./Mrs./Miss. MAINA PAUL GAKURU

of (Address) KENYATTA UNIVERSITY P.O.BOX 43844 NAIROBI

has been permitted to conduct research in ....

.... Location,

KIAMBU EAST District,

CENTRAL Province,

on the topic EFFECT OF PHYSICS INSTRUCTIONAL VIDEOS AS A LEARNING RESOURCE ON PERFORMANCE AMONG SEC. SCHOOL STUDENTS IN GITHUNGURI DIVISION KIAMBU EAST, KENYA

for a period ending 30TH NOVEMBER, 20 08

PAGE 3

Research Permit No. MOHEST 13/001/38C 394

Date of issue 4.7.2008

Fee received SHS.500

For PERMANENT SECRETARY MINISTRY OF EDUCATION SCIENCE AND TECHNOLOGY

Applicant's Signature

M.O.ONDIEKI

FOR: Permanent Secretary Ministry of Science and Technology